THIRTYMILE CREEK

WATERSHED ASSESSMENT

Prepared for the
Gilliam-East John Day Watershed Council

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Acknowledgements

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Statement of Purpose

The Thirtymile Creek watershed assessment was written for the Gilliam-East John Day Watershed Council and the Gilliam Soil and Water Conservation District with the intended audience of the board of directors of these two counsels, watershed residents, and the general public. A watershed assessment evaluates how well a watershed is functioning. This assessment will serve as a baseline for the intended audience to identify restoration opportunities.

Methods/Guidelines

The Oregon Watershed Enhancement Board's Oregon Watershed Assessment Manual was used as the guideline for this assessment. The manual provides background information on watershed functions in Oregon and resources for conducting the assessment. It provides step-by-step instruction for completing each chapter of the assessment. Copies of the manual can be downloaded from OWEB's website, http://www.oweb.state.or.us. The Thirtymile Creek watershed assessment encompasses the entire watershed, with a focus on private lands.

Data Collection

Information was collected from a variety of sources. Sources are cited in the text of the document and referenced at the end of each chapter.

Glossary

Bolded words in the text of this document are compiled in the glossary found at the end of the document.

Maps

Maps were created using ArcGIS and ArcView 8.3 which is software for viewing and creating Geographical Information System (GIS) data. GIS data has been used when calculating acreage, mileages, and other information included in this document. Copies of all maps and GIS data included in this document can be obtained at the Gilliam-East John Day Watershed Council office.

Appendices

Appendices pertinent to each chapter are referenced in the text and are found at the end of each chapter.

Landowner Participation

Landowner meetings were held in the winter of 2004 in the High School in the City of Condon. Issues of concern and general information identified from these meetings were addressed in this document. Interviews were held with local landowners where further information was collected both for historical data, restoration needs, and watershed concerns.

List of Abbreviations and Acronyms

Acre Foot	AF
Bureau of Land Management	BLM
Channel Habitat Types	CHTs
Conservation Reserve Program	CRP
Cubic Feet per Second	CFS
Department of Environmental Quality	DEQ
Department of Geology and Mining Industries	DOGAMI
Dissolved Oxygen	DO
Division of State Lands	DSL
Environmental Protection Agency (U.S.)	EPA
Geographical Information Systems	GIS
Large Woody Debris	LWD
National Wetland Inventory	NWI
Natural Resources Conservation Service	NRCS
Oregon Department of Fish and Wildlife	ODFW
Oregon Department of Forestry	ODF
Oregon Water Resources Department	OWRD
Oregon Watershed Assessment manual	OWAM
Oregon Watershed Enhancement Board	OWEB
Riparian Condition Unit	RCU
Soil and Water Conservation District	SWCD
Total Maximum Daily Load	TMDL
Umatilla National Forest	UNF
United States Forest Service	USFS
United States Geological Survey	USGS
Water Availability Basin	WAB
Water Availability RS	WARS
Watershed Professionals Network	WPN

Watershed Conditions Summary

Introduction
This section summarizes the findings of the Thirtymile Creek Watershed Assessment. Data gaps are included. **Figure 1** details the watershed conditions by sub-watershed. Recommendations for improving watershed conditions were generated through the coordinated effort of several agencies that form the Thirtymile Creek Watershed Assessment Group. These recommendations will be attached in a separate document that will be provided after the completion of the assessment.

Historical Conditions
There have been many changes to the Thirtymile Creek watershed since the early 1700s when the horse was introduced by Native Americans. Numbers of horses owned by Native American families was a sign of their wealth. Some tribes owned literally thousands of head of horses. Since then fur trappers have come and gone, taking the beaver with them. Settlers have passed through and many stayed or returned. Land has been cleared; farms have been cultivated. Wetlands have been drained. Roads have been built. Noxious weeds have entered the landscape. Humans have changed the landscape, through extracting resources and putting the land into agricultural production.

We cannot entirely return the watershed to its original, pristine state, as the land is now a livelihood for many people. We do not fully understand or know what its "original" state was. Some changes that may have impacted the watershed the most occurred when there was little documentation of their effects, such as removal of the beaver in the mid 1800s. As things currently stand, we can try to restore aspects of the watershed that benefit the habitat of aquatic and terrestrial species that we share the land with, while maintaining a viable economy.

Channel Habitat Types
In this chapter, streams were classified as various channel habitat types, in order to understand how land uses and environmental factors affect stream channel form and how channel habitat types can be expected to respond to restoration activities. The following channel habitat types were present in the Thirtymile Creek watershed.

CHTs with Gradient less than 2%
Low Gradient Small Floodplain Channel: streams in broad valley bottoms with well-established floodplains 7%.
Low Gradient Moderately Confined Channel: low-gradient streams with variable confinement by low terraces and slopes 28%
Low Gradient Confined Channel: low-gradient streams confined by adjacent, gentle land forms 28%

CHTs with Gradient 2-4%
Moderate Gradient Moderately Confined Channel: moderately sloped streams with variable confinement and a narrow floodplain 16%

Moderate Gradient Confined Channel: moderately-sloped streams confined by adjacent land forms 9%

CHTs with Variable Gradients from 0-5%.
Alluvial Fan Channel: tributary streams located on foot-slope land forms in a transitional area between valley floodplains and steep mountain slopes 1%.
Moderate Gradient Headwater Channel: channels in open valleys with hillslope constraints occurring in upper reaches of watershed 11%.

Data Gaps
- **None**

Hydrology and Water Use
Climate, soils, and geology are major determinants of the natural hydrology of a watershed. As the majority of precipitation in the Thirtymile Creek watershed occurs as snow, snow melts are the cause of peak flows. The period of low flows occurs during summer months, when there is little precipitation.

Of the land uses assessed in this chapter (agriculture, grazing, forestry, roads, and rural residential), all but agriculture and grazing had low potentials to affect peak flows in the watershed. Agriculture and grazing had a low to medium potential. There are many historical wetlands in the bottomlands of Thirtymile Creek, many of these were destroyed in the floods of 1964 and 1996. Loss of these wetlands has dramatically changed the length of time soils are saturated, thereby reducing groundwater recharging in the spring.

Peak flows and low flows in the Thirtymile Creek watershed are to some extent affected by human activities. Conservation measures can reduce some of these effects, to increase the amount of water stored in floodplains and soils, to restore stream structure, wetlands, and riparian areas.

Data Gaps
- Flow data
- Historical hydrological information
- Miles of private roads

Riparian Areas
Shade from riparian vegetation is important for maintaining cool water temperatures. As Thirtymile Creek has little shade for almost the entire length on the lower end of the stream, its high summer temperatures (see Chapter 7: Water Quality) are likely due, in part, to lack of shade. Seventy percent of the streams in Thirtymile Creek have little or no shade. If you take out Searcy and Little Searcy Creeks (which are forest streams) 91.5% of the riparian areas in the Thirtymile Creek drainage have little or no shade.

Amounts of large woody debris in the Thirtymile Creek watershed were found to be low in number or nonexistent. This attribute was not studied in this evaluation but it should be noted that because of the lack of shade or the vegetation that produces shade it can be assumed that woody vegetation is also severely lacking. As large woody debris plays an integral role in pool creation, this lack of in-stream wood and a lowered potential for future recruitment can have far reaching effects on stream structure and fish habitat.

Lack of riparian vegetation or vegetation without large and deep root systems also can contribute to bank instability. Bank instability is quantified as bank erosion, which can contribute to sediment problems. It also widens streams, which can make the vegetation present less effective for maintaining cool water temperatures.

Data Gaps:

- Woody debris amounts/values/needs within watershed
- Erosion measurements comparing existing status with proper functioning

Wetlands

Historically, wetlands were more widespread in the Thirtymile Creek watershed than they are today. Over time wetlands have been farmed over, disconnected from nearby streams, drained, and leveled. Removal of beavers may have also been responsible for diminishing wetlands, as land flooded, above beaver dams was no longer flooded.

Currently, the NWI shows less than one percent of the watershed as being wetlands. As this inventory was done on a large scale with no field checking, the actual amount of wetlands currently present in the watershed is higher. If you are interested in inventorying wetlands on your property, contact the local Natural Resources Conservation Service office.

There are funding opportunities for wetland restoration. While not possible on a large scale, due to the agricultural nature of the watershed, selected restoration of wetlands can improve the hydrology and water quality of the area. As wetlands play a role in groundwater charging, increasing wetlands can improve late season low flows.

Data Gaps

- Hydric soil mapping
- Compilation of soil survey characteristics that indicate areas of historical wetlands
- Wetland plant community information

Water Quality

Water quality is a difficult topic to adequately address with minimal data. The existing data shows Thirtymile Creek's impact on the water quality of the John Day River, but is too limited to show what portions are natural and human caused. To summarize the data, temperature exceeds the seven day moving average maximum temperature of 64˚F a good portion of the summer months on all three sites that were tested the summer of 2005. Nutrient levels in Thirtymile Creek did not exceed the **assumed** TMDL standards of 33µg/L (Dissolved Inorganic Nitrogen) or 7µg/L (orthophosphates) for the John Day River. pH levels are recorded at slightly below 9.0 (8.7 to 8.9) and dissolved oxygen has not dropped below the standard of 8.0 mg/L but some grab samples have been right at that level throughout the length of the stream. Although there is very limited flow data (EPA 1997 and 2000), Thirtymile Creek is a high priority for flow in the John Day River Watershed Sub-basin Revised Draft Plan. Fine sediments, another form of pollution, is also present at levels affecting fish reproduction (see Chapter 8: Sediment).

What does all this mean? How is water quality affecting salmonid fish in the Thirtymile Creek watershed? High nutrient levels, low flow, exposure to direct sun, and high water temperatures promote algae growth. Algal growth increases the magnitude of daily fluctuations in dissolved oxygen and pH. When dissolved oxygen, temperature, and pH fall outside the range which salmonids are adapted to, mortality and reduced reprodution occur. Extreme fluctuations place additional stress on the fish. As salmonid fish rearing is the most sensitive beneficial use in the Thirtymile Creek watershed, current water quality conditions are not adequate to support this beneficial use. Algal growth, with its effects on fish habitat requirements, is a large factor in this. By minimizing algal growth and minimizing human caused increases in temperature, fish habitat parameters can be improved and Thirtymile Creek's most sensitive beneficial use protected.

Minimizing algal growth requires limiting exposure to sunlight, lowering water temperatures and reducing nutrient levels in streams. Limited data is showing that nutrient levels are not outside of the parameters set by DEQ so the main emphasis should be placed on restoring a good condition riparian area with adequate brush to shade the stream from solar radiation which will have an effect on both flow and temperature.

Additional monitoring in the future will provide a stronger basis with which to assess and improve water quality in the Thirtymile Creek watershed. By monitoring in the headwaters of the watershed, information on how much pollution is natural and how much is human-induced can be gathered, providing further insight on how to improve water quality in the watershed.

Data Gaps

- Lack of water quality data
- Flow data
- Monitoring that measures daily DO and pH fluctuations
- Amount of natural versus human-caused pollution

Sediment

Too much sediment in spawning gravels can adversely affect salmonid spawning. Fine sediment in riffles ranged from 7 to 68% (estimated by author) in surveyed reaches in the Thirtymile Creek watershed. As the ODFW benchmarks are set for fish needs, the excessive fines in riffles or the surveyed reaches indicates that fish reproduction and development may be impaired in those reaches. This also means sediment deposition amounts are too large for quality fish habitat in those reaches. Most deposition occurs in pools, where there is less flow. It is possible that the sediment loads of Thirtymile Creek are more than the stream can handle and therefore you have deposition in riffles. It is also possible that the lack of large woody debris (LWD) and the low number of pools per mile (See Chapter 10: Fish and Fish Habitat discussion) have changed the distribution of sediment in the stream. To determine whether sediment loading, streams structure, or both are the causes of excessive fines in riffles, more sediment data needs to be collected.

The Thirtymile Creek watershed was listed as a high priority area for sediment in the John Day River Sub-basin plan. If the sediment loads are too large for the stream to handle, what can be done? Sediment sources need to be identified and minimized. Possible sediment sources in the Thirtymile Creek watershed include: roads, crop and range lands, stream bank erosion, ditch erosion, and landslides.

Roads can be one of the major contributors of sediment to streams, especially when there are high road densities. In the Thirtymile Creek watershed, the entire watershed and each sub-watershed all have relatively low road densities. But a large majority of the roads in the watershed are unpaved, and thus are contributing larger amounts of sediment to streams. Native surface roads contribute more sediment to streams than rocked or paved roads.

The geology and topography of the upland sections of the watershed show landslides as a potential occurrence. While the geology and topography cannot be changed, they can be recognized and land uses adjusted to minimize landslides and debris flows.

Most of the crop and range lands are highly erodible and some of those lands are on moderate slopes. These lands are probably contributing sediment to streams. Conservation practices and riparian buffers can minimize the amount of sediment that reaches streams and also conserve soil on crop and range lands.

The ODFW habitat survey shows the potential for high levels of bank erosion throughout all sections of the watershed. Therefore, stream bank erosion is a source of sediment to streams in the watershed. The erosion can be a result of stream bank instability or from peak flows reshaping the channel form. Flows passing through channelized reaches may have more energy than when in original channels, with the added energy resulting in stream bank and stream bed erosion. Stream bank instability can be the result of lack of riparian vegetation. As the results in Chapter 5: Riparian Areas show limited woody and brush vegetation in riparian areas, this is likely the case with bank erosion.

Erosion from ditches is also a source of sediment to streams in the Thirtymile Creek watershed. How and when ditches are cleaned can help control ditch erosion.

Understanding the geology, topography, climate, and soils of the watershed, along with how human activities can contribute sediment to streams and alter how streams manage their sediment loads is a good beginning for improving sediment conditions and fish habitat. Implementing actions to control sediment and improve stream structure will be the next step.

Data Gaps

- Miles of private unpaved roads
- Assessment of all culverts
- Identification and mapping of all landslides in watershed
- Miles of ditches in the watershed

Channel Modifications

Several types of channel modifications were identified while researching this chapter. Ditches and diversions are not that prevalent, due to the agricultural nature of the watershed but roads and road ditches are prevalent in the watershed. As mentioned in the background section of this chapter, these modifications have changed the hydrology of the watershed, causing less infiltration of water into the soil and water to enter the stream system more rapidly.

Stream channelization is not that common in the agricultural areas of the watershed, but agricultural lands on both sides of streams and roads that parallel streams have artificially confined stream channels. This can result in effects similar to those of channelization, namely disconnection with the stream's floodplain, loss of habitat complexity, and unstable stream banks.

Many of the channel modifications in the Thirtymile Creek watershed are necessary to infrastructure and agriculture. Irrigation and road ditches are necessary for crop production and road stability. Diversion dams are necessary for irrigation purposes. However, the effects that these necessary modifications have on fish habitat and stream structure can be minimized. Fish passage barriers can be identified and actions taken to provide passage, such as dam designs that allow passage. Roads and ditches can be maintained in order to have minimal sediment enter the stream system. Inadequate culverts can be replaced with 50-year or 100-year flood sized culverts. Opportunities exist for rerouting channelized sections of streams into their old channels. This would increase the length of stream channels and the amount of time that water stays within the watershed, thereby assisting with diminishing the intensity of peak flows and potentially decreasing the amount of time of low flows. Increasing the amount of channel could be combined with riparian buffers (see Chapter 5: Riparian Areas) to improve the adjacent floodplain's ability to store and hold water, thereby increasing the amount of water available for release during low flows.

Stream bank stabilization through the use of riprap and other man made materials is a channel modification that can ultimately do more harm than good. While temporarily preventing bank erosion, peak flow events can whittle stream banks out from behind riprap, causing even further erosion problems. Although sometimes necessary in the short term, manmade stream bank stabilization is best minimized in the long term. A long term alternative is riparian revegetation, which can provide natural bank stabilization that will not alter channel form.

Data Gaps

- Inventory of diversions
- Inventory of all possible fish passage barriers
- Culvert inventory on all culverts in the watershed

Fish and Fish Habitat

Historically, Thirtymile Creek and its tributaries supported large runs of summer steelhead. These runs were historically plentiful, but now have diminished to where they have been listed as threatened under the Endangered Species Act.

Fish passage is one of the greatest concerns for salmonids. Dams and diversions can partially or completely cut off fish access to spawning habitat. On a large scale, dams on the Columbia have impeded fish access to the John Day Basin and thus Thirtymile Creek, thereby playing a role in declining fish populations. Within the Thirtymile Creek watershed, fish passage barriers are assumed but not located with the use of pushup dams for irrigation purposes.

Habitat conditions in the 1971 habitat surveys on Thirtymile Creek highlighted some undesirable conditions that were prevalent in all the tributaries also. Desirable and undesirable benchmarks were derived by Oregon Department of Fish and Wildlife as a method of comparing a stream against standards to determine its general condition. As different channel habitat types and geological location will cause variances in an individual reach's potential habitat, these are general guidelines. Width to depth ratios, percent open sky, fines in riffles, bank erosion, and large woody debris all fell into the undesirable category for many reaches along Thirtymile Creek. However, on all reaches, the percent gravel available in riffles was equal to or greater than the desirable benchmark.

What can be done to improve habitat conditions? Width to depth ratios of streams increase as streams widen. Streams widen from increased flows and/or eroding banks. As eroding banks are prevalent in many reaches of Thirtymile Creek and its tributaries, these streams are likely widening over time. Widening streams are undesirable for their effects on water temperature (see Chapter 7: Water Quality). Also, as streams widen, their ability to transport and handle their sediment loads changes. Stabilization of stream banks through riparian revegetation will help decrease the widening of streams. Stream widening is undesirable for fish because of the resulting increase in water temperature and substrate degradation.

The percent of open sky present out of 180˚ at a given point, is the opposite of shade. Thus, high percent of open sky numbers mean low shade. As shade limits exposure of the water to solar radiation, it helps reduce the warming of stream temperatures. By increasing the amount of shade in the stream profile, the availability of summer habitat and mobility of salmonids also increases, since too-high water temperatures can be fish barriers.

In Chapter 5: Riparian Areas, in-stream large wood and the recruitment potential of riparian areas for future large woody debris were shown to be limited. As large wood helps in the formation of pool habitat, a critical area for salmonids in the warm summer months, the enhancement of fish habitat in the Thirtymile Creek watershed will ultimately necessitate large woody debris being present in the stream system in greater amounts. This can be accomplished in the short term by large woody debris placement projects and in the long term through increasing the recruitment potential of riparian areas for large wood.

Improving fish habitat through establishing riparian vegetation, increasing shade, improving riffle and pool habitats, and the placement of large woody debris is part of improving conditions for fish in the watershed. It would also be beneficial to increase fish access by identifying and removing fish barriers and to increase surveys to determine population trends and the entire distribution of steelhead in the system.

Data Gaps

- Current stream habitat surveys
- Current redd surveys in the watershed
- Complete inventory of fish passage barriers
- Development of specific Habitat Benchmarks for the John Day Basin

Noxious Weeds

Noxious weeds are present in the Thirtymile Creek watershed, although not in as large numbers as other parts of Oregon. Un-maintained patches of weeds can quickly jump to large acreages taken over by weeds. Thus, it is important to control weeds while they are small problems and before it becomes a large and unmanageable one.

Diffuse knapweed, the most prevalent noxious weed in the watershed and other noxious weeds can cause serious land degradation. Diffuse knapweed has a weak root system and does not hold soil as well as the native grasses it replaces, thereby increasing surface erosion. In addition to land degradation, it reduces land values and limits the amount of forage available to livestock and wildlife.

Coordinated efforts in weed control are important to reducing weed numbers. If only one landowner is maintaining his or her lands free from weeds in a given area, weeds will invade from nearby landowners. This includes coordinating with Gilliam County Public Works, which maintain roadsides, and state and federal agencies that are property owners within the watershed. Coordinated efforts are cost-effective and prevent weeds from re-colonizing an area.

Data Gaps

- Exact location of noxious weed sites on private, state, and federal lands
- Estimates on acreages of noxious weeds on private, state, and federal lands

Forest Health

Due to the lack of technical information, the author concludes that forest composition and structure in the Thirtymile Creek watershed have changed over time. Average tree size has decreased in size, with most stands currently small or medium in size classes. Crown closures are medium to dense, indicative of thick stands. The majority of forests are in dry mix or wet mix types. A smaller amount of dominate stands than historically are Ponderosa pine dominated stands.

Forest management is, and always has been, a highly debated issue in the West. People have different ideas about how a forest should be managed. Since how a forest is managed plays an integral role in forest health, how management is influenced should be understood. On public lands, forest management is often subject to public opinion. Private land management has some restrictions placed upon it by the Oregon Forest Practices Act. For the most part it is the landowners’ decision on how to manage their forests.

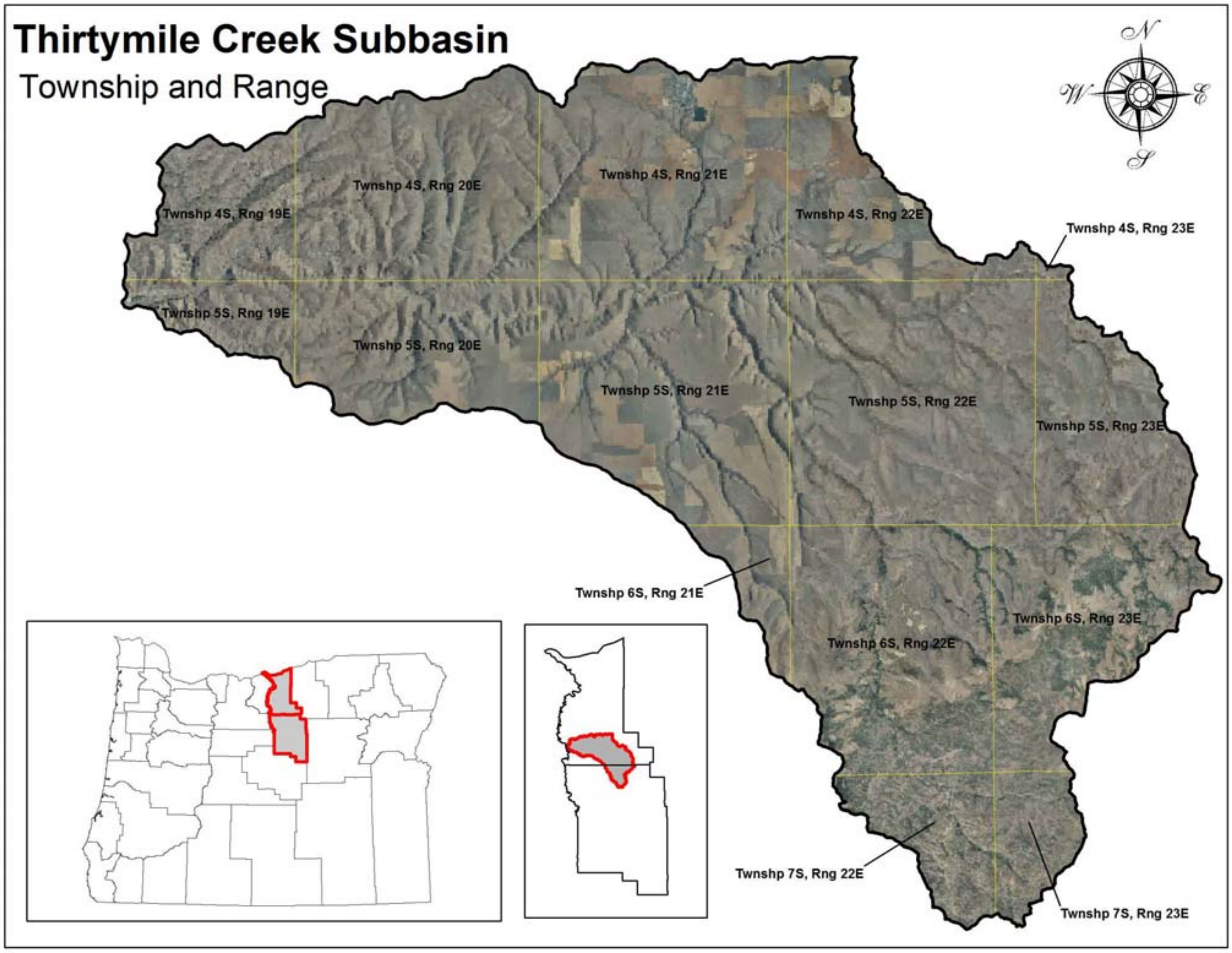
Data Gaps

- Historical conditions of specific forest stand structure and composition

Subwatershed	Riparian Conditions	Wetland Conditions	Stream Conditions	Water Quality	Sediment Sources	Channel Modifications	Hydrology And Water Use	Noxious Weeds
Lower Thirtymile Creek	Mostly grasses with some brush species (hawthorn and willow) present. Low shade coverage and no LWD recruitment potential.	Current Wetlands mostly in riparian areas or around springs.	The 30 Mile Creek substrate is mostly cobbley. The number of pools per mile is less than before the 1964 flood event. Stream bank erosion is higher than desirable. Fine sediments in riffles is higher than desirable.	Information for long term analysis was non-existent. Extensive information was collected in the spring, summer, and fall of 2005. Temperature, dissolved inorganic nitrogen, orthophosphates, and pH were collected at 1 week intervals. Invertebrate were collected at 3 sites spanning the whole of 30 Mile Creek. Data shows that the only concern through the summer of 2005 was temperature and flow.	Bank erosion, roads, agriculture, and range activities are located on highly erodible soils and are influencing sediment in 30 Mile Creek	After the 1964 Christmas floods the main channel was eroded to the point that the original channel was unrecognizable in sections of the lower watershed. Land owners used heavy equipment to relocate the channel in the original location.	During the summer months flows reduce to nothing during the dry part of the year. There is some irrigation but flow reductions are caused more from poor riparian areas and lack of woody vegetation.	Knapweed, Toadflax. Scotch Thistle, and Yellowstar Thistle are the main noxious weeds of concern

Subwatershed	Riparian Conditions	Wetland Conditions	Stream Conditions	Water Quality	Sediment Sources	Channel Modifications	Hydrology And Water Use	Noxious Weeds
Upper Thirtymile Creek	Mostly grasses with some brush species (hawthorn and willow) present. Moderate shade coverage and moderate LWD recruitment potential. There are areas within this section of the watershed that have successful CREP plantings.	Current Wetlands mostly in riparian areas or around springs.	The 30 Mile Creek substrate is mostly cobbley. The number of pools per mile is less than before the 1964 flood event. Stream bank erosion is higher than desirable. Fine sediments in riffles is higher than desirable. CREP is improving these limitations.	Information for long term analysis was non-existent. Extensive information was collected in the spring, summer, and fall of 2005. Temperature, dissolved inorganic nitrogen, orthophosphates, and pH were collected at 1 week intervals. Invertebrate were collected at 3 sites spanning the whole of 30 Mile Creek. Data shows that the only concern through the summer of 2005 was temperature and flow.	Bank erosion, roads, agriculture, and range activities are located on highly erodible soils and are influencing sediment in 30 Mile Creek	After the 1964 Christmas floods the main channel was eroded to the point that the original channel was unrecognizable in sections of the lower watershed. Land owners report that portions of the stream have healed significantly and other sections still are damaged.	During the summer months flows reduce to nothing during the dry part of the year. There is some irrigation but flow reductions are caused more from poor riparian areas and lack of woody vegetation.	Knapweed, Toadflax. Scotch Thistle, and Yellowstar Thistle are the main noxious weeds of concern

Map 1.1: Location of the Thirtymile Creek Watershed



Chapter 1: Watershed Overview

Location:
The Thirtymile Creek watershed is located in the north central part of Oregon, in Gilliam County. Thirtymile Creek joins the John Day River at river mile 218. **Map 1.1** shows the location of the watershed.

Watershed Boundaries
The Thirtymile Creek Watershed is a **5th field HUC** watershed, as designated by the State of Oregon 5th Field Watersheds. As the State of Oregon has not designated sub-watershed boundaries for this part of Oregon, the Gilliam-East John Day Watershed Council had divided the Thirtymile Creek Watershed into 2 sub-watersheds based upon changes in ecological sites that fall very closely to State Highway 19.

Streams
There are many intermittent creeks and canyons that drain into Thirtymile Creek. Most of these creeks and canyons have a minimal impact on Thirtymile Creek, so, only creeks will be listed here that are marked as perennial or have the potential for significant impacts on topographic maps:

- Sniption Creek
- Badger Creek
- Searcy Creek
- Little Searcy Creek
- East Fork Thirtymile Creek
- Trail Fork Creek

Population
Thirtymile Creek watershed is a rural watershed with one small population center. The City of Condon has a population of 759 with 413 housing units and is on the far north edge of the watershed. Estimated total population for the watershed is approximately 810. Rural homes and family farms are dispersed throughout the valley and foothills of the watershed.

Land Uses
Gilliam and Wheeler County zoning in the Thirtymile Creek watershed includes areas of Rural Residential/ Exclusive Agriculture, Grazing, Timber Grazing, Agriculture/Timber/Grazing and Farm Residential.

Agriculture: The majority of the farm ground in the watershed is devoted to dryland agriculture. The major crop grown is wheat with a year of summer fallow.

Timber: Most of the timber ground is managed by private land owners where technical assistance is received through the Oregon Department of Forestry there are also small acreages belonging to the Umatilla National Forest.

Grazing: There are several grazing allotments managed by the National Forests and Bureau of Land Management. Cattle, sheep, horses, and other livestock are grazed on private lands. From the 1890's until the 1950's the watershed was grazed by large flocks of sheep. Most of the grazing was converted to cattle in the 1950's.

Rural Residential and Farm Residential: There are a number of residential homes and farms located throughout the 30 Mile Creek watershed.

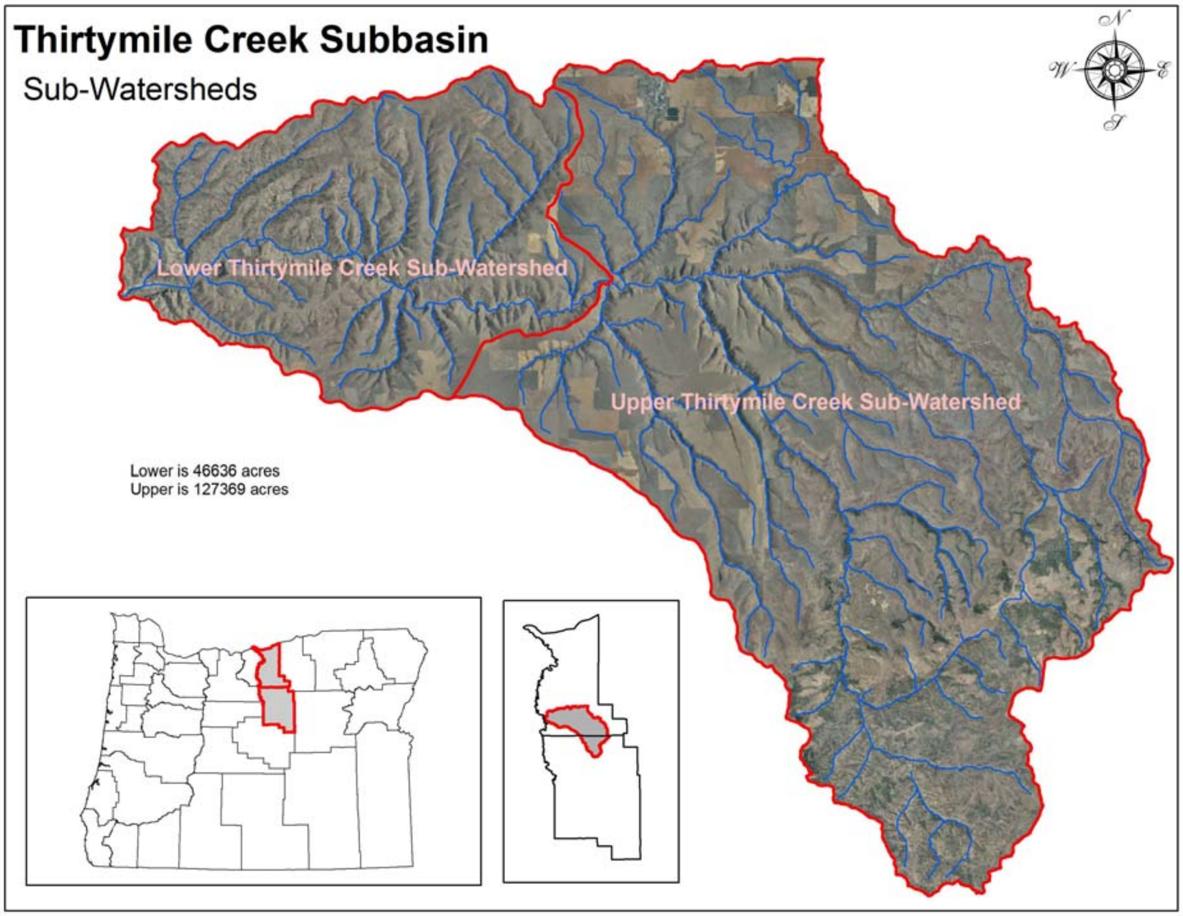
Land Ownership

Map 1.2 shows land ownership in the Thirtymile Creek watershed. **Table 1.1** shows land ownership acreage in the Thirtymile Creek watershed.

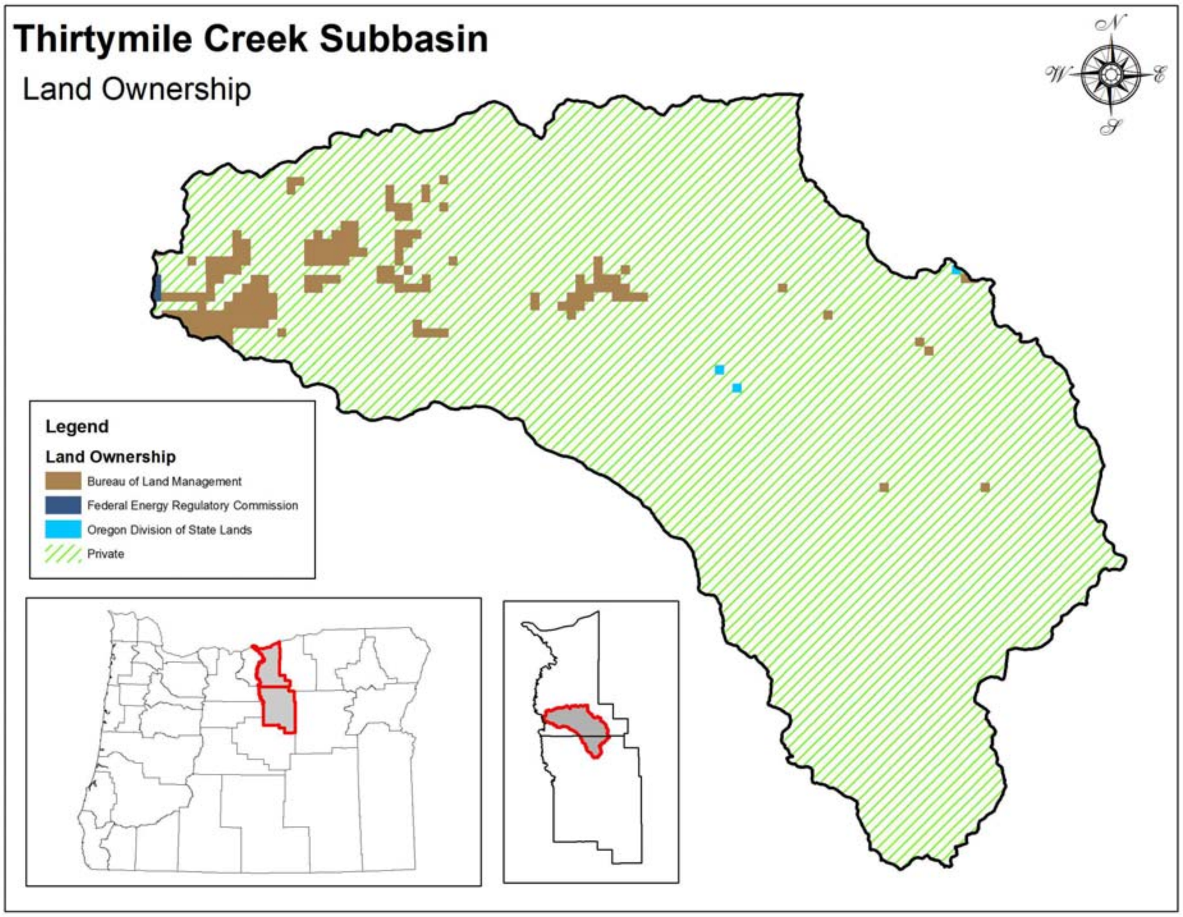
Table 1.1: Land ownership in 30 Mile Creek watershed

OWNER	ACRES	% OF WATERSHED
Private	166,899	96%
Bureau of Land Management	6,883	4%
State of Oregon	116.2	<1%
F.E.R.C.	106.2	<1%
All Lands	174,004	100%

Map 1.2: Subwatersheds of the Thirtymile Creek Watershed

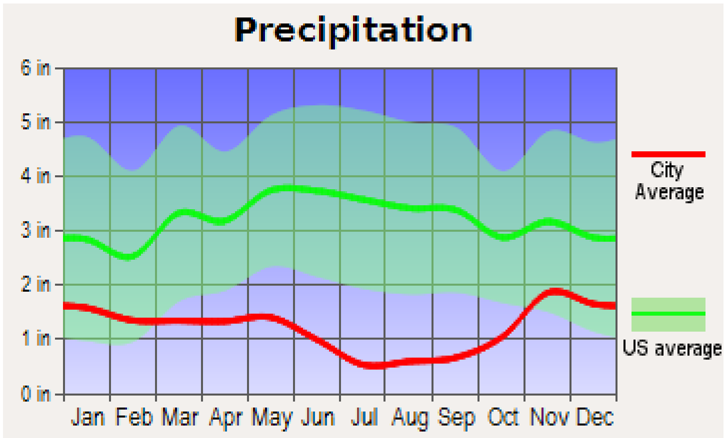

Thirtymile Creek Subbasin
Sub-Watersheds
Lower Thirtymile Creek Sub-Watershed
Upper Thirtymile Creek Sub-Watershed
Lower is 46636 acres
Upper is 127369 acres

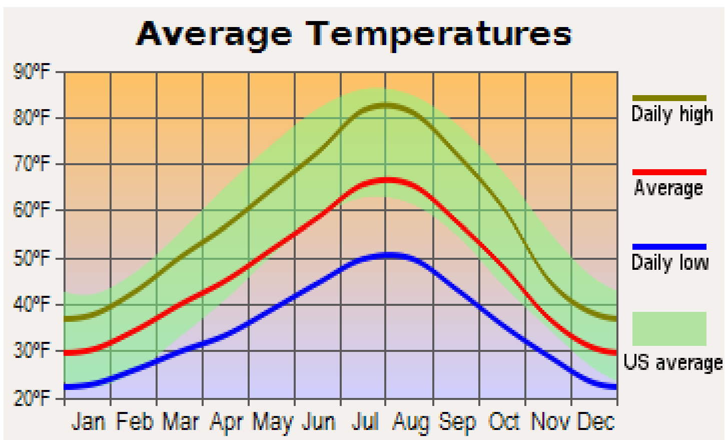
Map 1.3: Land Ownership in the Thirtymile Creek Watershed

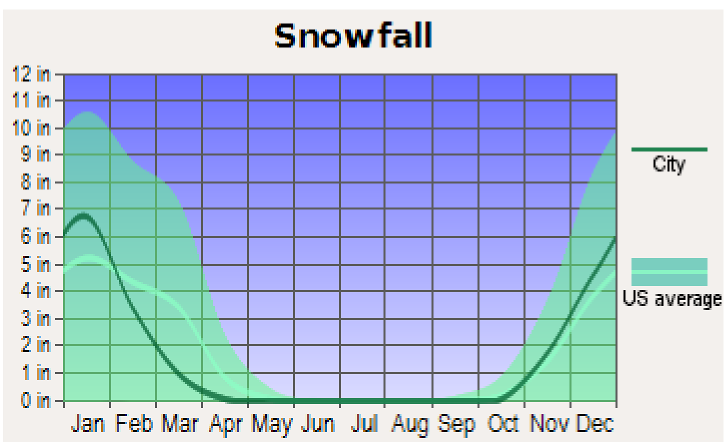


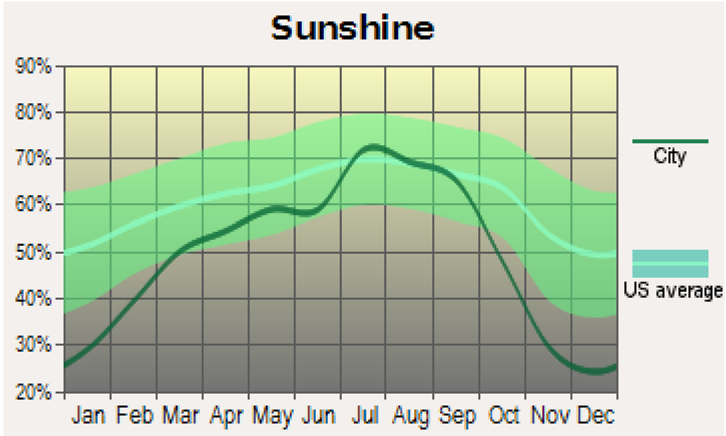
Climate

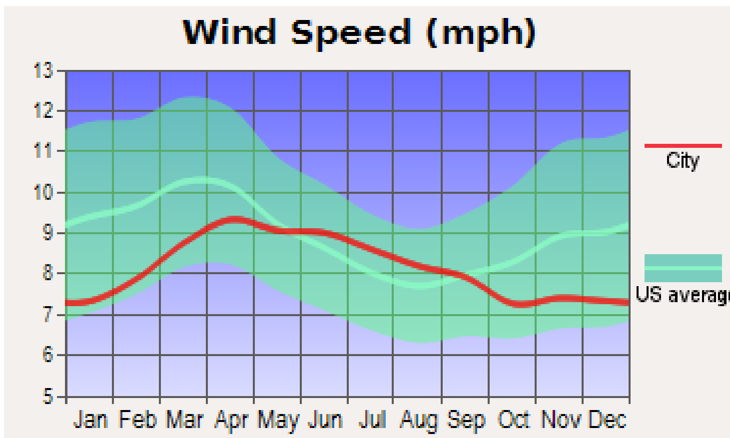
The only weather station in the watershed is located in the City of Condon. The information presented in this chapter is from that weather station.











Sources: http://www.city-date.com

Mean monthly temperature changes with the seasons and elevation in the watershed. The coolest month is January, with a mean temperature of 31.6˚F at Condon. The warmest month is July, with a mean temperature of 66.4˚F. (Oregon Climatic Service)

Average annual precipitation varies within the watershed. Where Thirtymile Creek enters the John Day River is less than 10 inches. In the uplands, it varies between 20 and 40 inches per year. The majority of precipitation occurs during the winter and early spring. The driest month is July and the wettest month is November. The average precipitation in Condon is 12.94 inches. (Averaged since 1928, Oregon Climatic Service)

Geology

The geology of the Thirtymile Creek Watershed is dramatically diverse. The lower and middle sections of Thirtymile Creek are in the Columbia Plateau physiographic province and the upper part of the watershed are in the Blue Mountain section of this province. Generally, most of the watershed is a plain that was covered by molten basalt and then uplifted. The basalt in the floor of the plain is overlain by wind-deposited silt. Elevation of the plain ranges from 984 feet at the mouth of Thirtymile Creek to approximately 5,100 feet on the highest ridge. Relief is dominantly nearly level to rolling on the plain above the dissected streams.

The Blue Mountain section is a tilted, folded, and faulted uplift of the Columbia River basalt and older underlying rocks. This section is characterized by flat topped, ridges, broad flats, and steep walled canyons. Topography is mainly the result of erosion and stream cutting in the basalt. Ash deposited during the past volcanic activity in the Cascade Mountains has influenced the soils in the Blue Mountain section, especially north facing exposures. The drainage pattern of the watershed is mainly effected by the underlying basalt. The mantle of loess has had little effect on modifying this pattern. Stream gradient is determined by the tilt of the basalt.

Forests

Forest lands in the Thirtymile Creek watershed can be divided into 2 types: lowland dry forest and montane forest.

Lowland Dry Forest

The high temperature and low moisture levels characteristic of this forest limit the number of species that can grow in this zone. Historically, these forests have been composed of the fire-resistant and fire dependant tree species Ponderosa pine and Western larch, which can survive in this climate. Historically, wildfires that occurred every five to 30 years prevented fuel buildup, so fires were usually low in intensity. Ponderosa pine and Western larch were selected for by fires, as other tree species were more easily killed by these fires. In unmanaged forests, Ponderosa pine tends to replace itself as it matures. Because of fire suppression , dense multi-layered stands of other conifer species, such as Grand fir, have sprung up underneath the canopy. Now these species ultimately tend to replace the Ponderosa pine and Western larch when mature trees die. Shade from the dense understory does not favor seedling and sapling Ponderosa pine from surviving and growing. Poor, dry sites with shallow soils, remain dominated by Ponderosa pine, even when fire is suppressed, since only Ponderosa pine is adapted to the poor growing conditions.

Montane Forest

Mixed-conifer forests are typical between the foothills and the sub alpine zones of the Blue Mountains. Here, forests contain a larger number of species than the lower, drier pine-dominated forests. Grand fir, Ponderosa pine, Douglas fir, Western larch, Engleman spruce, Lodgepole pine, and other conifer species can all be represented in montane forests. These forests are more productive than lowland forests and there is a larger natural fuel build-up. Fires occur every 20-40 years, with some of these fires stand-replacing. These forests are favored by long intervals between fires and disturbances. Insects and diseases are common occurrences in mixed-conifer forests and can kill off entire stands. Trees and insects have co-evolved together, and regeneration can be dependant upon insects to kill entire stands, when not altered for timber production.

Grassland and Wetland Communities

The Thirtymile Creek watershed includes forest, grasslands, and wetland plant communities. Agriculture has replaced many acres of grassland and wetlands in the watershed, but soil types indicate what the potential plant communities are.

In the Soil Survey of the Gilliam County Area, each soil type description describes the potential plant communities found in uncultivated areas of that soil type. In addition to the coniferous forest in the uplands, the soils in the Thirtymile Creek watershed support a number of grassland communities. These include: Bluebunch Wheatgrass/Idaho Fescue/Stiff Sagebrush; Bluebunch Wheatgrass/Idaho Fescue/Sandberg Bluegrass; Bluebunch Wheatgrass/Idaho Fescue/Big Sagebrush; Bluebunch Wheatgrass/Idaho Fescue. One other potential plant community is: water tolerant grasses/sedges/rushes.

Riparian Vegetation

Riparian vegetation is dependant upon the elevation and topography of the stream. In the Thirtymile Creek watershed, riparian vegetation will generally be willow, other brush species, and cottonwoods along streams in the valley floor. However, it is thought that only brush species, not hardwoods, grew historically along lower Thirtymile Creek, because of seasonal inundations. In higher forested regions, riparian vegetation will generally be composed of conifers, such as Grand Fir, hardwoods, such as Cottonwood and Alder, and some brush species such as Willow. (OWEB, Ecosystem Appendix, 1999).

Fish and Wildlife

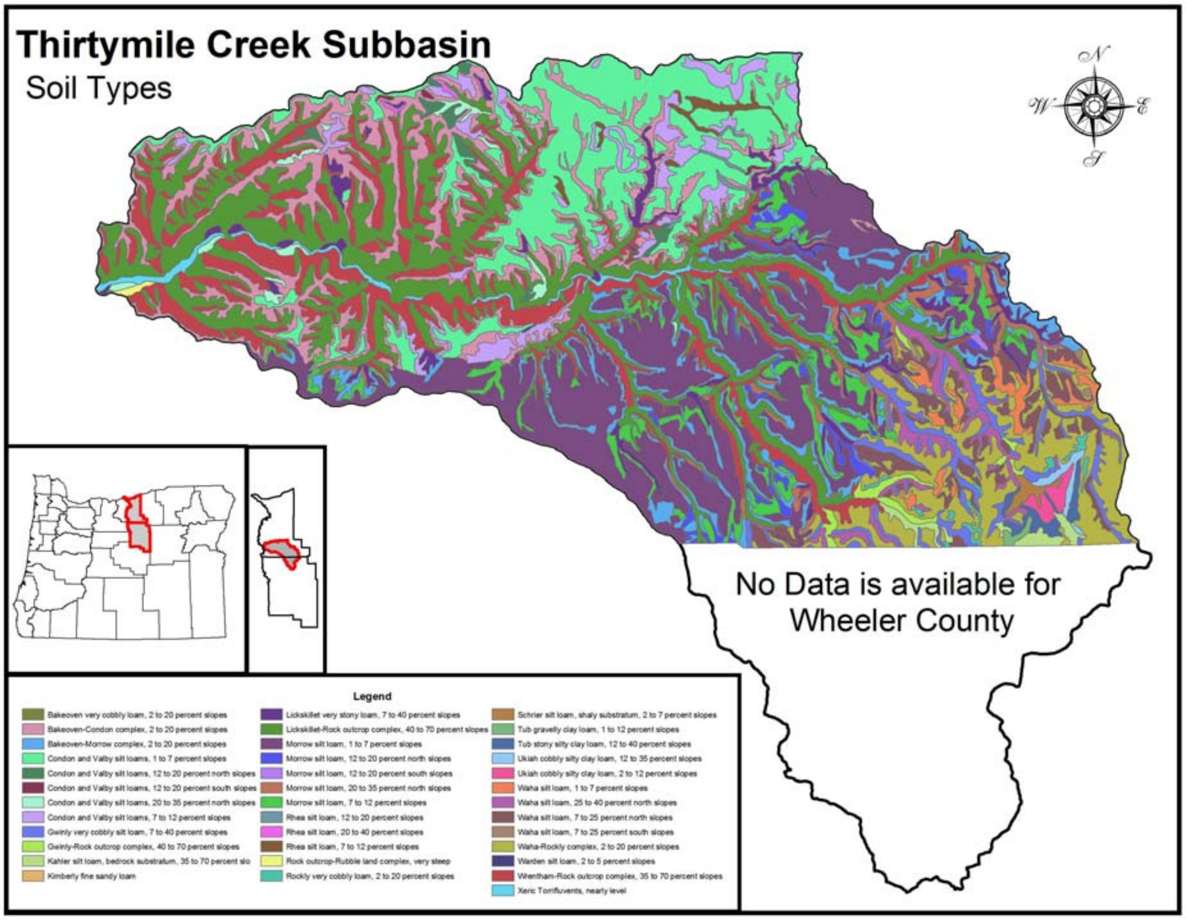
Summer steelhead and rainbow trout are among the cold water fish species currently found in the Thirtymile Creek watershed. There are also a number of non-salmonoid fish, including dace, sculpins, shiners, suckers, squawfish, and small mouth bass.

Wildlife residing in the watershed include deer, elk, cougar, bear, big horn sheep and numerous migratory and resident bird species, beaver, and many other species. Most species known or suspected to occur historically in the watershed still do, with the exception of grizzly bears and the gray wolf. While species that thrive in early serial stages have increased in numbers, other species' numbers have declined. (Personal communication with Tim Unterwegner)

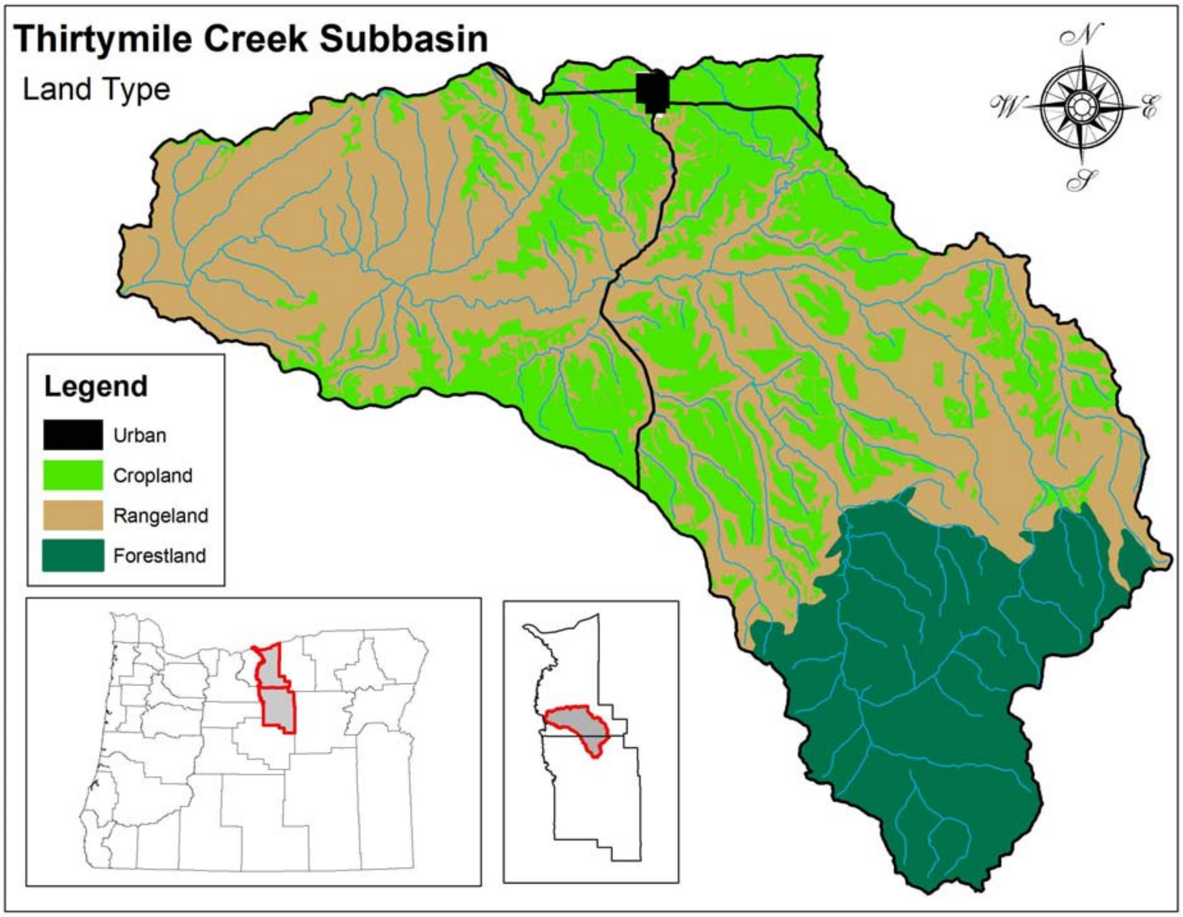
Noxious Weeds

There are a number of noxious weeds found in the Thirtymile Creek watershed. Knapweed is considered by the Gilliam County Weed Control Board to be the most severe noxious weed problem in the watershed area. (Personal communication with Don Farrar) It is mostly found in areas where there is heavy grazing or some sort of human activity, it is also located along roads high up in the watershed. Knapweed is known to spread by water, putting riparian habitat at risk of invasion (Sheley & Petrof, 1999).

Map 1.4: Gilliam County Soil Survey General Map



Map 1.5: Thirtymile Creek Land Types



Soils

Soils in the Thirtymile Creek Watershed vary based upon geology and topography. **Map 1.4** shows the soil complexes in Thirtymile Creek watershed. The numbers on the map correspond to the description below the map. There are five basic soils in the watershed area:

Lickskillet-Wrentham – Shallow and moderately deep well drained very gravelly silt loams and very stony loams.

Condon-Valby – Moderately deep, well drained silt loams.

Morrow-Bakeoven – Very shallow and moderately deep, well drained silt loams and very cobbly loams.

Waha-Gwinly-Rockly – Very shallow to moderately deep, well drained stony silt loams, very cobbly loams and very cobbly silt loams.

Tub-Simas-Ukiah – Moderately deep and very deep, well drained stoney silt loams, cobbly silty clay loams and stoney silty clay loams.

Ecoregions

Oregon is divided into ecoregions based upon climate, geology, physiography, vegetation, soils, land use, wildlife, and hydrology (OWEB manual, Ecoregion Appendix, 1999). Each ecoregion has characteristic disturbance regimes that shape the form and function of watersheds in the region. Generalized ecoregion information characterizes patterns within a watershed that can aid in understanding watershed processes.

Thirtymile Creek watershed lies within the John Day Basin: Lower John Day Sub-Basin with three level IV ecoregions: Umatilla Plateau (10C), Deschutes/John Day Canyons (10k), and the John Day/Clarno Highlands (11b).

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Draft Ecosystem Appendix, Oregon Watershed Assessment Manual, Salem, Oregon: prepared for the Oregon Watershed Enhancement Board. 2001

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Chapter 2: Historical Conditions

Introduction

Explorers and settlers in the 1800s often documented the area around the Columbia and John Day Rivers in journals, dramatically different from today's agricultural lands. "We had no sooner gained the foot of this mountain than another more steep and dreadful was before us. After dinner and rest we descended it. Mount Pleasant, in Prattsburg, would not compare with these Mount Terribles. Our ride this afternoon exceeded anything we have had yet, and what rendered it the more aggravating was the fact that the path all the way was very stony, resembling a newly macadamized road. Our horses' feet were very tender, all unshod, so that we could not make the progress we wished. The mountain in many places was covered with this black broken basalt. We were very late in making camp to-night. After ascending the mountain we kept upon the main divide until sunset, looking in vain for water and a camping place. While upon this elevation we had a view of the Valley of the Columbia River. It was beautiful. Just as we gained the highest elevation and began to descend the sun was dipping his disk behind the western horizon. Beyond the valley we could see two distinct mountains - Mount Hood and Mount St. Helens. These lofty peaks were of a conical form, separated from each other by a considerable distance. Behind the former the sun was hiding part of his rays, which gave us a more distinct view of this gigantic cone. The beauty of this extensive valley contrasted well with the rolling mountains behind us, and at this hour of twilight was enchanting and quite diverted my mind from the fatigue under which I was laboring. We had yet to descend a hill as long, but not as steep or as stony as the other. By this time our horses were in haste to be in camp, as well as ourselves, and mine made such lengthy strides in descending that it shook my sides surprisingly. It was dark when we got into camp, but the tent was ready for me, and tea also, for Mr. McLeod invited us to sup with him. (Narcissa Whitman)"

Other documentation talks about huge grasslands with well timbered mountains, abundant water, with fields of camas and riparian forests with cottonwood, willow, and other woody species. Today, virtually all historic wetlands, camas fields, and cottonwood forests have been drained, cleared, and converted to farm land (Gildmiester 1999).

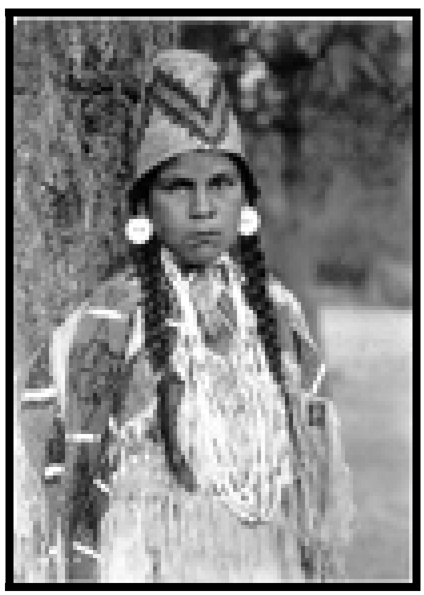
Methods

Various oral histories, historical reports, and compilations of historical information were gathered for this chapter. Pertinent information has been included in the text of this chapter, with references at the end of the chapter. Some of the quotes and references are for Oregon in general and not specific to the Columbia Basin

Results

Native Americans

Nez Perce Indian Women



Umatilla Indian Women

The evidence shows that there were Native Americans living on the Columbia Plateau as long as 15,000 years ago. There is no documentation of tribes living in the Thirtymile Creek watershed but evidence in several locations show pictographs and camp sites. The tribes located in that area were originally the Wascos, Tenino, Wyams, Tygh or Ty-ichs, Snakes and Piutes. The book, The First Oregonians, describes the tribes living in this area as Nez Perce, Umatilla, John Day, Celilo, Tenino and Tygh Valley people (Sue Greer).

Camas root and berries was a staple of the Native Americans' diet, and it was plentiful in the Blue Mountains. During the winter they would live close to the Columbia River in small houses made of tule. In March they would catch spawning suckers and then dig various roots in the foothills. In May the Chinook salmon run would start with various runs of steelhead and salmon through the spring until fall. Usually during the heat of the summer the various Indian families would move to higher elevations to avoid the heat. While on these trips they would dig camas, collect berries, and hunt.

Columbia Basin tribes acquired horses in the 1730's (Hug 1861). When the first white visitors came to the Columbia Basin they reported thousands of horses grazing in the vicinity of the various tribes camps. Some feel that this was the first major impact to riparian areas in the west.

Fur Trappers and Explorers

Early journals indicate beavers were plentiful (Gildemiester 1999). In a few decades, with the arrival of the fur trade, beavers were systematically removed from the upper elevations of the Blue Mountain watersheds (ibid). By the 1860s, when the beaver were almost removed entirely, the control beaver had over stream flows, water quality, and sediment was removed as well. Meadows previously "irrigated" by beaver dams became dried (ibis). Nathaniel Wyeth wrote in 1832 that "Streams are being trapped out by mountain men" (qtd. In Gildemiester 1999).

The Oregon Trail

The Oregon trail began in 1841, the largest historical migration of people in the United States (Evans 1990). When passing through the Columbia Basin the train stayed mainly next to the river with a few spurs passing in other areas. While the trail did not pass through what is today the Thirtymile Creek watershed, the people that it brought would shape the area's future.

First Settlers

Gilliam County's western border is formed by the John Day River, named after a member of the Astor-Hunt overland party. Entrepreneur John Jacob Astor sent the party west from St. Louis in 1810 with the goal of setting up a post at the mouth of the Columbia River. Astor wanted to dominate fur trapping in the region. The expedition became divided and widely separated. Experiencing incredible hardships, John Day's group dwindled to two people. Close to the mouth of the river that would later bear his name, Day and Ramsey Crooks were attacked by hostile Indians and robbed of everything—even their clothes. While they were soon rescued, one source claimed that Day later went insane and died in 1814 (Oregon Blue Book).

The first permanent settlers came to Gilliam County in 1862 by what was later called "The Reverse Migration" of people who originally settled in the Willamette Valley. Thirtymile Creek has its own unique history. The first settlers in the Thirtymile Creek drainage were at the mouth where Thirtymile Creek and the John Day River join. A family by the name of Armstrong built a house in 1869 and started to raise cows, sheep, and hay. They also ran a ferry to help travelers cross the John Day River. Their home is still standing and is used as a cabin for the Rattray family.

Armstrong Home Built in 1869

Graham's were the second family to move into Thirtymile Creek and then a family by the name of Smith arrived. The Smith's also built a ferry and competed with the original Armstrong's for business. Pemberton's settled up Thirtymile Creek and raised sheep and hay. A family by the name of Moore bought most of the mouth of Thirtymile Creek and owned it until 1933 when the current owners, Rattray, purchased it during the depression (Personal Communication with John Rattray).

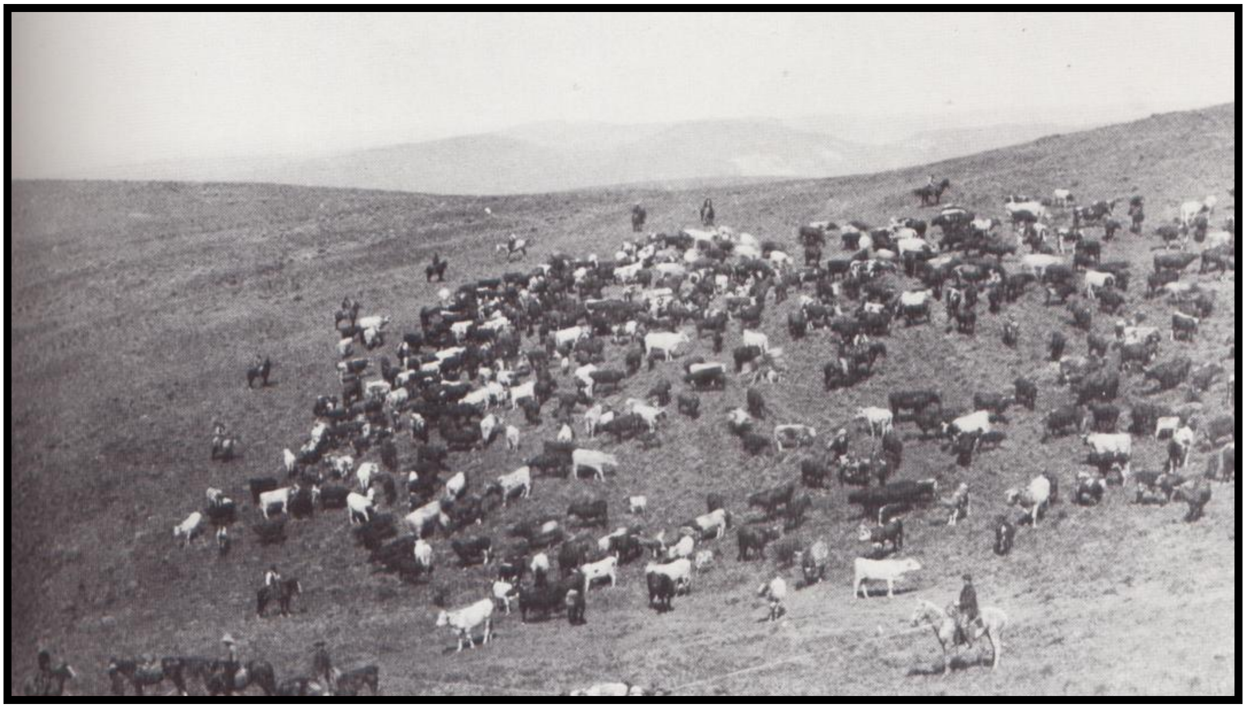
Interviewees say that Thirtymile Creek had floods in 1948 and 1949 that caused severe damage but nothing compared with the floods of 1964. In 1964 Thirtymile Creek was scoured and land owners along the creek said that Thirtymile Creek flowed perennial until 1964 and now large sections are intermittent. It was also stated by land owners along Thirtymile Creek that before 1957 there were always numerous fish observed spawning along the Creek but from 1957 until 1985 very few steelhead were observed. Some landowners felt that the reduction in fish was due to the large saw mill installed at a location called Kinzua and that steelhead runs increased when the saw mill was closed (Rattray & Hardie).

Farther upstream the first member of the Hardie family (Alex) arrived in what is now called Gilliam County from Scotland in 1875 and hearded sheep in the upper reaches of Rock Creek near the town of Lonerock. Bill Hardie tells a family story: "On Christmas day, 1879, Alex's brother, David, walked into Lonerock, fresh from Scotland. It was the first time in nearly five years that Alex had seen another member of his family. David was then 17. His route from Scotland had been by steamer to New York, by train to San Francisco, and then by a series of boats to The Dalles. The last lap, from The Dalles to Lonerock, was by foot. The temperature dipped to minus 24˚ F. on Rock Creek that December, two days before David reached Lonerock". In 1880 Alex homesteaded a 160 acres on Papersack Creek which is a tributary to Thirtymile Creek. Bill Hardie says that he remembers as a boy seeing his father pitch fork steelhead out of Trailfork Creek at the homestead where he was born and his grandfather David homesteaded in 1883.

Scottish celebration at Oregon Hotel, 1907, note kilts and piper.
(No doubt there were Hardie's present)

There were many families that have their own stories of the hardships that they faced while trying to make a living in the early days along Thirtymile Creek. Names like Dyer, Verse, Maddock, Russell and others that were mentioned with respect and fondness (personal communication with Bill Hardie).

Grazing/Agriculture



Cattle roundup near Mayville, approximately 1900

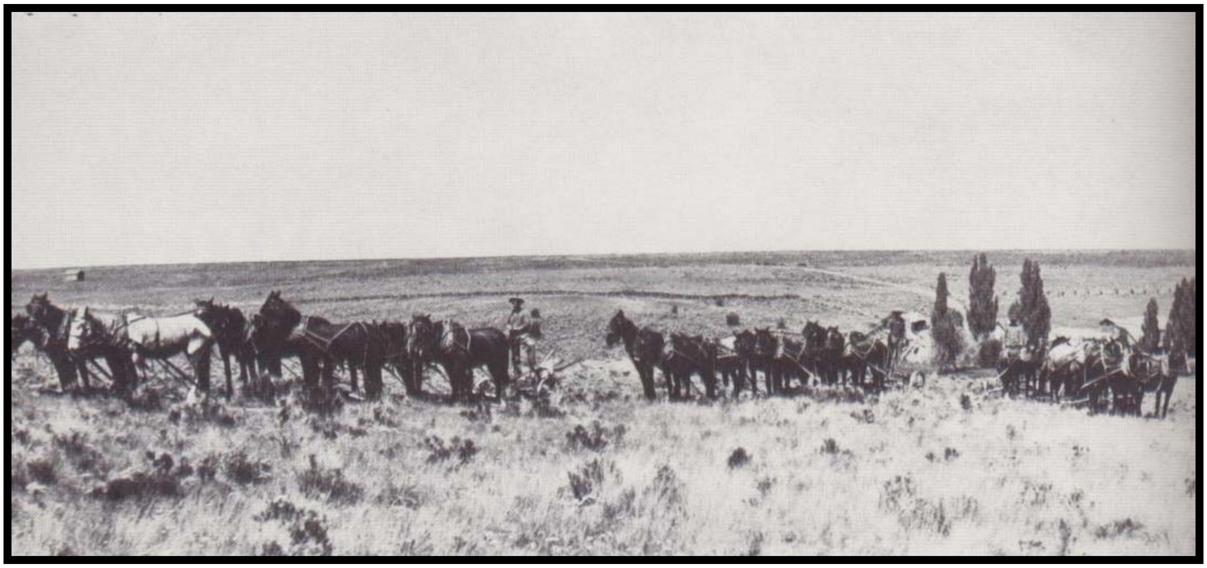
"A most noticeable change has taken place in Gilliam County, Oregon, during the past ten years. Namely, the conversion of the cowboy into an ordinary farmer. Ten short years ago the resident of this part of Oregon knew little of the meaning of wheat or barley raising, while today, these same two articles are its principle productions. The early settler came to this county with the sole intention of raising cattle and sheep. Today he keeps just enough cows to supply his household with milk and butter.

Another very noticeable feature is the change in the climatic condition. When this country was covered with the tall, waving bunch grass, the annual amount of rain-fall amounted to little or nothing, and the winters were severe to an extreme, the mercury frequently registering 20˚ or more below zero.

While during the last five years, since over half of the tillable soil has been in cultivation, the annual rainfall has exceeded that of the proceeding five years by more than three times, and only once in the past three years has the mercury reached the zero mark, and then only 4˚ below for one day.

At the time of the writers first visit to this county twelve years ago, there was not a barbed wire fence to be seen, and every man you saw with the exception of a few business men in the various wetting points, owned a saddle pony and wore Chappederos, Spurs, and fanfare. While today there is one continuous stretch of barbed wire fences extending over the entire length and breadth of the county. And a man wearing Chaps and Spurs is considered a curiosity" (Pauling 1939).

The original settlers raised sheep in the Thirtymile Creek watershed. It is estimated that within the lower Thirtymile Creek watershed there were 6 bands of sheep that lived year long within the canyon. One band of sheep in those days constituted approximately 1,500 animals which made a total of 9,000 animals. Starting in 1920 settlers started plowing the bunch grass and planting wheat. The first yields were approximately 17 to 20 bushels with a year of summer fallow. The yields now are 30-35 bushels with a year of summer fallow. Sheep was the main livestock produced until the 1940's when cattle began to replace sheep (Rattray & Hardie).



Virgin grasslands near Mayville were plowed by eight and nine horse teams

Discussion

There have been many changes to the Thirtymile Creek watershed since the early 1700s when the horse was introduced by Native Americans. Numbers of horses owned by Native American families was a sign of their wealth. Some tribes owned literally thousands of head of horses. Since then fur trappers have come and gone, taking the beaver with them. Settlers have passed through and many stayed or returned. Land has been cleared; farms have been cultivated. Wetlands have been drained. Roads have been built. Noxious weeds have entered the landscape. Humans have changed the landscape, through extracting resources and putting the land into agricultural production.

We cannot entirely return the watershed to its original, pristine state, as the land is now a livelihood for many people. We do not fully understand or know what its "original" state was. Some changes that may have impacted the watershed the most occurred when there was little documentation of their effects, such as removal of the beaver in the mid 1800s. As things currently stand, we can try to restore aspects of the watershed that benefit the habitat of aquatic and terrestrial species that we share the land with, while maintaining a viable economy. The following chapters of this assessment characterize the current conditions of the watershed and identify restoration opportunities.

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Chapter 3: Channel Habitat Types

Introduction

In this chapter, the streams in the Thirtymile Creek watershed have been classified as various channel habitat types (CHTs). Stream classification groups stream reaches into "types", thereby creating a root for understanding how land uses can affect and alter stream channel form. Stream classification also can assist in identifying how different "types" will respond to restoration efforts.

Background

Stream classification is the designation of a stream network, stream, or segment as a generic "type", based upon certain characteristics of the stream. The OWEB system, Channel Habitat Typing, is used to classify stream segments in Oregon into basic channel types. This system is a compilation of previously existing classification systems, including Rosgen and the Tongass National Forest systems. By using a classification system at this scale, patterns can be predicted in channel physical characteristics, but the scale is still broad enough to be identified from topographic maps and limited field work. (WPN 1999)

Methods

USGS topographic maps were used as the base map for channel habitat typing. A map distance meter was used to calculate the length of each reach.

Streams were divided into individual reaches based upon the following guidelines:

- Minimum segment length of 1,000 feet
- Segments were broken out at stream convergence
- Segments covered a minimum of 3 contour lines on USGS topographic 1:24,000 scale maps
- Segments were broken out where distances between contour lines changed significantly
- Segments that were channelized/straightened were broken out

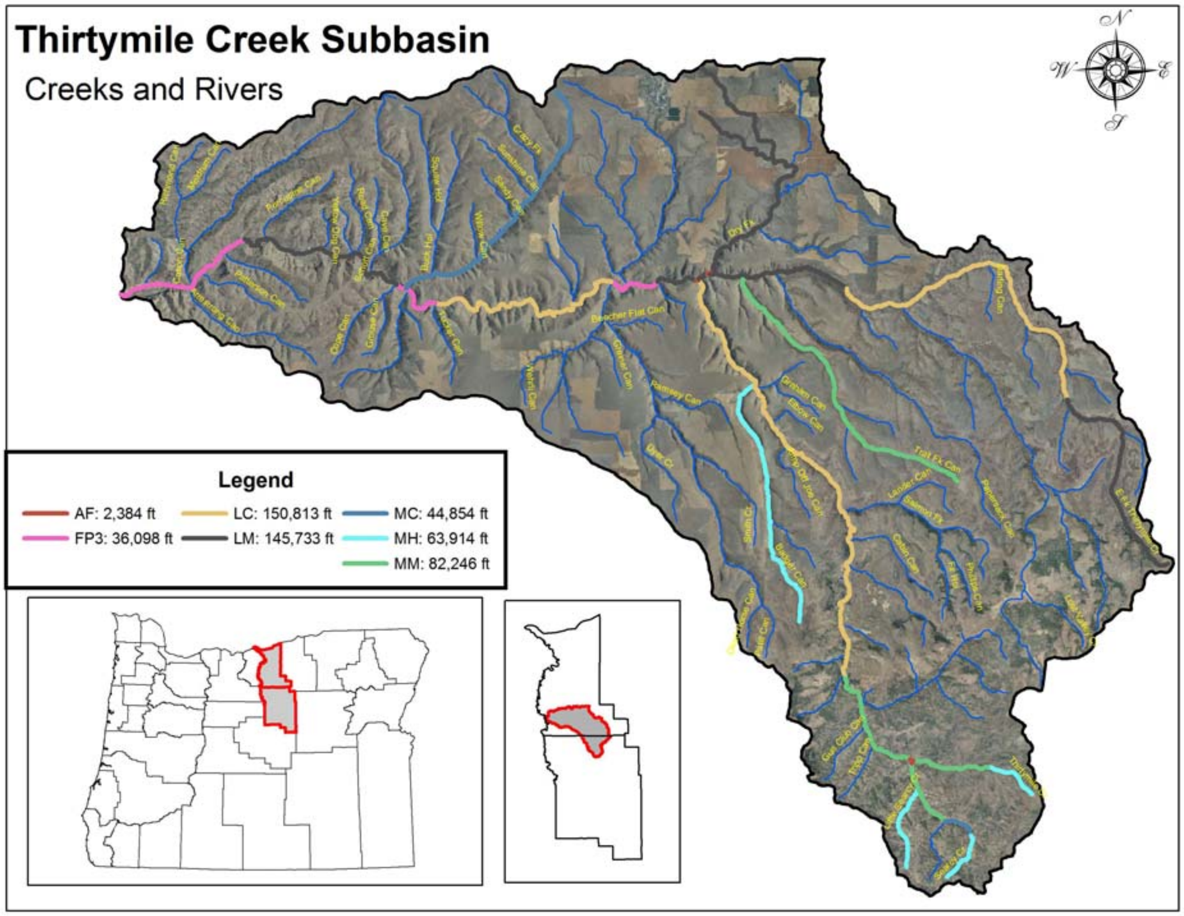
Once streams were divided into reaches, channel gradient and channel confinement were calculated for each reach. According to the OWEB manual, channel gradient is defined as "the slope of the channel bed along a line connecting to the deepest points of the channel". Channel gradient was calculated by dividing the difference in elevation by the horizontal distance of a given length of stream. This was done by measuring the length of the reach, using a distance meter, and the difference in elevation, using USGS topographic maps and a GPS unit. Once channel gradients were calculated they were divided into gradient classes: <1%, 1-2%, 2-4%, 4-8%, 8-16%, and >16%.

The OWEB manual defines channel confinement as "the ratio of bankfull channel width to width of modern flood plain". For Channel Habitat Typing, confinement is broken into three classes: Unconfined, Moderately Confined, and Confined. As channel confinement is difficult to accurately determine from topographic maps alone, in this assessment, confinement was classified based upon both topographic and flood plain maps, which show the **100-year flood plain.** While the 100-year flood plain does not necessarily correspond with the modern flood plain, or the "**flood-prone area"**, using flood maps helped verify the confinement classes assigned to reaches using USGS topographic maps.

Completely channelized reaches as mapped on the 1:100,000 EPA stream layer and the USGS topographic maps were not assigned CHTs. As the length of the stream is shortened when channelized, designating a channel habitat type based upon this method may result in an inaccurate CHT. It should be noted that there was only one short area briefly above the mouth of 30 Mile Creek that appeared to be channelized.

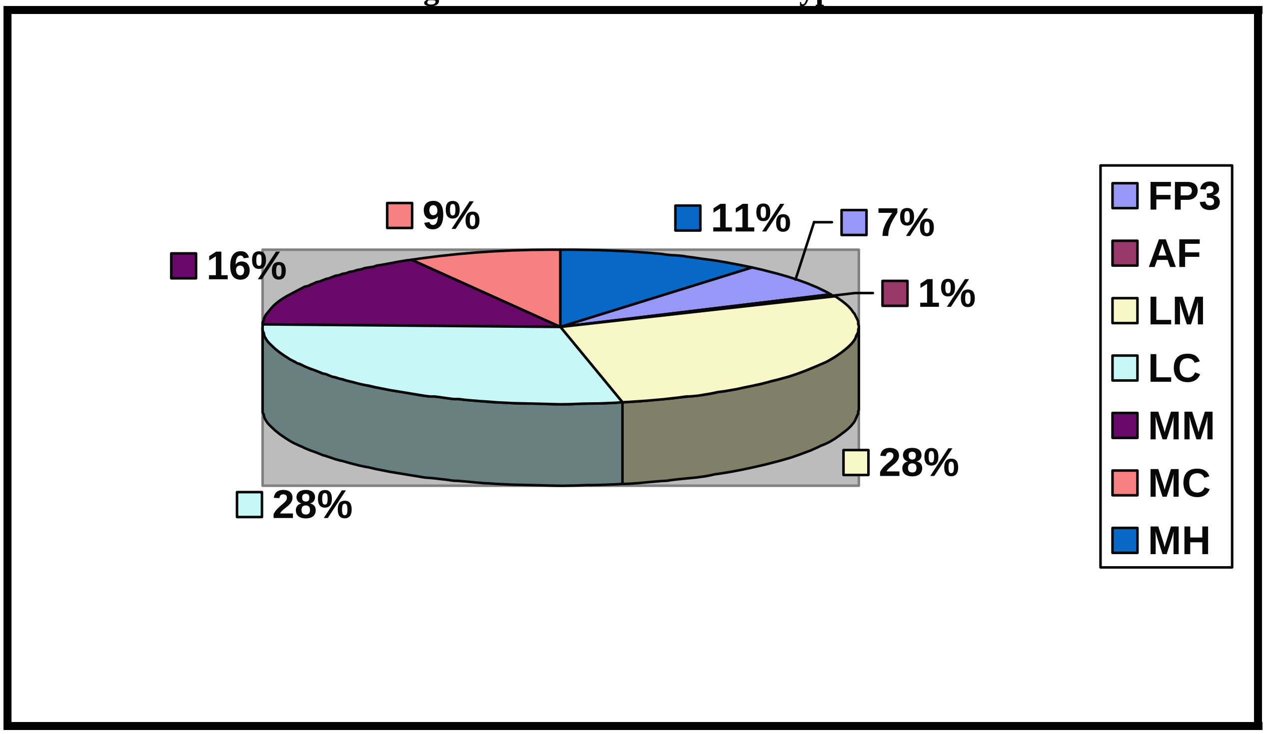
Oregon Youth Conservation Corps (Stream Measurements)

Map 3.1: Channel Habitat Types



Results

Figure 3.1 Channel Habitat Types



Discussion

As stated in the channel habitat type characterizations in **Appendix 3.1**, some channel habitat types are more responsive to stream enhancement efforts than others. However, all respond favorably to riparian vegetation. Revegetation of riparian areas is the single most important aspect of riparian restoration. Riparian vegetation helps to stabilize stream banks, reduce water temperatures, and provide flood control and other benefits to riparian areas. It can also act as a buffer between aquatic ecosystems and adjacent land uses. For more information on the conditions of riparian areas in Thirtymile Creek, see Chapter 5, **Riparian Areas.**

Channel habitat types are most useful when determining how a section of stream will react to in-stream treatments. The active energy and lateral movement of floodplain channels (FP2 and FP3) limit the success of in-stream treatments except at a very local scale. The steeper channel types (SV, VH, and MV) also are often only responsive locally, as the steepness and confinement of the stream channel limits the effectiveness of treatment. Alluvial fans (AF) do not easily lend themselves to stream enhancement, as the high levels of sediment deposition can limit the success of habitat complexity efforts, such as large wood placement for creation of pools.

The most responsive CHT's to in-stream treatments are moderately confined to unconfined and low to moderate gradient (LM, MM, and MH). These channel habitat types are the best areas to concentrate on increasing stream habitat complexity. They also are among the most responsive to changes in land management activities (floodplain CHTs are the others). As they are not confined by topography, these channel habitat types are more affected by changes in sediment loads (fine and course), peak flows, and large woody debris. For example, removing woody debris can decrease the number of pools and other stream habitat complexities. An increase in sediment load can cause streambed scouring and/or bank erosion. When streams are artificially confined (limited in lateral movement), the channel may react by down cutting or scouring. This disparity between potential and actual channel habitat type can be identified at the project level. Information on how to restore a stream to its potential channel habitat type is included in **Chapter 10: Fish and Fish Habitat.**

Data Gaps

- **None**

References

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Appendix 3.1: Description of Channel Habitat Types

Included below are descriptions of channel habitat types present in the Thirtymile Creek watershed. This information is taken from the OWEB Watershed Assessment Manual. More detail on these and other channel habitat types can be found in Appendix A of Component III of the manual.

Note that the descriptions focus on in-stream process. As all channel types respond favorably to riparian revegetation, this is not emphasized in the descriptions. But it is still an integral, perhaps the most important, part of stream and riparian restoration.

Low Gradient Small Floodplain Channel: FP3

FP3 streams are located in valley bottoms and flat lowlands. They frequently lie adjacent to the toe of foot slopes or hill slopes within the valley bottom of larger channels, where they are typically fed by high-gradient streams. This may be directly downstream of a small alluvial fan and contain wetlands. FP3 channels may dissect the larger floodplain. These channels are often the most likely CHT to support beavers if they are in the basin. Beavers can dramatically alter channel characteristics such as width, depth, form, and most aquatic habitat features.

These channels can be associated with a large floodplain complex and may be influenced by flooding of adjacent main-stem streams. Sediment routed from upstream high and moderate gradient channels is temporarily stored in these channels and on the adjacent floodplain.

Channel Responsiveness

Floodplain channels can be among the most responsive in the basin. The limited influence of confining terrain features and fine substrate allows the stream to move both laterally and vertically. Although often considered low-energy systems, these channels can mobilize large amounts of sediment during high flows. This often results in channel migration and new channel formation.

Riparian and In-stream Enhancement Opportunities

Floodplain channels are, by nature, prone to lateral migration, channel shifting, and braiding. While they are often the site of projects aimed at channel containment (diking, filling, etc.), it should be remembered that floodplain channels can exist in a dynamic equilibrium between stream energy and sediment supply. As such, the active nature of the channel should be respected, with restoration efforts carefully planned. The limited power of these streams offers a better chance for success of channel enhancement activities than the larger floodplain channels. While the lateral movement of the channel will limit the success of many efforts, localized activities to provide bank stability or habitat development can be successful.

Alluvial Fan Channel: AF

Alluvial fans are generally tributary streams that are located on the foot-slope land form in a transitional area between valley floodplains and steep mountain slopes. Alluvial fan deposits are formed by a rapid change in transport capacity as the high-energy mountain-slope stream segments spill onto the valley bottom. Channel pattern is highly variable, often dependent on substrate size and the age of the land form. Channels may change course frequently, resulting in a multi-branched stream network. Channels can also be deeply incised within highly erodible alluvial material. Smaller alluvial fan features may be difficult to distinguish from FP3 channels.

Alluvial fans are usually at the lower end of small tributaries. Their dominate substrate is fine gravel to large cobble. Their size varies from small to medium.

Channel Responsiveness

The response of alluvial fans to change in input factors is highly variable. Response is dependent on gradient, substrate size, and channel form. Single-thread channels confirmed by high banks are likely to be less responsive than an actively migrating multiple channel fan. The moderate-gradient and alluvial substrate of many fans result in channels with a moderate to high overall sensitivity.

Riparian and In-stream Enhancement Opportunities

As many alluvial fans are actively moving at a rate greater than most channels, they are generally not well-suited to successful enhancement activities. Although they are considered responsive channels, long term success of enhancement activities is questionable. High sediment loads often limit the success of efforts to improve habitat complexity such as wood placement for pool development.

Low Gradient Moderately Confined Channel: LM

These channels consist of low-gradient reaches that display variable confinement by low terraces or hill slopes. A narrow flood plain approximately two to four times the width of the active channel is common, although it may not run continuously along the channel. Often low terraces accessible by flood flows occupy one or both sides of the channel. The channels tend to be of medium to large sizes, with substrate varying from bedrock to gravel and sand. They tend to be slightly to moderate sinuous, and will occasionally have islands and side-channels.

Channel Responsiveness

The unique combination of an active floodplain and hill slope or terrace controls acts to produce channels that can be among the most responsive in the basin. Multiple roughness elements are common with bedrock, large boulders, or wood generating a variety of aquatic habitat within the stream network.

Riparian and In-stream Enhancement Opportunities

Like floodplain channels, these channels can be among the most responsive of channel types. Unlike floodplain channels, the presence of confining land form features often improves the accuracy of predicting channel response to activities that may affect channel form. Additionally, these controls help limit the destruction of enhancement efforts common to floodplain channels. Because of this, LM channels are often good candidates for enhancement efforts.

In forested basins, habitat diversity can often be enhanced by the addition of roughness elements such as wood or boulders. Pool frequency and depth may increase, and side-channel development may result from these efforts. Channels of this type in non-forested basins are often responsive to bank stabilization efforts such as riparian planting and fencing. Beavers are often present in the smaller streams of this channel type. Fish habitat in some channels may benefit from beaver introduction through side-channel and scour pool development. Introducing beavers, however, may have significant implications for overall channel form and function and should be thoroughly evaluated by land managers as well as biologists as a possible enhancement activity.

Low Gradient Confined Channels: LC

LC channels are incised or contained within adjacent, gentle land forms or incised in volcanic flows or uplifted coastal land forms. Lateral channel migration is controlled by frequent bedrock outcrops, high terraces, or hill slopes along stream banks. They may be bound on one bank by hill slopes and lowlands on the other and may have a narrow floodplain in places, particularly on the inside of meander bends. Stream-bank terraces are often present, but they are generally above the current floodplain. The channels are often stable, with those confined by hill slopes or bedrock less likely to display bank erosion or scour than those confined by alluvial terraces.

High-flow events are well contained by the upper banks. High flows in these well-contained channels tend to move all but the most stable wood accumulations downstream or push to the channel margins. Stream banks can be susceptible to land slides in areas where steep hill slopes of weathered bedrock, glacial till, or volcanic-ash parent materials above the channel. The dominant substrate varies from boulder, cobble, or bedrock with pockets of sand/gravel/cobble.

Channel Responsiveness

The presence of confining terraces or hill slopes and control elements such as bedrock limit the type and magnitude of channel response to changes in input factors. Adjustment of channel features is usually localized and of modest magnitude.

Riparian and In-stream Enhancement Opportunities

These channels are highly responsive and in channel enhancements may not yield intended results. In basins where water temperature problems exist, the confined nature of these channels lends itself to establishment of riparian vegetation. In non-forested lands, these channels may be deeply incised and prone to bank erosion from livestock. As such, these channels may benefit from livestock access control measures.

Moderate Gradient Moderately Confined Channel: MM

This group includes channels with variable controls on channel confinement. Alternating valley terraces and/or adjacent mountain slope, foot slope, and hill slope land forms limit channel migration and floodplain development. Similar to the LM channels, a narrow floodplain is usually present and may alternate from bank to bank. Bedrock steps with cascades may be present. The dominant substrate is gravel to small boulder.

Channel Responsiveness

The unique combination of narrow floodplain and hill slope or terrace acts to produce channels that are often the most responsive in a basin. The combination of higher gradients and the presence of a floodplain set the stage for a dynamic channel system. Multiple roughness elements such as bedrock, large boulders, or wood may be common, resulting in a variety of aquatic habitats within the stream network.

Riparian and In-stream Enhancement Opportunities

Like floodplain channels, these channels are among the most responsive of channel types. Unlike floodplain channels, however, the presence of confining land forms features improves the accuracy of predicting channel response to activities that may affect channel form. Additionally, these controls help limit the destruction of enhancement efforts, a common problem in floodplain channels. The slightly higher gradients give a bit more uncertainty as to the outcome of enhancement efforts as compared to LM channels. MM channels, however, are often good candidates for enhancement efforts.

In forested basins, habitat diversity can often be enhanced by the addition of roughness elements such as wood or boulders. Pool frequency and depth may increase as well as side-channel development as the result of these efforts. Channels of this type in nonforested basins are often responsive to bank stabilization efforts such as riparian planting and fencing.

Beavers are often present in the smaller streams of this channel type. Fish habitat in some channels may benefit from beaver introduction through side-channel and scour pool development. Introduction of beavers, however, may have significant implications for overall channel form and function, and should be thoroughly evaluated by the land managers as well as biologist as a possible enhancement activity.

Moderate Gradient Confined Channel: MC

Moderate Gradient Confined Channels flow through narrow valleys with little river terrace development, or are deeply incised into valley floors. Hill and mountain slopes composing the valley walls may lie directly adjacent to the channel. Bedrock steps, short falls, cascades, and boulder runs may be present; there are usually sediment transport systems. Moderate gradients, well-contained flows, and large-particle substrate indicate high stream energy. Landslides along channel side slopes may be a major sediment contributor in unstable basins. The dominant substrate is course gravel to bedrock.

Channel Responsiveness
The presence of confining terraces or hill slopes and control elements such as bedrock substrates limits the type and magnitude of channel response to changes in input factors. Adjustment of channel features is usually localized and of a modest magnitude.

Riparian and In-stream Enhancement Opportunities
These channels are not highly responsive. In-channel enhancements may not yield intended results. Although channels are subject to relatively high energy, they are often stable. In basins where water temperature problems exist, the stable banks generally found in these channels lend themselves to establishment of riparian vegetation. In non-forested land, these channels may be deeply incised and prone to bank erosion from livestock. As such, these channels may benefit from controlling livestock.

Moderate Gradient Headwater Channel: MH

These moderate-gradient headwater channels are common to plateaus in Columbia River basalts, young volcanic surfaces, or broad drainage divides. They may be sites of headwater beaver ponds. These channels are similar to LC channels, but occur exclusively in headwater regions. They are potentially above the anadromous fish zone.

These gentle to moderate headwater streams generally have low stream flow volumes and, therefore, low stream power. The confined channels provide limited sediment storage in low-gradient reaches. Channels have a small upslope drainage area and limited sediment supply. Sediment sources are limited to upland surface erosion. The dominant substrate varies from sand to cobble or bedrock. Boulders may be present from erosion of surrounding slopes and soils.

Channel Responsiveness
The low stream power and presence of confining terraces or hill slopes and control elements such as bedrock substrates limit the type and magnitude of channel response to changes in input factors. Adjustment of channel features is usually localized and of a moderate magnitude.

Riparian and In-stream Enhancement Opportunities
These channels are moderately responsive. In basins where water temperature problems exist, the stable banks generally found in these channels lend themselves to establishment of riparian vegetation. In nonforested land, these channels may be deeply incised and prone to bank erosion from livestock. As such, these channels may benefit from controlling livestock access.

Chapter 4: Hydrology and Water Use

Introduction

The purpose of this component is to evaluate the major potential impacts of land and water use practices on the hydrology of Thirtymile Creek watershed. Alterations to the natural hydrologic cycle can potentially change peak flows and/or low flows. Depending on the alteration, water quality and aquatic ecosystems can be positively or adversely affected.

Background

To understand how water moves through a watershed, from ridge top to mouth of stream and back, it is important to review the hydrologic cycle. **Figure 4.1** demonstrates the hydrologic cycle.

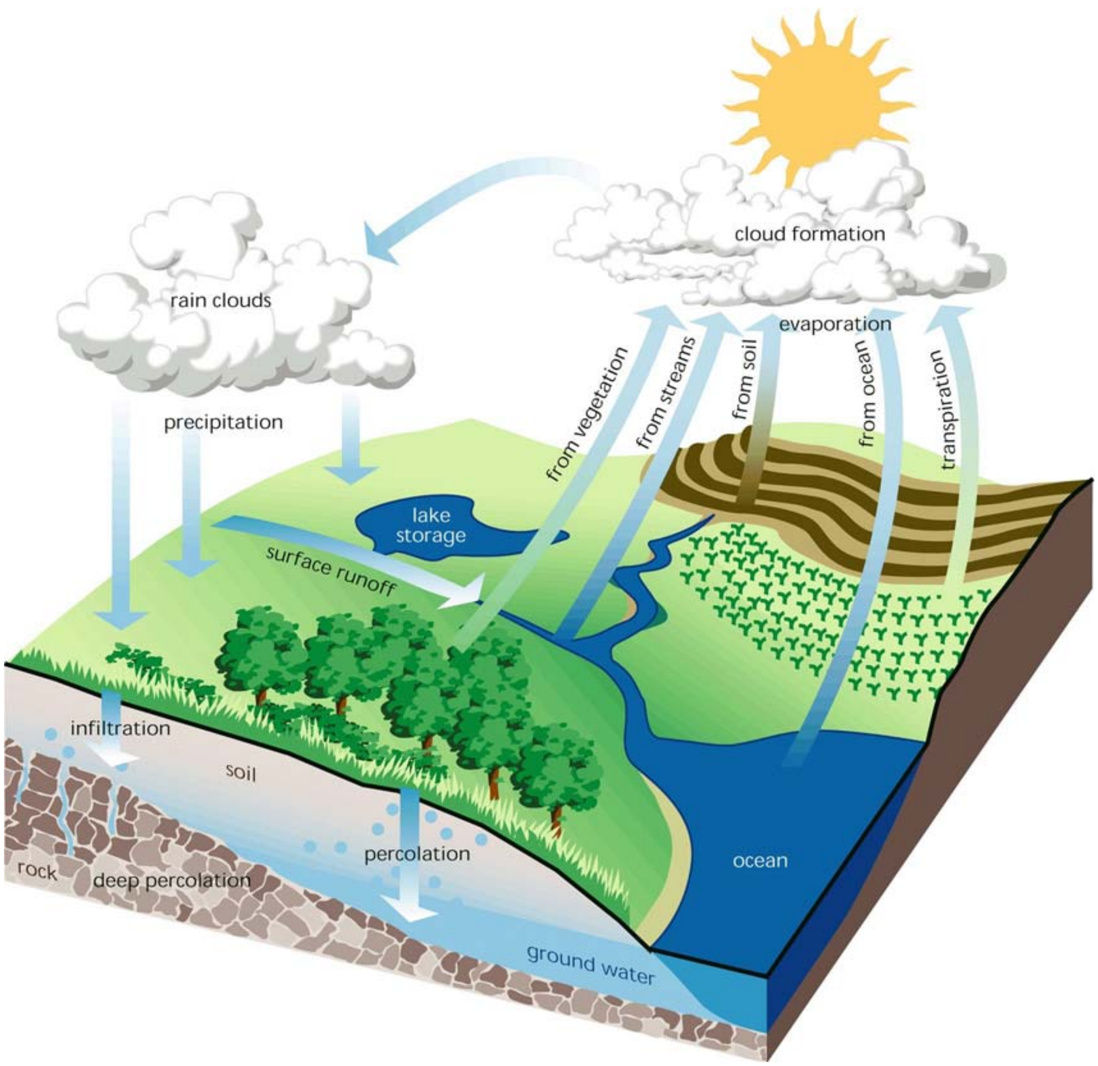


Figure 4.1 Source: <u>Stream Corridor Restoration: Principles, Processes, and Practices</u>

Surface Water
Surface water is fed by runoff from precipitation or groundwater seepage. Groundwater seepage occurs to streams when the ground water elevation is higher than the stream, resulting in a **hydraulic gradient** from the ground to the surface, due to the water table level and flow levels.

Groundwater
Groundwater is water held underground by soils and rock. As water infiltrates, it migrates vertically to the groundwater table. The amount of water held in the groundwater is dependent upon precipitation, hydraulic gradient, and void space in the soils or rock. During times of low flows, groundwater may supply water to stream channels. During high flows, groundwater can be recharged from nearby streams and channels.

Storage
Water storage can occur through manmade or natural conditions. Types of natural storage include snow pack, ponds, and wetlands. Man made storage includes reservoirs and ponds.

Peak Flows
Peak flows are the highest flow of water in a stream in a given year, and are not necessarily floods. Spring snowmelt or the occasional rain-on-snow event result in peak flows in the Thirtymile Creek watershed. However, precipitation is not the only factor influencing peak flows. Human changes in the landscape can cause areas to drain more rapidly than naturally, resulting in a higher, earlier peak flow. Human created storage can also cause areas to retain water further in the season, thereby decreasing the intensity and extending the duration of peak flow.

Low Flows
Low flows are the period of lowest flows of water in a stream in a given year. In the Thirtymile Creek watershed, low flows generally occur between July and September. Low flows affect water quality, as there is less water in a stream to dilute pollutants. Less water also heats more rapidly, contributing to increases in water temperature. Usually, the months when flows occur are the months that irrigated crops require the most water.

Land Uses' Potential Effects on Hydrology
Forestry practices can result in the removal of vegetative cover, compaction of soils, road building, and culvert installation. Removing vegetation cover can lead to a short-term decrease in **evapotranspiration** and increased seasonal run-off (WPN 1999). Forestry practices can also have neutral to positive effects on the hydrology of the area.

Grazing alters plant community composition and can affect soil characteristics. Both can adversely affect infiltration rates, thus increasing runoff. Surface runoff is the most common type of runoff on grazed lands (WPN 1999).

Agriculture can also dramatically affect stream flows. Farming can alter runoff rates on soils, depending upon the soil type and the agricultural practice. Agriculture has a greater effect on naturally highly permeable soils, as it can reduce the infiltration rates of the soil. In soils that are naturally of low permeability, this effect is much smaller (WPN 1999). Certain agricultural practices can increase infiltration rates, such as increasing organic matter in the soil. Leveling and field draining have resulted in the elimination of many wetlands and depressions that previously diffused flood peaks by providing detention storage (WPN 1999). These practices also have reduced infiltration opportunities, as surface and subsurface flows move faster into the channel network when not temporarily stored in wetlands and depressions.

Water removed from streams for irrigation can result in lower stream flows. Irrigation ditches increase the velocity of surface and subsurface flows, thereby reducing infiltration opportunities. Removal of groundwater for irrigation and other consumptive uses can alter water table levels and affect stream flows (WPN 1999).

Rural residential development can result in larger impervious surfaces, reduced infiltration, and increased surface runoff. Ditches, gutters, and roads divert and route precipitation to streams faster than infiltration into the soil (WPN 1999).

Water Use

Water Rights

In Oregon, all water is publicly owned. To remove surface water, a water right is necessary. Some methods of removing groundwater also requires water rights. Water rights are managed by the Oregon Water Resources Department (OWRD). Water rights information, including maps of points of diversion and places of use, can be accessed on the ORWD website. For more information on water rights, contact the Gilliam County Watermaster.

Water Availability

Oregon Water Resources Department allocates current water rights based on water availability in their Water Availability Basins (WABs). A water availability basin is an area of land that drains to the mouth of a stream, designated by OWRD for planning purposes. In the Thirtymile Creek watershed there is one WAB. **Map 4.3** shows the Water Availability Basin for Thirtymile Creek watershed.

For Water Availability Basins without historical stream flow data, a computer model is used to estimate water availability. As there have been no stream gages in the Thirtymile Creek watershed, this is the method for measuring water availability in the watershed. The model uses drainage area, elevation, precipitation, and other characteristics to calculate natural stream flow.

OWRD defines water availability as the amount of water physically and legally available for future **appropriation**. It is calculated as “natural stream flow minus consumptive uses minus in-stream water rights”. Consumptive use is “any water use that causes a net reduction in stream flow”. It is calculated with the assumption that the non-consumed water is returned to the stream from which it is diverted. In-stream water rights are “water rights held in trust by OWRD for the benefit of the people of Oregon to maintain water in-stream for public use”.

When calculating water availability for water appropriation, OWRD determines natural stream flow at two **exceedance** levels: 50% and 80%. Stream flow data from the base period (1958-1987) is used to calculate exceedance levels. At the 50% exceedance, half the time the natural flows are above this value and half the time flows are below this value. Surface and ground water rights are allocated based on the 80% exceedance level (OWRD). In-stream and storage rights are allocated using the 50% exceedance level (WPN 1999).

Water availability is calculated by the following formula:

Water availability = natural stream flow (at the 50% or 80% level) – consumptive use of diverted water – in-stream rights

Methods

Data was gathered from a variety of sources. Anna Smith a hydrologist from the Bureau of Land Management, helped the author develop the estimated hydrograph for 30 Mile Creek. Geological information was gathered from maps and communication with Oregon Department of Geology geologists. Water rights and water availability information was accessed on-line at www.wrd.state.or.us.

Results

Climate

Average annual precipitation varies within the watershed. The driest month is July and the wettest month is November. (NOAA annual precipitation map). **Map 4.1** shows levels of annual precipitation in the 30 Mile Creek Watershed. **Table 4.1** shows precipitation, area and elevation by sub-watershed.

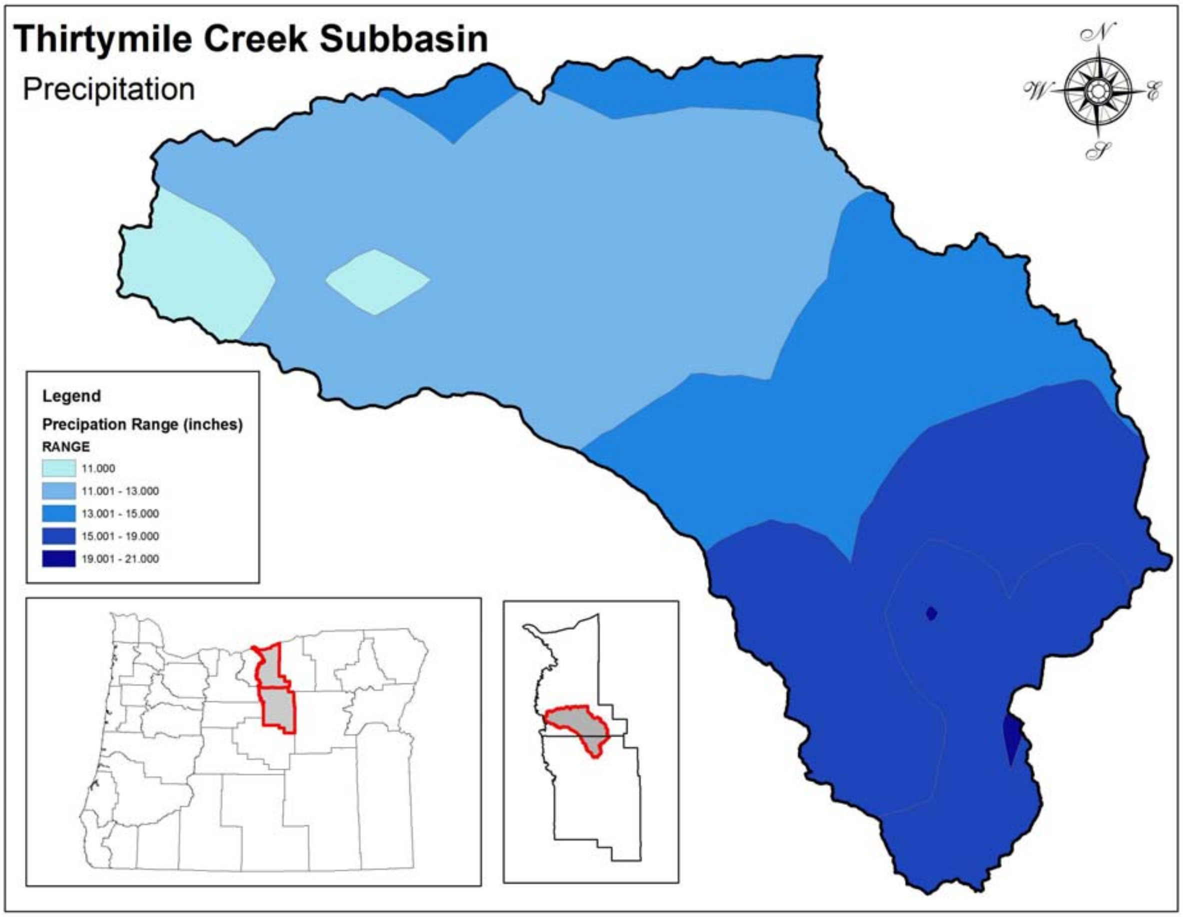
Only the Upper Thirtymile Creek Watershed includes the transient snow zone (3,000-5,000 feet). This is the area where rain-on-snow events usually occurs. A rain-on-snow event is a peak flow generating process that occurs during a quick warming in the late winter, where rain falls on snow and causes large scale runoff. In years when rain-on-snow events occur, they are the primary peak flow generating event. But rain-on-snow events do not occur every year. Most years, the peak-flow generating process is spring snowmelt, which usually occurs between November and March. Intense summer storms with hail and fast heavy precipitation can also occur but not as often. Flood events usually occur in December and January, when warm temperatures and high precipitation results in high flows.

Table 4:1 Area, Elevation, and Annual Precipitation by Sub-watershed

Sub-watershed	Area (mi^2)	Minimum Elevation (ft)	Maximum Elevation (ft)	Mean Annual Precipitation (in)
Lower Thirtymile Creek	**72.9**	**971**	**2,950**	**12 in**
Upper Thirtymile Creek	**199**	**2,000**	**5,117**	**18 in**

sources: USGS topographic maps and NOAA annual precipitation map.

Map 4.1: Precipitation Map of the Thirtymile Creek Watershed



Geology
Map 4.2 shows the geology of the Thirtymile Creek watershed. Fault lines are included in the map. It can be speculated that the fault line along portions of Thirtymile Creek is the reason the creek is seasonally dry (personal conversation with, Mark Ferns, DOGAMI). The fault may act as a sink for the water, causing it to enter the fault and leave both the groundwater and surface water systems.

Springs and seeps are common in the Thirtymile Creek watershed. Many are the result of water stored in between basalt layers coming to the surface as the basalt erodes. As the sides of these ridges erode, they do so in a stair step, with the permeable rock exposed horizontally. It is at these levels that the springs come to the surface.

Stream Density
Table 4.2 shows stream density (341 stream miles/area) by sub-watershed in Thirtymile Creek watershed. These densities were calculated from the EPA 1:100,000 stream layer, which does not include all the small streams in the upper and lower watershed. Stream density can indicate the potential infiltration and runoff of an area.

Stream Flow
One way to summarize and display hydrologic information is through the development of a hydrograph. A hydrograph is the plot of stream flow over time. Stream flow is measured by stream gages placed in streams at specific locations. Where there is no stream gage, it is possible to create a representative hydrograph for the stream in question. Within the same basin, another stream of similar topography and drainage area that has a stream gage may be used instead.

Table 4.2: Stream Density

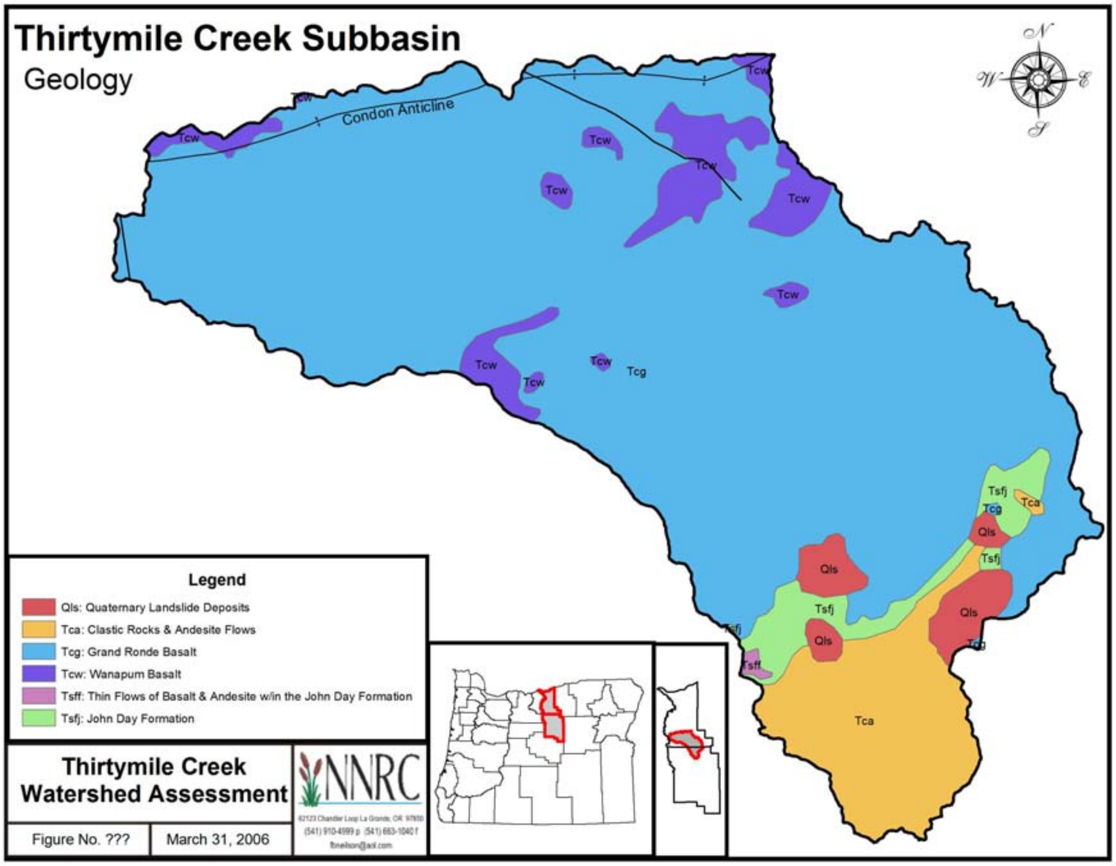
Sub-watershed	Stream Density (mi/mi^2)	Total Stream Miles
Thirtymile Creek	**1.3**	**341 Miles**

Source: EPA 1:100,000 Stream Layer

As Thirtymile Creek has never had a stream gauge, this method was used to generate its hydrograph. Nearby Pine Creek in Wheeler County (drainage area = 64.96mi^2). This stream has a stream gauge and is a smaller drainage area and stream size. The average unit discharges (average discharge divided by the drainage area) were averaged, as to minimize watershed-specific differences in drainage area and flow. The average cfs/year was multiplied by a percentage for each month, to generate the hydrograph over a year's time. The percentages per month were obtained from the statistical summaries calculated for the stream gauge on the John Day River below Thirtymile Creek.

Figure 4.2 shows the generated hydrograph for Thirtymile Creek. Monthly percentages used to calculate monthly discharge are listed in the table. This is an estimated average hydrograph, which will only show the general characteristic of flow in the Thirtymile Creek watershed. Peak flows are generated in early spring/late spring. Low flows generally occur during late summer to early fall.

Map 4.2: Geology of the Thirtymile Creek Watershed



Map 4.3: Fault Lines Within Thirtymile Creek Watershed

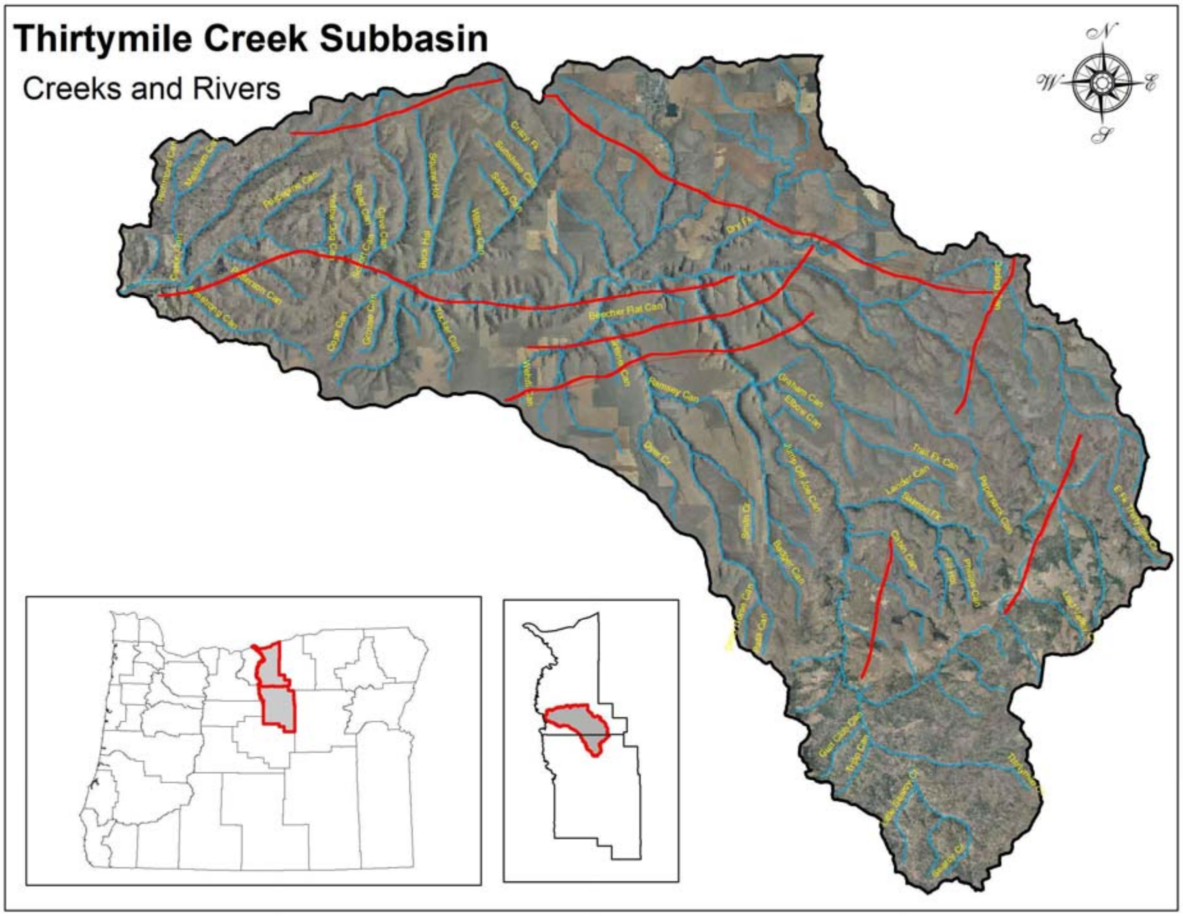
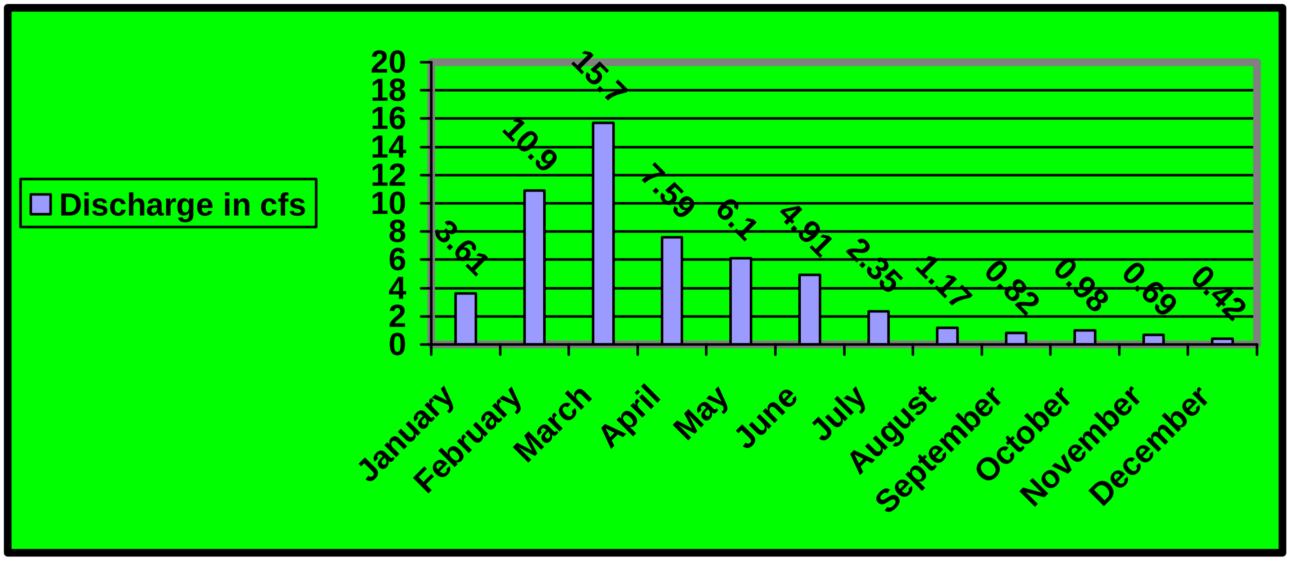


Figure 4.2: Estimated Average Monthly Discharge of Thirtymile Creek



Analysis of Hydrologic Impacts of Land Uses

Peak flows and low flows can be affected by land uses, as mentioned in the introduction of this component. This section includes basic analysis that measure the potential of various land uses to affect peak and low flows in the watershed.

Forestry

Historically, lower elevation forests in the watershed were open and park-like, with a species composition of large ponderosa pines. This was caused because fire was a natural part of the eco-system and ponderosa pine was relatively fire resistant. The **crown closure** (the amount of canopy cover in a given area) was historically less than 30% in these stands. In higher elevation forests, the species composition was a variety of conifers, and the forests were denser, with a crown closure greater than 30%.

As species composition in the once ponderosa pine forest has diversified to include other conifers, the crown closure has increased. Though the total acreage is small, stands that have always been dense, mixed conifer forests, for the most part, have crown closures greater than 30%. Potential of crown closure to affect peak flows was analyzed using the Washington State Department of Natural Resources Interim Rain-on-Snow Rules. This process determines potential as low or at risk by looking at the percent of forestry land use area above rain-on-snow area with less than 30% crown closure. About 90% of the forestry land use area is in the 3,000-5,000 feet rain-on-snow zone. In order for the rain-on-snow forested lands to affect peak flows, there would have to be 65% of those lands with less than 30% crown closure. From close observations while in the field, numerous field measurements, and aerial photo review it is estimated that 50% of those lands in the rain-on-snow zone have less than 30% crown closure, Therefore, the potential is **LOW** for the forested lands to be contributing to changes in peak flows in the Thirtymile Creek watershed at this time.

Percent Equivalent Clearcut Acre (ECA) is a measurement used to estimate the effect of timber harvesting on the hydrology of a watershed. Equivalent clearcut acres were calculated for the Umatilla National Forest Analysis. The Thirtymile Creek watershed's ECA was 3.2%. As the level of concern for Equivalent Clearcut Acres is 15%, this watershed is well under the level where timber harvest would detrimentally affect the hydrology of the area.

Agriculture and Range Lands

Range lands is the major land use in the Thirtymile Creek watershed, accounting for 50% of the total acres. Agriculture is second with 29% and the most abundant crop is a wheat/summer fallow rotation.

The Natural Resources Conservation Service has calculated runoff curves for various agricultural and range practices, along with background curves of runoff for lands in natural condition. Soil types are assigned a hydrologic soil group, depending upon infiltration rates. Hydrologic soil group (HSG) A has the highest infiltration rate and (HSG) D has the lowest infiltration rate.

Potential change in runoff was calculated for each agricultural and range practice in the Thirtymile Creek watershed by comparing each practice's runoff curve with background curves. The background curves used were grassland in good hydrologic condition and woods in good hydrologic condition (for areas where forests were converted into farmland). **Appendix 4.1** details the results. The majority of crop and range land management practices had low or moderate potentials to cause a change in runoff that would affect peak flows in the watershed. Thus, the overall potential of agriculture and range land uses affecting peak flows in the Thirtymile Creek watershed was **LOW TO MODERATE.** This is only a measurement of cultivation practices and their effects on the hydrology. It does not account for how irrigation ditches, tiling, land leveling, loss of wetlands, conversion of land from forest to crop land, and other changes in the watershed that have improved conditions for agriculture have affected the hydrology of the watershed. To understand these practices' effects on the watershed's hydrology would require a more in-depth analysis.

Roads

Road density in the Thirtymile Creek watershed was calculated by multiplying public road mileage by an average width of .0066 for county and private roads and an average width of .0047 miles for forest service roads. **Table 4.3** shows the total miles of roads and road density in the Thirtymile Creek watershed, by sub-watershed.

Table 4.3: Road Mileage in the Thirtymile Creek Watershed

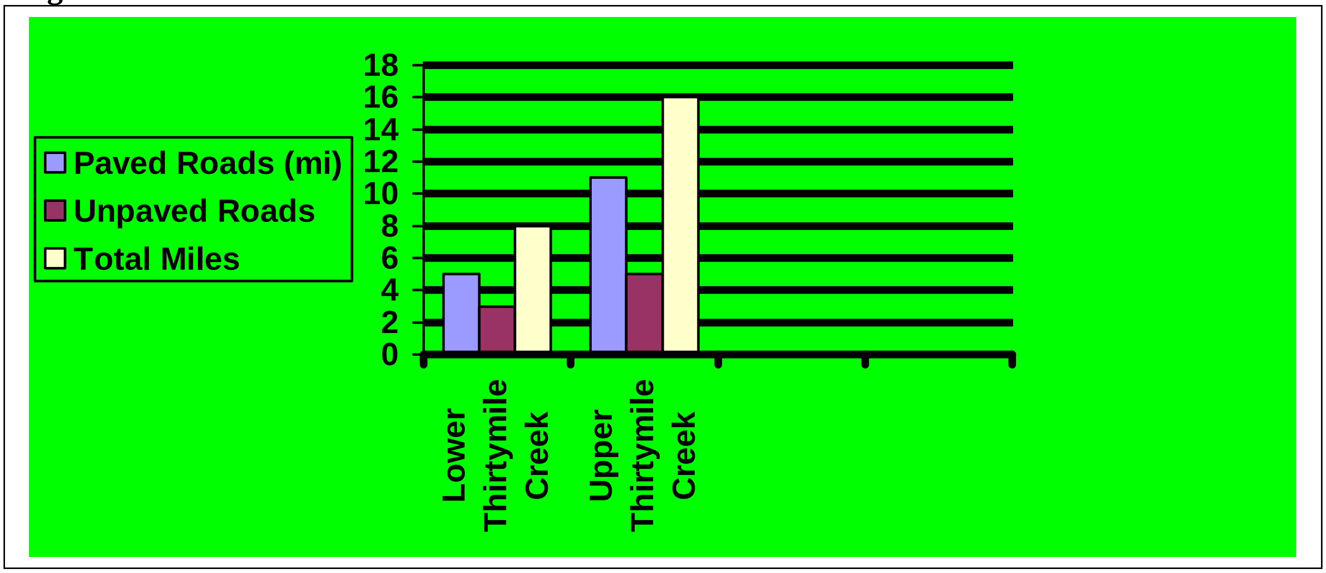
Sub-watershed	Total Road Miles	Road % of Total Area	Total Road Area (mi^2)
Lower Thirtymile Creek	8 Miles	<1%	.05(mi^2)
Upper Thirtymile Creek	16 Miles	<1%	.11(mi^2)
Total	24 Miles	<1%	.16(mi^2)

Source: ODOT road shapefile data

Road densities greater than 4% of total land area are considered to have the potential to affect runoff and peak flows (WPN 1999). As the Thirtymile Creek watershed and each of its sub-watersheds fall far below road densities of 4%, the potential that roads are influencing peak flows and runoff is **LOW.**

As infiltration rates and runoff patterns are affected by road surfaces, paved, and unpaved road mileage was calculated. **Figure 4.3** shows paved and unpaved road mileage. Unpaved roads include both native surface and rock, which differ in infiltration rates.

Figure 4.3: Road Surfaces In Watershed



Rural Residential

Impervious surface was calculated using the estimated acreage of Rural Residential (514 acres, 0.29% of watershed). Average lot size of the rural residential area was estimated at 1 acre, with a corresponding average impervious area of 20%. Percent of impervious surface in the Thirtymile Creek watershed was determined to be <1%, with a corresponding **LOW** potential for affecting peak flows. Low potential is any watershed with an impervious surface of less than 5 percent (OWEB 1999).

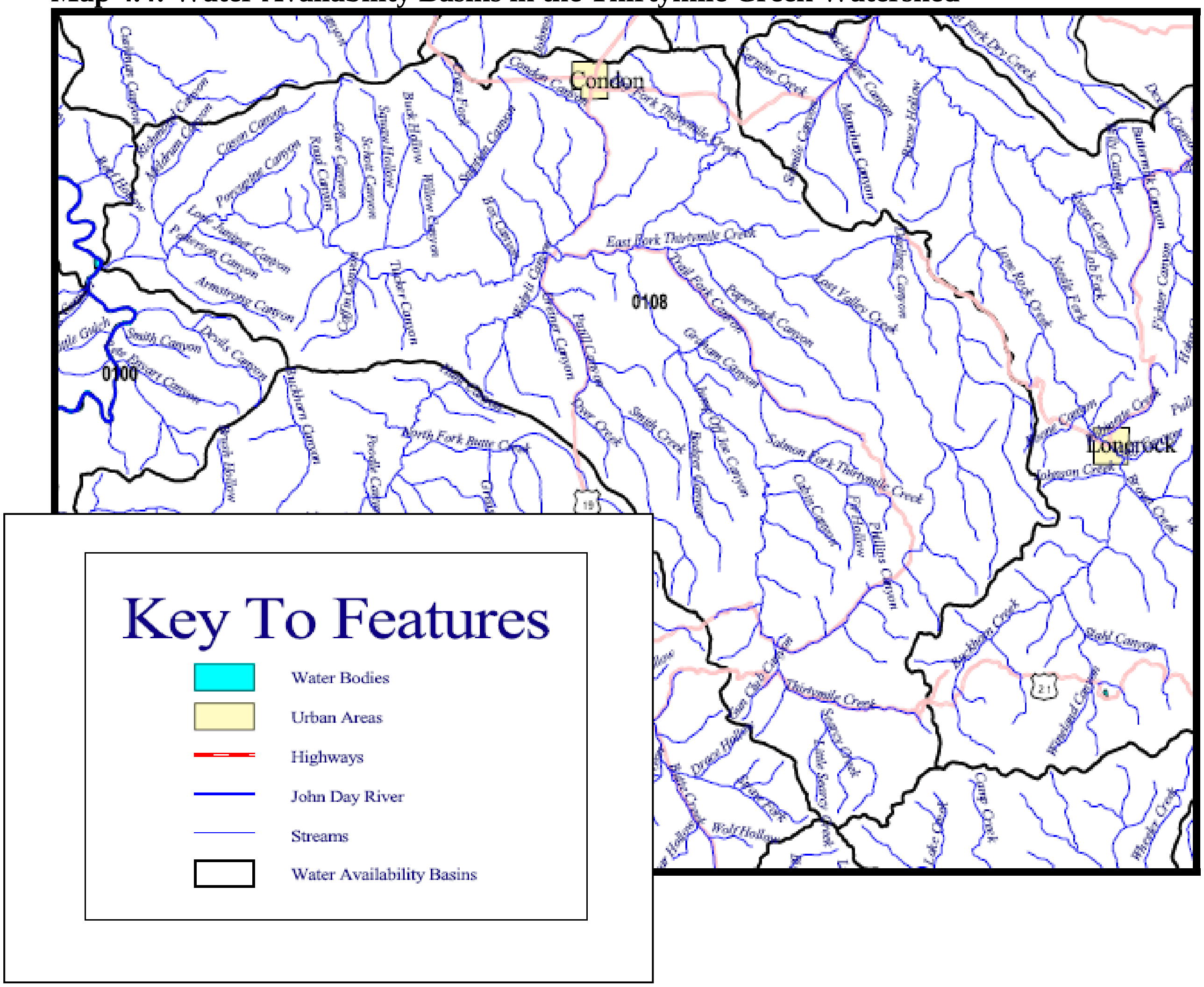
Water Use

Types of consumptive uses in the Thirtymile Creek watershed were obtained from the WARS database for each Water Availability Basin. **Table 4.4** shows these uses in each WAB. In each WAB, irrigation is the primary consumptive use. **Map 4.4** shows the Water Availability Basins in the Thirtymile Creek watershed.

Table 4.4: Consumptive Uses by Water Availability Basin in the Thirtymile Creek Watershed

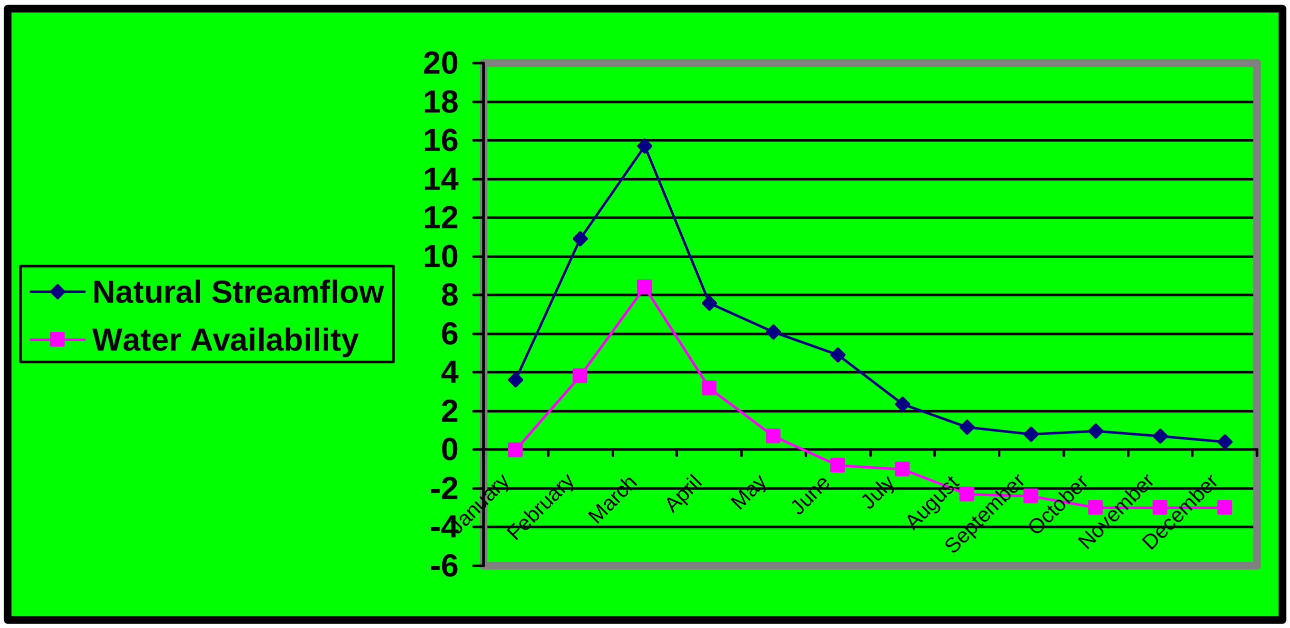
Water Availability Basin	Irrigation	Domestic	Storage
Thirtymile Creek	99%	1%	0%

Map 4.4: Water Availability Basins in the Thirtymile Creek Watershed



Water Availability
Water availability information at the 50% and 80% exceedance levels was obtained from the Water Availability Database System (WARS) at the OWRD website (www.wrd.state.or.us). **Figure 4.4** graph water availability and natural stream flow for each WAB at the 80% exceedance level. Note that both in-stream water rights and consumptive uses are the difference in cfs between water availability and natural stream flow. Where water availability goes negative, water rights are over allocated.

Figure 4.4: Water Availability and Natural Stream Flow in Thirtymile Creek Basin



Discussion
Climate, soils, and geology are major determinants of the natural hydrology of a watershed. Since the majority of precipitation in the Thirtymile Creek watershed occurs as snow, snow melts are the cause of peak flows. The period of low flows occurs during summer months when there is little precipitation. There are also a number of springs in the watershed located at different elevations throughout the system. Some of these springs provide varying amounts of water throughout the year. Others are seasonal springs, releasing water during the late winter and early spring months. Because of the steep, narrow banks and high infiltration rates water is rapidly absorbed into the soils until it reaches saturation. During the hot and dry months this causes the creek to dry up on the surface in some locations. It is what also causes flooding when the soil profile is full and there is heavy spring run off.

Land uses have affected the hydrology of Thirtymile Creek through changing soil infiltration rates, the relationship between ground and surface waters, and diminishing already natural low flows. Given that there were many historical wetlands in the bottomlands of Thirtymile Creek (see Chapter 6: Wetlands), the subsequent major flooding events has dramatically changed the length of time soils are saturated, thereby reducing groundwater recharging in the spring. Most of this was caused by the removal of woody vegetation along the creeks riparian area.

Of the land use effects on hydrology assessed in this chapter, all, except agriculture, had low potentials to affect peak flows in the watershed. Change in crown closure over time has probably not affected peak flows, as there is currently denser crown closure than historically and the amount of ECSs is small. Rural residential lands in the watershed have a relatively small impervious layer, thus not affecting overall hydrology. Agriculture and range lands had a low to moderate potential to affect peak flows. Agriculture and range lands were assessed only by the difference in runoff rates due to crop and range management practices, but did not evaluate the impact of irrigation, or grazing intensities. These are much more difficult to quantify, especially given the lack of data, but are probably the land use activities that have most greatly impacted the watershed's hydrology.

Water is primarily used for irrigation, with some allocated for domestic uses. As shown by OWRD's Water Availability modeling, water is over-allocated from May on, meaning that there are more water rights than there is flow in the stream system. As these months include months of low flow (July-September), water uses in the Thirtymile Creek watershed are affecting low flows. It should be noted that even though there are more water rights than water in Thirtymile Creek many of those rights don't appear to be used on a consistent basis.

Data Gaps

- Flow data
- Historical hydrological information
- Miles of private roads

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Watershed Professionals Network. Oregon Watershed Assessment Manual. Salem, Oregon: prepared for the Governor's Watershed Enhancement Board, June 1999.

Appendix 4.1: Analysis of Agricultural and Range Lands for Potential Change in Peak Flow

Cover Type/Conservation Practice/Hydrologic Condition/HSG	Runoff Curve	Back ground	Back ground Runoff Curve #	Rainfall Lower Range (in)	Rainfall Upper Range (in)	Runoff Depth Lower Range	Runoff Depth Upper Range	Runoff Depth Back ground Lower Range	Runoff Depth Back ground Upper Range	Change in Runoff, Range	Potential to Affect Peak Flow
Previously Forested, Now Cultivated/Range Land											
Small Grain/Straight Row/Poor/B	76	Woods Good B	55	1.4	1.8	0.13	0.29	0.0	0.0	.13-.29	Low
Small Grain/Straight Row/Good/B	75	Woods Good B	55	1.4	1.8	0.13	0.29	0.0	0.0	.13-.29	Low
Small Grain/Straight Row/Poor/C	84	Woods Good C	70	1.4	1.8	0.39	0.65	0.06	0.17	.33-.48	Moderate
Small Grain/Straight Row/Good/C	83	Woods Good C	70	1.4	1.8	0.39	0.65	0.06	0.17	.33-.48	Moderate
Pasture, Grassland, or Range/Poor/B	79	Woods Good B	55	1.4	1.8	0.24	0.44	0.0	0.0	.24-.44	Moderate
Pasture, Grassland, or Range/Fair/B	69	Woods Good B	55	1.4	1.8	0.06	0.17	0.0	0.0	.06-.17	Low
Pasture, Grassland, or Range/Good/B	61	Woods Good B	55	1.4	1.8	0.0	0.03	0.0	0.0	0-.03	Low
Pasture, Grassland, or Range/Poor/C	86	Woods Good C	70	1.4	1.8	0.39	0.65	0.06	0.17	.33-.48	Moderate
Pasture, Grassland, or Range/Fair/C	79	Woods Good C	70	1.4	1.8	0.24	0.44	0.06	0.17	.18-.27	Low
Pasture, Grassland, or Range/Good/C	74	Woods Good C	70	1.4	1.8	0.13	0.29	0.06	0.17	.07-.12	Low
Previously, Grassland, Now Cultivated/Range Land											
Small Grain/Straight Row/Poor/B	76	Herb/Good/B	62	1.4	1.8	0.13	0.29	0.0	0.03	.13-.26	Low
Small Grain/Straight Row/Good/B	75	Herb/Good/B	62	1.4	1.8	0.13	0.29	0.0	0.03	.13-.26	Low
Small Grain/Straight Row/Poor/C	84	Herb/Good/C	74	1.4	1.8	0.39	0.65	0.13	0.29	.26-.36	Moderate
Small Grain/Straight Row/Good/C	83	Herb/Good/C	74	1.4	1.8	0.39	0.65	0.13	0.29	.26-.36	Moderate
Pasture/Grassland, or Range/Poor/B	79	Herb/Good/B	62	1.4	1.8	0.24	0.44	0.0	0.03	.24-.41	Moderate
Pasture/Grassland, or Range/Fair/B	69	Herb/Good/B	62	1.4	1.8	0.06	0.17	0.0	0.03	.06-.14	Low
Pasture/Grassland, or Range/Good/B	61	Herb/Good/B	62	1.4	1.8	0.0	0.03	0.0	0.03	0.0	Low
Pasture/Grassland, or Range/Poor/C	86	Herb/Good/C	74	1.4	1.8	0.39	0.65	0.13	0.29	.26-.36	Moderate
Pasture/Grassland, or Range/Fair/C	79	Herb/Good/C	74	1.4	1.8	0.24	0.44	0.13	0.29	.09-.15	Low
Pasture/Grassland, or Range/Good/C	74	Herb/Good/C	74	1.4	1.8	0.13	0.29	0.13	0.29	0.0	Low

rainfall was estimated from NOAA 2yr 24 hr precipitation map, runoff curves used were calculated by the NRCS and obtained from the OWEB Watershed Assessment manual, background curve used was herbaceous-mixture of grass, weeds, and low-growing brush, with brush the minor element in good hydrologic condition

Chapter 5: Riparian

Introduction
This chapter describes current conditions of riparian areas in the Thirtymile Creek watershed as compared with potential riparian ecosystems for the purpose of identifying restoration.

Background
Riparian vegetation or the plant communities along streams and rivers, plays many important roles in aquatic ecosystems. It shades streams, keeping water temperatures from warming. It furnishes cover for fish populations, dissipates stream velocity, stabilizes stream banks, helps filter pollutants and sediments, and provides food and habitat for many aquatic and terrestrial animals. During peak flows, riparian vegetation may slow and dissipate floodwater energies, thereby preventing streambank and bed erosion (WPN 1999). Riparian vegetation can provide a buffer between aquatic ecosystems and adjacent land uses.

By measuring riparian vegetation cover, the amount of shade and potential recruitment for large woody debris (LWD) can be estimated. Large woody debris, which includes dead trees, root wads, and large limbs, is important to stream structure and fish habitat. When dead trees or limbs enter the stream system, water flow patterns are changed and pools are created. These pools capture gravel and sediment and provide sheltered habitats for fish and other aquatic species.

Methods
Aerial photographs taken in May of 1996, orthophoto's and on the ground data were the primary source used to measure riparian cover. Stream banks were divided into numerous Riparian Condition Units (RCU), where the amount of riparian vegetation and adjacent land uses were relatively constant throughout each individual unit. For each RCU, the following parameters and descriptions of the unit and stream were also noted: RCU number, bank (right or left); length of RCU; stream name; sub-watershed; ecoregion; channel habitat types; stream size; width of vegetation directly along stream banks; discontinuities due to land use; riparian recruitment situation; level of shade; and vegetation. Some field checking was made to ensure correct identification of vegetation. This data should only be used as a general overview of riparian conditions in the watershed.

Materials used in the riparian assessment were:
- 1996 Orthophotoquads
- Computerized measuring tool
- USGS Topographic maps
- ODFW Fish and Habitat survey

Shade was measured in terms of low, medium, and high, as determined by the OWEB assessment manual. Low shade is where the stream surface is visible and banks are entirely visible or visible at times (<40%). Medium shade is where the stream surface is visible, but the banks are not visible (40-70%). High shade is where the stream surface is not visible, is slightly visible, or is visible in patches (>70%).

Riparian vegetation was measured in terms of abundance (sparce/dense), size (small, medium, large **diameter breast high),** and dominant species (herbaceous/grasses, brush, hardwood, conifer, mixed species, (conifer/hardwood). Results of vegetation were simplified, thus excluding size of dominant vegetation. Habitat surveys were lacking or very brief that were conducted at redd sites while mapping anadramous fish habitat.

Results

Riparian conditions were measured on the main stream of Thirtymile Creek and 6 tributary streams (Sniption, Badger, Searcy, Little Searcy, East Fork Thirtymile, and Trail Fork) in the Thirtymile Creek watershed. A total of 200 units were assessed for a total of 81.6 miles. Thirtymile Creek (40.1 miles), Sniption Creek (7.4 miles), Badger Canyon (1.8 miles), Little Searcy Creek (2.3 miles), Searcy Creek (3.4 miles), Trail Fork Canyon (8.3 miles), and East Fork Thirtymile Creek (18.6 miles) were surveyed from the mouth to the headwaters.

Table 5.1: Shading along Creeks in Thirtymile Creek Watershed

Shade Catigory	Thirtymile Creek	Sniption Creek	Badger Canyon	Searcy Creek	Little Searcy Creek	East Fork Thirtymile Creek	Trail Fork Canyon
High (>70%)	10.5%	0%	0%	22%	21%	0%	0%
Medium (40-70%)	16%	1%	0%	69%	56%	8%	7%
Low (<40%)	73.5%	99%	100%	9%	23%	92%	93%
Total	100%	100%	100%	100%	100%	100%	100%

Table 5.2: Vegetation Types on Thirtymile Creek and Tributaries

Vegetation	Thirtymile Creek	Sniption Creek	Badger Canyon	Searcy Creek	Little Searcy Creek	East Fork Thirtymile Creek	Trail Fork Canyon
Herbaceous/ Grasses	43.5%	99%	100%	18%	8%	80%	78%
Sparse Brush	30%	1%	0%	4%	15%	12%	15%
Sparse Hardwood	1%	0%	0%	0%	0%	0%	2%
Sparse Mixed Trees	13%	0%	0%	22%	41%	3%	5%
Sparse Conifer	2%	0%	0%	47%	15%	5%	0%
Dense Brush	2%	0%	0%	0%	4%	0%	0%
Dense Hardwood	4%	0%	0%	0%	0%	0%	0%
Dense Mixed Trees	4%	0%	0%	1%	7%	0%	0%
Dense Conifer	.5%	0%	0%	8%	10%	0%	0%
Total	100%	100%	100%	100%	100%	100%	100%

Appendix 5.1 shows potential streamside vegetation by **ecoregion** in the watershed. Of the streams surveyed they all fall within three ecoregions, Umatilla Plateau (10C), Deschutes/John Day Canyons (10K), and John Day/Clarno Highlands (11b).

Streamside vegetation width (how far from the stream riparian vegetation extends) is naturally dependent upon ecoregion and the confinement of the stream (See Appendix 5.1). Land uses can also limit riparian vegetation widths. Agriculture, the main limiting land use in the watershed limits riparian width in many reaches to less than what would occur naturally. In many reaches, native riparian vegetation was almost entirely replaced with agriculture or altered by pasture use.

Discussion

Shade from riparian vegetation is important for maintaining cool water temperatures. As Thirtymile Creek has little shade for almost the entire length on the lower end of the stream, its high summer temperatures (see Chapter 7: Water Quality) are likely due, in part, to lack of shade. Seventy percent of the streams in Thirtymile Creek have little or no shade. If you take out Searcy and Little Searcy Creeks (which are forest streams) 91.5% of the riparian areas in the Thirtymile Creek drainage have little or no shade.

Amounts of large woody debris in the Thirtymile Creek watershed were found to be low in number or nonexistent. This attribute was not studied in this evaluation but it should be noted that because of the lack of shade or the vegetation that produces shade it can be assumed that woody vegetation is also severely lacking. As large woody debris plays an integral role in pool creation, this lack of in-stream wood and a lowered potential for future recruitment can have far reaching effects on stream structure and fish habitat.

Lack of riparian vegetation or vegetation without large and deep root systems also can contribute to bank instability. Bank instability is quantified as bank erosion, which can contribute to sediment problems. It also widens streams, which can make the vegetation present less effective for maintaining cool water temperatures.

Data Gaps:

- Woody debris amounts/values/needs within watershed
- Erosion measurements comparing existing status with proper functioning

References

Ecosystem Appendix, Oregon Watershed Assessment Manual, Salem, Oregon; prepared for the Oregon Watershed Enhancement Board, 2001.

Watershed Professionals Network. Oregon Watershed Assessment Manual, Salem, Oregon; prepared for the Governor's Watershed Enhancement Board, 1999.

Appendix 5.1: Potential Streamside Vegetation

Table 1: Umatilla Plateau (10c) Ecoregion

CHT Group	RA1 Zone	RA1 Description	RA2 Width	RA2 Description	Other Considerations
Constrained	0-25’	**Type:** Shrubs such as Douglas spirea, red osier dogwood, willows, water birch, and mountain alder. **Size:** N/A **Density**: N/A	**N/A**	**Type: N/A** **Size: N/A** **Density: N/A**	
Semi-constrained	0-50’	**Type**: Shrubs such as Douglas spirea, red osier dogwood, willows, water birch, and mountain alder. **Size**: N/A **Density:** N/A	**N/A**	**Type: N/A** **Size: N/A** **Density: N/A**	
Un-constrained	0-75’	**Type**: Shrubs such as Douglas spirea, red osier dogwood, willows, water birch, and mountain alder. **Size**: N/A **Density:** N/A	**N/A**	**Type: N/A** **Size: N/A** **Density: N/A**	

Current Streamside Conifer Regeneration: Naturally not present.

Upland Vegetation: Agricultural crops (primarily wheat). Native vegetation includes bluebunch wheatgrass, Idaho fescue, rose, hawthorn, and snowberry.

Historic Crown Closure: Less than 30%.

Land Uses: Wheat farming, grazing.

Other:

Source: Ecoregion Appendix for the Oregon Watershed Assessment Manual

Table 2: Deschutes/John Day Canyons (10k) Ecoregion

CHT Group	RA1 Zone	RA1 Description	RA2 Width	RA2 Description	Other Considerations
Constrained	0-25’	**Type:** Hardwoods (white alder, willow) and shrubs such as willow and red osier dogwood. Infrequent ponderosa pine. **Size:** Medium **Density**: Sparse	**N/A**	**Type: N/A** **Size: N/A** **Density: N/A**	
Semi-constrained	0-50’	**Type**: **:** Hardwoods (white alder, willow) and shrubs such as willow and red osier dogwood. Infrequent ponderosa pine.. **Size**: Medium **Density:** Sparse	**N/A**	**Type: N/A** **Size: N/A** **Density: N/A**	
Un-constrained	0-75’	**Type**: **:** Hardwoods (white alder, willow) and shrubs such as willow and red osier dogwood. Infrequent ponderosa pine. **Size**: Medium **Density:** Sparse	**N/A**	**Type: N/A** **Size: N/A** **Density: N/A**	

Current Streamside Conifer Regeneration: Few occur naturally.

Upland Vegetation: Agricultural crops (primarily wheat). Native vegetation includes juniper, bluebunch wheatgrass, Idaho fescue, rose, hawthorn, and snowberry.

Historic Crown Closure: Less than 30% historic crown closure.

Land Uses: Wheat farming, grazing, recreation.

Other:

Source: Ecoregion Appendix for the Oregon Watershed Assessment Manual

Table 3: John Day/Clarno Highlands (11b)

CHT Group	RA1 Zone	RA1 Description	RA2 Width	RA2 Description	Other Considerations
Constrained	0-25’	**Type:** Hardwoods (alder & cottonwood) and shrubs (willows, Sitka alder, mountain alder) **Size:** Small **Density**: Dense	25-100’	**Type:** Conifers (infrequent true fir and ponderosa pine) **Size: Medium** **Density: Sparse**	Fire suppression in recent decades has caused an increase in true fir dominance. See Kovalchik (1987) for more details about specific plant communities and where they occur.
Semi-constrained	0-50’	**Type:** Hardwoods (alder & cottonwood) and shrubs (willows, Sitka alder, mountain alder and common snowberry) **Size:** Small **Density**: Dense	50-100’	**Type:** Conifers (infrequent true fir and ponderosa pine) **Size: Medium** **Density: Sparse**	Fire suppression in recent decades has caused an increase in true fir dominance. See Kovalchik (1987) for more details about specific plant communities and where they occur.
Un-constrained	0-75’	**Type:** Hardwoods (alder, willow, aspen & cottonwood) and shrubs (willows, Sitka alder, mountain alder and common snowberry, shrubby cinquefoil) **Size:** Small **Density**: Dense	75-100’	**Type:** Conifers (infrequent true fir and ponderosa pine) **Size: Medium** **Density: Sparse**	Fire suppression in recent decades has caused an increase in true fir dominance. Under certain circumstances, there are few potential plant communities which have no woody vegetation in RA1, and are characterized by herbaceous plants such as beaked sedge or aquatic sedge at higher elevations. See Kovalchik (1987) for more details about specific plant communities and where they occur.

Current Streamside Conifer Regeneration: Some true fir, ponderosa pine.

Upland Vegetation: Native vegetation includes grasses, ponderosa pine, true fir.

Historic Crown Closure: Historically and currently, the forests in this ecoregion were highly variable. Historic canopy closure was <30% in the areas dominated by ponderosa pine savannas. Some park-like ponderosa pine stands had canopy closures of 40%-60%. Some pole sized stands that originated after fire had densities of greater than 70%. Other forest types in this region also had canopy closures of greater than 30%.

Land Uses: Grazing, timber harvest .

Other:

Source: Ecoregion Appendix for the Oregon Watershed Assessment Manual

Chapter 6: Wetlands

Introduction

This chapter identifies wetlands in the watershed and examines their role in the hydrology of the area. Restoration opportunities are also discussed.

Background

Wetlands are areas with saturated, or **hydric,** soils dominated by water tolerant plants (The Oregon Wetlands Conservation Guide). The term "wetlands" generally include swamps, marshes, bogs, and similar areas. The Army Corps of Engineers defines wetlands as "those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated conditions" (qtd. In WPN 1999). Wetlands are often located in riparian areas, but they also can occur in upslope areas with no obvious connection to stream channels.

Wetlands in Oregon are protected and regulated by the Division of State Lands, under the state Removal-Fill Law, the Army Corps of Engineers, under the federal Clean Water Act, and for some agricultural wetlands, the Natural Resources Conservation Service, under a provision in the Federal Food Securities Act (Morlan 1990).

Wetlands provide many important functions to the landscape, including water quality improvements, flood control, groundwater charging, and habitat for fish and wildlife. By trapping sediments and contaminants and slowing the flow of runoff, wetlands help maintain good water quality. By storing, intercepting, and delaying runoff, wetlands can reduce downstream flooding. Wetlands are also strongly associated with groundwater. Some wetlands can recharge aquifers, which can help extend streamflows during the drier months. In eastern Oregon, the duration of streamflow has been extended by restoring wet meadows in headwaters (WPN 1999). Many plants, fish, and wildlife have co-evolved with wetlands and are dependant upon them for habitat and food sources.

As wetlands can contribute to critical hydrological and biological functions in a watershed, it is important to determine the locations and extent of wetlands in a watershed.

Methods

For the Thirtymile Creek watershed assessment, digital National Wetland Inventory (NWI) maps were not available through www.nwi.fws.gov, so hard copies were ordered through the Oregon Department of State Lands. Acreages and wetland types were determined using these maps. No other wetland inventories have been completed within the watershed.

The National Wetland Inventory was conducted by the U.S. Fish and Wildlife Service in 1974, NWI maps are based on aerial photography for an initial wetlands inventory of the larg areas (Morland 1990) and are not created for regulatory purposes. As the scale of these surveys is rough, representation of individual wetlands may be inaccurate. Oregon has adopted the NWI maps as a basis for a State Wetlands Inventory and Wetlands Management Program.

Results

Historical Wetlands in the Watershed

Historically, a large majority of the wetlands were located along the stream channel or in side canyons where water collected from smaller watershed areas. It is unknown the extent of historical wetlands in the watershed, as many potential wetland sites have been drained and/or farmed.

Appendix 6.2 describes potential wetland plant communities in the Thirtymile Creek watershed as described by the Natural Resources Conservation Service.

Current Wetlands in the Watershed

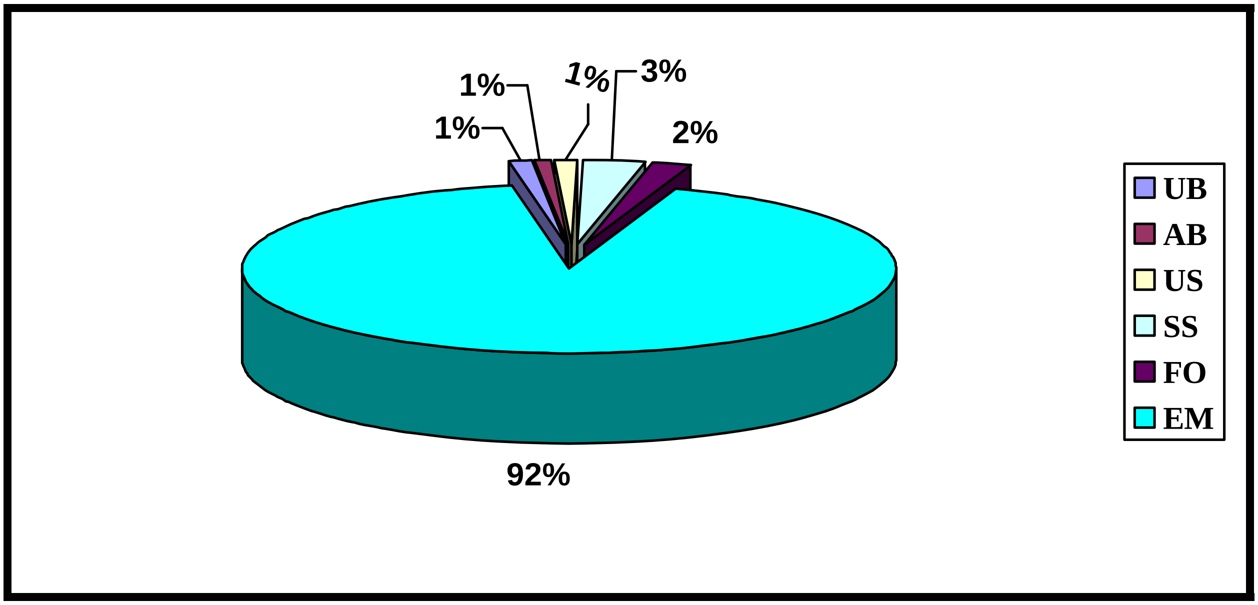
The National Wetland Inventory is the only watershed inventory available for the Thirtymile Creek watershed. Of the 172,943 acres in the Thirtymile Creek watershed, 52 acres were identified as wetlands.

The National Wetlands Inventory divides wetlands into five systems: marine, estuarine, riverine, lacustrine, and palustrine. Thirtymile Creek watershed's wetlands are all riverine or palustrine in nature. Riverine is the designation for the stream and palustrine wetlands are defined as including "all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 parts per thousand" (qtd. In Morlan 1990). Once a wetland has been classified by system, it is then classified by subsystem and class. Palustrine wetlands are not divided into subsystems, only classes. Classes in the palustrine system are shown in **Table 6.1.**

Table 6.1: Classes of Palustrine Wetlands

Class	Symbol
Rock Bottom	RB
Unconsolidated Bottom	UB
Aquatic bed	AB
Unconsolidated Shore	US
Moss-Lichen	ML
Emergent Wetland	EM
Scrub/Shrub Wetland	SS
Forested Wetland	FO
Open Water/Unknown Bottom	OW

Figure 6.2: Thirtymile Creek Wetlands by Class



Location of NWI Wetlands in the Watershed
Wetlands are typically found in depressions and the lower part of the landscape (Just the Facts #4). In the Thirtymile Creek watershed, the majority of the wetlands are distributed alongside streams with smaller, isolated wetlands scattered throughout the intermittent drainages that drain into Thirtymile Creek. A map was not included in this assessment as the level of detail requires a larger map size. Hard copies of the NWI maps can be obtained at the Gilliam-East John Day Watershed Council Office.

Lower Thirtymile Creek Sub-watershed 22 Acres of Wetland

Upper Thirtymile Creek Sub-watershed 30 Acres of Wetland

Hydric Soils
While hydric soils have not been mapped in the Thirtymile Creek Watershed, there are soil types that can include hydric soils. The entire soil type is not a potential hydric soil, rather, just areas with a certain landform (such as a depression). **Table 6.2** lists the potential hydric soil types according the the Gilliam County Hydric Soil List. The column "local landform" list the areas where the soil type could be hydric. To confirm hydric soils in an area, soil testing would need to be conducted.

Table 6.2: Potential Hydric Soils in the Thirtymile Creek Watershed

Soil Type	Name	Inclusion	Local Landform	Criteria Met
29D	Quincy-Rock Outcrop Complex 1-20%	Wet Spots	Depression	Saturation
35	Riverwash	Marsh and Wet Spots	Flood Plain	Saturation, Flooding

Discussion

Historically, wetlands were more widespread in the Thirtymile Creek watershed than they are today. Over time wetlands have been farmed over, disconnected from nearby streams, drained, and leveled. Removal of beavers may have also been responsible for diminishing wetlands, as beaver dams were removed, nearby wetlands were no longer flooded.

Currently, the NWI shows less than one percent of the watershed as being wetlands. As this inventory was done on a large scale with no field checking, the actual amount of wetlands currently present in the watershed is higher. If you are interested in inventorying wetlands on your property, contact the local Natural Resources Conservation Service office.

There are funding opportunities for wetland restoration. While not possible on a large scale, due to the agricultural nature of the watershed, selected restoration of wetlands can improve the hydrology and water quality of the area. As wetlands play a role in groundwater charging, increasing wetlands can improve late season low flows.

Data Gaps

- Hydric soil mapping
- Compilation of soil survey characteristics that indicate areas of historical wetlands
- Wetland plant community information

References

"Enhancing Wetlands Inventory Data for Watershed-based Wetland Characterizations and Functional Assessment". Power Point presentation by National Wetlands Inventory available on-line as .pdf file at nwi.fws.gov.

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Morlan, Janet, Oregon Department of State Lands. Oregon Wetlands: Wetlands Inventory User's Guide. Publication 90-1, 1990

United States Department of Agriculture. Natural Resources Conservation Service. SCS-OR MLRS B10. August 1990

The Oregon Wetlands Conservation Guide: Voluntary Wetlands Stewardship Options for Oregon's Private Landowners, Oregon Wetlands Conservation Alliance.

Watershed Professionals Network. Oregon Watershed Assessment Manual. Salem, Oregon: prepared for the Governor's Watershed Enhancement Board, 1999.

Appendix 6.1: Potential Wetland Plant Communities in the Thirtymile Creek Watershed (from NRCS Site Descriptions)

Wet Meadow

- Occurs on low floodplains of perennial streams and rivers
- Soils of this site are recent, very deep and poorly drained. The potential for erosion is moderate. The optimum growth period for native plants is from April through August. The soils are in hydrologic group D. The soils of this site have runoff potential. The soils in this site have excellent water holding capacities providing late season water for plant growth and slow water releases to streams.
- The potential native plant community is strongly dominated by sedges. Rushes and tufted hairgrass are common.

Meadow

- Occurs on low floodplains of perennial streams and rivers
- Soils of this site are recent, very deep and poorly drained. The potential for erosion is moderate. The optimum growth period for native plants is from April through August. The soils are in hydrologic group D. The soils of this site have runoff potential. The soils in this site have excellent water holding capacities providing late season water for plant growth and slow water releases to streams.
- The potential native plant community is dominated by tufted hairgrass. Sedges and rushes are common. Tufted Hairgrass production is dependant on the extent and duration of subsurface water flows.

Loamy Bottom

- Occurs mainly on the floodplains of perennial streams and rivers. It is near channels occupying secondary terraces.
- Soils are recent, very deep and well drained. The soils in this site have excellent water holding capacities providing late season water for plant growth and slow water release to streams. The soils are in hydrologic group B. The soils of this site have moderately low runoff potential.
- The potential native plant community is dominated by Basin Wildrye.

Sodic Bottom

- Occurs on low to mid-elevation floodplains of perennial streams and rivers.
- The soils of this site are recent, very deep and somewhat poorly drained. The soils are in hydrologic group D. The soils of this site have high runoff potential. The souils in this site have good water holding capacities providing late season water for plant growth and slow water releases to streams.
- The potential native plant community is dominated by Basin Wildrye.

Willow Riparian

- Occurs on depositional floodplains along perennial streams and rivers. Floodplains are well connected.
- Soils are silt loam over gravelly silt loam and are deep.
- The potential native plant community is dominated by willow with an unknown understory. Current plant community is willow and reed canarygrass. As willows decrease reed canarygrass becomes strongly dominant.

Gravelly Braided Bottom

- Occurs on floodplains of perennial streams and rivers.
- The soils on this site are very deep, gravelly and well to excessively well drained. The soils are in hydrologic group B. The soils of this site have moderately low runoff potential. The soils of this site typically reflect hydric soil characteristics.
- The potential native plant community is dominated by black cottonwood and tall willows, alder, hawthorn, rose and basin wildrye are present.

Chapter 7: Water Quality

Introduction

In this chapter, water quality data collected in the Thirtymile Creek watershed is presented and summarized.

Background

Water quality is influenced by both natural and human activities. Human caused point and non-point source pollution, land use activities in riparian zones, in-stream disturbances, and water withdrawls or diversions all affect water quality. Natural conditions of streams, such as low summer flows and low stream gradient, can result in streams being more susceptible to water quality changes and less able to handle pollution levels.

Under the Clean Water Act, the U.S. Congress required the Environmental Protection Agency (EPA) to "protect and maintain the chemical, physical and biological integrity of the nations waters." The EPA has, for the state of Oregon, put the Oregon Department of Environmental Quality (DEQ) in charge of setting the state's standards for quality and to enforce them.

Water quality in Oregon is evaluated by comparing existing conditions to criteria contained in water quality standards set by the DEQ. These criteria were set as a way to determine whether the quality is sufficient to support beneficial uses of each basin. In the case of multiple beneficial uses in a body of water, federal law requires DEQ to protect the most sensitive of those beneficial uses. This premise assumes that by protecting the most sensitive beneficial use, all will be protected. Beneficial uses vary from basin to basin to account for land use patterns and existing aquatic life. The Oregon Water Resources Department has listed 14 beneficial uses for all waters in the Lower John Day Basin:

- Public water supply
- Domestic water supply
- Industrial water supply
- Irrigation
- Livestock watering
- Anadromous fish passage
- Salmonoid fish rearing
- Salmonid fish spawning
- Resident fish and aquatic life
- Wildlife and hunting
- Fishing
- Boating
- Water contact recreation
- Aesthetic quality

Stream reaches that do not meet one or more of the Oregon Water Quality Standards are considered impaired or threatened and placed on the **303(d) list.** For all reaches on the 303(d) list and any waterbody designated is water quality impaired. DEQ is required to establish a **Total Maximum Daily Load (TMDL)**. When TMDLs were set for the Lower John Day Sub-basin, DEQ identified criteria, including temperature, dissolved oxygen (DO), pH, nutrients, bacteria, turbidity, habitat and flow modification, and aquatic weeds or algae.

DEQ has signed Memorandums of Agreement (MOA) with Oregon Department of Agriculture (ODA) and Oregon Department of Forestry (ODF). The MOA with ODA assigns ODA with the task of implementing TMDLs on state and private agricultural lands. According to **Senate Bill 1010,** ODA will implement TMDLs through water quality management plans for each sub-basin in the state of Oregon. ODF is assigned to implement TMDLs on state and private forested lands. This will be done through **Best Management Practices** and revisements of the **Forest Practices Act** in order to meet water quality standards.

Temperature

Cool water temperatures are a basic requirement for many aquatic species, including summer steelhead, that have evolved in the Thirtymile Creek basin. Reproduction and development are adversely affected when water temperatures are outside the ranges these species have historically lived in.

Temperature is also closely linked with other water quality parameters, like dissolved oxygen and pH. Dissolved oxygen levels and pH are inversely related to temperature.

Solar radiation is one of the primary sources of heating water in streams. The amount of surface area versus volume affects stream temperature. A stream that is widening but not increasing its net flow will have a greater exposed surface area for the volume of water it holds. This can result in increased temperatures. Shade from riparian vegetation and topography decreases the amount of solar radiation hitting a stream, thereby slowing the rate of stream temperature increases due to heat radiation. At night, stream temperatures decrease.

DEQ's temperature standard states that "where salmonid fish rearing is a designated beneficial use, no increase in temperature should be caused by human activities when temperatures exceed 64˚F. thus, when temperatures exceed 64˚F, only the portion of heating that results from human activity is considered to be pollution. The 64˚F criterion refers to the seven-day moving average of maximum daily temperature. This method of reporting temperature decreases the effect of a single peak temperature in data interpretation.

Dissolved Oxygen

The amount of dissolved oxygen in water is vital to fish and other aquatic animal respiration. In the Pacific Northwest, these species have evolved in the high dissolved oxygen levels characteristic of the regions waters. Developing steelhead and trout eggs and fry are especially sensitive to low DO levels. Nearly saturated levels are necessary for salmonids to maintain normal metabolic function. Lower levels inhibit salmonids' ability to find food and shelter.

Oxygen is usually dissolved in running water in equilibrium with the atmosphere. Water temperature and atmospheric pressure determine oxygen saturation. Dissolved oxygen levels fluctuate throughout the day, because of stream temperature and the presence of **photosynthesis** and **respiration** of plant and algae species. During the day, when photosynthesis is occurring, plants convert carbon dioxide into energy, expelling oxygen as a waste product. This causes dissolved oxygen levels to rise. Plants and algae respire continuously, consuming oxygen and producing carbon dioxide. During the night, when algae and plants do not photosynthesize but do respire, dissolved oxygen levels fall. Because of this daily fluctuation, dissolved oxygen is best measured over a 24 hour period for the results to be useful. Samples taken in the early morning and late afternoon can also capture this daily fluctuation (pers. Comm.., Mitch Wolgamott, DEQ).

For the Thirtymile Creek watershed, the DEQ 30-day average standard for Dissolved Oxygen is 8.0mg/L. The TMDL target for DO in the Lower John Day River has not been set as of this date but should be completed in 2006.

pH

pH is a measurement of the activity or basicity of a body of water. The pH scale is 1-14, with 1 being most acidic, 7 being neutral, and 14 being the most basic. The scale is logarithmic, meaning that the difference between a pH of 1 and 2 is not 1 but a factor of 10. Therefore, a pH of 9 is 10 times more basic than a pH of 8.

The pH of natural waters varies according to an area's level of precipitation and geologic composition. In arid northeast Oregon, higher average pH levels are to be expected. But geology and precipitation cannot explain the large daily fluctuations in pH. pH varies throughout the day because of aquatic plant and algae photosynthesis and respiration, making it difficult to measure the maximum daily pH without sampling an entire 24 hour period. If other watersheds in eastern Oregon are used as an example the DEQ will more than likely set the pH standard to between **6.5 and 9.0.**

Nutrients

Phosphorus and nitrogen are the primary growth limiting macronutrients in water and, therefore, are the two nutrients most often measured when monitoring water quality. In moderation, these nutrients promote a healthy stream system, increased levels of dissolved oxygen, and food for macroinvertebrates by plant growth. High nutrient levels in streams can be unhealthy for fish and other aquatic organism because they lead to excessive algae growth which causes problematic changes in Do and pH levels. Algae blooms also inhibit recreation and the aesthetic value of the water.

Nitrogen is present in streams as nitrates, nitrites, ammonia, and organic forms. The forms readily available for plant uptakes are nitrates, nitrites, and ammonia (or Dissolved Inorganic Nitrogen). The lower John Day Sub-basin has not determined a TMD Level for Dissolved Inorganic Nitrogen but the assumption is that it will be at **33µg/L.**

Phosphorus is also present in streams in organic and inorganic forms. The form of phosphorus readily available for plant use is called orthophosphate. It is assumed that the TMD Level will be in the vicinity of **7µg/L.**

Bacteria
Coliform bacteria are used as indicators for testing the sanitary quality of water for drinking, swimming, and shellfish culture. Oregon Water Quality Standards for bacteria are: no single sample shall exceed 406 E. coli organisms per 100ml of water and no 30 day log mean shall exceed 126 E. coli organism per 100ml of water. For the purposes of this assessment, the single sample standard shall be used, due to limited data. However, this method shows only a moment in time, not trends of bacterial contamination.

Turbidity and Suspended Sediment
Turbidity measures the clarity of water. Turbidity can be caused by suspended sediments, algae, or other suspended materials. Turbidity is measured by passing a light beam through a sample. The more suspended material, the less the light that passes through the sample, resulting in a higher turbidity value. Turbidity is measured in NTUs (Nephelometric Turbidity Unit).

Suspended sediment is all the sediment suspended in the water column. It is measured by drying a water sample and then weighing the residual sediment. Concentrations are usually reported in mg/L, the equivalent of parts per million (ppm). To calculate sediment load, discharge data is needed.

Turbidity and suspended sediment will vary naturally with soil types. Silts and clays will stay suspended for long period and cause turbidity, while larger particles, like sand, will settle to the bottom. Turbidity will also increase during storm and runoff events.

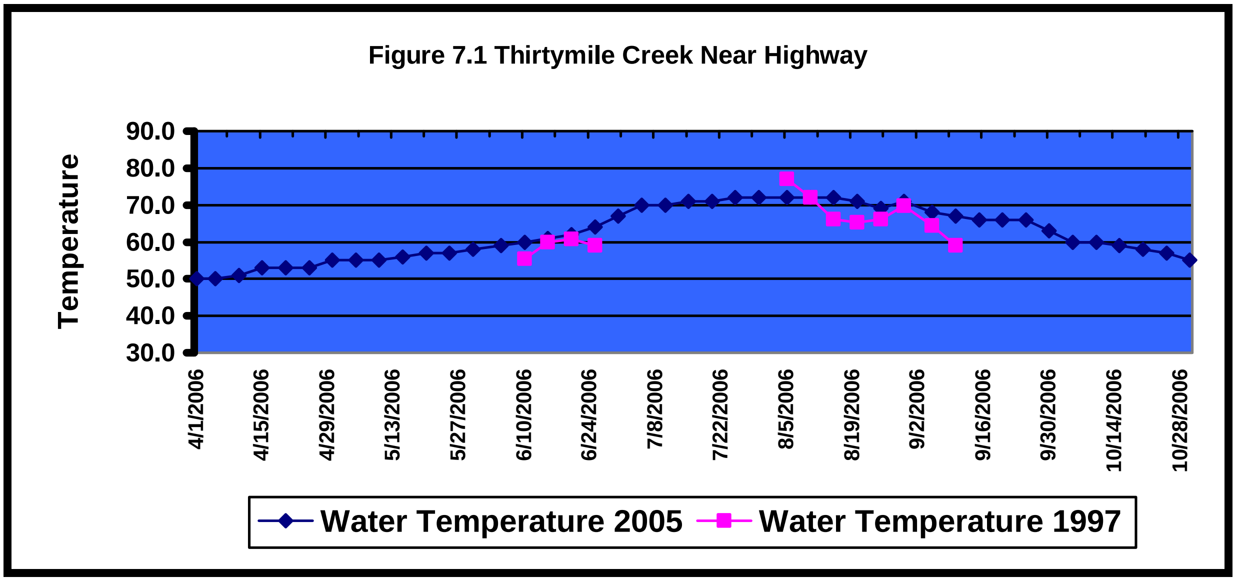
DEQ specifies a criterion that compares an activity's turbidity level relative to a background level measured upstream. An increase in turbidity greater than 10% exceeds the turbidity standard.

Methods

Data presented in this component was gathered from the Gilliam-East John Day Watershed Council monitoring completed in the year 2005. Very little data was available in the Thirtymile Creek watershed prior to this date, so most of the information available in preparing this report is a one year picture in time. Though, some information was made available from the EPA that was used but again it is only information that was collected during a one year time period. The TMDL for the Lower John Day River Sub-basin is scheduled to be completed during 2006 so TMDL information is assumed from other eastern Oregon watersheds.

Results

Water Quality Data was collected by the Gilliam-East John Day Watershed Council. Three sites have been sampled for water quality in the Thirtymile Creek watershed by the Gilliam-East John Day Watershed Council. **Map 7.1** shows their locations**.** Temperature data was sampled every hour from April to October using a data logger. Chemistry data was collected weekly with grab samples. There is also some partial data collect by the EPA in 1997 that will be assumed as accurate and used in this report.



64º F is the DEQ Temperature Criterion (Temperatures on Graph is the Daily Average)

Discussion

Water quality is a difficult topic to adequately address with minimal data. The existing data shows Thirtymile Creek's impact on the water quality of the John Day River, but is too limited to show what portions are natural and human caused. To summarize the data, temperature exceeds the seven day moving average maximum temperature of 64˚F a good portion of the summer months on all three sites that were tested the summer of 2005. Nutrient levels in Thirtymile Creek did not exceed the **assumed** TMDL standards of 33µg/L (Dissolved Inorganic Nitrogen) or 7µg/L (orthophosphates) for the John Day River. pH levels are recorded at slightly below 9.0 (8.7 to 8.9) and dissolved oxygen has not dropped below the standard of 8.0 mg/L but some grab samples have been right at that level throughout the length of the stream. Although there is very limited flow data (EPA 1997 and 2000), Thirtymile Creek is a high priority for flow in the John Day River Watershed Sub-basin Revised Draft Plan. Fine sediments, another form of pollution, is also present at levels affecting fish reproduction (see Chapter 8: Sediment).

What does all this mean? How is water quality affecting salmonid fish in the Thirtymile Creek watershed? High nutrient levels, low flow, exposure to direct sun, and high water temperatures promote algae growth. Algal growth increases the magnitude of daily fluctuations in dissolved oxygen and pH. When dissolved oxygen, temperature, and pH fall outside the range which salmonids are adapted to, mortality and reduced reproduction occur. Extreme fluctuations place additional stress on the fish. As salmonid fish rearing is the most sensitive beneficial use in the Thirtymile Creek watershed, current water quality conditions are not adequate to support this beneficial use. Algal growth, with its effects on fish habitat requirements, is a large factor in this. By minimizing algal growth and minimizing human caused increases in temperature, fish habitat parameters can be improved and Thirtymile Creek's most sensitive beneficial use protected.

Minimizing algal growth requires limiting exposure to sunlight, lowering water temperatures and reducing nutrient levels in streams. Limited data is showing that nutrient levels are not outside of the parameters set by DEQ so the main emphasis should be placed on restoring a good condition riparian area with adequate brush to shade the stream from solar radiation which will have an effect on both flow and temperature.

Additional monitoring in the future will provide a stronger basis with which to assess and improve water quality in the Thirtymile Creek watershed. By monitoring in the headwaters of the watershed, information on how much pollution is natural and how much is human-induced can be gathered, providing further insight on how to improve water quality in the watershed.

Data Gaps

- Lack of water quality data
- Flow data
- Monitoring that measures daily Do and pH fluctuations
- Amount of natural versus human-caused pollution

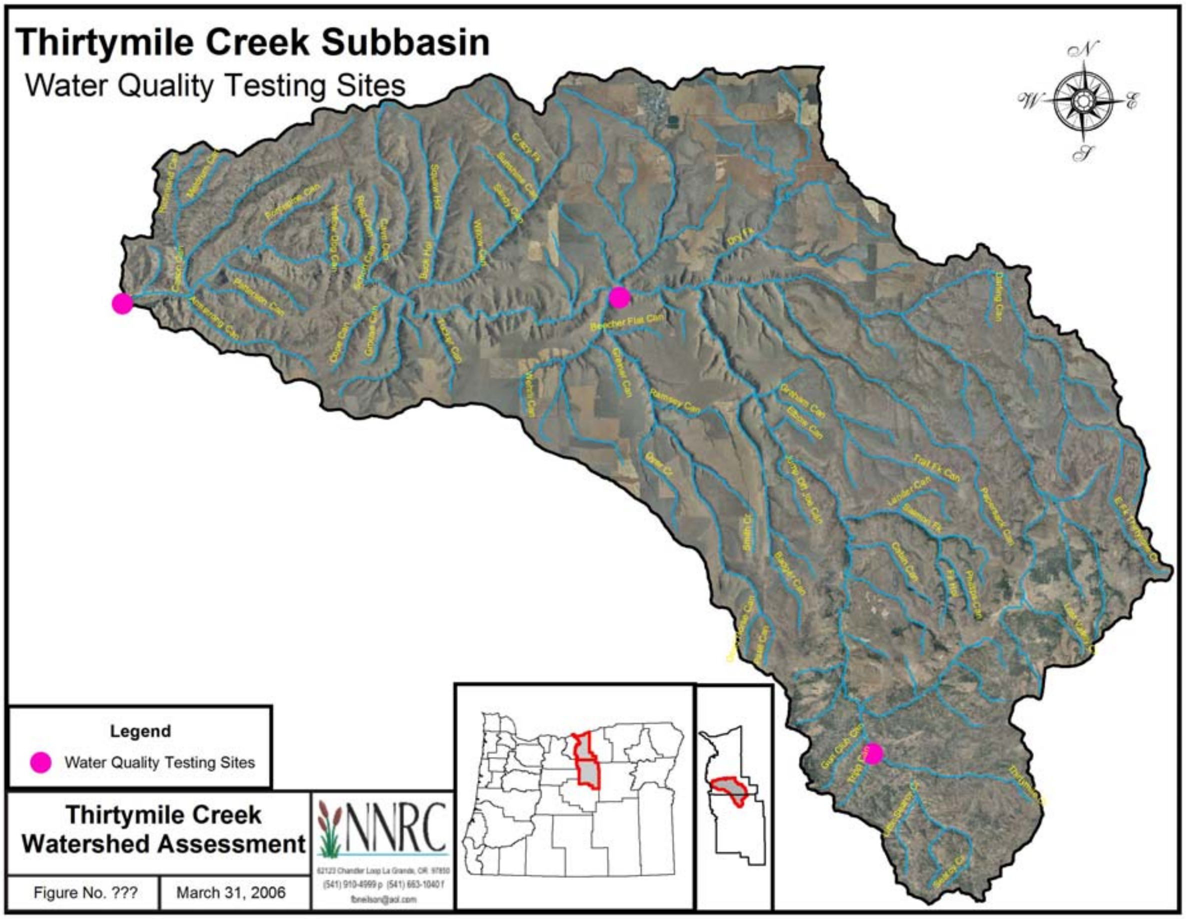
References

Monitoring Guidelines to Evaluate Effects of Forestry Activities on Stream in the Pacific Northwest and Alaska. Environmental protection Agency. May 1991

Watershed Professionals Network. Oregon Watershed Assessment Manual, Salem, Oregon: prepared for the Governor's Watershed Enhancement Board, 1999

John Day Subbasin Revised Draft Plan. Prepared by Columbia-Blue Mountain Resource Conservation and Development Area, March 15, 2005.

Map 7.1: Water Quality Data Collection Sites in the Thirtymile Creek Watershed



Chapter 8: Sediment

Introduction

In this chapter potential sediment sources are identified and discussed. As high levels of sediment can negatively affect salmonid reproduction and cause undesired changes in channel form, understanding sediment's current role in the watershed is needed.

Background

Erosion is a natural occurrence. Fish and other aquatic organisms have adapted to a range of sediment amounts entering streams in their habitat. Erosion and sediment load in streams vary throughout the year, with most sediment moving during the short time periods with the highest flows. In the Thirtymile Creek watershed, this usually occurs during spring snowmelt.

Humans can also induce erosion in a watershed. Separating human-induced erosion from natural erosion can be difficult because of the highly variable nature of natural erosion patterns. Generally, the greater a stream's sediment load deviates from natural conditions, the greater the chance that fish will be affected.

Sediment in streams can also negatively affect humans. High sediment level can increase the costs of treating drinking water, can be aesthetically displeasing, and can decrease angling success.

Sediment Transport Process

Sediment moves in a system and eventually is deposited. Sediment processes are often discussed in terms of collection, transport, and deposition. Rock is eroded through runoff into high gradient streams, from where it is transported through the stream system until the gradient lowers and the confinement eases. As the gradient levels out, the stream's energy is dissipated, through increased **sinuosity** and slower flows. This causes the stream to deposit its sediment load into **alluvial** and **floodplain** channels of the stream system. Generally, the larger the particle of sediment, the less distance it will travel. Thus, boulders will only move a few feet, while sand may move miles. Sediment input into streams can come from two sources: hillslope or channel sources.

Hillslope Sources

Sediment moves downslope by surface erosion and mass wasting. Landslides are a form of mass wasting. They can occur when soil cohesiveness is exceeded by high soil moisture content or when slope steepness causes soils to detach and move downslope rapidly.

Surface erosion can occur when precipitation exceeds the ability of the soil to absorb water or where soil surface have been exposed or compacted (ex. Road surfaces, heavily grazed areas, areas compacted by heavy machinery). Surface erosion includes many types of erosion**: sheet erosion, raindrop splash erosion, rill and gully erosion,** and **raveling** (see glossary).

Sediment transport to a stream is dependent on soil type, slope, proximity to the stream, and the duration and intensity of rainfall. Vegetative cover can affect the likelihood of sediment impacting streams. Erosion potential can also be affected by the degree of soil compaction, road drainage systems, and land management activities.

Channel Sources

Channel sources are associated with debris flows and bank sloughing. Debris flows occur when a landslide reaches a steep stream channel and incorporates logs, boulders, soil and water. It grows in size as it heads downstream and stops when the slope lessens. Most streams that have experienced debris flows will probably have more in the future. Bank sloughing occurs when stream channels migrate laterally. It is often increased by a lack of riparian vegetation and is more prevalent in unconstrained channels.

Methods

Information was collected from the Gilliam County Public Works, Oregon Department of Geology, Umatilla National Forest, Oregon Department of Fish and Wildlife, and the Natural Resources Conservation Service. USGS topographic maps, Geographical Information System data, aerial photos, and Department of Geology maps were also used.

Results

Sediment Sources in the Thirtymile Creek Watershed

The following were assessed as potential sediment sources: roads, channel erosion, slope instability, erosion from land uses, and erosion from burned lands.

Roads

Roads account for .16% of the entire area of the Thirtymile Creek watershed (see Chapter 4). There is minimal information about private roads within the watershed.

Culverts

Culvert assessments have not been conducted on the culverts in the Thirtymile Creek watershed.

Road Conditions

Roads can contribute to sediment in streams, especially if not properly maintained.

Streams and Roads

Roads that are within 200 feet of streams can affect a stream's morphology by artificially constraining the channel and can be direct contributors of sediment to streams, **Table 8.1** shows the miles of roads that are within 200 feet of streams in each sub-watershed.

Table 8.1: Road Miles Within 200 Feet of Streams

Subwatershed	Miles of Stream within 200 Feet of Stream	Total Road Miles	% of Road Within 200 feet of Stream
Upper	8.3 Miles	16 Miles	50%
Lower	1.2 Miles	8 Miles	15%

Channel and Near Channel Erosion
The Oregon Department of Fish and Wildlife conducted an extensive survey for summer steelhead habitat in Thirtymile Creek and fish producing tributaries. Though bank erosion in itself was not measured other measurements that can give us a good idea of the condition of the bank are available. In almost all of the survey points spawning gravels were marginal because of fine sediments, streamside cover was herbaceous with no woody vegetation, and stream area shaded was marked at either 0 or 10%. The assumption that can be made from this survey is that riparian vegetation is not adequate on most of Thirtymile Creek. The lack of riparian area, almost always, suggests that bank erosion is occurring.

Bank erosion greater than 20% is considered unnatural and undesirable (per. comm.., Tim Unterwegner). Streams that are **dynamic** will often have eroding banks as one bank erodes to move laterally. Channel habitat types in the Thirtymile Creek watershed that move laterally include medium floodplain (FP2) and small floodplain (FP3). In confined CHTs, natural bank erosion may result from fallen trees, landslides, and or debris flows (EPA 1991). For more information about channel habitat types in the Thirtymile Creek watershed, see Chapter 3: Channel Habitat Types.

Fine sediments in riffles are an indication of the ability of a stream to manage its sediment load. In ideal conditions, slow moving pools are where most deposition occurs. However, if the sediment load is high for the stream or there are not enough pools, then the stream will deposit sediment in other sections of the stream, such as riffles. Because riffles are where spawning gravel is most likely to be found, this can result in a net loss of spawning gravel, or impede the successful reproduction of cold water fish. The ODFW undesirable benchmark for fine sediments in riffles in eastern Oregon has been set at 20% and the desirable benchmark at 8%.

Slope Instability Not Related to Roads
Historically the upper watershed has had slope instability due to landslides and debris avalanches. In draft geology quad maps the Oregon Department of Geology has recently created, there are a number of landslides that have occurred in the Holocene period (the last 11,000 years). **Map 4.2** in Chapter 4: Hydrology and Water Use shows these landslides. The majority are on the steeper higher elevation areas in the watershed.

The Department of Geology considers landslides a geologic hazard of the watershed and has stated that a landslide could occur at any given time (Mark Ferns). Land use practices such as harvesting trees and road building on steep slopes can increase the risk of landslides.

Debris Flows are known to occur in the watershed. In the 1964 and 1996 rain-on-snow events, debris flows that began in the upper watershed brought debris and sediment downhill. (Pers. Comm., Jordan Maley)Debris flows can be a significant source of sediment in streams when they do occur.

Erosion from Agriculture and Range Lands
The Natural Resources Conservation Service (NRCS) has divided soils in the Gilliam County Soil Survey into two categories: non-highly erodible and highly erodable. Soils can be highly erodible from wind and/or water. 66 percent of agricultural soils in the Thirtymile Creek watershed are highly erodible by water (NRCS, digital Gilliam County soil survey data). 82 percent of potential range soils on private land are highly erodible by water. Some soils types are highly erodible by wind. For more information about soils, see the Gilliam County Soil Survey. **Appendix 8.3** lists the soil types present in the private lands of the watershed.

Soil types are not the only factor in erosion from crop and rangelands. Cover type, conservation measures, precipitation, and slope also determine whether an area is likely to be contributing sediment to streams. A detailed assessment of agriculture's sediment contribution to streams needs to be conducted.

Erosion from Ditches
There are uncounted miles of ditches in the Thirtymile Creek watershed, used for road drainage, irrigation, and land drainage. Unstable ditches can contribute sediment directly into the stream system. Annual cleaning of ditches can increase sediment contributions to streams from ditches.

Erosion from Burned Land
There are no recent fires within the Thirtymile Creek watershed. The fuel loads of many forest stands are large enough to have increased fire risks. For more information, see Chapter 12: Forest Health.

Discussion
Too much sediment in spawning gravels can adversely affect salmonid spawning. Fine sediment in riffles ranged from 7 to 68% (estimated by author) in surveyed reaches in the Thirtymile Creek watershed. As the ODFW benchmarks are set for fish needs, the excessive fines in riffles or the surveyed reaches indicates that fish reproduction and development may be impaired in those reaches. This also mean sediment deposition amounts are too large for quality fish habitat in those reaches. Most deposition occurs in pools, where there is less flow. It is possible that the sediment loads of Thirtymile Creek are more than the stream can handle and therefore you have deposition in riffles. It is also possible that the lack of large woody debris (LWD) and the low number of pools per mile (See Chapter 10: Fish and Fish Habitat discussion) have changed the distribution of sediment in the stream. To determine whether sediment loading, streams structure, or both are the causes of excessive fines in riffles, more sediment data needs to be collected.

The Thirtymile Creek watershed was listed as a high priority area for sediment in the John Day River Sub-basin plan. If the sediment loads are too large for the stream to handle, what can be done? Sediment sources need to be identified and minimized. Possible sediment sources in the Thirtymile Creek watershed include: roads, crop and range lands, stream bank erosion, ditch erosion, and landslides.

Roads can be one of the major contributors of sediment to streams, especially when there are high road densities. In the Thirtymile Creek watershed, the entire watershed and each sub-watershed all have relatively low road densities. But a large majority of the roads in the watershed are unpaved, and thus are contributing larger amounts of sediment to streams. Native surface roads contribute more sediment to streams than rocked or paved roads.

The geology and topography of the upland sections of the watershed show landslides as a potential occurrence. While the geology and topography cannot be changed, they can be recognized and land uses adjusted to minimize landslides and debris flows.

Most of the crop and range lands are highly erodible and some of those lands are on moderate slopes. These lands are probably contributing sediment to streams. Conservation practices and riparian buffers can minimize the amount of sediment that reaches streams and also conserve soil on crop and range lands.

The ODFW habitat survey shows the potential for high levels of bank erosion throughout all sections of the watershed. Therefore, stream bank erosion is a source of sediment to streams in the watershed. The erosion can be a result of stream bank instability or from peak flows reshaping the channel form. Flows passing through channelized reaches may have more energy than when in original channels, with the added energy resulting in stream bank and stream bed erosion. Stream bank instability can be the result of lack of riparian vegetation. As the results in Chapter 5: Riparian Areas show limited woody and brush vegetation in riparian areas, this is likely the case with bank erosion.

Erosion from ditches is also a source of sediment to streams in the Thirtymile Creek watershed. How and when ditches are cleaned can help control ditch erosion.

Understanding the geology, topography, climate, and soils of the watershed, along with how human activities can contribute sediment to streams and alter how streams manage their sediment loads is a good beginning for improving sediment conditions and fish habitat. Implementing actions to control sediment and improve stream structure will be the next step.

Data Gaps

- Miles of private unpaved roads
- Assessment of all culverts
- Identification and mapping of all landsides in watershed
- Miles of ditches in the watershed

References

Tim Unterwegner, Physical and Biological Stream Survey Forms, Oregon Department of Fish and Wildlife, August 1971.

John Day Subbasin Revised Draft Plan. Prepared by Columbia-Blue Mountain Resource Conservation and Development Area, March 15, 2005.

Monitoring Guidelines to Evaluate Effects of Forestry Activities on Stream in the Pacific Northwest and Alaska. Environmental protection Agency. May 1991

Watershed Professionals Network. Oregon Watershed Assessment Manual, Salem, Oregon: prepared for the Governor's Watershed Enhancement Board, 1999

Chapter 9: Channel Modification

Introduction
The purpose of the channel modification component is to identify current and historical channel modifications in the Thirtymile Creek watershed. By knowing the types and amount of channel modifications, current watershed functions can be better understood and restoration opportunities identified.

Background
Channel modifications occur when humans alter stream channels. These modifications can change channel geomorphology and biotic function in the altered reach and in reaches and streams downstream of the modification. Modification types include: dams, roads, bridges, rip-rap, ditches, channelization, culverts, in-stream mining, dredging, levee building, and other bank stabilization efforts. These activities typically result in more uniform channel cross sections, steeper stream gradients, and reduced average pool depth.

By changing stream gradients and straightening channel paths, channel modifications cause increases in the energy of stream flows. This energy, no longer dissipated over length and meandering channels, instead can cut into the stream bed and banks, causing instability and increased erosion. This causes an increase in the sediment load on the stream. An undisturbed stream's sediment load is in equilibrium, as the stream is able to handle the sediment eroded and transported and then deposited. Channel instability occurs when the scouring process leads to **degradation**, or excessive sediment deposition results in **aggradation.**

Channel modifications have significantly altered salmonid habitat in the Pacific Northwest. Dams along the Columbia, Snake, and other rivers have created fish passage barriers for sea-migrating species such as summer steelhead. Changes in salmonid spawning and rearing habitat have also affected salmonid population numbers.

Methods
Topographic maps, aerial photographs, and other records were gathered and used in identifying channel modifications in the Thirtymile Creek watershed. Stream lengths were estimated using a measurement meter on the computer generated maps.

Results
Channelization
Aerial photos were used to estimate the amount of channelization on Sniption, Badger, Searcy, Little Searcy, East Fork Thirtymile, and Trail Fork Creeks. During the floods of 1964 the lower end of Thirtymile Creek had a large area where the channel jumped out of the original channel and carved a new channel through some agricultural land. An effort was made to move the channel back into the vicinity of the original channel, this new channel was straighter than the original channel and sections of it did not stay where it was located but moved back into the newly carved channel that was formed during the flooding event. Finally the irrigated

agricultural land was abandoned. The rest of the lower watershed looks to be in the natural channel.

In the upper watershed Thirtymile Creek has been moved to allow for the road to be installed which has straightened and removed the meander for several miles. Other roads along the tributaries have moved the channel and straightened the meander in small sections. The total amount of manipulation to the channels within the Thirtymile Creek watershed has been low.

Ditches/Irrigation Canals

Since most of the irrigated land is high in the watershed and there are only small amounts of irrigated ground, ditches are not a severe problem but do add to the cumulative effects of channel modifications.

Roads

Roads that parallel streams affect stream structure by actinically constraining the stream in a narrow area. They also contribute sediment to streams and decrease infiltration rates, depending upon their surfaces. Chapter 4: Hydrology and Water Use includes information on the hydrological effects of roads in the Thirtymile Creek watershed. Chapter 8: Sediment provides more information on sediment contributions of roads, the mileage of streams affected by nearby roads and culvert information.

Discussion

Several types of channel modifications were identified while researching this chapter. Ditches and diversions are not that prevalent, due to the agricultural nature of the watershed but roads and road ditches are prevalent in the watershed. As mentioned in the background section of this chapter, these modifications have changed the hydrology of the watershed, causing less infiltration of water into the soil and water to enter the stream system more rapidly.

Stream channelization is not that common in the agricultural areas of the watershed, but agricultural lands on both sides of streams and roads that parallel streams have artificially confined stream channels. This can result in effects similar to those of channelization, namely disconnection with the stream's floodplain, loss of habitat complexity, and unstable stream banks.

Many of the channel modifications in the Thirtymile Creek watershed are necessary to infrastructure and agriculture. Irrigation and road ditches are necessary for crop production and road stability. Diversion dams are necessary for irrigation purposes. However, the effects that these necessary modifications have on fish habitat and stream structure can be minimized. Fish passage barriers can be identified and actions taken to provide passage, such as dam designs that allow passage. Roads and ditches can be maintained in order to have minimal sediment enter the stream system. Inadequate culverts can be replaced with 50-year or 100-year flood sized culverts. Opportunities exist for rerouting channelized sections of streams into their old channels. This would increase the length of stream channels and the amount of time that water stays within the watershed, thereby assisting with diminishing the intensity of peak flows and potentially decreasing the amount of time of low flows. Increasing the amount of channel could be combined with riparian buffers (see Chapter 5: Riparian Areas) to improve the adjacent floodplain's ability to store and hold water, thereby increasing the amount of water available for release during low flows.

Stream bank stabilization through the use of riprap and other man made materials is a channel modification that can ultimately do more harm than good. While temporarily preventing bank erosion, peak flow events can whittle stream banks out from behind riprap, causing even further erosion problems. Although sometimes necessary in the short term, manmade stream bank stabilization is best minimized in the long term. A long term alternative is riparian revegetation, which can provide natural bank stabilization that will not alter channel form.

Data Gaps

- Inventory of diversions
- Inventory of all possible fish passage barriers
- Culvert inventory on all culverts in the watershed

References

Watershed Professionals Network. Oregon Watershed Assessment Manual, Salem, Oregon: prepared for the Governor's Watershed Enhancement Board, 1999

Tim Unterwegner, Physical and Biological Stream Survey Forms, Oregon Department of Fish and Wildlife, August 1971.

Chapter 10: Fish and Fish Habitat

Introduction

This chapter discusses fish presence and distribution, migration barriers, and habitat conditions in the Thirtymile Creek watershed.

Background

Salmonids are the most widespread group of fish in the state of Oregon and are well recognized as indicators of watershed health (OWEB manual 1999). Thus, protecting and restoring salmonid habitat will ultimately result in improving the health of a watershed. To do so, we must understand salmonid life cycles and habitat needs and evaluate current habitat conditions.

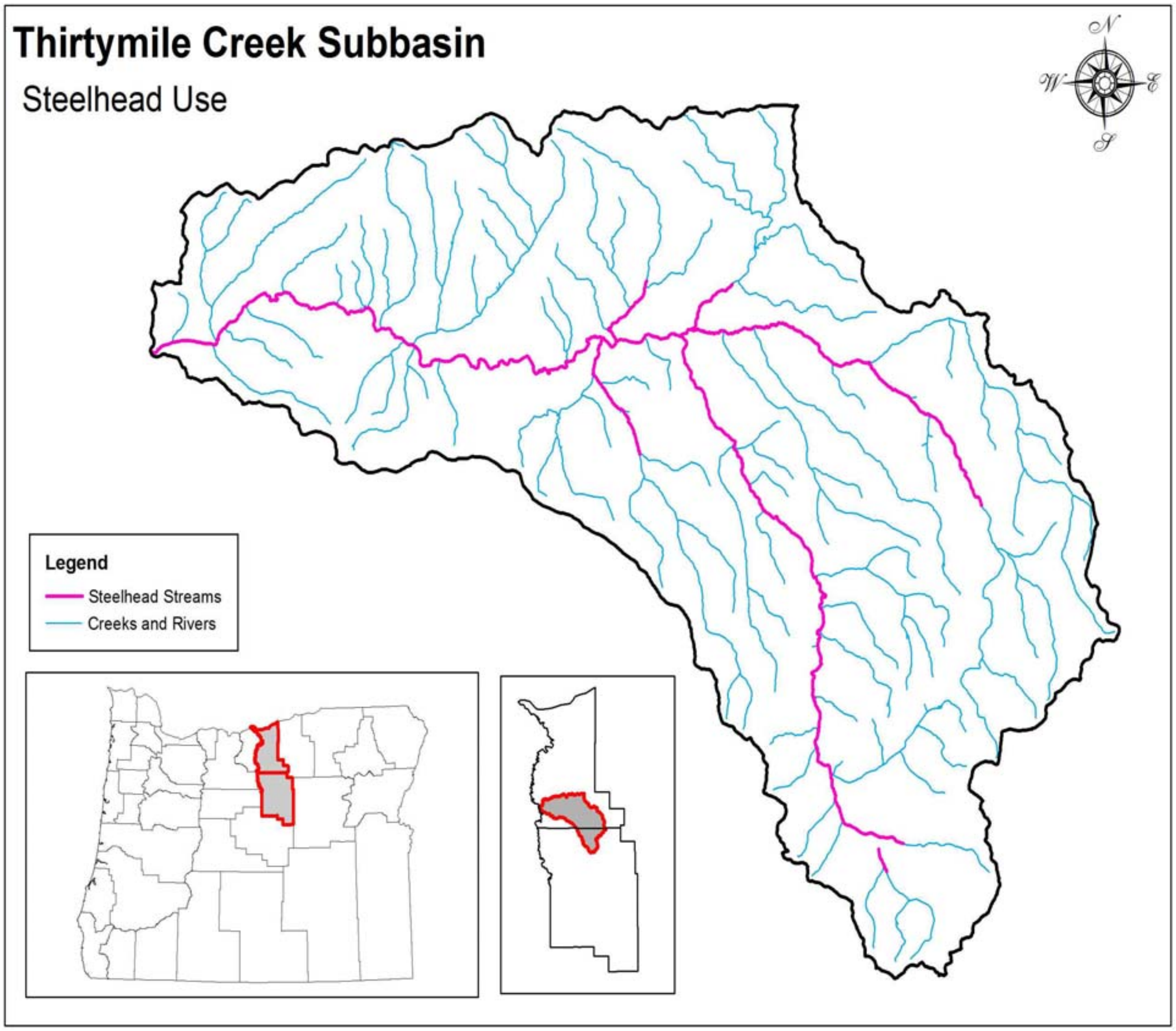
Declining steelhead populations in the interior Columbia Basin have prompted the National Marine Fisheries Service to list the Middle Columbia Steelhead as threatened on March 25, 1999. Declining salmonid populations in the John Day Basin are believed to be caused by a combination of factors in the basin, along with the Columbia River and the Pacific Ocean. Habitat degredation in all habitats, fish passage barriers due to dams on the Columbia River, ocean conditions, and over exploitation of mixed-stock fisheries are the downstream causes of population loss (NPPC 1986, ref. in McIntosh 1992). In the John Day Basin, the major in-basin causes of salmonid population declines are in-channel and riparian habitat degradation, along with high summer and low winter water temperatures (per. comm., Tim Unterwegner).

The Oregon Department of Fish and Wildlife has developed a series of habitat benchmarks of undesirable and desirable conditions. Since loss of habitat complexity is a major cause of population decline, it is important to understand what provides complexity in streams. Important components of habitat complexity include: the amount of pools, riffles, and gravels, stream width to depth ratio, large woody debris, and riparian vegetation. Removal of large woody debris beginning after the 1964 floods and the scouring affect of the flood has been two of the reasons behind loss of habitat complexity. Removing the large wood caused a drastic reduction in the pool area on streams (McIntosh 1992). Pools, mostly found on lower unconstrained channels, are important rearing habitat. Loss of riparian vegetation due to adjacent land uses has also reduced the amount of in-stream large woody debris and shade and increased width to depth ratios.

Methods

Stream surveys, fish presence surveys, redd surveys and salmonid distribution maps were obtained from the Oregon Department of Fish and Wildlife. Information from these sources and other published reports were used to document salmon life cycles, distribution, origin, population trends, habitat conditions, and limiting factors. Oregon Department of Fish and Wildlife fisheries biologists were consulted for additional assistance and professional opinions.

Map 10.1: Known Summer Steelhead Distribution in Thirtymile Creek Watershed



*** 55.9 miles of steelhead streams in Thirtymile Creek watershed.**

Results

Fish Life Cycles

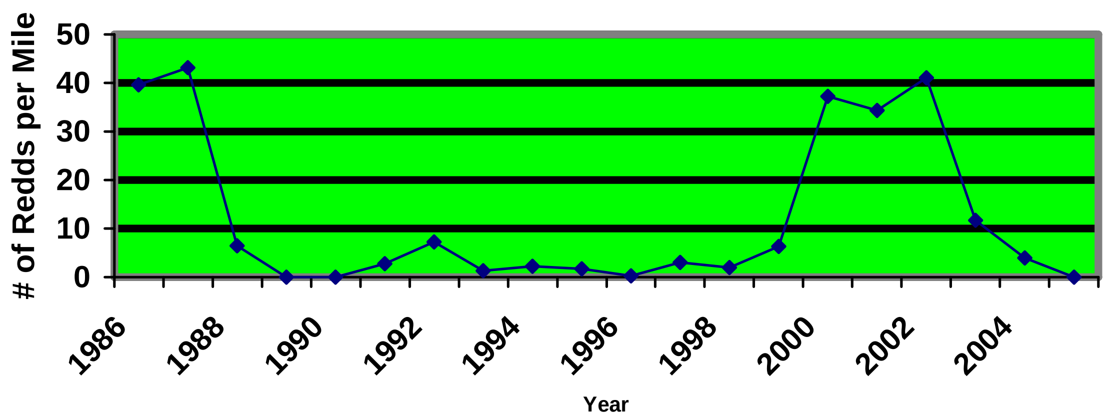
Summer Steelhead

Steelhead trout (Oncorhychus mykiss) are a sea-run, or **anadromous**, form of rainbow trout. Steelhead juveniles migrate in the spring to the sea and undergo a physiological transformation known as “smolting” to adapt to seawater. These steelhead in the John Day Basin are also known as summer steelhead. This signifies that juvenile steelhead return to freshwater from spring to early fall (May-Oct). They then mature and spawn from January through May of the following year (ODFW 1995).

Female steelhead dig redds and deposit eggs in gravel. The eggs hatch 35-50 days later, depending upon the water temperature. The alevins (young fish that still survive off their yolk sac) remain 2 to 3 weeks longer in the gravel, until the sacs are absorbed. They then emerge as fry and begin to feed (ODFW 1995).

Steelhead life cycles are unpredictable and juveniles can rear in freshwater from 1 to 4 years. Juvenile steelhead swim to the ocean as “smolts” when they are approximately 6-8 inches, migrating individually. Steelhead can remain in the ocean as little as a few months or as long as two years, until they return to spawn. (ODFW 1995).

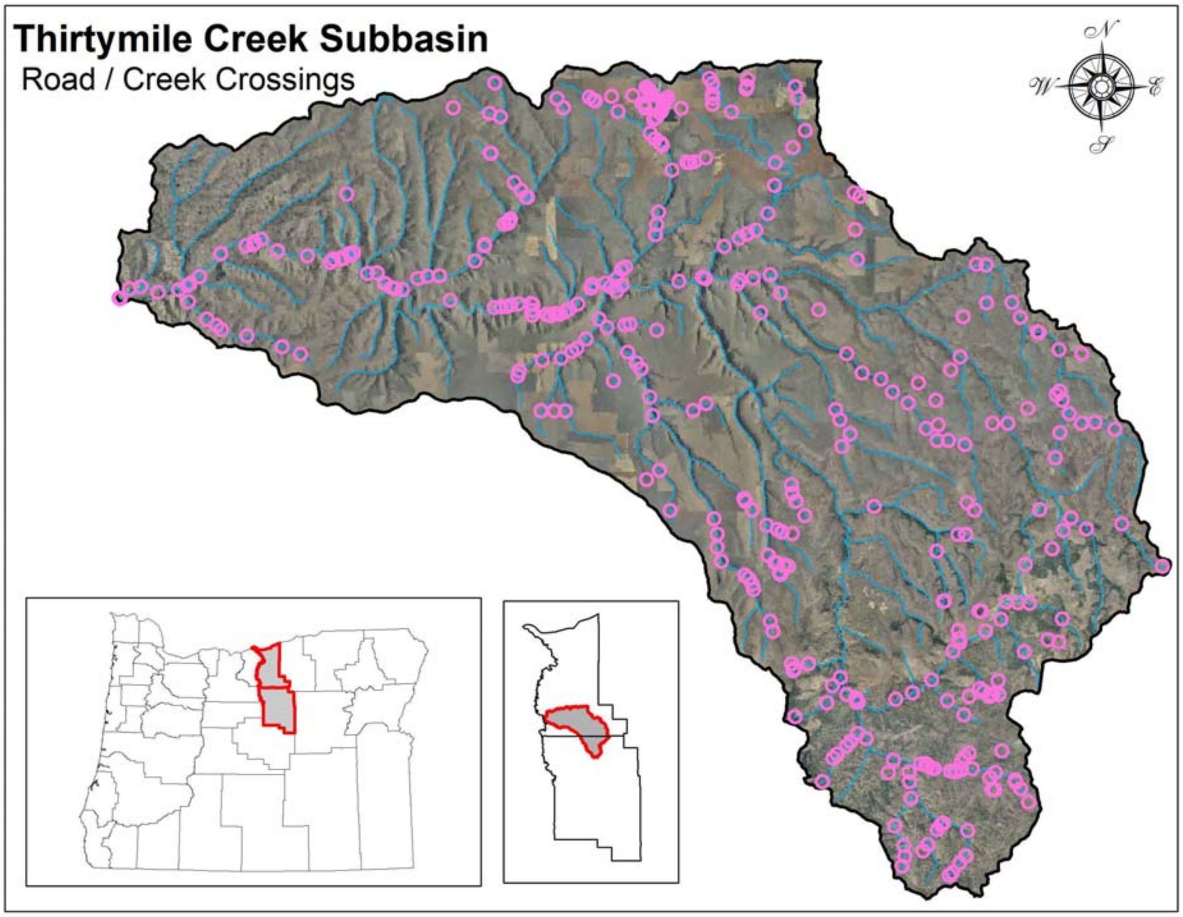
Figure 10.1: Redds per Mile on Thirtymile Creek



Distribution

Salmonid distribution maps for the Thirtymile Creek watershed have been created digitally by ODFW’s state GIS department. **Map 10.1** show summer steelhead distribution in the Thirtymile Creek watershed. Thus, it is possible for steelhead to be present in other streams in the watershed, but there is no data to support this.

Map 10.2: Stream and Road Crossings



Discussion

Historically, Thirtymile Creek and its tributaries supported large runs of summer steelhead. These runs were historically plentiful, but now have diminished to where they have been listed as threatened under the Endangered Species Act.

Fish passage is one of the greatest concerns for salmonids. Dams and diversions can partially or completely cut off fish access to spawning habitat. On a large scale, dams on the Columbia have impeded fish access to the John Day Basin and thus Thirtymile Creek, thereby playing a role in declining fish populations. Within the Thirtymile Creek watershed, fish passage barriers are assumed but not located with the use of pushup dams for irrigation purposes.

Habitat conditions in the 1971 habitat surveys on Thirtymile Creek highlighted some undesirable conditions that were prevalent in all the tributaries also. Desirable and undesirable benchmarks were derived by Oregon Department of Fish and Wildlife as a method of comparing a stream against standards to determine its general condition. As different channel habitat types and geological location will cause variances in an individual reach's potential habitat, these are general guidelines. Width to depth ratios, percent open sky, fines in riffles, bank erosion, and large woody debris all fell into the undesirable category for many reaches along Thirtymile Creek. However, on all reaches, the percent gravel available in riffles was equal to or greater than the desirable benchmark.

What can be done to improve habitat conditions? Width to depth ratios of streams increase as streams widen. Streams widen from increased flows and/or eroding banks. As eroding banks are prevalent in many reaches of Thirtymile Creek and its tributaries, these streams are likely widening over time. Widening streams are undesirable for their effects on water temperature (see Chapter 7: Water Quality). Also, as streams widen, their ability to transport and handle their sediment loads changes. Stabilization of stream banks through riparian revegetation will help decrease the widening of streams. Stream widening is undesirable for fish because of the resulting increase in water temperature and substrate degradation.

The percent of open sky present out of 180˚ at a given point, is the opposite of shade. Thus, high percent of open sky numbers mean low shade. As shade limits exposure of the water to solar radiation, it helps reduce the warming of stream temperatures. By increasing the amount of shade in the stream profile, the availability of summer habitat and mobility of salmonids also increases, since too-high water temperatures can be fish barriers.

In Chapter 5: Riparian Areas, in-stream large wood and the recruitment potential of riparian areas for future large woody debris were shown to be limited. As large wood helps in the formation of pool habitat, a critical area for salmonids in the warm summer months, the enhancement of fish habitat in the Thirtymile Creek watershed will ultimately necessitate large woody debris being present in the stream system in greater amounts. This can be accomplished in the short term by large woody debris placement projects and in the long term through increasing the recruitment potential of riparian areas for large wood.

Improving fish habitat through establishing riparian vegetation, increasing shade, improving riffle and pool habitats, and the placement of large woody debris is part of improving conditions for fish in the watershed. It would also be beneficial to increase fish access by identifying and removing fish barriers and to increase surveys to determine population trends and the entire distribution of steelhead in the system.

Data Gaps

- Current stream habitat surveys
- Current redd surveys in the watershed
- Complete inventory of fish passage barriers
- Development of specific Habitat Benchmarks for the John Day Basin

References

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Tim Unterwegner, Physical and Biological Stream Survey Forms, Oregon Department of Fish and Wildlife, August 1971.

Appendix 10.1: ODFW Habitat Benchmarks for Eastern Oregon

	Undesirable	Desirable
Pools		
Pool Area (%)	<10	>35
Pool Frequency (Channel Widths)	>20	<8
Residual Pool Depth		
Low Gradient (slope <3%) or Small (<7m width)	<0.2	>0.5
High Gradient (slope >3%) or larger (>7m width)	<0.5	>1.0
Riffles		
Width/Depth Ratio (Gradient <3%). Eastside	>30	<10
Silt-Sand-Organics (% Area), Northeast	>20	<8
Gravel Availability (% Area)	<15	>35
Shade (Reach Average, Percent)		
Stream Width <12 meters, Northeast	<70	>60
Stream Width >12 meters, Northeast	<50	>50
Large Woody Debris (15cm X 3 m minimum piece size)		
Pieces/100 m stream length	<10	>20
Volume (m^3)/100 m stream length	<20	>30
"Key" pieces (>50cm dia. And >ACW long)/100m	<1	>3
Riparian Conifers (30m from both sides of channel)		
Number >20in dbh/1000 ft stream length	<150	>300
Number >35in dbh/1000 ft stream length	<75	>200

Note: After personal communication with Tim Unterwegner, he has some question if the information above is accurate for the John Day Basin. He feels that the information was developed more for a forested area and needs to be reviewed for the John Day basin.

Chapter 11: Noxious Weeds

Introduction

This chapter identifies what noxious weeds are present in the Thirtymile Creek Watershed and discusses options for weed control.

Background

Weeds that invade native habitats are an increasing problem in the inland West. For the purposes of this assessment, the term noxious weeds will be defined as: "exotic, non-indigenous species that are injurious to public health, agriculture, recreation, wildlife or any public or property" (Oregon State Weed Board).

The majority of noxious weeds in the John Day and Umatilla ecoregions were introduced from Europe or Asia. They arrived in weed-infested crop seed and animal feed or as ornamentals and crop plants. It is believed that knapweed was first found in Gilliam County in the late 1930's. Now it has spread to almost all sections of the county. Seeds are spread locally by vehicles, machinery, crop seed, stock feed, livestock, wildlife, highways, irrigation ditches, trails, and landings.

Noxious weeds can negatively affect soils, plants, and animals. Noxious weeds, depending upon species, land, and invasion level, can increase erosion and runoff, alter seasonal water flows when highly infested in an area, increase soil evaporation, reduce organic matter in the upper inches of soil, and deplete soil nutrient reserves. They also can alter the composition of plant communities by out-competing native perennial grasses, changing the community composition, perennial, multiple species to a few annual species. By changing plant community composition, wildlife distribution changes as well. Animals that have co-evolved with a certain type of habitat often times cannot adapt to the degraded habitat that weeds create (Sheley & Petroff, 1999).

Weeds are also economically detrimental. They reduce land's carrying capacity for livestock. Some species are toxic to livestock; others are undesirable to animals as food. Land values can be dramatically reduced if invaded with noxious weeds. Weeds can also increase operating costs of ranches and farms through money invested in controlled weed outbreaks (Sheley & Petroff, 1999).

Proper management of noxious weeds involves prevention, early detection, and eradication. Ways of preventing invasion include: limiting seed dispersal, containing nearby weed infestations, minimizing soil disturbance, establishing competing grasses, and properly managing grasses. Early detection is important because of the rapid reproduction rates of noxious weeds. Controlling a one acre problem is much easier than a 100 acre problem (Sheley & Petroff, 1999).

There are many options for weed removal. Cultural, biological, and chemical are the basic types of treatment. Cultural treatment includes the physical removal of weeds (tilling, pulling), replacing weeds with other plants through replanting, and creating barriers to weeds, such as windbreaks. Biological treatments involve the use of herbicides to kill and control noxious weed populations (Jaindl, 1996). Using a combination of treatments to remove weeds is recommended as the most effective method

Methods

Noxious weed information was gathered through conversations and information gathered from Don Farrar, Gilliam County Weed Supervisor.

Results

Appendix 11.1 lists the noxious weed species the Gilliam County Weed Control Board has determined are in the county. Class A weeds are non-natives that have limited distribution or are unrecorded and pose a serious threat to the state. Class B weeds are non-natives with a limited distribution or are recorded in particular regions within the state and pose a serious threat to the regions. Class C weeds are generally more abundant than Class A and B (personal conversation with Don Farrar). Diffuse knapweed is the most widespread noxious weed in the Thirtymile Creek watershed. Gilliam County Weed Board has taken the stand to not issue citations to private landowners at this time.

Information and methods of identification for these weeds can be obtained from the Gilliam County Weed Board.

Discussion

Noxious weeds are present in the Thirtymile Creek watershed, although not in as large numbers as other parts of Oregon. Un-maintained patches of weeds can quickly jump to large acreages taken over by weeds. Thus, it is important to control weeds while they are small problems and before it becomes a large and unmanageable one.

Diffuse knapweed, the most prevalent noxious weed in the watershed and other noxious weeds can cause serious land degradation. Diffuse knapweed has a weak root system and doe not hold soil as well as the native grasses it replaces, thereby increasing surface erosion. In addition to land degradation, it reduces land values and limits the amount of forage available to livestock and wildlife.

Coordinated efforts in weed control are important to reducing weed numbers. If only one landowner is maintaining his or her lands free from weeds in a given area, weeds will invade from nearby landowners. This includes coordinating with Gilliam County Public Works, which maintain roadsides, and state and federal agencies that are property owners within the watershed. Coordinated efforts are cost-effective and prevent weeds from re-colonizing an area.

For information on weeds and how to control them, contact:

Don Farrer
Weed Supervisor
Condon, Oregon
541-384-4222

Data Gaps

- Exact location of noxious weed sites on private, state, and federal lands
- Estimates on acreages of noxious weeds on private, state, and federal lands

References

Sheley, Roger L and Janet K. Petroff, eds. Biology and Management of noxious Rangeland Weeds. Oregon State university press, Corvallis, Oregon, 1999.

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Appendix 11.1: Gilliam County 1995 Noxious Weed List

COMMON NAME	SCIENTIFIC NAME
CLASS "A" WEEDS	
Buffalobur	Solanum rostratum
Distaff Thistle	Carthamus lanatus
Field Dodder	Cuscuta pentagona
Hydrilla	Hydrilla verticillata
Johnsongrass	Sorghum halepense
Kudzu	Pueraria Montana var. lobata
Leafy Spurge	Euphorbia esula
Murtle Spurge	Euphorbia myrsinites
Musk Thistle	Carduus nutans
Poison Hemlock	Conium maculatum
Purple Loosestrife	Lythrum salicaria
Rush Skeletonweed	Chondrilla juncea
Salt Cedar	Tamarix aphylla
Spartina	Spartina alternaflora
Spotted Knapweed	Centaurea maculosa
Tansy Ragwort	Senecio jacobaea
Yellow Starthistle	Centaurea solstitialis
CLASS "B" WEEDS	
Bull Thistle	Cirsium vulgare
Canadian Thistle	Cirsium arvense
Dalmatian/ Yellow Toadflax	Linaria dalmatica
Diffuse Knapweed	Centaurea diffusa
Field Bindweed/ Morning Glory	Convolvulus arvensis
Himalayan Blackberry	Rubus discolor
Jointed Goatgrass	Aegilops cylindrica
Klamath Weed/ St. Johnswort	Hypericum perforatum
Kochia	Kochia scoparia
Puncturevine	Tribulus terrestris
Russian Knapweed	Centaurea repens
Sandburr	Cenchrus longispinus
Scotch Thistle	Onopordum acanthium
Spikeweed	Hemizonia pungens
Whitetop	Cardaria draba

"T" LIST

Dalmation Toadflax
Kochia
Leafy Spurge
Rush Skeletonweed
Spikeweed
Spotted Knapweed
Yellow Starthistle

"A" designated weed: A weed of known economic importance which occurs in the country in small enough infestation to make eradication/containment possible; or not known to occur but it's presence in a neighboring county makes future occurrence seem imminent.

Recommended Action: Infestations are subject to intensive control when and where found.

"B" designated weed: A weed of economic importance, which is regionally abundant, but of limited distribution in other counties.

Recommended Action: Moderate to intensive control at the state or county level.

"C" designated weed: All other weeds as listed on the state weed list.

"T" county priority weed.

Chapter 12: Forest Health

Introduction

This chapter discusses forest health as it applies to Blue Mountain forests, specifically the forest types found in the Upper Thirtymile Creek watershed. Most of the forest land in the Thirtymile Creek watershed is private lands with small partials of U.S. Forest Service lands that have recently been traded and converted to private lands. Because the private land is site specific to management, very little information is available on forest health, forest species composition, or forest stand size.

Background

Forest health has been a growing concern the last few decades in the Blue Mountains. Insect and disease outbreaks beginning in the mid-1970s killed millions of acres of trees, causing forest managers to seek solutions. What they found was a complex problem with no simple solutions. Selective logging, fire suppression, and grazing, among other factors, had changed forest structure and composition to types that were more susceptible to attacks by insects and disease (Langston 1995).

Historically, lower elevation and dry mid-elevation forests in the Blue Mountains were dominated by large Ponderosa pines (Jaindl 1996). Some of these forests, on south-facing slopes, were mostly pine, while north-facing slope forests contained more Douglas fir and Grand fir (Langston, 1995). Frequent fires on gentle slopes with non-brushy plant associations maintained open stands with little understory and grasses as ground cover. Wet mid-elevation forests, which had longer fire intervals, were composed of fire-intolerant conifers, including Grand fir, Western larch, and Douglas fir. At higher elevation, Lodgepole pine and Engelmann spruce were dominant species (Jaindl, 1996). Fire's role in higher elevation and moist middle elevation forests was more complex and variable. Fire intervals were longer in these forests, ranging from 40 to 150 years, and were usually stand replacing fires. Most trees were killed in these fires and new stands of pioneer species regenerated in their place.

By the 1930's, the U.S. Forest Service implemented a fire suppression policy for the national forests (Langston 1995). Oregon Department of Forestry was responsible for fire suppression on private forest lands. In the Blues, fire dependent forest types, such as the low elevation pine forest, would be dramatically changed in forest composition. Without fire to maintain the open, park like forests, fire intolerant species were able to invade these stands, resulting in mixed Ponderosa pine/Douglas fir forests on the drier southern slopes, and the entire replacement of Ponderosa pine with Douglas fir/true fir forests on the wetter northern slopes (Jaindl 1996). In addition to a change in species, a forest structural change was made as the forests coming in were smaller in size and denser (Langston 1995).

Selective logging has also played a large role in the changing forests. Selective logging is the practice of removing some trees from a stand and leaving others. Which trees are logged can be a determinant in the future composition of the forest. Ponderosa pine has traditionally been the economically valuable species in the Blue Mountains and thus the most often cut. High grading, the removal of large, high quality trees, while leaving the economically undesirable trees, was common in the early to mid 1900s (Langston 1995). On national forests, harvest levels increased drastically in the 1970s and early 1980s (Jaindl). These harvest were designed to change stands from uneven aged to even aged stands, in order to maximize timber production for the demands of a growing nation. Multiple species were planted.

When selective logging in the lower elevation forest removed Ponderosa pine from a stand, stands were not replaced with the same species. In the first crucial years, the Douglas fir and true firs can out compete the Ponderosa pine in denser stands. With the presence of historical fire, stands were kept more open, helping Ponderosa pine's survival. However, as fire was suppressed at the same time as timber harvesting, the acres of Ponderosa pine forests in the Blues decreased as the acres of mixed conifer forests increased.

Grazing in the Blue Mountains has also helped shape the current landscape. Livestock alter forest dynamics by reducing the biomass and density of understory grasses and sedges, which otherwise out compete conifer seedlings and prevent dense tree recruitment (Belsky 1997). Grazing thereby assists in the expansion of forests into grasslands. Grazing also affects forest structure and composition by reducing fuel loads in more open stands so fires do not kill as many young trees (personal communication, John Herbst).

Disease and insect outbreaks in the Blues are thought to have always occurred. In the 1920's, before most of the human impacts to forests took place, there were reports of loss of trees to disease and insects (Langston 1995). Climate plays a role in disease and insect outbreaks. Drier years stress the trees, opening opportunities for insects and disease to attack them. Nancy Langston argued in Forest Dreams, Forest Nightmares that insects and disease may be an integral part of the Blue Mountain ecosystem (Langston 1995). Others believe that the large scale disease and insect outbreaks in the 1980s and early 1990s were an indicator of unhealthy forests. Charles Johnson reported that "outbreaks of the beetle in east-side Lodgepole pine forests was an ecosystem response to the lack of stand replacement fire that normally would have burned many Lodgepole pine stands before they would become susceptible to bark beetles" (Johnson 1994).

Methods
Forest structure, composition, and fuels information was not available from the Oregon Department of Forestry for the watershed. Usually maps are created from ODF aerial photo interpreted GIS information on crown closure, tree species, stand sizes, and fuel modeling. This information was not available.

Discussion
Due to the lack of technical information, the author concludes that forest composition and structure in the Thirtymile Creek watershed have changed over time. Average tree size has decreased in size, with most stands currently small or medium in size classes. Crown closures are medium to dense, indicative of thick stands. The majority of forests are in dry mix or wet mix types. A smaller amount than historical are Ponderosa pine dominated stands.

Forest management is, and always has been, a highly debated issue in the West. People have different ideas about how a forest should be managed. Since how a forest is managed plays an integral role in forest health, how management is influenced should be understood. On public lands, forest management is often subject to public opinion. Private land management has some restrictions placed upon it by the Oregon Forest Practices Act. For the most part it is the landowners' decision on how to manage their forests.

Data Gaps

- Historical conditions of specific forest stand structure and composition

References

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Johnson, Jr., Charles G. "Forest Health in the Blue Mountains: A Plant Ecologist's Perspective on Ecosystem Processes and Biological Diversity." September 1994. PNW-GTR-339.

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Glossary

303(d) list: List of water quality impaired water bodies that do not meet ODEQ/EPA water quality standards.

4th-field HUC: Hydrologic Unit Code for sub-basin

5th-field HUC: Hydrologic Unit Code for watershed

6th-field HUC: Hydrologic Unit Code for sub-watershed

100-year floodplain: The area adjacent to the channel which has a 1 in 100 chance of being flooded in any given year.

Aggradation: The filling and raising of the level of a streambed by deposition of sediment.

Alluvium: Sedimentary material deposited by flowing water, as in a riverbed or delta.

Bankfull width: Width of a channel to the top of its banks, at the point where water begins to overflow onto the flood plain.

Beneficial uses: Uses of water specified in Oregon Water Quality Standards.

Best Management Practices: Practices developed to best address water quality problems in a specific area.

Channel confinement: Ratio of bankfull channel width to width of modern floodplain. Modern floodplain is the flood prone area and may correspond to the 100 year floodplain. Typically, channel confinement is a description of how much a channel can move within its valley before it is stopped by a hill slope or terrace.

Connectivity: The physical connection between tributaries and the river, between surface water and groundwater, and between wetlands and these water sources.

Criteria: Elements of Oregon Water Quality Standards expressed as concentrations or narrative statements representing a quality of water that supports a particular use.

Crown closure: The amount of canopy cover in a given area. Canopy cover is the overhanging vegetation in a given area.

Debris flow: A type of landslide that is a mixture of soil, water, logs, and boulers which travels quickly down a steep channel.

Degradation: The general lowering of the earth's surface by erosion or transportation in running water.

Diameter Breast Height (DBH): A standardized measurement of the diameter of a tree, taken at breast height (approx. 4 feet).

Downcutting: When a stream channel deepens over time.

Drainage area: The region drained by a stream system.

Ecoregion: Land areas with fairly similar geology, flora and fauna, and landscape characteristics that reflect a certain ecosystem type.

Evaporation: The conversion of water into water vapor.

Evapotranspiration: The amount of water leaving to the atmosphere through both evaporation and transpiration.

Exceedence: When a measure of water quality exceeds the criteria. The exceedence needs to be evaluated with respect to natural or human causes.

Flood plain: The flat area adjoining a river channel constructed by the river in the present climate, and overflowed at times of high river flow.

Forest Practices Act: The Oregon Forest Practices Act, first enacted in 1972, regulates harvesting practices on private and state forest lands in Oregon.

Geographic Information System (GIS): A computer system designed for storage, manipulation, and presentation of geographical information such as topography, elevation, geology, etc..

Gradient: Channel gradient is the slope of the channel bed along a line connecting the deepest points (thalweg) of the channel.

Gully erosion: Erosion resulting in a ditch or channel cut in the earth by running water after precipitation.

Hydraulic gradient: Water level from a given point upstream to a given point downstream; or the height of the water surface above a subsurface point. Used in analysis of both ground and surface water flow, and is an expression of the relative energy between two points.

Hydrograph: A graph of runoff rate, inflow rate, or discharge rate, past a specific point over time.

Hydrologic Soil Group (HSG): Soil classification to describe the minimum rate of infiltration obtained for bare soil after prolonged wetting.

Hydrology: The science of the behavior of water from the atmosphere into the soil.

Impairment: An interpretation of criteria exceedence which indicates that the beneficial use is harmed.

Infiltration: The rate of movement of water from the atmosphere into the soil.

Large Woody Debris (LWD): Logs, stumps, or root wads in the stream channel, or near by. These function to create pools and cover for fish, and to trap and sort stream gravels.
Morphology: A branch of science dealing with the structure and form of objects. Geomorphology as applied to stream channels refers to the nature of landforms and topographic features.

Precipitation: The liquid equivalent (inches) of railfall, snow, sleet, or hail collected by storage gages.

Raindrop splash erosion: Erosion caused as raindrops hit the ground during rain.

Ravel: Erosion caused by gravity, especially during rain, frost, and drying periods. Often seen on steep slopes immediately uphill of roads.

Redd: The gravel based nest of a salmonid fish.

Riffle: Shallow section of stream or river with rapid current and a surface broken by gravel, rubble, or boulers.

Rill erosion: Erosion caused by water carrying off particles of surface soil.

Riparian area: Areas bordering streams and rivers in which ecosystem processes are within the influence of stream process.

Riparian Condition Unit (RCU): A portion of the riparian area for which riparian vegetation type, size, and density remain approximately the same.

Riparian vegetation: Vegetation growing on or near the banks of a stream or other body of water in soils that are wet during some portion of the growing season. Includes areas in and near wetlands, floodplains, and valley bottoms.

Riprap: Rock and or concrete placed along stream banks for artificial stream bank stabilization.

Senate Bill 1010 (SB 1010): Oregon Senate Bill that placed Oregon Department of Agriculture in charge of developing water quality management plans for agricultural lands, across the state.

Sheet erosion: Soil erosion caused by surface water that occurs somewhat uniformly across a slope.

Sinuosity: The amount of curves or turns in a stream or river.

Sponge effect: The absorption of moisture into the banks that caused riparian areas.

Spring snowmelt: The time when the seasonal snow pack melts out.

Stream density: Total length of natural stream channels in a given area, expressed as miles of stream channel per square mile of area.

Stream reach: A section of stream possessing similar physical features such as gradient and confinement; usually the length of stream between two tributaries.

Total Maximum Daily Load (TMDL): A written plan and analysis established to ensure that water bodies will attain and maintain water quality standards.

Transpiration: Loss of water to the atmosphere from living plants.

Waterbar: A deep trough in a skid trail or road that is excavated at an angle to drain surface water from the skid trail or road to an adjacent area that is not compacted.

Wetland vegetation: Plants that are adapted to living in saturated or inundated conditions for at least part of the growing season.