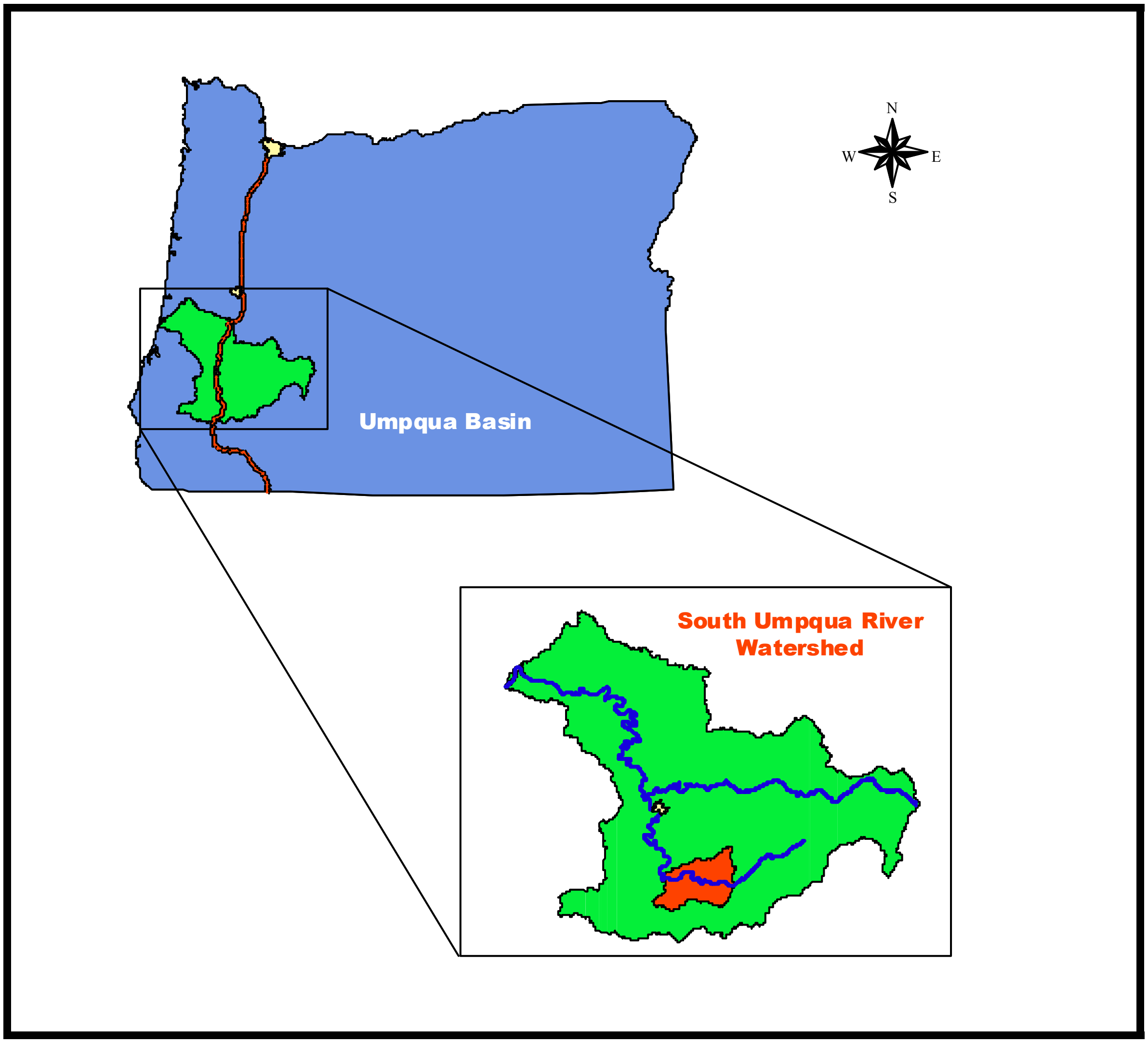
South Umpqua River

Watershed Assessment and Action Plan



Prepared by Nancy A. Geyer for the

Umpqua Basin Watershed Council

November, 2003

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Publication citation

This document should be referenced as Geyer, Nancy A. South Umpqua River Watershed Assessment and Action Plan. Roseburg, Oregon: Prepared for the Umpqua Basin Watershed Council; 2003 November.

This project has been funded in part by the United States Environmental Protection Agency under assistance agreement CO-000451-02 to the Oregon Department of Environmental Quality. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Acknowledgments

This assessment would not have been possible without the help of community volunteers. I am very grateful to the landowners, residents, and UBWC directors and members who attended the monthly watershed assessment meetings and offered their critical review and insight. Their input and participation was invaluable.

I am also grateful for the assistance of the following individuals and groups:

- The staff of the Douglas Soil and Water Conservation District, Oregon Department of Environmental Quality, Oregon Department of Fish and Wildlife, and Oregon Water Resources Department who answered many questions and provided much of the assessment's quantitative and qualitative data.
- The resource professionals who agreed to serve as guest speakers at our monthly watershed assessment meetings:
    - Bobbi Lindberg, ODEQ;
    - Dave Harris, ODFW;
    - Dave Williams, OWRD;
    - Frank Nielsen, Douglas County Natural Resources Department;
    - Kent Smith, InSight Consultants;
    - Sam Dunnavant, ODFW; and
    - Walter Barton, Douglas Soil and Water Conservation District.

I would also like to thank Eric Geyer for his unwavering support throughout the process.

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Acronym List

BLM	Bureau of Land Management
Cfs	Cubic feet per second
DFPA	Douglas Forest Protective Association
GIS	Geographic information system
NTU	Nephelometric turbidity units
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
OWEB	Oregon Watershed Enhancement Board
OWRD	Oregon Water Resources Department
TMDL	Total maximum daily load
TSZ	Transient snow zone
UBWC	Umpqua Basin Watershed Council
UNF	Umpqua National Forest
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USGS	United States Geological Survey
WAB	Water availability basin

Forward

We often hear the term "watershed" these days. We all live within a watershed. Fish habitat and water quality can be affected by the watershed's condition and by the activities within it. All of us depend upon the water that flows from our watershed. But what exactly is a watershed?

A watershed is the area of land where all surface and groundwater drains into the same body of water, such as a river, wetland, or the ocean. Watersheds can be many millions of acres like the Colombia River Basin, or less than a dozen acres for a single small stream. Since the term "watershed" can be used for drainage areas of any size, the US Geological Survey (USGS) has divided watersheds into distinct units, or "fields," based on size. Sizes range from multi-million acre first-field watersheds to seventh-fields that can be less than 3,000 acres.

For this assessment, the most important fields are third-field and fifth-field watersheds.[1] Third-field watersheds are large river basins. The Umpqua River Basin includes the South, North, and main Umpqua Rivers, as well as Smith River, and has roughly the same boundary as Douglas County. Third-field watersheds are usually referred to as "basins," and in this document "basin" will be used to refer to the Umpqua Basin third-field watershed. Fifth-field watersheds have become the standard size used for research and projects by a variety of agencies and organizations. Therefore, it is convenient for fifth-field watershed to be the unit usually referred to herein by the term "watershed." Watersheds are around 40,000 to 120,000 acres, and there are 33 fifth-fields in the Umpqua Basin.

Although the borders of the watersheds are standardized, the names are not. Different organizations and agencies may call the watersheds by different names, but, in general, all watersheds are named for the creek or the section of stream into which all tributaries drain.[2] For example, the Calapooya Creek Watershed includes all land that drains into Calapooya Creek or its tributaries. A very large stream, such as the South Umpqua River, is usually separated into multiple fifth-field watersheds.

All watersheds have their own features, challenges, and potential. The conditions in one watershed may not reflect the conditions in a neighboring watershed. This assessment evaluates the unique past, present, and potential future conditions of the South Umpqua River Watershed in terms of fish habitat and water quality.

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[1] Fourth-field watersheds refer to sub-basins. Just as there are three main rivers in the Umpqua Basin, there are also three fourth-field watersheds, or sub-basins: the Umpqua River fourth-field watershed, the North Umpqua River fourth-field watershed, and the South Umpqua River fourth-field watershed.

[2] When one watershed does not encompass the entire drainage area, such as with a river or large creek, names reflect the relative location of the watershed along the mainstem. Upper South Umpqua would be near the headwaters of the South Umpqua River, while Middle Cow Creek is somewhere in the middle of Cow Creek.

1. Introduction

The introduction provides a general description of the watershed in terms of its natural and human-made features, ownership and current land uses, and the communities within the watershed. Information in sections 1.2 and 1.3 was compiled from the *Oregon Watershed Assessment Manual* (Watershed Professionals Network, 1999), the *Lower South Umpqua Watershed Analysis* (USDI Bureau of Land Management, 2000), the *Myrtle Creek Watershed Analysis (Draft)* (USDI Bureau of Land Management, 2002) and the *Middle South Umpqua Watershed Analysis* (USDI Bureau of Land Management, 1999). Additional information is from the following sources' databases: The Oregon Climate Service, the US Census Bureau, and the Douglas County Assessor.

Key Questions

- What is the Umpqua Basin Watershed Council?
- What is the purpose of the watershed assessment and action plan document?
- How was the watershed assessment developed?
- Where is the South Umpqua River Watershed and what are its defining characteristics?
- What are the demographic, educational, and economic characteristics of South Umpqua River Watershed residents?
- What is land ownership, use, and parcel size within the watershed?

1.1. Purpose and development of the watershed assessment

1.1.1. The Umpqua Basin Watershed Council

The Umpqua Basin Watershed Council (UBWC) is a non-profit, non-government, non-regulatory charitable organization that works with willing landowners on projects to enhance fish habitat and water quality in the Umpqua Basin. The council has its origins in 1992 as the Umpqua Basin Fisheries Restoration Initiative (UBFRI) and was changed to the UBWC in May of 1997. Three years later, the council was incorporated as a non-profit organization. The UBWC's 16-member Board of Directors represents resource stakeholders in the Umpqua Basin. The board develops localized and basin-wide fish habitat and water quality improvement strategies that are compatible with community goals and economic needs. Activities include enhancing salmon and trout spawning and rearing grounds, eliminating barriers to migratory fish, monitoring stream conditions and project impacts, and educating landowners and residents about fish habitat and water quality issues in their areas. Depending on the need, the UBWC will provide direct assistance to individuals and groups, or coordinate cooperative efforts between multiple partners over a large area.

1.1.2. The watershed assessment and action plan

The South Umpqua River Watershed assessment has two goals:

1) To describe the past, present, and potential future conditions that affect water quality and fish habitat within the South Umpqua River Watershed; and
2) To provide a research-based action plan that suggests voluntary activities to improve fish habitat and water quality within the watershed.

The action plan developed from findings in Chapter Three is a critical component of the assessment. The subchapters include a summary of each section's key findings and a list of action recommendations developed by UBWC staff, landowners, and restoration specialists. Chapter Five is a compilation of all key findings and action recommendations and includes a summary of potential UBWC South Umpqua River Watershed enhancement opportunities. Activities within the action plan *are suggestions for voluntary projects and programs*. The action plan should not be interpreted as landowner requirements or as a comprehensive list of all possible restoration opportunities.

1.1.3. Assessment development

This document is the product of a collaborative effort between the UBWC and South Umpqua River Watershed residents, landowners, and stakeholders. Members of the UBWC staff assembled information about each assessment topic and compiled the data into graphic and written form.[3] Landowners and other interested parties met with Nancy Geyer of the UBWC staff to review information about the South Umpqua River Watershed and offer comments and suggestions for improvement.

The South Umpqua River Watershed assessment meetings were held in conjunction with meetings for the Lower Cow Creek, West Fork Cow Creek, and Upper Cow Creek Watersheds. Landowners and residents met for 10 meetings and one field trip from October, 2002, through August, 2003. A total of 53 people attended one or more meetings and the field trip, with an average of 11.8 participants per meeting. Meeting participants included ranchers, family forestland owners, industrial timber company employees, city officials, city residents, and land management agency personnel.

1.2. Watershed description

1.2.1. Location, size, and major features

The South Umpqua River fifth-field watershed is located in Douglas County, Oregon, and is 141,574.7 acres. The watershed stretches a maximum of 14 miles north to south and 20 miles east to west (see Map 1-1). The City of Canyonville is the only incorporated city within the watershed; other population centers are Days Creek and Milo.[4] Interstate Five (I-5) runs through Canyonville and the western portion of the watershed. The Tiller Trail Highway follows the South Umpqua River, and Days Creek Road follows Days Creek.

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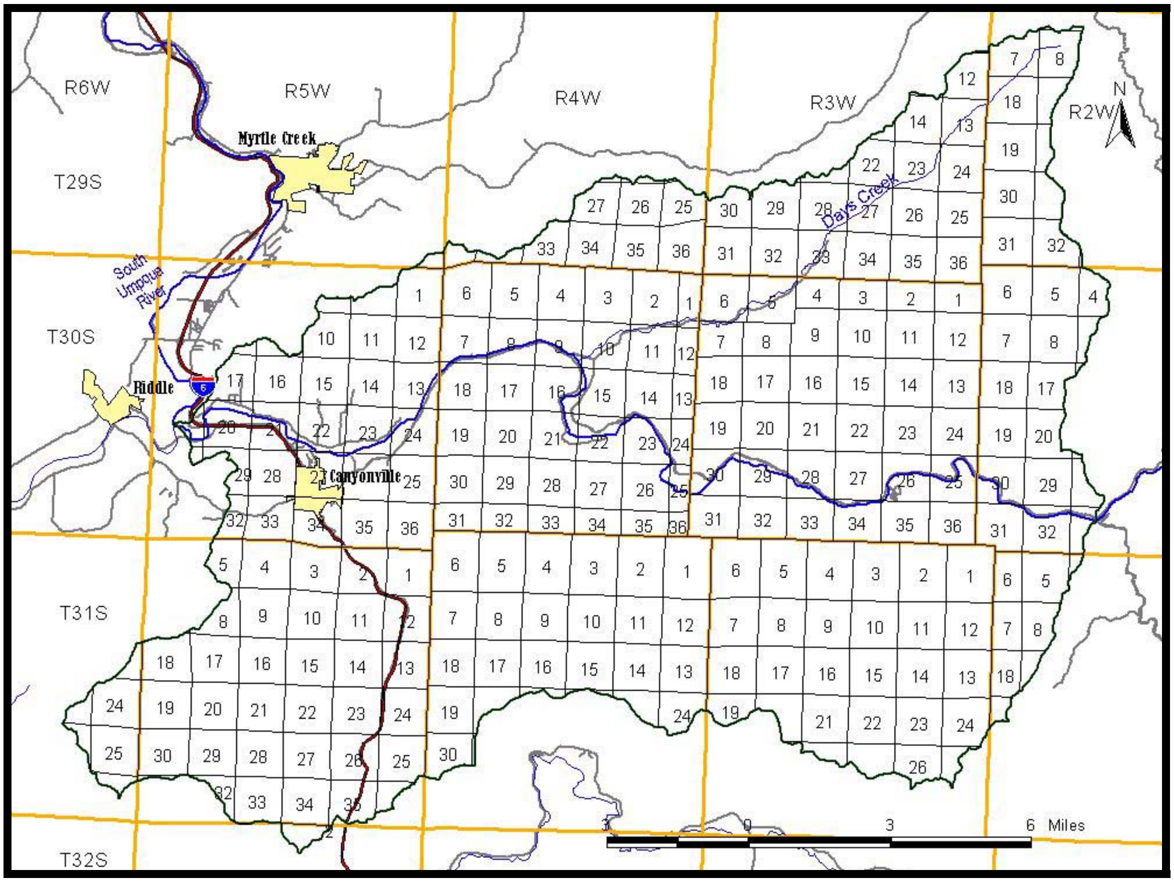
[3] Unless otherwise indicated, Nancy Geyer and Heidi Kincaid of the Umpqua Basin Watershed Council developed all text, tables, maps, and figures.

[4] The Days Creek population center is located near the mouth of Days Creek. Milo is located on the South Umpqua River near the mouth of St. John Creek. See Map 1-7 for stream locations.



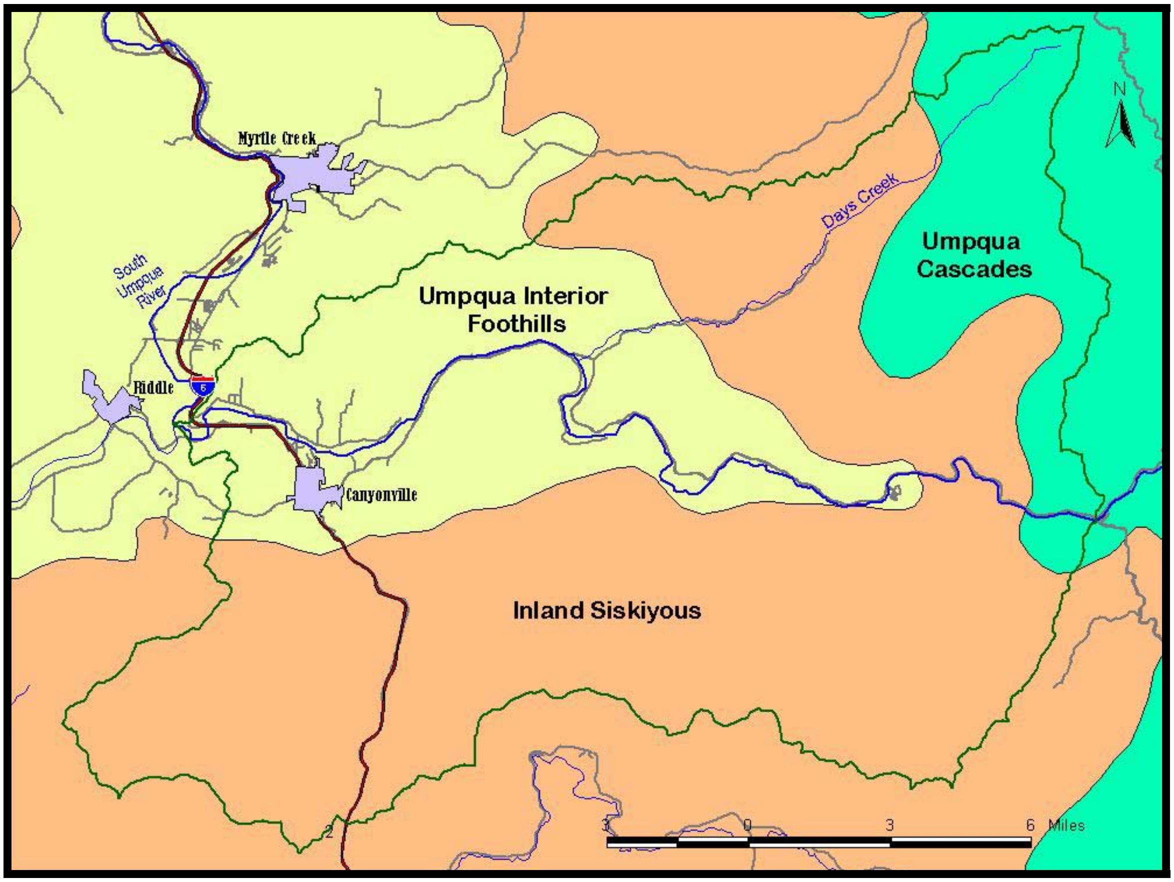
Map 1-1: Location of the South Umpqua River Watershed.

1.2.2. Ecoregions

Ecoregions are areas with similar type, quality, and quantity of environmental resources, including landscape, climate, vegetation, and human use.[5] Ecoregion information is not specific to an individual watershed and is too general for the purposes of this assessment. However, ecoregions are useful because they divide the watershed into areas based on natural characteristics rather than on political boundaries or township, ranges, and sections. In this section, ecoregions are used to distinguish three unique areas in the South Umpqua River Watershed. In some cases, ecoregion information is used to supplement other data.

Map 1-2 and Table 1-1 show the South Umpqua River Watershed's location, acres, and percent within each ecoregion. The majority of the watershed (62%) falls within the Inland Siskiyous Ecoregion. The central area along the South Umpqua River is part of the Umpqua Interior Foothills Ecoregion, while the eastern and northeastern portions are part of the Umpqua Cascades Ecoregion.

[5] The Environmental Protection Agency (EPA) and the Oregon Natural Heritage Program (ONHP) developed ecoregion boundaries for the State of Oregon.



Map 1-2: Ecoregions of the South Umpqua River Watershed.

Ecoregion	Acres	Percent of total
Inland Siskiyous	87,258.6	61.6
Umpqua Interior Foothills	37,129.1	26.2
Umpqua Cascades	17,187.0	12.1
TOTAL	**141,574.7**	**100.0**

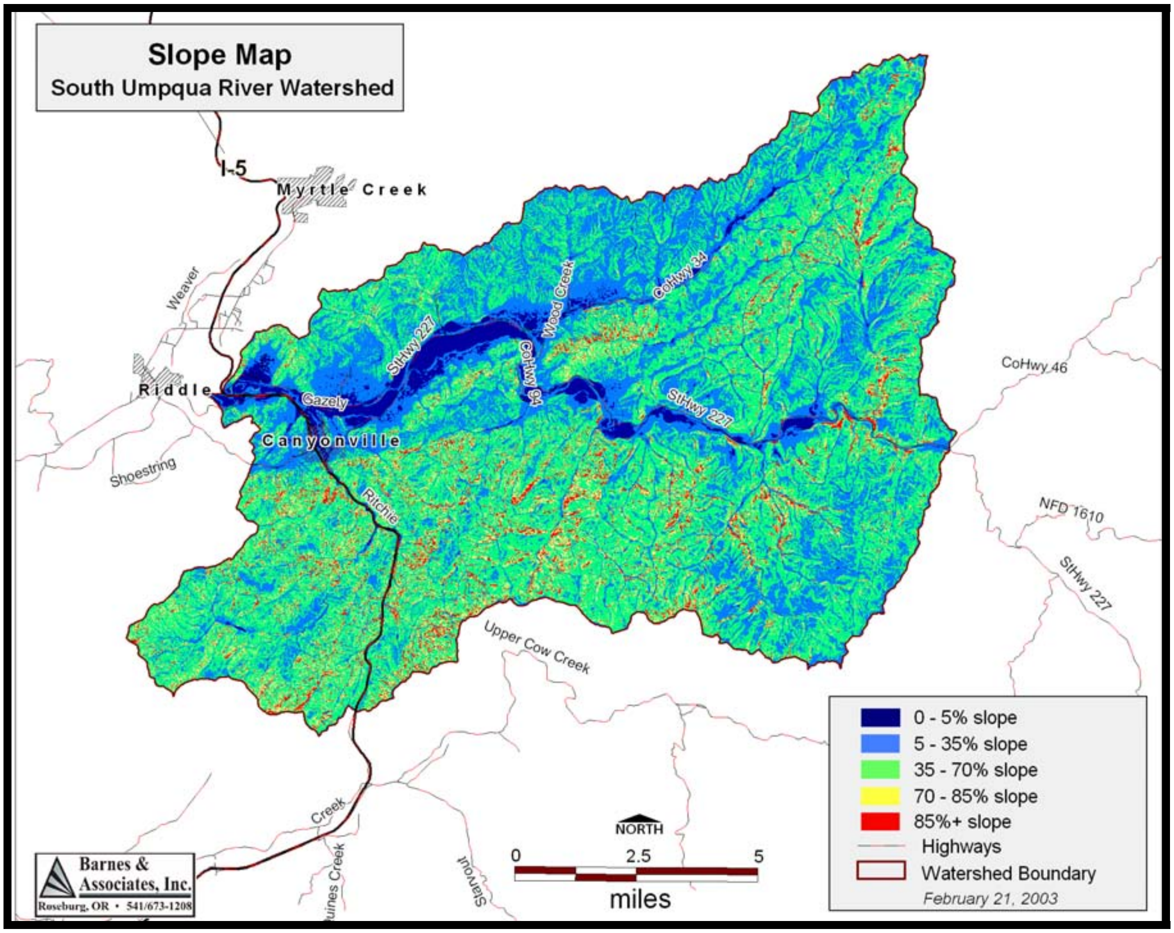
Table 1-1: Acres and percent of the South Umpqua River Watershed within each ecoregion.

1.2.3. Topography

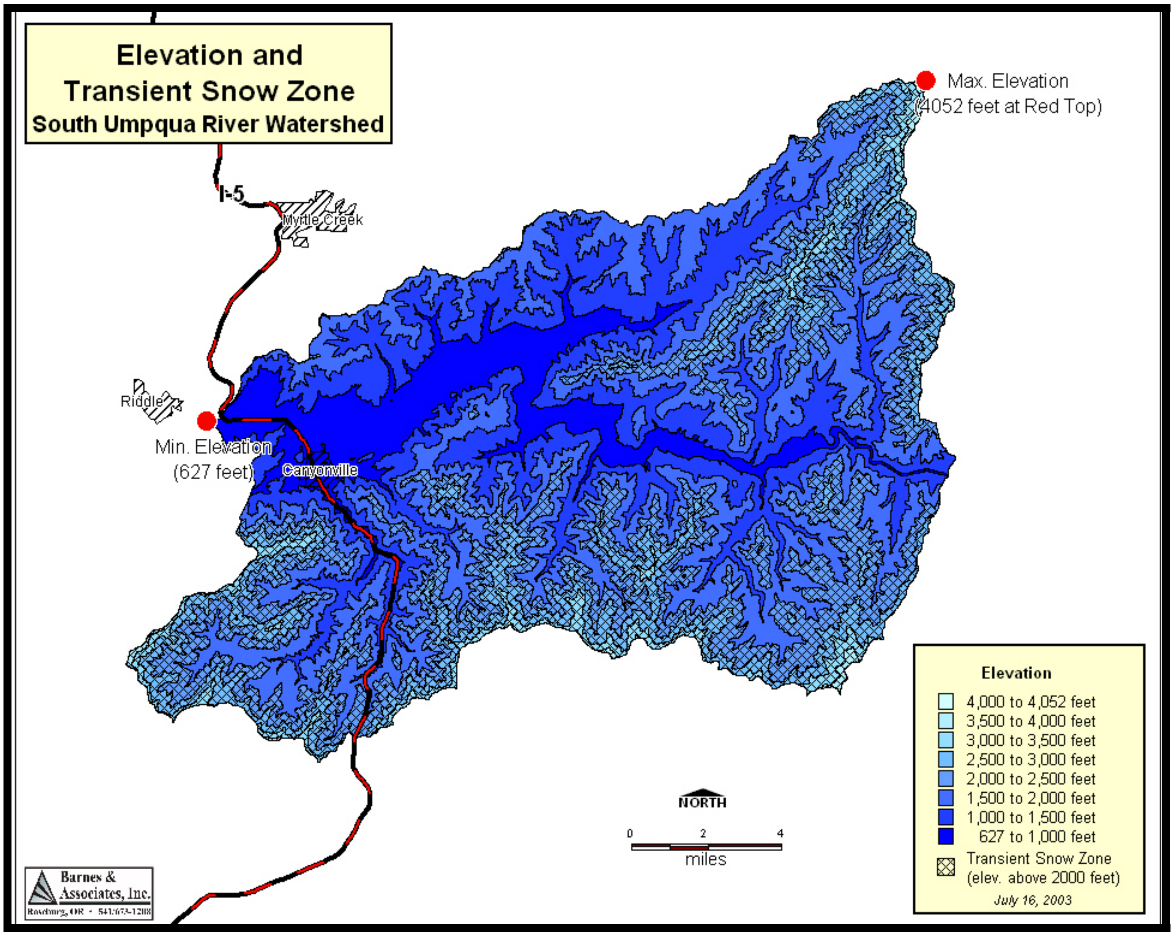
Narrow valleys, terraces, and steep foothills characterize the Umpqua Interior Foothills Ecoregion. The Inland Siskiyous Ecoregion has mountains with deep, "V" shaped valleys, as does the Umpqua Cascades Ecoregion. Stream channels in these two ecoregions are usually moderate to high gradient.

In the South Umpqua River Watershed, slopes range from 0% to 35% around the South Umpqua River and Days Creek. Upland area slopes are generally from 35% to 70% (see Map 1-3). The lowest point in the watershed is 627 feet where the South Umpqua River meets Cow Creek east of the City of Riddle. The highest point is 4,052 feet at Red Top Mountain on the northeastern tip of the watershed (see Map 1-4). In the South Umpqua

River Watershed, 36.4% of the land base is above 2,000 feet. Areas between 2,000 and 5,000 feet in elevation are known as the transient snow zone (TSZ). Rain-on-snow events, in which rain falls on accumulated snow causing it to melt, may occur in these areas (see Map 1-4).



Map 1-3: **Percent slope for the South Umpqua River Watershed.**



Map 1-4: Elevation of the South Umpqua River Watershed with highest and lowest points.

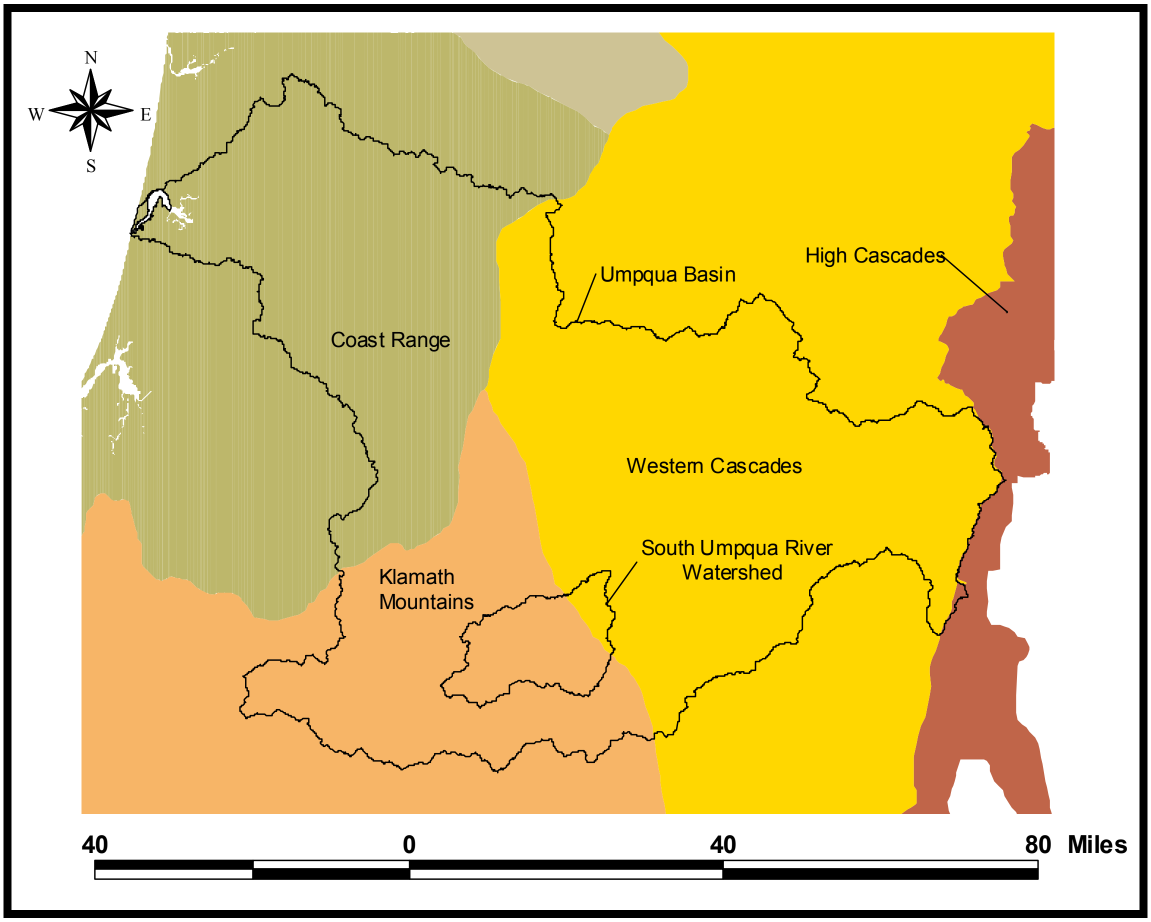
1.2.4. Geology[6]

The geologic history and current setting of any watershed is critical to understanding natural resource issues within it. In Oregon, geologic processes have created a unique and varied landscape throughout the state. In southwestern Oregon, the history of the landscape is dominated by the collision of western North America with the floor of the Pacific Ocean and fragments of earth crust lying on it. This report summarizes the geology and geomorphology of the South Umpqua River Watershed. Appendix 1 provides more information about the geologic history of western Oregon and a glossary of terms. Information in this section has been summarized from the following documents: *Geology of Oregon* (Orr et al., 1992); *Northwest Exposures, A Geologic History of the Northwest* (Alt and Hyndman, 1995); *Earth* (Press and Siever, 1986); *Geologic Map of Oregon* (Walker and MacCleod, 1991); and *Atlas of Oregon* (Allen et al., 2001).

[6] Kristin Anderson and John Runyon of BioSystems, Inc., contributed the text, table, and maps for section 1.2.4. Terms such as "Jurassic" and "Cretaceous" refer to periods in the geologic/evolutionary timetable. However, the UBWC takes no position regarding the time periods with which these terms are associated and is using the terms to refer to natural processes and the relative order in which they occurred.

Physiography

Geologic processes have created many different physiographic provinces, or areas of similar geomorphology, within the state. According to the boundaries of these provinces as delineated by the Oregon/Washington Bureau of Land Management (USDI Bureau of Land Management, 1992), the Umpqua River Basin lies at the intersection of three physiographic provinces as follows: the Coast Range, the Klamath Mountains, and the Western Cascades (see Map 1-5). The majority of the South Umpqua River Basin lies in the Klamath Mountains Province, and the northeastern-most portion lies in the Western Cascades. In *The Geology of Oregon*, however, Orr and Orr (2000) show that within the South Umpqua River Watershed, nearly all of the geology, except for a few very small areas along the western fringe, is typical of the Klamath Mountains.



Map 1-5: Physiographic provinces of the South Umpqua River Watershed.

<u>Klamath Mountains Province</u>

The Klamath Mountain Province lies in the southwestern corner of Oregon, and extends south into California as an elongate north-south lying province. The Klamath Mountain area has a varied landscape with some steep narrow canyons and high peaks; yet in most places, it has a fairly even relief. The Rogue River and its tributaries drain the majority of the province, but the South Umpqua River and its tributaries extend into the northeastern-most reach of this province. The Chetco and Pistol river systems also drain a portion of the province.

Western Cascades Province

The Western Cascades range in elevation from approximately 1,700 feet in the west to 5,800 feet above sea level on the eastern edge abutting the High Cascades. The Cascades run the entire north-south length of Oregon and divide the state into the wet western portion and the dry eastern portion of the state. Deep erosion in the Western Cascades has occurred as a result of high rainfall. South of the Calapooya divide, streams draining the Cascades westward, including the Umpqua Basin, flow into the ocean rather than the Willamette River Valley.

South Umpqua River Watershed

The South Umpqua River Watershed exhibits varied relief. Most of the watershed is fairly steep with stream channels that dissect the landscape. Days Creek and the South Umpqua River both have floodplains. The largest low relief feature is the South Umpqua River floodplain from Canyonville to the confluence with Days Creek (see Photo 1-1). Changes in slope are evident along contacts between geologic units. A general southwest-northeast trend in the hills is noticeable; this trend is governed by the geology of the area.

Photo 1-1: Photograph looking southwestward across farmland toward Canyon Mountain.[7]

Geologic units of the South Umpqua River Watershed
According to Walker and MacLeod (1991), there are eleven geologic units within the South Umpqua River Watershed, ranging in age from Jurassic to Quaternary (see Table 1-2 and Map 1-6). A detailed description of units and a glossary of terms can be found in Appendix 1.

The Tertiary age units are typical of Western Cascades rock formations, while the Cretaceous and Jurassic units are typical of Klamath Mountain rocks. The oldest rocks in the watershed are rocks of the Klamath Mountains. Jurassic ophiolite sequences (Ju), or oceanic crust incorporated into the continent, are found in the far southeast reach of the watershed. In a large portion of the watershed, Jurassic volcanic rocks (Jv) that include lava flows, breccias, and agglomerate are interspersed with Jurassic sedimentary rocks (Js), including mudstone, shale, siltstone, graywacke, tuff, and limestone. Rocks of the late Jurassic and early Cretaceous are found throughout the watershed. The Myrtle Group (KJm) consists of conglomerate, sandstone, siltstone, and limestone, and the Dothan Formation sedimentary rocks (KJds) consist of sandstone, conglomerate, graywacke, and chert. Granitic textured intrusive igneous rocks (KJg) varying in

[7] The photograph was taken from Universal Transverse Mercator coordinate 482329/4757372.

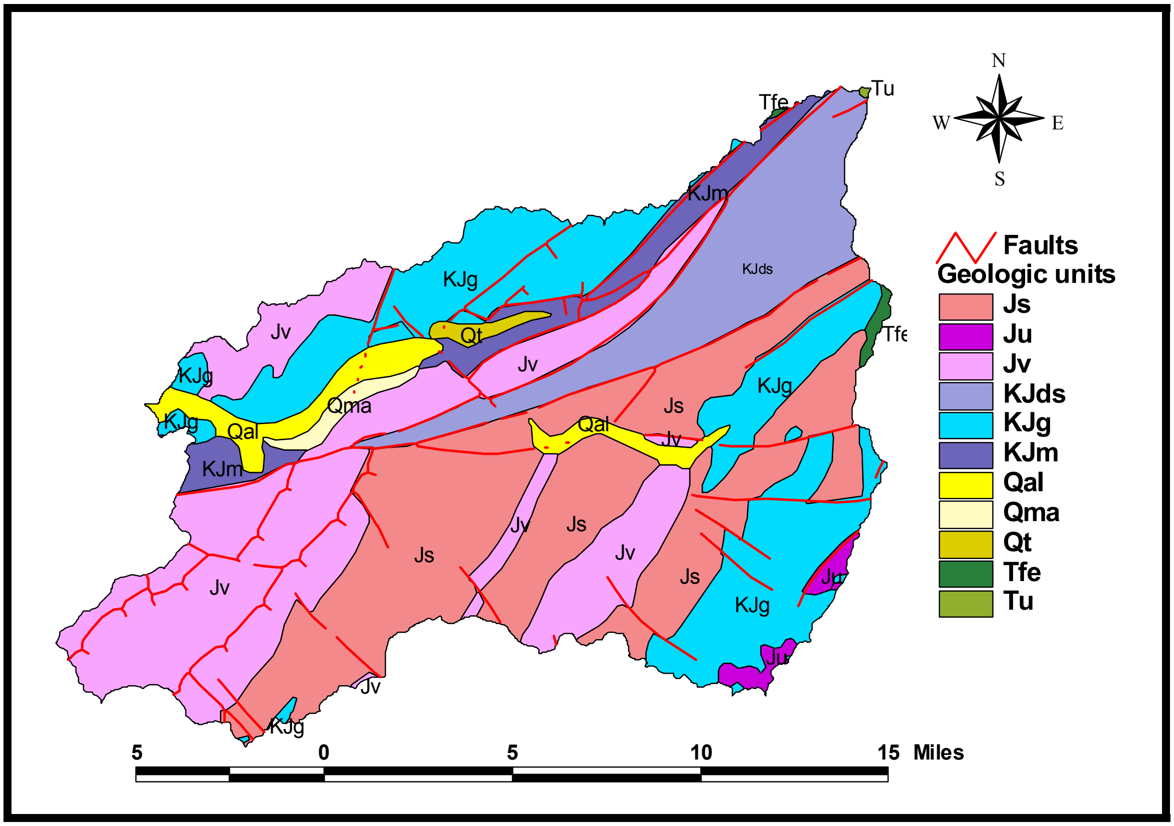
composition from diorite to true granite occur in the northwestern and southeastern parts of the watershed.

A very small portion of the watershed comprises Tertiary-aged deposits of Cascades origin. The unit Tfe consists of arkosic and micaceous sandstone and siltstone of the Eugene Formation and andesitic lapilli tuff, breccia, and water-laid and air-fall silicic ash of the Fisher and Colestine Formations. Tuffaceous sedimentary rocks, tuffs, and basalt (Tu) are continental and largely volcanigenic deposits of basalt and basaltic andesite.

The youngest geologic units in the watershed are Quaternary in age. Ash flow deposits (Qma) of Mt. Mazama (the volcano that existed where Crater Lake is today) are found south of the South Umpqua River in the downstream reaches within the watershed. Alluvial (stream) deposits of sand, gravel, and silt, mostly in floodplains and channels (Qal), and stream terrace deposits (Qt) are located above the present flood plain of the South Umpqua River near its confluence with Days Creek.

Era	Period	Epoch
Cenozoic	Quaternary	Holocene
		Pleistocene
	Tertiary	Pliocene
		Miocene
		Oligocene
		Eocene
		Paleocene
Mesozoic	Cretaceous	
	Jurassic	
	Triassic	
Paleozoic	Permian	
	Pennsylvanian	
	Mississippian	
	Devonian	
	Silurian	
	Ordovician	
	Cambrian	
Precambrian		

Table 1-2: Relative geologic time scale (most recent to oldest – top to bottom).



Map 1-6: Geologic units and faults within the South Umpqua River Watershed.

Structural geology

The long history of tectonic subduction of the floor of the Pacific Ocean with the North American continent as well as a northward movement of the oceanic plate has left the landscape of Oregon riddled with faults. The South Umpqua River Watershed has many major faults within its boundaries. Most of these faults are in a southwest-northeast orientation (see Map 1-6), but some smaller faults fall in an orientation nearly perpendicular to this. Although recent earthquake activity has been focused mostly in the northwestern part of the state, the tectonic subduction zone that extends under the entire western part of the state poses an earthquake hazard in the entire area. The location of faults seen at the surface is not necessarily an indication of where crustal movement may occur in the future.

Impacts of geology on stream characteristics

As stated earlier, the geology of an area impacts the water resources of that area. Geologic processes govern the topography of an area, which in turn greatly influences the morphology of streams. The hydraulic conductivity, or permeability, of rock units plays a significant role in determining the groundwater inputs to streams, and groundwater can contribute to stream water quality. Generally, groundwater has a more consistently high quality than surface water. However, many streams in mountainous areas, such as the South Umpqua River Watershed, are naturally surface water dominated, with groundwater playing a relatively minor role.

The composition of rocks can impact the quality of fish habitat and water quality. Generally, granitic rocks are more acidic, while calcareous rocks are more alkaline. Fish prefer neutral to alkaline conditions (Hastings et al., 2002). Erosion of rocks and subsequent delivery of sediments to streams as well as groundwater inputs delivered to streams through rock units influence the water chemistry of those streams. Within the South Umpqua River Watershed, large areas of deeply weathered granitic textured intrusive rocks exist.

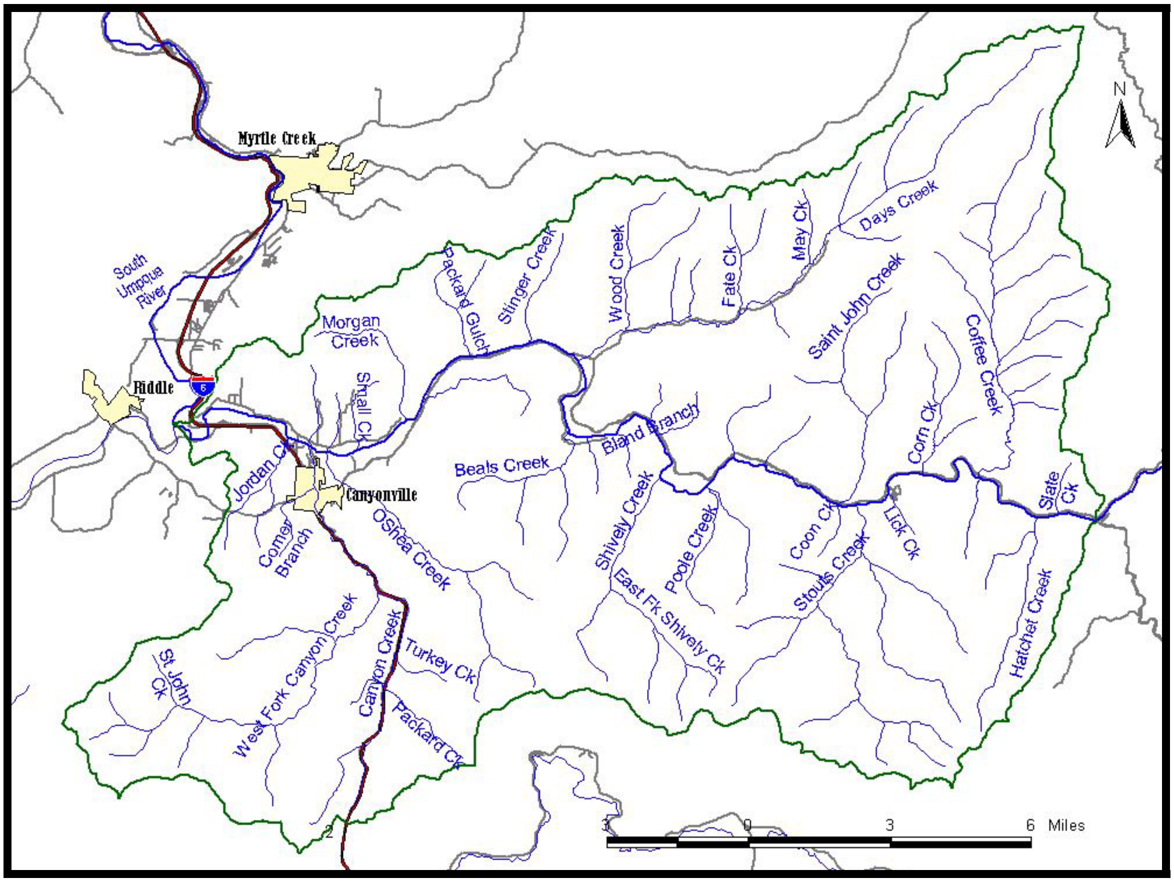
The topography that results from geologic processes helps to shape the steepness of slopes and their likelihood of failing. Topography also influences the local climate, causing, for instance, more rain on the western slopes of large hills than on the eastern slopes. This may influence runoff and sediment inputs locally. Geology largely governs the process of soil formation. Rocks provide the parent material for soil development. The minerals within rocks also influence the organisms that grow and abide within the soil. Relief and climate, both influenced by geology, also impact soil genesis. The characteristics of the resulting soil impact the contribution of sediment to streams (see section 3.3.7 for more information on stream sedimentation).

1.2.5. The South Umpqua River Watershed stream network

The South Umpqua River Watershed begins approximately at stream mile 47 and includes 28 stream miles of the South Umpqua River.[8] Map 1-7 shows all of the tributaries that feed into this portion of the South Umpqua River that are visible on a US Geological Survey 100,000 resolution map, where one inch equals 8,333.3 feet. According to this map, there are 248.5 stream miles in the South Umpqua River Watershed. The longest tributary to this section of the South Umpqua River is Days Creek (13.9 stream miles). The South Umpqua River's average stream gradient within the watershed is 0.8% (see Photo 1-2). The average stream gradient for Days Creek is 5.0%, while other tributaries have an average gradient of 7.5%.

Stream density is fairly high in the Inland Siskiyous Ecoregion and Umpqua Cascades Ecoregion. The Umpqua Interior Foothills Ecoregion is characterized by lower stream density, even though this is not readily apparent in Map 1-7. Low precipitation can result in intermittent summer streamflow.

[8] Stream miles and river miles measure distance from the mouth following the center of the stream channel to a given point. "Total stream miles" is the length of a stream in miles from the mouth to the headwaters. "Stream mile zero" always refers to the mouth.



Map 1-7: Major streams of the South Umpqua River Watershed.[9]

[9] "Stinger Creek" on this map is also known as "Stinger Gulch." The names are used interchangeably in this assessment. "Oshea Creek" is sometimes written as "O'Shea Creek."

Photo 1-2: The South Umpqua River within the South Umpqua River Watershed.[10]

1.2.6. Climate

As is typical of southwest interior Oregon, all three ecoregions are drier and colder than the northwest interior because much of the area is within the Coastal Mountain Range rain shadow. In the Umpqua Interior Foothills Ecoregion, precipitation typically ranges from 30 to 50 inches. Inland Siskiyous Ecoregion precipitation is generally between 35 to 70 inches, while precipitation in the Umpqua Cascades Ecoregion usually ranges from 50 to 80 inches. Both ecoregions can receive up to 90 inches in higher elevations.

There is no climate station within the South Umpqua River Watershed. The nearest climate station that collects temperature and precipitation data is near Riddle (station #7169).[11] As the ecoregion information indicates, temperatures are generally mild. Figure 1-1 shows the average daily minimum and maximum temperatures by month for Riddle. Maximum temperatures in the summer are generally in the 70s or low 80s. Minimum winter temperatures are usually above freezing.

[10] Kristin Anderson and John Runyon of BioSystems, Inc., contributed this photograph. The photograph was taken from Universal Transverse Mercator coordinate 486102/4757616.
[11] The National Oceanographic and Atmospheric Administration (NOAA) administers this station. Data are available from the Oregon Climate Station website http://ocs.oce.orst.edu/.

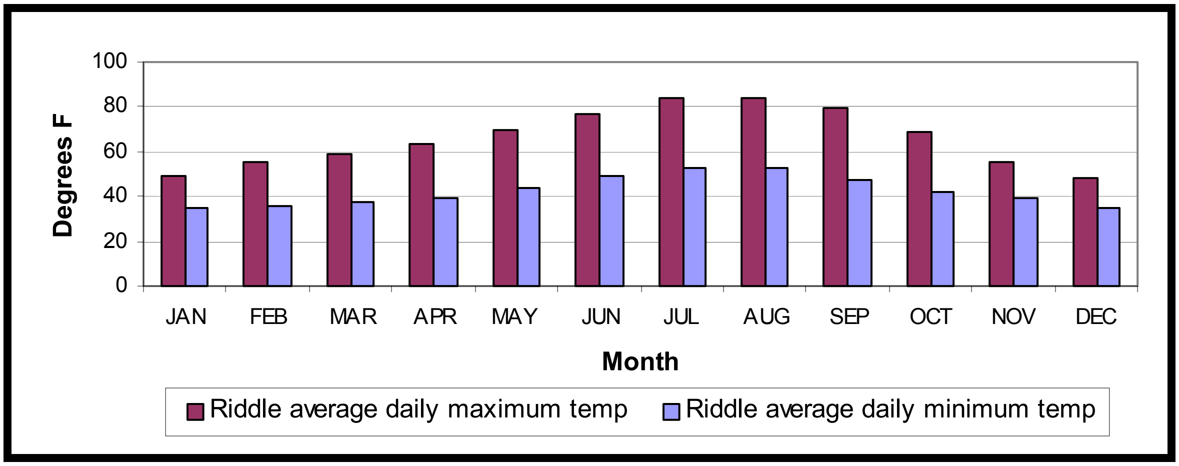


Figure 1-1: Average minimum and maximum temperature for Riddle (station #7169).

Rainfall averages 30.8 inches in Riddle, but can vary widely depending upon the year (see Figure 1-2). As is typical of southwest Oregon, most precipitation occurs in the winter months (see Figure 1-3). In Riddle, rainfall averages 4.8 inches for the months of November through February and 0.6 inches for June through September.

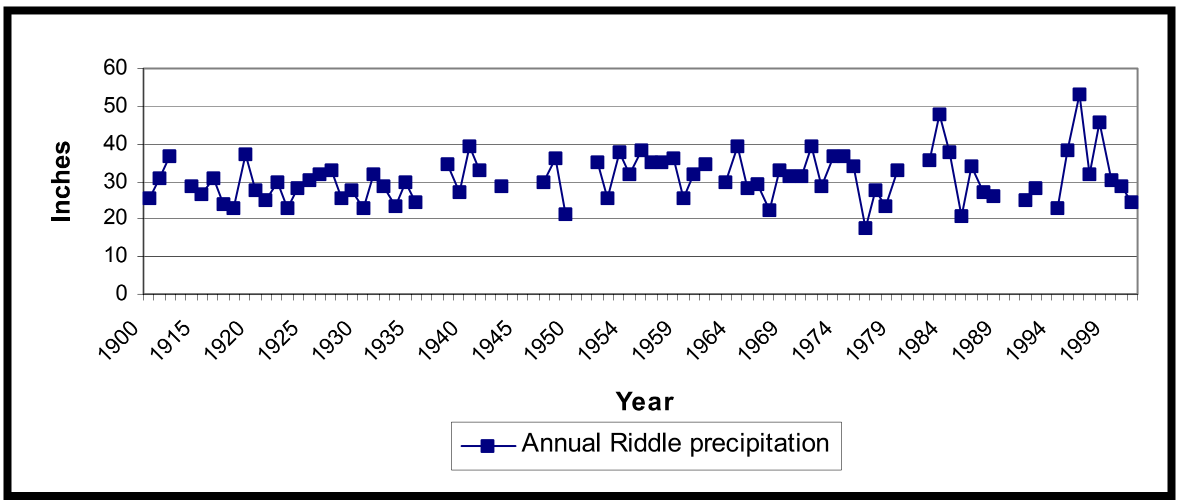


Figure 1-2: Annual precipitation for Riddle (station #7169).

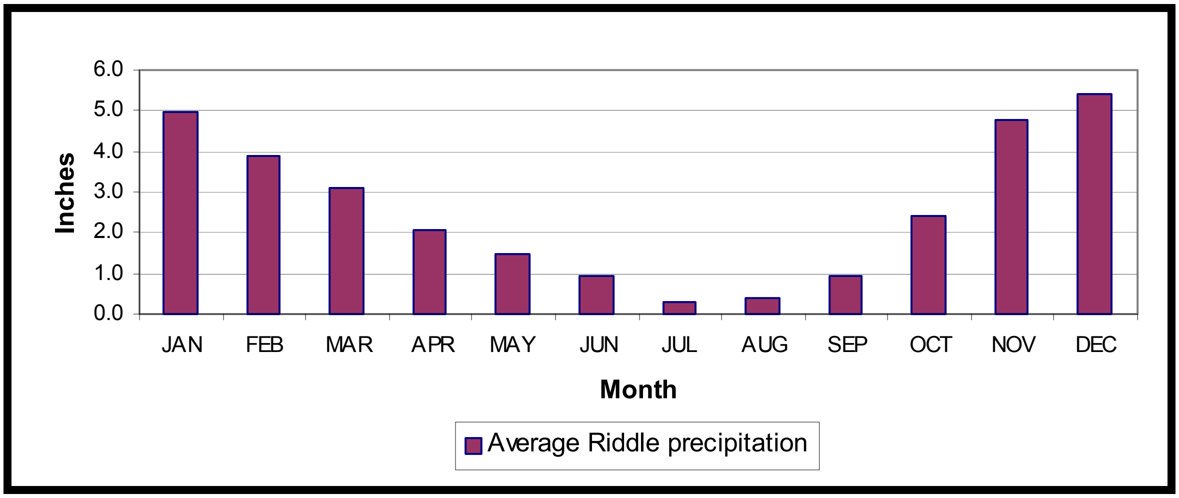


Figure 1-3: Average monthly precipitation for Riddle (station #7169).

1.2.7. Vegetation

In the Umpqua Interior Foothills Ecoregion, valley bottoms have been converted from native prairie and savanna to urban and rural residential areas, agriculture lands, and grazing lands. Where the soil is favorable and there is sufficient moisture, the uplands support Douglas-fir, madrone, bigleaf maple, California black oak, incense cedar, and Oregon white oak. Where soils are drier, madrone and oaks are the dominant species, with some Douglas-fir, ponderosa pine, and incense cedar.

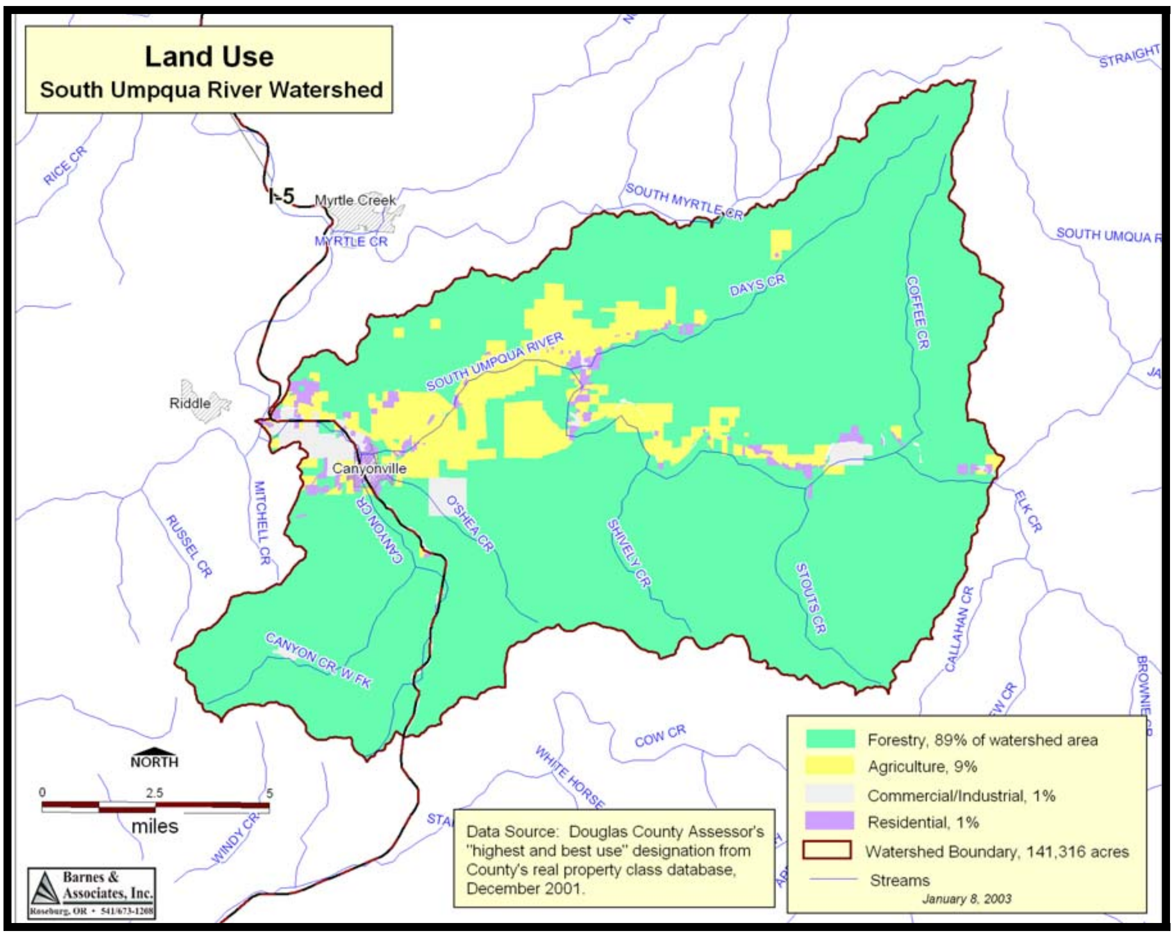
In the higher elevation Inland Siskiyous Ecoregion, Douglas-fir is dominant, with grand fir and white fir on northern aspects but minor or absent on southern aspects. Bigleaf maple, western redcedar, and incense cedar are also present. Hemlock and California black oak can be found where conditions are favorable. Northern aspects favor golden chinquapin, while madrone is prominent on south-facing slopes. For both aspects, the understory consists of salal, Oregon grape, western hazel, ocean spray, and red huckleberry; however, due to insufficient moisture, salal, Oregon grape, and red huckleberry are less common on southern slopes.

The high elevations of the eastern Umpqua Cascades are dominated by Douglas-fir and western hemlock. Overstories also include western redcedar, sugar pine, Pacific yew, grand fir, and white fir. Some madrone is present on warmer south-facing slopes. Canyon oaks can be found on stony soils on all aspects. Understory vegetation includes rhododendron, Oregon grape, salal, golden chinquapin, red huckleberry, western sword fern, and bracken fern. In the very high eastern elevations, vegetation is the same for the rest of the Umpqua Cascades Ecoregion. However, the growing season is much shorter than for other locations in the watershed.

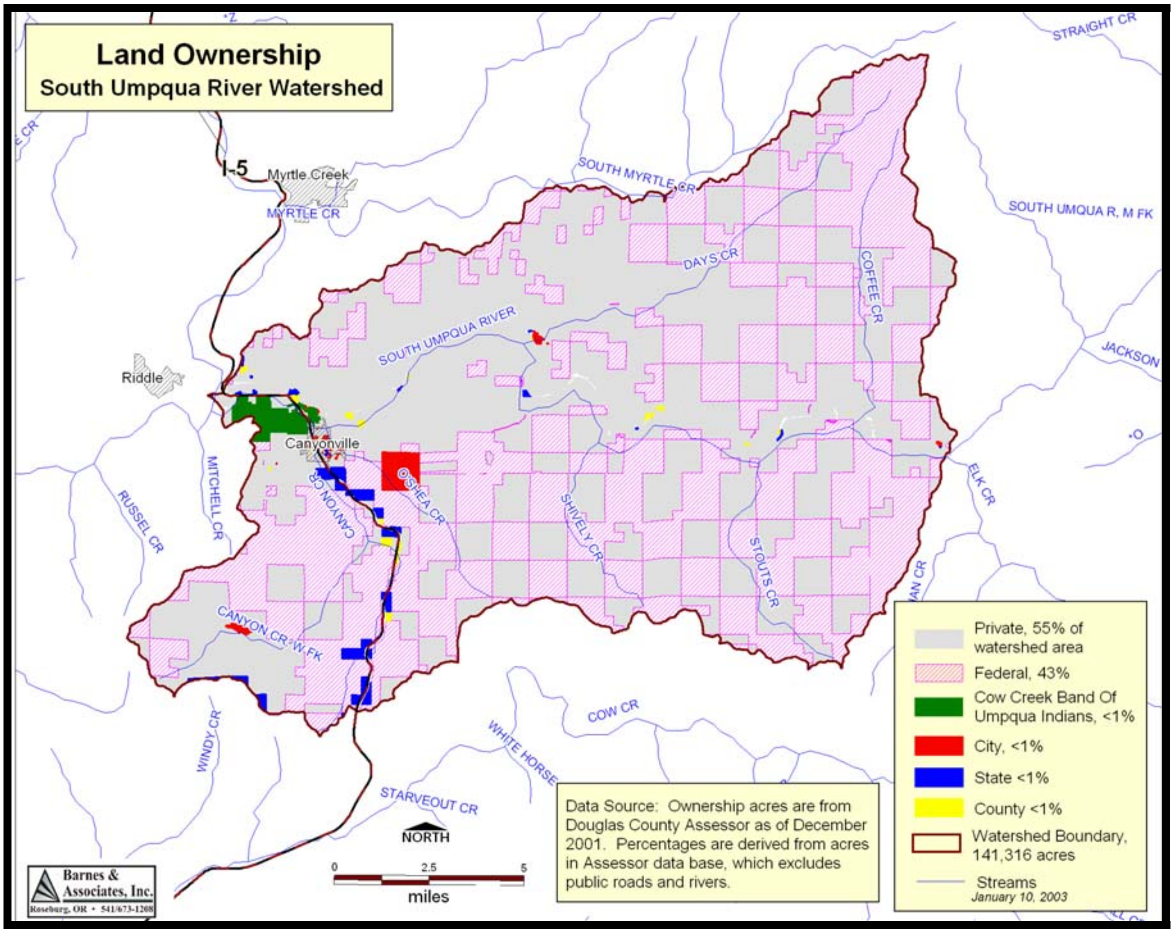
1.3. Land use, ownership, and population

1.3.1. Land use and ownership

As shown in Map 1-8, the most common land use in the South Umpqua River Watershed is forestry, with 89% of the land base used for public or private forestry. Agriculture constitutes 9% of the land use, and mostly occurs in and around the South Umpqua River and Days Creek floodplains. Commercial/industrial lands and residential lands each constitute approximately 1% of the watershed. As shown in Map 1-9, land ownership is primarily private (55%), with public ownership mostly administered by the Bureau of Land Management. City, state, county, and Cow Creek Band of the Umpqua Tribe of Indians lands each constitute less than 1% of the watershed.



Map 1-8: Land use in the South Umpqua River Watershed.

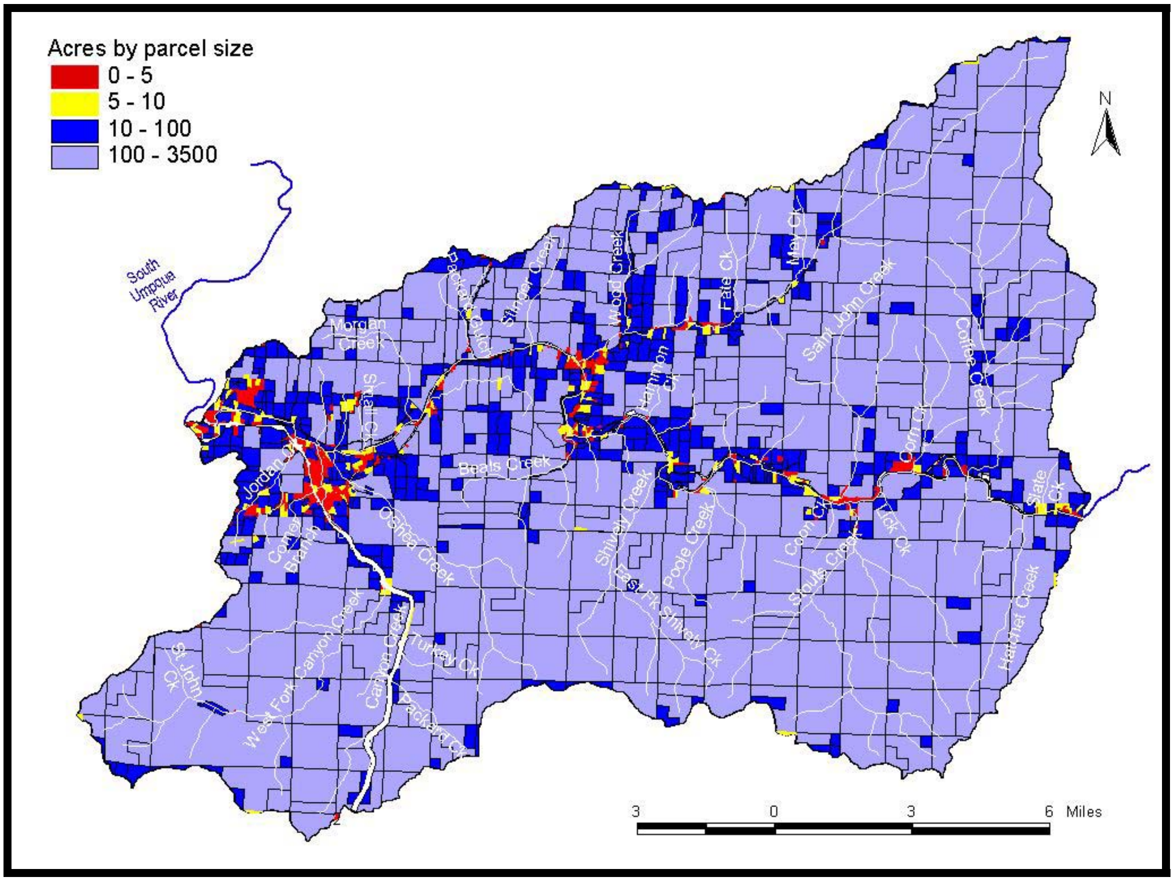


Map 1-9: Land ownership in the South Umpqua River Watershed.

Map 1-10 and Table 1-3 show parcel size distribution and percent by class for the South Umpqua River Watershed as of 2001. Most of the watershed (80.7%) consists of ownership parcels that are over 100 acres. Less than three percent of parcels are less than 10 acres. These are mostly located within and around the City of Canyonville and along the South Umpqua River and Days Creek.

Parcel size	Percent
0-5	1.2%
5-10	1.0%
10-100	17.0%
100+	80.7%

Table 1-3: Percent of landholdings by parcel size for the South Umpqua River Watershed.

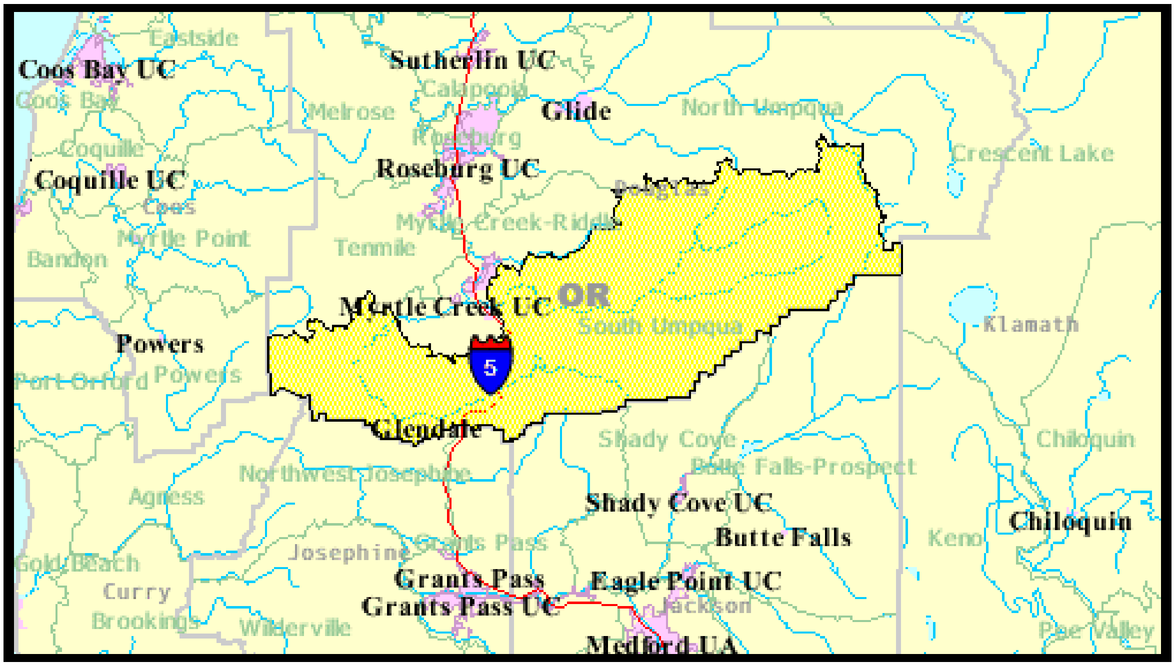


Map 1-10: Parcel size distribution for the South Umpqua River Watershed.

1.3.2. Population and demographics

Areas for which the US Census Bureau has population and demographic information do not correspond with the South Umpqua River Watershed boundary. Only data for the City of Canyonville are entirely within the South Umpqua River Watershed. Part of the South Umpqua Census County Division (CCD) is within the watershed (see Map 1-11).[12] Data from these areas are included in this section to provide an overview of the populations that live within the South Umpqua River Watershed.

[12] According to the US Census Bureau (http://factfinder.census.gov/servlet/BasicFactsServlet), a census county division (CCD) is "a subdivision of a county that is a relatively permanent statistical area established cooperatively by the Census Bureau and state and local government authorities. Used for presenting decennial census statistics in those states that do not have well-defined and stable minor civil divisions that serve as local governments."



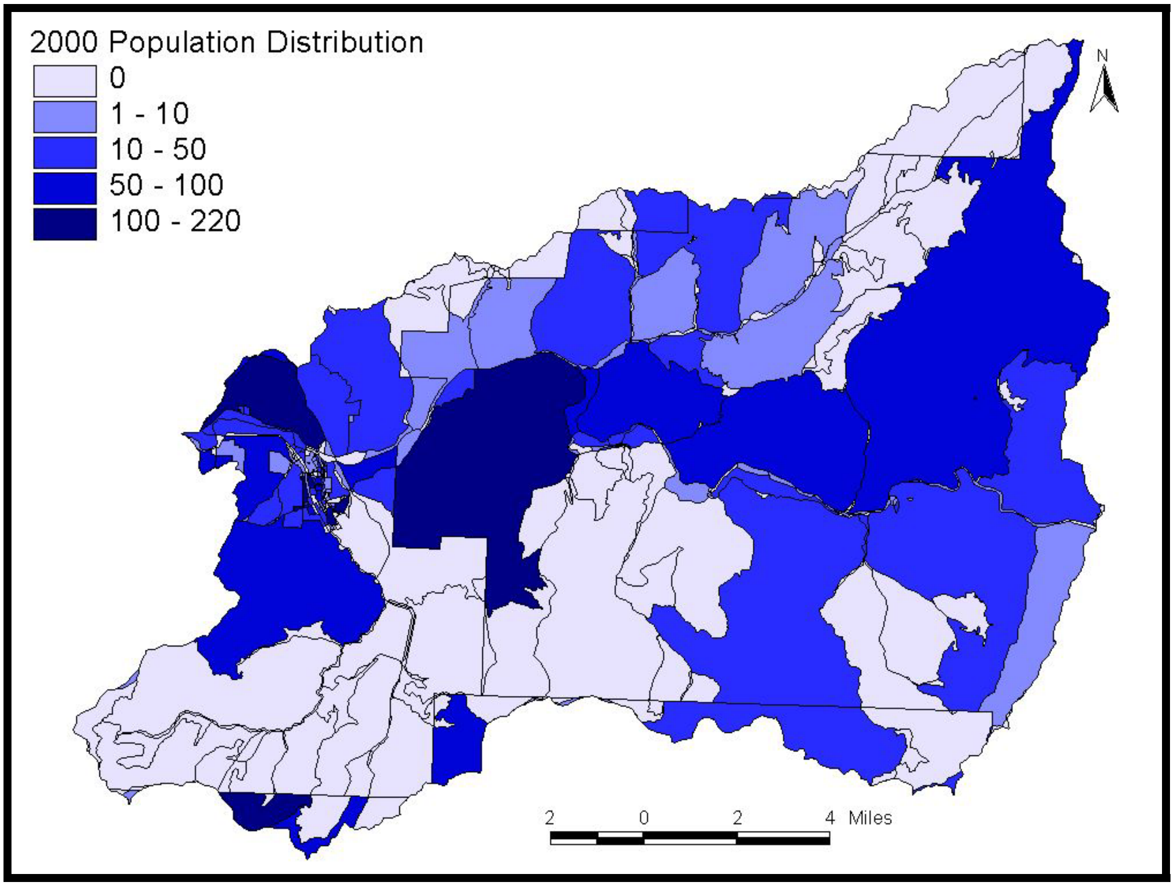
Map 1-11: Location of the South Umpqua CCD.[13]

Population

The only city within the South Umpqua River Watershed is Canyonville. In 2000, the population of Canyonville City was 1,293 people. The population of the South Umpqua River Watershed is estimated to be no more than 3,945 people, or an average of 17.8 people per square mile. The relative population distribution in the watershed is shown in Map 1-12.[14]

[13] This map is from the US Census Bureau's American FactFinder website: http://factfinder.census.gov.

[14] US Census tracts and blocks do not follow watershed boundaries, so it is impossible to make a precise estimate of the watershed's population.



Map 1-12: Relative population density within the South Umpqua River Watershed.[15]

General demographic characteristics and housing

Table 1-4 provides Census 2000 information about general demographic characteristics and housing for the City of Canyonville and the South Umpqua CCD; Douglas County data are provided for comparison. The median ages for Canyonville and the South Umpqua CCD are slightly higher than the county's median age. The largest racial group for all areas is white, with the next largest groups being Hispanic or Latino. Average household size and family size are comparable for all three areas. Canyonville's percent of owner-occupied housing is less than the percents for the South Umpqua CCD and the county. The South Umpqua CCD has a higher housing vacancy rate than the county or the City of Canyonville.

[15] The lines on Map 1-12 indicate US Census divisions.

Parameter	**Canyonville City**	**South Umpqua CCD**	**Douglas County[16]**
Median age (years)	42.3	42.6	41.2
Race			
White	90.1%	89.2%	91.9%
Hispanic or Latino	3.2%	4.8%	3.3%
Asian	0.9%	0.4%	0.6%
American Indian or Alaskan Native	2.9%	2.1%	1.4%
African American	0.2%	0.1%	0.2%
Native Hawaiian or Pacific Islander	0.2%	0.2%	0.1%
Some other race	0.0%	0.2%	0.1%
Two or more races	2.6%	3.1%	2.4%
Households			
Avg. household size (#)	2.41	2.51	2.48
Avg. family size (#)	2.97	2.91	2.90
Owner-occupied housing	60.1%	71.5%	71.7%
Vacant housing units	7.9%	11.7%	8.0%

Table 1-4: 2000 Census general demographic characteristics and housing for the City of Canyonville, the South Umpqua CCD, and Douglas County.

Social characteristics

Table 1-5 provides information from the 2000 Census for education, employment, and income for the City of Canyonville and the South Umpqua CCD; Douglas County data are included for comparison. Both areas are below Douglas County for the percent of high school graduates and the percent of people with at least a four-year college degree. The percent of unemployed persons in the labor force is much higher in Canyonville than for the county or the South Umpqua CCD. The top three occupations in Table 1-5 account for around 70% of the labor force in all three areas, and the top three industries employ over half of workers. Per capita income and median family income for the City of Canyonville and the South Umpqua CCD are lower than for Douglas County, while poverty levels are higher.

[16] In 2000, the population of Douglas County was 100,399 people.

Parameter	**Canyonville City**	**South Umpqua CCD**	**Douglas County**
Education – age 25+			
High school graduate or higher	70.4%	76.5%	81.0%
Bachelor's degree or higher	8.5%	10.0%	13.3%
Employment- age 16+			
In labor force	52.5%	52.0%	56.9%
Unemployed in labor force	13.2%	7.3%	7.5%
Top three occupations	Production, transportation, and material moving; Service;[17] Sales and office	Production, transportation, and material moving; Management, professional, and related; Service	Management, professional and related occupations; Sales and office; Production, transportation, and material moving.
Top three industries	Arts, entertainment, recreation, accommodation, food service; Manufacturing; Retail	Manufacturing; Educational, health, and social service, Arts, entertainment, recreation, accommodation, food service	Educational, health, and social services; Manufacturing; Retail
Income			
Per capita income	$14,017	$15,036	$16,581
Median family income	$31,500	$34,559	$39,364
Families below poverty	15.8%	11.2%	9.6%

Table 1-5: 2000 Census information for education, employment, and income for the City of Canyonville, the South Umpqua CCD, and Douglas County.

[17] Production, transportation, and material moving occupations were tied with service occupations at 24.5% for Canyonville City.

2. Past Conditions[18]

The past conditions section provides an overview of events since the early 1800s that have impacted land use, land management, population growth, and fish habitat in Douglas County and in the South Umpqua River Watershed. Sections 2.1 through 2.5 describe the history of Douglas County. Section 2.6 provides information specific to the South Umpqua River Watershed. Most of sections 2.1 through 2.5 is based on S.D. Beckman's 1986 book *Land of the Umpqua: A History of Douglas County, Oregon.* Material obtained from other sources will be cited in the text and included in the reference list at the end of the section.

Key Questions

- What were the conditions of the Umpqua Basin watersheds before the arrival of the settlers?
- What events brought settlers to Douglas County?
- How did land management change over time and how did these changes impact fish habitat and water quality?
- What were the major socioeconomic changes in each period?
- When were laws and regulations implemented that impacted natural resource management?

2.1. Pre-Settlement: Early 1800s

The pre-settlement period was a time of exploration and inspiration. In 1804 President Thomas Jefferson directed William Clark and Meriwether Lewis to "secure data on geology, botany, zoology, ethnology, cartography, and the economic potentials of the region from the Mississippi Valley to the Pacific" (Beckham, 1986, p. 49). The two men successfully completed their journey in 1806 and returned with field collections, notes and diaries. The information they collected soon became an inspiration for others to follow their path. Fur trappers came first, reaching Douglas County in the 1820s. The pre-settlement period was an eye-opener for both the European explorers and the native Indians.

2.1.1. Indian lands

The Indians of Douglas County used fire to manipulate the local vegetation to improve their hunting success. George Hall, Sr., a settler of Douglas County in the 1850s, found the hills in the Oakland area with only a few large fir trees. In the draws were poison oak, small shrubs and abundant deer. "The Indians kept these hills burned off for good hunting" (Chenoweth, 1972, p. 66). In southern Douglas County early white men told of the Indian custom of burning during the late summer months. Burning stimulated the grasses and helped eliminate the undergrowth. "Reports from some of the first white men to see the Cow Creek Valley compared it to a giant wheat field" (Chandler, 1981, p. 2). Grass covering the rolling prairies often was waist high. An expedition in the fall of

[18] Robin Biesecker of Barnes and Associates, Inc., contributed sections 2.1 through 2.5. Jeanine Lum of Barnes and Associates, Inc., contributed section 2.6.

1841, funded by the federal government and led by Lt. George F. Emmons, met with dense, choking smoke as they traveled through the Umpqua Valley. Indians had created the smoky conditions by burning grasslands on the hillsides and along the river.

Accounts of the native Douglas County vegetation reveal extensive prairies and large trees. In June of 1826 David Douglas crossed the Calapooya Mountains and entered Yoncalla. His purpose was to collect specimens of native vegetation for the Royal Horticultural Society of London. Douglas was searching for stands of sugar pine. In the Umpqua Valley he was fortunate to meet and, with the help of beads and tobacco, make friends with an Indian. The Indian pointed to the south after Douglas drew pictures of the sugar pine and its huge cones. The pine stand was located and Douglas later described the largest pine windfall he had found: "57 feet nine inches in circumference; 134 feet from the ground, 17 feet five inches; extreme length, 215 feet" (Lavender, 1972, p. 148). Douglas was very fortunate to live through this experience. He was shooting up into the pine trees to clip cones when eight Indians, attracted by the noise, arrived armed with bows, arrows, and knives. Douglas cocked his gun, backed up and "as much as possible endeavored to preserve my coolness" (Lavender, 1972, p. 148). After an eight- to 10-minute staredown the Indian leader requested tobacco. Douglas complied, quickly retreated to his camp and, along with his three sugar pine cones, survived the encounter.

<u>Origin of the name "Umpqua"</u>

Many ideas exist about the origin of "Umpqua." An Indian chief searching for hunting grounds came to the area and said "umpqua" or "this is the place." Other natives refer to "unca" meaning "this stream." One full-blooded Umpqua Indian interviewed in 1960 believed the term originated when white men arrived across the river from their village and began shouting and gesturing their desire to cross. "Umpqua," she feels means "yelling," "calling," or a "loud noise" (Minter, 1967, p. 16). Another Indian when asked the meaning of "Umpqua" rubbed his stomach, smiled, and said, "Uuuuuump-kwa – full tummy!" (Bakken, 1970, p. 2).

Explorers and early settlers described the trees and other vegetation found in Douglas County. Large cedar trees were found along the South Umpqua River. In 1855 Herman and Charles Reinhart found yellow and red cedars clear of limbs for 30 to 50 feet. The Pacific Railroad Surveys passed through the Umpqua Valley in 1855. The oak groves found in the valleys were reported to grow both in groups and as single trees in the open. The oaks were described as reaching two to three foot diameters and to have a low and spreading form. Many early visitors describe the fields of camas. Hall Kelley traveled the Umpqua River in 1832. "The Umpqua raced in almost constant whitewater through prairies covered with blue camas flowers and then into dense forest" (Cantwell, 1972, p. 72). In the present-day Glide area, Lavola Bakken (1970) mentions the Umpqua Indian diet of sweet camas bulbs taken from the "great fields of camas" (p. 2). The Cow Creek Indians of southern Douglas County also ate the camas bulb (Chandler, 1981).

The diet of the native Indians also included fish and wildlife. The Cow Creek Indians built dams of sticks across stream channels to trap the fish. Venison was their main game meat that, prior to the use of guns, was taken with snares and bows and arrows (Chandler, 1981). Salmon was the fundamental food of the Indians along the main Umpqua River. The Lower Umpqua Indians fished with spears and by constructing barriers along the narrow channels. The large number of fish amazed a trapper working for the Hudson's Bay Company: "The immense quantities of these great fish caught might furnish all London with a breakfast" (Schlesser, 1973, p. 8). Wildlife was prevalent throughout Douglas County and included elk, deer, cougar, grizzly bear, beaver, muskrat, and coyotes.

2.1.2. European visitors

The Lewis and Clark Expedition gave glowing reports of the natural riches to be found and proved travel to Oregon was difficult but not impossible. Fur seekers, missionaries, and surveyors of the native geology, flora, and fauna were among the first European visitors to Douglas County. Methodist missionary Gustavus Hines preached to the Indians of the Umpqua in 1840. He concluded "the doom of extinction is suspended over this wretched race, and that the hand of Providence is removing them to give place to a people more worthy of this beautiful and fertile country" (Beckham, 1986, p.59).

Fur trading in Douglas County began in 1791 in the estuary of the Umpqua River. Captain James Baker traded with the Indians for about 10 days and obtained a few otter skins. The first land contact by fur traders in the Umpqua Valley was in 1818 by the Northwest Company of Canada. Trapping did not expand until Alexander Roderick McLeod – working for Hudson's Bay Company - explored the Umpqua Valley in 1826. The number of trappers steadily increased along the Umpqua River from 1828 to 1836. Hudson's Bay Company established Fort Umpqua first near the confluence of Calapooya Creek and the Umpqua in the 1820s and then, in 1836, near the present-day city of Elkton. Fort Umpqua was reduced in size in 1846 and finally destroyed in a fire in 1851. By 1855, the beaver were trapped out and fur trading had ended along the Umpqua River (Schlesser, 1973).

Pre-Settlement timeline	
1804 - 1806	Lewis & Clark Expedition
1810	John Jacob Astor establishes Pacific Fur Company in Astoria
1818	Umpqua Massacre – North West Company fur seekers kill at least 14 Indians in northern Douglas County
1826	David Douglas (botanist) travels Douglas County
1828	Smith Massacre – Jedediah Smith's party attacked by Indians at the junction of the Smith and Umpqua Rivers; 14 killed

The travel routes of the trappers and early explorers closely parallel many of Douglas County's current roads. For example, Interstate Five (I-5) is located in the vicinity of an old trade route. The main difference is the original trail followed Calapooya Creek to its mouth and then up the Umpqua and South Umpqua rivers to Roseburg (Schlesser, 1973). Interstate Five uses a more direct route from Calapooya Creek to Roseburg via Winchester. The Umpqua Indian trails followed the major rivers and streams of the county including the main Umpqua and the North and South Umpqua Rivers, Little River, Rock Creek, and Steamboat Creek (Bakken, 1970).

The population of the Umpqua Valley is estimated to have been between 3,000 and 4,000 before the arrival of the white man (Schlesser, 1973). The Europeans brought diseases that reduced the population of Oregon Indians. Disease occurrences in Douglas County probably started between 1775 and the 1780s with the first smallpox outbreak. A smallpox or measles outbreak may have affected the far western part of the county in 1824 and 1825. The possibility of malaria in the central portion of the county occurred in 1830 through 1837. Smallpox was documented in the coastal portions of Douglas County in 1837 and 1838. Measles occurred in the western portions of the county in 1847 and 1848 (Allen, 2001). "The five bands of Athabascan speakers who lived along the Cow Creek were decreased to half their original number due to an epidemic during the severe winter of 1852-53" (Chandler, 1981, p. 9).

2.2. Settlement period: Late 1840s to the 1890s

2.2.1. Early settlement

California's Gold Rush was one factor in the early settlement of the county. First of all, the new miners demanded goods and services. "The California Gold Rush of 1849 suddenly created a market for Oregon crops and employment for Oregonians" (Allan, 2001). Secondly, travelers on their way to the gold fields passed through Douglas County. Many of these visitors observed the great potential for farming and raising stock and, after the trip to California, returned to Douglas County to take up permanent residence

The Donation Land Act of 1850 was a further impetus for the settlement of Douglas County. This act specified married couples arriving in Oregon prior to December 1850 could claim 640 acres; a single man could obtain

<u>Settlement period timeline</u>

1849	California Gold Rush
1850	Donation Land Act
1850s	Indian Wars; Douglas County Indians relocated to Grand Ronde Reservation
1860	Daily stages through Douglas County
1861	Flood
1870	*Swan* travels Umpqua River (Gardiner to Roseburg)
1872	Railroad to Roseburg
1873	Coos Bay Wagon Road completed
1887	Railroad connection to California
1893	Flood

320 acres. Men arriving after December 1850 were allowed to claim 320 acres if married and 160 acres if single. The patent to the land was secured with a four-year residency. The Donation Land Act was scheduled to end in December of 1853 but an extension increased this deadline to 1855. After 1855, settlers in Oregon were allowed to buy their land claims for $1.25 per acre following a one-year residency (Allan, 2001; Patton, 1976).

Large numbers of settlers entered Douglas County between 1849 and 1855. Lands were settled along Calapooya Creek, in Garden Valley, at Lookingglass, at the mouth of Deer Creek (Roseburg), in Winchester, and along Myrtle and Cow Creeks. For example, in Cow Creek Valley almost all open lands were claimed by 1855 (Chandler, 1981). The rich bottomland of the Umpqua Valley was very attractive to the emigrants looking for farmland. As the number of settlers increased, the Indian population of the county decreased. Diseases, as mentioned previously, took a toll, as did the Indian Wars of the 1850s. Douglas County Indians were relocated to the Grand Ronde Reservation in the 1850s.

2.2.2. Gold mining

One of the earliest mines in Douglas County was the Victory Mine close to Glendale. The Roseburg Review on November 6, 1893, reported the mine consisted of 800 acres of gold bearing gravel. In order to work the Victory Mine a dam was built across a canyon with a reservoir capable of holding millions of gallons of water.

The early 1850s brought placer mining to the South Umpqua near Canyonville and Riddle. The miners worked many different branches of Cow Creek. Coffee Creek, a tributary of the South Umpqua, was one of the most important mining areas. A minor rush occurred in the Steamboat area - east of Glide - in the 1870s.

In May of 1890 construction was begun on the “China Ditch.” This ditch was to bring water from Little River to the Lower South Umpqua River area. The initial purpose was for use in hydraulic mining with future goals of floating logs and irrigating the local fruit orchards. In 1891, 200 Chinese laborers were hired, giving the ditch its name. About 18 miles of ditch were dug before the work was stopped in 1893 by a court order - employees had not been paid. The target destination of Little River was never reached (Tishendorf, 1981).

<u>Mining techniques</u>

Placer mining was commonly used to recover gold. Gravel deposits were washed away using water from ditches (often hand-dug) and side draws. The runoff was directed through flumes with riffles on the bottom. The gold settled out of the gravel and was collected by the riffles.

Hydraulic mining was placer mining on a large scale. A nozzle or “giant” was used to direct huge amounts of water - under pressure - at a stream bank. The soil, gravel, and, hopefully, gold was washed away and captured downstream.

Gold mining affected the fish habitat of the streams and rivers. The drainage patterns were changed when miners diverted and redirected water flow. The removal of vegetation along the stream banks increased erosion and added sediment to the waterways. Salmon spawning grounds were destroyed when the gravels were washed away and the stream bottom was coated with mud. Placer and hydraulic mining may have created spawning areas by washing new gravels into the streams.

2.2.3. Mercury mining

The Bonanza and Nonpareil mines were located about eight miles east of Sutherlin. The Nonpareil mine was discovered in 1860 but was not developed until 1878. By 1880 the smelter was capable of handling 40 tons of ore per day. The Bonanza Mine had some early production in 1887 but the large-scale development did not occur until 1935. The Elkhead Mine, southeast of Yoncalla, began mercury mining and production around 1870.

2.2.4. Nickel mining

Sheepherders discovered nickel near Riddle on Old Piney (Nickel Mountain) in 1864 or 1865. Production was infrequent until 1882 when tunnels (some 320 feet long) and shafts were dug and a series of open cuts completed. Work slowed in the late 1890s and would not increase again until the late 1940s.

2.2.5. Agriculture

The early settlers brought livestock and plant seeds to use for food and for trade. Settler livestock included cattle, sheep, hogs, and horses. The early farmers sowed cereal crops of oats, wheat, corn, rye, and barley. Gristmills - used to grind the cereal crops into flour or feed - were first established in Douglas County in the 1850s and within 20 years almost every community in the county had one. Water was diverted from nearby streams and rivers to create power for the gristmills.

The early farmers reduced the indigenous food sources and changed the natural appearance of Douglas County. Hogs ate the acorns in the oak groves. The camas lilies were nipped by the livestock and diminished in number when the bottomlands were plowed to plant cereal crops. The deer and elk herds were decreased as the settler population increased. Indians were not allowed to burn the fields and hillsides in the fall because the settlers were concerned about their newly constructed log cabins and split rail fences.

2.2.6. Commercial fishing

The bountiful trout and salmon of the Umpqua were first sold commercially in the 1870s. William Rose caught trout and salmon at the confluence of the North and South Umpqua and sold them as far north as Portland. He caught the fish at night with nets and then shipped them out early the next morning. In 1877 the *Hera* – a boat with 100 Chinese workers and canning machinery – visited the lower Umpqua River. Local fishermen used gill nets stretched from the shore into the river to capture large numbers of fish as quickly as possible. Six-foot-long sturgeons were unwelcome captives. They were clubbed and thrown back in the river to rot on the shore. Yearly visits by the *Hera* and other cannery boats continued for three decades. Commercial fishing at a much smaller level occurred along the North Umpqua River. The fishermen constructed small dams and breakwaters. These obstructions created eddies and slow-moving water - ideal for capturing fish with gill nets.

2.2.7. Logging

The first wood product export was shipped from the Umpqua estuary in 1850. Trees were felled into the estuary, limbed, and loaded out for piling and spars on sailing ships. An additional market was found in San Francisco for piles for wharfing. The earliest sawmills in Douglas County appeared in the 1850s. The sawmills were water powered, often connected with a gristmill, and scattered throughout the county. Early sawmills were built on South Myrtle Creek, Pass Creek (north of Drain), the main Umpqua River (at Kellogg), Calapooya Creek, and in Canyonville. Dams were created to secure water to drive the mills.

Splash dams

Loggers created splash dams to transport logs to the mills. A dam was built across the stream creating a large reservoir. Logs were placed in the reservoir. The dam timbers were knocked out and the surge of water started the logs on their journey downstream

Log drives were used on many of the streams and rivers of Douglas County to deliver logs to the mill. The most common form of log drive included loading up the drainages with logs in the drier part of the year and then waiting for a winter freshet. When the rains came and the logs began to float, the “drive” would begin. Loggers would be positioned along the banks and at times would jump on and ride the logs. They used long poles to push and prod the logs downstream. Stubborn log jams would be blasted apart with dynamite. Log drives were often aided by the use of splash dams (see box). During these log drives, the stream channels were gouged, spawning gravels were removed or muddied, and fish passage may have been affected (Markers, 2000).

2.2.8. Transportation

Improvements in transportation were key to the economic development and population growth during this time period. The period began with limited transportation options into and through Douglas County. Ships came into the Umpqua estuary and delivered goods destined for the gold mines of California and the remainder of Douglas County. Goods moved from the estuary inland along the Scottsburg-Camp Stuart Wagon Road. Camp Stuart was a temporary military post occupied in 1851 in the Rogue River Valley. This route passed through Winchester and then into California following the Applegate Trail. Congress funded improvements to the Scottsburg-Camp Stuart Wagon Road and to the old Oregon-California Trail (Portland to Winchester) from 1853 through 1879. These road improvements led to the beginning of stage travel from Portland to Sacramento in 1860. The Oregon and California Stage Company began offering daily stages through Douglas County in July of 1860. A daily stage came through the Cow Creek area starting in 1862 (Chandler, 1981). The Coos Bay Wagon Road opened in 1873 allowing stage travel from Roseburg to Coos Bay.

Another form of transportation was attempted in 1870. A group of hopeful investors, *Merchants and Farmers Navigation Company*, financed a small sternwheel steamer, *Swan*, to navigate the Umpqua and South Umpqua Rivers from Gardiner to Roseburg. The voyage began February 10, 1870, and became a great social event as whole communities lined the riverbanks to watch the *Swan's* progress. Witness accounts recall the slowness of the trip upriver and the swiftness of the downriver journey. The *Swan* safely arrived in Roseburg with the captain, Nicholas Haun, very optimistic about vessel travel on the Umpqua. Captain Haun thought a minor clearing of the channel would allow a ship the size of the *Swan* to pass the rapids except in periods of very low water (Minter, 1967).

The U.S. Corps of Engineers surveyed the river and reported that it could be made navigable seven months of the year. Congress appropriated money for the removal of obstructions and W.B. Clarke was awarded the job. Reports are sketchy about how much channel modification was actually carried out. One witness remembered some blasting in the Umpqua River channel near Tyee. In February, 1871, the *Enterprise* began a maiden voyage upriver but, because of low water, only reached Sawyers Rapids - downstream of Elkton. The cargo was subsequently dumped at the rapids, and no further attempt was made to navigate the upper Umpqua (Minter, 1967).

River travel on the Umpqua was soon forgotten when the Oregon California Railroad reached Roseburg in 1872. Financial problems stalled the southerly extension of the railroad for 10 years. Those 10 years proved to be an economic boon for Roseburg. Travelers heading south took the train to Roseburg and then rode the stage into California. Travelers poured in and out of Roseburg creating a need for new hotels and warehouses and leading to rapid population growth. Finally, in 1887, the tracks were completed, extending the railroad into California.

2.3. Onset of the modern era: Early 1900s to the 1960s

2.3.1. Transportation

The first automobiles arrived in Oregon in 1899 and in Douglas County in the early 1900s. After 1910 automobile travel in western Oregon became a key motivation for road construction and improvements in Douglas County. One of the first major road construction projects in the state was the Pacific Highway (Highway 99) running from Portland to Sacramento and Los Angeles. Construction began in 1915 and by 1923 Oregon had a paved highway running the entire length of the state. In Douglas County the Pacific Highway passed through Drain, Yoncalla, Oakland, Sutherlin, Roseburg, Myrtle Creek, Canyonville, and Galesville for a total length of 97.7 miles.

Other major road construction projects completed before 1925 include routes between Roseburg and Coos Bay, Dixonville to Glide, Drain to Elkton, and Elkton to Reedsport. These roads were built to meet the expanding numbers of vehicles in the state. Registered vehicles in Oregon rose from 48,632 in 1917 to 193,000 in 1924. World War II slowed the road construction projects in the early 1940s but when the soldiers returned in 1945 road construction accelerated. The most important road-building project in the 1950s was Interstate Five (I-5), a four-lane, nonstop freeway, completed in 1966. I-5 was a windfall for cities along its path - Roseburg for example - but difficult for the bypassed cities of Yoncalla, Riddle, and Glendale.

2.3.2. Logging

Logging expanded in Douglas County in the early 1900s for two main reasons: the invention of the steam donkey engine and the use of logging railroads. The steam donkey engine was a power-driven spool with a rope or cable attached for yarding logs. It could be mounted on a log sled and yard itself, as well as logs, up and down extremely steep slopes. The logs were yarded with the steam donkey engine and then hauled to the sawmill on logging railroads. In Douglas County more than 150 miles of logging railroads were used between 1905 and 1947.

Gyppo loggers came into prevalence in the 1920s. These were loggers and mill owners with limited capital trying to break into the market. The term “gyppo” related to the real possibility that these loggers would “gyp” or not pay their workers. Many of the gyppos operated on the edge, cutting corners and costs whenever possible. Equipment breakdowns, fuel leaks, and accidents were common occurrences. The gyppo loggers searched for valuable logs, such as cedar, left after the initial logging.

<u>1890s to the 1960s timeline</u>

1900	Fish hatchery established near Glide
1903	Prunes major agricultural crop
1909	Flood
1923	Pacific Highway (Highway 99) completed
1927	Flood
1929	Northwest Turkey Show in Oakland (Douglas County ranked 6th in U.S. turkey production)
1936	Kenneth Ford establishes Roseburg Lumber Company
1945	Returning soldiers (WW II) create a housing - and timber - boom
1947 - 1956	Eight dams are built in the headwaters of the North Umpqua River as part of the North Umpqua Hydroelectric Project
1950	Flood
1953	Hanna Nickel production
1955	Flood
1962	Columbus Day Storm
1964	Flood
1966	Interstate Five completed

Splash dams and log drives were still used in Douglas County into the 1940s (Markers, 2000). Log drives were phased out as more roads were built into the woods. In 1957 log drives in Oregon were made illegal; sport fishermen led the campaign against this form of log transport (Beckham, 1990). Waterways used to transport logs were scoured to bedrock, widened, and channelized. The large woody debris was removed and fish holding pools lost. As more logging roads were built in the 1950s, fish habitat was affected. Landslides associated with logging roads added sediment to the waterways. Logging next to streams removed riparian vegetation and the possibilities for elevated summer water temperatures and stream bank erosion were increased. Fewer old growth conifers were available as a new wood source in many Douglas County streams (Oregon Department of Fish and Wildlife, 1995).

Following World War II larger sawmills with increased capacity began to operate – just in time to take advantage of the housing boom. Kenneth Ford established Roseburg Lumber Company in 1936 by taking over the operation of an existing sawmill in Roseburg. He built his own mill at Dillard in 1944.

2.3.3. Mercury mining

H.C. Wilmot purchased the Bonanza Mine, approximately eight miles east of Sutherlin, in 1935 and began extensive development. The demand for mercury (quicksilver) for war purposes (World War II) led to a surge in prices to more than $200 a flask.[19] Flasks were made of cast iron and resembled the size and shape of a fruit jar (Oberst, 1985). A vast new deposit discovered in 1939 together with the high mercury demand, resulted in a production of 5,733 flasks by 1940, second highest in the nation. Some of the mineshafts extended more than 1,000 feet deep (Libbey, 1951; Oberst, 1985).

As with many other natural resources, mercury production followed the prices received. Prices fell to $150 per flask in 1949 and then to $70 in 1950, causing the first shutdown since 1936. A price surge in

<u>Mining at the Bonanza Mine in 1955</u>

The mine is well-equipped with modern automatic machinery. The trains of cars which bring the ore to the reduction plant, perched on the side of the hill, are powered with electric batteries.

The reduction plant, in principle, is just one giant still. Ore from the mine is fed into a long, revolving kiln, where heat from an oil-fired furnace practically melts the small bits of ore. The mercury vaporizes and is carried into a battery of 24 3-story-high condensers.

The mercury is recovered in rubber buckets at the base of the condensers. The buckets are kept beneath water as a safeguard against escaping mercury vapor which is extremely poisonous.

Dust collects in the form of mud with the mercury. The final step in the recovery process is to allow the "mud" to dry on a sloping tray. Then, the mud is stirred and chopped with a garden hoe and the mercury trickles to a lower corner where it is collected and later stored in squat, 76-pound flasks (Wyant, 1955, p. 1).

[19] A flask is 76 pounds of mercury.

the mid-1950s to $300 a flask reopened the mine. The Bonanza Mine had produced 39,488 flasks by 1960, its final year of operation (Libbey, 1951; Oberst, 1985; Wyant, 1955).

Other mercury mines were also active in the 1900s in Douglas County. The Elkhead Mine, southwest of Yoncalla, operated on and off into the 1960s. The Nonpareil Mine, next to the Bonanza Mine, was active from 1928 to 1932. The Tiller area had two mines, the Buena Vista and the Maud S, both active for short periods in the in the 1920s and 1930s. The Red Cloud Mine in upper Cow Creek was worked between 1908 and 1911 and then sporadically in the 1930s and 1940s.

The Oregon Department of Environmental Quality (DEQ) currently rates the Bonanza Mine as a high priority for further investigation and cleanup. High levels of mercury and arsenic have been found in the area of the old mine. Possibilities exist for movement of mercury into Foster Creek, which flows directly into Calapooya Creek. The site is a considerable risk to aquatic organisms in nearby drainages receiving runoff (Oregon Department of Environmental Quality, 2002).

2.3.4. Nickel mining / copper and zinc mining

M.A. Hanna Company obtained a lease in 1947 and contracted with U.S. government in 1953 to produce nickel. A tramway running almost to the top of Nickel Mountain was completed in 1954. By 1958, 21 million pounds of nickel had been produced. Production continued on Nickel Mountain into the 1990s.

The Formosa Mine is located about seven miles south of Riddle. This copper and zinc mine first opened in the early 1900s with the highest production occurring between 1927 and 1933. Formosa Explorations, Inc. reopened the mine in 1990 (Oregon Department of Environmental Quality, 2002).

2.3.5. Hatcheries

Douglas County's first fish hatchery was located northeast of Glide on the North Umpqua River near the mouth of Hatchery Creek. Built in 1900, the hatchery had an initial capacity for 1,000,000 eggs. In its first year of operations 200,000 salmon eggs were harvested. Another 600,000 chinook salmon eggs were brought in from a federal hatchery on Little White Salmon. These eggs produced approximately 700,000 fry that were released in the Umpqua river system. In 1901 a hatchery was constructed at the mouth of Steamboat Creek. A hatchery on Little Mill Creek at Scottsburg began operation in 1927 and operated for eight years (Bakken, 1970; Markers, 2000). The single remaining hatchery in Douglas County was established in 1937 northeast of Glide on Rock Creek.

In the 1910s large amounts of fish eggs were taken from the Umpqua river system. "In 1910 the State took four million chinook eggs from the Umpqua; the harvest mounted to seven million eggs in 1914. Over the next five years the State collected and shipped an estimated 24 million more eggs to hatcheries on other river systems" (Beckham, 1986, p. 208). The early hatcheries were focused on increasing salmon production for harvest.

"Hatcheries have been essential in maintaining supplies of salmon, whose natural spawning grounds and migration routes have been severely disrupted in many areas by dams, agricultural reclamation and irrigation, and by timber operations" (Patton, 1976, p. 168). In recent years the effect of hatchery fish on the natural fish population has been examined. Flagg et al. (2000) concluded that salmonids raised in an artificial hatchery environment do not respond the same as fish reared in a natural setting. However, they also felt current information was not sufficient to make concrete conclusions about how hatchery fish affect the survival of wild fish.

2.3.6. Agriculture

Crop irrigation was introduced to Douglas County farmers in 1928. J.C. Leady, Douglas County Agent (predecessor of County Extension Agent) gave a demonstration of ditch blasting in 1928. In the demonstration one ditch in Melrose and one ditch in Smith River was created by blasting. The dimension of the resulting ditch was four feet deep by six feet wide. The report recommended this method of ditch creation in the low lands adjoining the Umpqua and Smith Rivers (Leedy, 1929).

In 1935 Douglas County Agent J. Roland Parker introduced crop irrigation using gas and electric pumps. "The lift necessary to place irrigation water upon most land, laying along the numerous streams throughout the county, ranges from 15 to 30 feet. Only in exceptional cases will a higher lift be necessary" (Parker, 1936, p.15). Parker predicted the applications for water rights and the installation of irrigation systems would double in 1936. In his 1935 Annual Report, Parker listed 21 farms and their proposed irrigation projects. The water sources included the South Umpqua River, Calapooya Creek, Little River, North Umpqua River, Tenmile Creek, Myrtle Creek, Hubbard Creek, and Cow Creek (Parker, 1936).

The appropriation of water rights for agriculture left less water in the streams for fish, especially in the critical late months of summer. In Oregon water law follows the "prior appropriation" doctrine that is often described as "first come, first served." The first person to obtain a water right on a stream will be the last user shut off when the streamflows are low. Junior users have water rights obtained at a later date than higher priority users. In periods of low water, the water right holder with the oldest priority date is entitled to the water specified in the senior water right regardless of the needs of junior users.[20]

2.4. Modern era: 1970s to the present

2.4.1. Logging

In 1972 the Oregon Forest Practices Act became effective. Standards were set for road construction and maintenance, reforestation, and streamside buffer strips. New rules were added in 1974 to prevent soil, silt, and petroleum products from entering streams. Starting in 1978, forest operators were required to give a 15-day notification prior to a

[20] The water rights information was obtained on January 7, 2003, from the Oregon Water Resources Department website http://www.wrd.state.or.us/.

forest operation. New rules were also added relating to stream channel changes. In 1987 riparian protection was increased - specific numbers and sizes of trees to be left in the riparian areas were specified. New rules in 1994 were added to create the desired future condition of mature streamside stands. Landowner incentives were provided for stream enhancement and for hardwood conversion to conifer along certain streams (Oregon Department of Forestry, 2002).

In the 1970s, Roseburg Lumber's plant in Dillard became the world's largest wood products manufacturing facility. Key to the development of this facility was the availability of federal timber from both the U.S. Forest Service and the Bureau of Land Management. A housing slump in the early 1980s and a decline in federal timber in the 1990s resulted in the closure or reduced the size of many other manufacturing companies in the 1980s and 1990s (Oregon Labor Market Information System, 2002). In 2002 and 2003, increased wood products imports from foreign producers such as Canada and New Zealand resulted in a surplus of timber-based products in the US. This caused a depression in the local forest products manufacturing industry. In April, 2003, Roseburg Forest Products, the largest private employer in Douglas County, laid off approximately 400 workers.[21]

<u>1970 to the present timeline</u>

1971	Flood
1972	Clean Water Act
1972	Oregon Forest Practices Act
1973	Endangered Species Act
1974, 1981, 1983	Floods
1987	Hanna nickel mine in Riddle closed
1988	Glenbrook Nickel in Riddle begins production
1994	Northwest Forest Plan results in reduced federal log supplies
1996	Flood
1998	Glenbrook Nickel in Riddle closed
1999	International Paper Mill in Gardiner closed

2.4.2. Mining

The M.A. Hanna Company permanently closed the mine and smelter on Nickel Mountain (near Riddle) in January, 1987. Nickel prices had fallen to below $2 per pound. By March of 1988 average prices rose to between $5 and $6 per pound allowing Glenbrook Nickel to start production. Glenbrook Nickel closed in April, 1998. The M. A. Hanna Company followed by Glenbrook Nickel diligently strived to reclaim Nickel Mountain and to maintain good water quality from the discharge points. Walter Matschkowsky of Glenbrook Nickel Company was named Reclamationist of the Year in 1998 for his career of responsible mining and reclamation. He supervised the Thompson Creek Reclamation project and was successful in converting an area affected by mining into a green, healthy forest (Oregon Department of Geology and Mineral Industries, 2002).

[21] This information is based on conversations between Nancy Geyer, Society of American Foresters president and president-elect Jake Gibbs and Eric Geyer, and Dick Beeby of Roseburg Forest Products.

Formosa Explorations Inc. was not as successful in reclamation efforts in the mine south of Riddle. Formosa reopened the Silver Butte Mine in 1990 and produced copper and zinc ore until 1993. Formosa closed the mine in 1994, completed reclamation activities, and filed for bankruptcy. In the winter of 1995-96, acidic wastes were detected in Middle Creek and the South Fork of Middle Creek. Middle Creek is a tributary of Cow Creek. Bureau of Land Management fish surveys in the Middle Creek watershed in 1984 indicated the presence of coho salmon and steelhead. These fish have not been observed in upper Middle Creek for several years. The Oregon Department of Environmental Quality and the Bureau of Land Management are working together to clean up the site (Oregon Department of Environmental Quality, 2002).

2.4.3. Dam construction

During the late 1960s through 1980s several dams were constructed in Douglas County. The largest ones are included in Table 2-1 obtained from the Oregon Water Resources Department.

Year completed	Dam name	Creek	Storage (acre feet)
1967	Plat I Dam	Sutherlin	870
1971	Cooper Creek Dam	Cooper	3,900
1980	Berry Creek Dam	Berry	11,250
1985	Galesville Dam	Cow	42,225

Table 2-1: Name, location, and storage capacity of Umpqua Basin dams built since 1960.

Dams have both beneficial and detrimental influences on fish. Water release during periods of low flow in the late summer can assist fish survival. However, Galesville Dam and Berry Creek Dam are complete barriers to fish movement. Cooper Creek Dam and Plat I Dam may be barriers to juvenile fish (see section 3.1.2).

2.4.4. Tourism

The rapid expansion of tourism in Douglas County came after World War II. The improving economy left Americans with an increased standard of living and the mobility of automobile travel. The Umpqua Valley offers scenic attractions and good access roads. Interstate Five and the connecting State Highways 38, 42, and 138, provide access to Umpqua Valley's excellent tourist areas. Tourist destination points include Crater Lake National Park, Wildlife Safari, Salmon Harbor, and the Oregon Dunes National Recreation Area. Tourism is a growing industry in Douglas County.

2.4.5. Settlement patterns and urbanization

Unlike many other Oregon counties, over 50 percent of Douglas County residents lived outside incorporated cities in 1980. The settlement pattern was mostly linear. Population density in 1980 was greatest in the central valley from Riddle to Roseburg to Sutherlin and lowest in the eastern and northwestern areas of the county (Cubic, 1987).

The population of Douglas County in 2000 was 100,399, which is an increase of almost 32,000 since 1960 (see Figure 2-1). Major urban areas have developed along the South Umpqua River to the confluence with the North Umpqua River and around the Umpqua estuary. Water quality along these streams gained protection with the passage of the Clean Water Act in 1972. The Clean Water Act established pollution discharge levels on point sources such as sewage treatment and wood processing plants.

2.5. Douglas County population growth

Figure 2-1 shows population growth data for Douglas County during the settlement period (1840s-1890s), the onset of the modern era (1900-1960s), and the modern era (1970s-present).

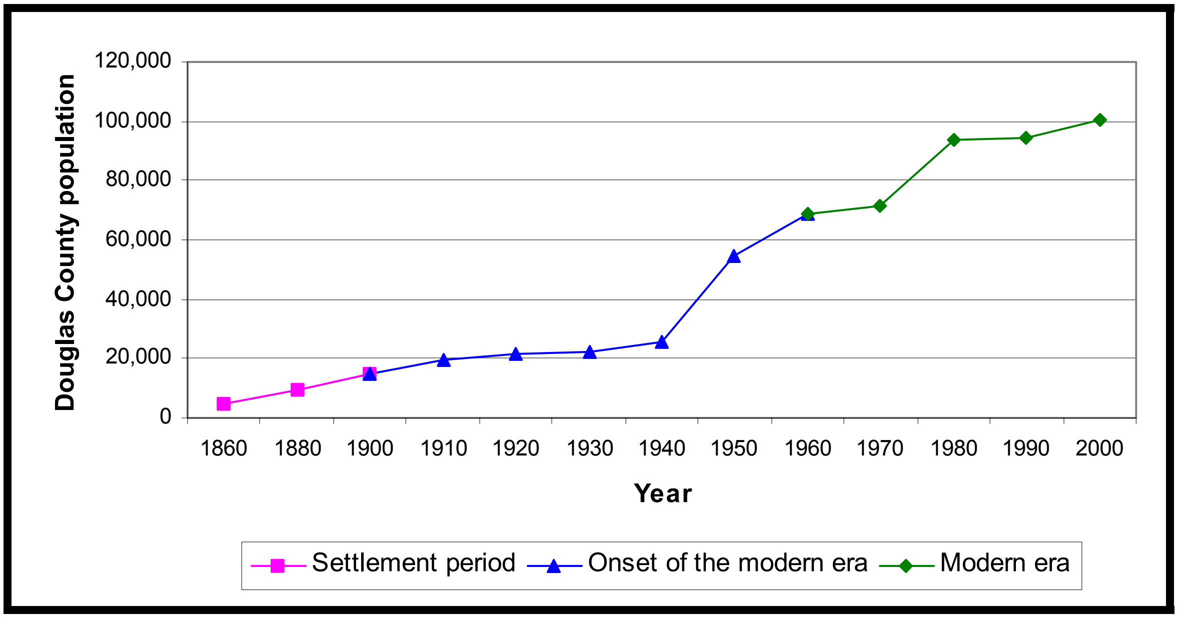


Figure 2-1: Population growth in Douglas County from 1860 through 2000.

2.6. History of the South Umpqua River Watershed

2.6.1. Historical timeline

This section includes significant historical events that most likely had an impact on the South Umpqua River Watershed. Background information for this section was compiled from the following groups' documents, websites, and specialists: the Bureau of Land Management (BLM), the Oregon Fish and Wildlife (ODFW), and the USDA Forest Service (USFS). Additional information was compiled from the following books: *Land of the Umpqua: A History of Douglas County, Oregon* (Beckham, 1986); *History of Southern Oregon* (Walling, 1884); *One Hundred Years in Canyonville* (Clough, 1958); and *Oregon Geographic Names* (McArthur, 1982).

1820-1840	Hudson's Bay Company fur trappers and other explorers penetrated the interior of southwestern Oregon. Trappers were instructed to "trap out" beaver in the remote streams of southwest Oregon.
1837	Ewing Young and his entourage led the first cattle drive through Cow Creek on his way to Willamette Valley from California with seven hundred head of cattle.
1846	Lindsay Applegate along with others surveyed for a new emigrant trail through Canyon Creek into the Willamette Valley from the south.
1850	The Donation Land Claim Act passed and "gold rush" moved into southern Oregon, attracting more settlers to the area.
1850-52	Canyonville was settled with Jackson Reynolds as the first to claim land in the Canyonville area, followed by Joseph Knott and other settlers such as John Fullerton, J.F. Gazley, S.S. Briggs, I. Boyle, and Mr. Beckworth.
1851	Days Creek (the stream) was named for Patrick and George Day who settled near the mouth of the creek. Later, a sawmill, school, and Methodist church were built. This area had a relay station where horses were exchanged on the stagecoach en route to Trail, Oregon.
1852	North Canyonville post office was established with John T. Boyle as postmaster. Canyonville was an important stop along the pack train route from Scottsburg to the gold mining region in southern Oregon. The town provided food, lodging and dry goods for travelers.
1852-53	A fever affected Cow Creek Indians and an estimated one-half to two-thirds of the Indians died within a couple of weeks. Contact and tension between miners and Indians increased, creating conflict and wars with Indians.
1853	The first sawmill in the area was a vertical sash saw operation owned and operated by David Ransome of Canyonville.
1855	Almost all open lands of the Cow Creek Valley were claimed and additional settlers moved to outlying areas such as the South Umpqua River Watershed. These areas required more clearing and were further from amenities.
1855	A thriving gold mining camp existed for 10 years at Coffee Creek (including Texas Gulch, Graham Gulch, and Granite Creek). The camp included a trading post, saloon and dance hall.
1856	The government removed over 2,000 Indians from southwestern Oregon.
1856	Jesse Roberts built the Roberts hotel and a gristmill at Canyonville.

1866	Oregon and California Land Grant Act was established to finance railroad construction.
1873	Two water-powered sawmills operated on Canyon Creek, cutting fir and cedar. One (Pickett & Wilson) produced 200,000 board feet annually and the other (J. Packard) produced 300,000 board feet of lumber annually.
1873	A gristmill owned by F. Schultz produced 24 barrels of flour daily. Another owned by D.A. Levins produced 20 barrels daily.
1878	Day's Creek post office was established with Samuel Taylor as postmaster. In 1890, the post office was renamed Days Creek.
1880	The Overland Hotel in Canyonville was visited by President Rutherford Hayes, his wife, and General William Sherman for lunch as they traveled from Redding north to Roseburg by stage.
1880-1890s	Prune trees were planted on thousands of acres throughout the Umpqua Valley.
1882	The Oregon and California (O&C) Railroad reached Riddle and was temporarily terminated before construction resumed to the south. This provided a new means of transportation and commerce to the north for Riddle and other communities such as Canyonville, Perdue (Milo), Days Creek, Tiller and Drew.
1888	The Milo post office was originally established as the Elk Creek post office in 1877 (at the mouth of Elk Creek near Tiller). The post office was renamed after John Perdue Sr. and relocated to Perdue. That post office was eventually closed and reopened as Milo in 1923.
1887	The railroad was completed in California after diverting around Canyon Creek and following Cow Creek south to Glendale. This opened access for commerce to southern Oregon and California.
1892	North Canyonville post office name was changed to Canyonville.
1893	The town of Riddle was incorporated.
1897	Ed Schieffelin, an experienced miner from Tombstone, Arizona, returned to the Coffee Creek area to prospect to gold. He was found dead in his cabin with gold in his hand. Other miners continued to look for gold in this area
1900s	Fire suppression efforts began in earnest.
1901	Canyonville was incorporated in 1901.
1905	Another sawmill (Duncan and Ross) was established in Canyonville and annually produced 283,000 board feet of lumber.

1916	The Chamberlain-Ferris Act of 1916 revested to the federal government 2.3 million O&C acres with an estimated 50 billion board feet of timber. This land was administered by the General Land Office and later the Bureau of Land Management. [22]
1920s	The Pacific Highway (Highway 99) paved road bypassed Riddle and was routed through Canyonville to Galesville.
1930s	Prune production declined and was replaced primarily with sheep and cattle grazing.
1944	The Sustained-Yield Management Act of 1944 provided the momentum in shifting the role of US Forest Service from caretaker to administering the sale of timber.
1948-1953	Hanna Nickel Company constructed a nickel smelter and tramways for the processing of ore at Nickel Mountain.
1950s	Interstate Five was constructed through the South Umpqua Valley and for the most part paralleled Highway 99. This major thoroughfare bypassed Riddle and Glendale.
1950s-1960s	Timber harvesting, construction of access roads, and rock quarries were major influences on the South Umpqua landscape.
1976	A water treatment plant was built with a water intake on Canyon Creek so Canyonville no longer had to depend solely on Oshea Creek.
1982	Win Walker Dam Reservoir was constructed on the West Fork of Canyon Creek to provide drinking water for the City of Canyonville.
1987	The Canyon Mountain fire, started by a dry lightning storm, burned 5,700 acres in the watershed. The Bland Mountain Fire burned 10,000 acres in the St. John, Lavadoure, and Stouts Creek drainages.
1988	The shift in management emphasis on federal land from timber production to protecting habitat for endangered species resulted in the beginning of a steady decline in timber harvest on federal forestland.
1989	Glenbrook Nickel Company purchased the Hanna Mine and operated intermittently from 1991 through 1998.

[22] According to the Oregon State University Forest Sciences Laboratory (1988): “The Oregon and California Railroad Act of 1866 provided for 3,700,000 acres in Oregon in alternate sections to go to the builder of a railroad line down the Willamette Valley to California (12,800 acres for each mile of track laid)…. The land grant was made on condition that the company sell the land in small tracts (no more than 160 acres each) to bonafide settlers, at a price of no more than $2.50 per acre….[The] railroad had deferred the taking of title to unsold grant lands until there was a market for the property, thus avoiding taxes. This kept those lands unavailable for acquisition by anyone else. On the request of the Oregon legislature, the federal government investigated and discovered that the terms of the O&C land grant had been violated. Litigated before the Supreme Court in 1915, the remaining unsold O&C grant lands, over 2,800,000 acres, were revested by Congress to the United States in 1916."

2.6.2. Population

The town of Canyonville is the primary town development within the South Umpqua Watershed. The town of Riddle is located in the adjacent Lower Cow Creek Watershed. Their close proximity to each other and historical events often affected each community. Therefore, their population trends are similar as shown in Figure 2-2.

Many towns and rural communities evolved and faded as a lifestyle of subsistence grew to one of commerce. The towns provided goods and services for the demands of settlers, miners, loggers, and the labor force to construct railroads and roads. Often the placement of the railroad, stagecoach corridors, and highways "made" or "broke" a town and its entrepreneurs. The railroad through Riddle boosted its growth and later attracted lumber mills. However, the Pacific Highway and Interstate Five bypassed Riddle and, instead, Canyonville became the "visible" town and continued to be a "gasoline stop."

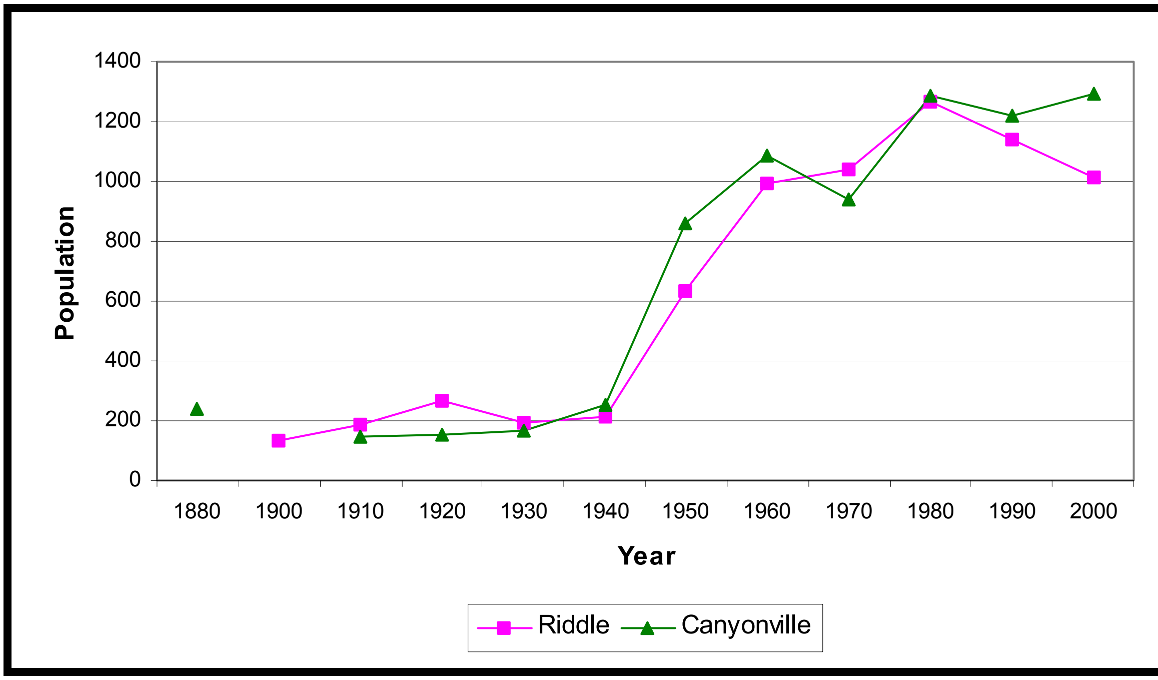


Figure 2-2: Population growth for Riddle and Canyonville from 1880 through 2000.[23]

The increase in population growth between the 1940s and 1950s in these towns is attributed to the booming logging industry and the associated sawmills and plywood mills as well as the development of mining on Nickel Mountain. It has been suggested by local residents that the decline in the 1960s was related to the consolidation of some forest product mills and abandonment of several communes in the area. The shift in management emphasis on federal land from timber production to protecting habitat for

[23] The information in Figure 2-2 is extracted from the *Cultural Resource Overview* and the *Oregon Blue Book* [website].

endangered species resulted in the beginning of a steady decline in timber harvest on federal forestland. The impact from this shift affected the communities and is probably reflected in the downward trend in population in the Riddle area. The author was unable to find an apparent explanation for the population decline in Riddle from 1920 through 1930.

Coffee Creek gold mining began at the mouth of the creek in the late 1850s and attracted an estimated 1,000 men into this drainage during its prime. “Coffeeville” was a rough mining camp and reputed to have been one of the richest mining areas in the west. Many mineral prospects such as gold prospect Levan’s Ledge (Jordan Creek) and Miller Mine (Shively Creek), silver prospects (Lower West Fork of Canyon Creek), and mercury prospects (Bear Gulch) drew miners to the watershed. It is uncertain how accurately the fluctuating numbers are reflected in the census counts above.

In the 1860 census, 10.6% of Douglas County’s population lived in the Canyonville precinct, 6.2% lived in the Myrtle Creek precinct and 3.5% lived in the Cow Creek precinct. In 1900, less than one percent (129 people) of Douglas County’s population lived in the Perdue (Milo) precinct.

2.6.3. Historical fish use

This section on historical fish use is based on information from BLM and US Forest Service watershed analyses and from *Fish and Wildlife Resources of the Umpqua Basin, Oregon, and Their Water Requirements* (Lauman et al, 1972).

The South Umpqua River Watershed is located within the South Umpqua River sub-basin. In 1937, the Umpqua National Forest surveyed portions of the South Umpqua Basin for fish use. An abundance of salmon, steelhead, and cutthroat trout were found throughout the South Umpqua River and its tributaries.

From 1880 to 1946, a dam constructed on the South Umpqua River near Roseburg was considered a major barrier for anadromous fish at low water conditions and a partial barrier even after modifications to the dam.[24] In 1946, the Oregon State Game Commission (predecessor to ODFW) recommended that the Umpqua River and its tributaries to be closed for spring chinook salmon fishing for five years and fishing to be curtailed for coho due to declining catch rates.

Prior to the 1960s, it is estimated the fish runs in the South Umpqua River sub-basin for winter steelhead were as high as 30,000; spring chinook were 5,000, and coho were 70,000. In 1972, the Oregon State Game Commission estimated 10,000 sea-run cutthroat, 10,000 winter steelhead, 4,000 coho, and 1,500 fall chinook used the South Umpqua River. These anadromous fish used an estimated 39 tributaries to the South Umpqua at that time.

[24] The dam was believed to be in the vicinity of the current Douglas County fairgrounds.

2.6.4. 1900 forest conditions

Figure 2-3 provides an indication of the forest cover at the turn of the last century.[25] Forty-four percent of the South Umpqua River Watershed was identified as timberless and six percent as woodland. Timberless would include grasslands, grazed land, cultivated and homestead areas. Woodland was categorized as scattered trees with an open canopy. The woodland and timberless areas were most likely severely altered by human-caused fire.

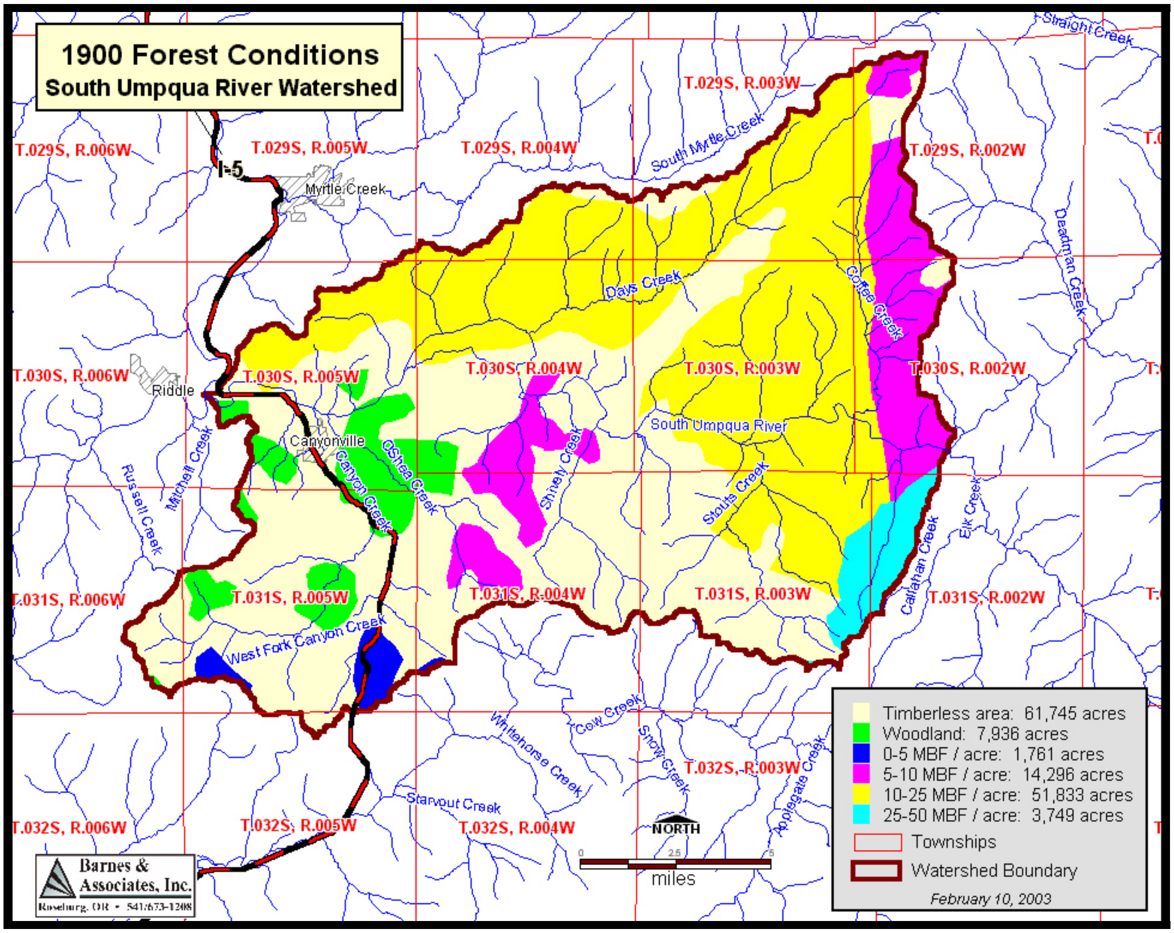


Figure 2-3: 1900 vegetation patterns for the South Umpqua River Watershed.

Approximately half of the watershed was classified as forested. Seventy-eight percent of the forested area (71,639 acres) had 10 thousand board feet or more per acre. The Days Creek drainage was included in this area, of which an abundance of fir, cedar, and sugar pine was known to grow along the creek.

Historically, fire has played an important role in the South Umpqua River Watershed. Large stand replacement fires caused by lightning and humans created a mosaic of age

[25] Henry Gannet gathered the information for the map from 1898 through 1902. The map was compiled by A.J. Johnson and produced by Gilbert Thompson in 1902. The BLM enlarged the map and then digitized it in 1995.

classes, even before any extensive logging began. Effective fire suppression began in the early 1900s and altered the fire regime compared to historical times. For example, fire suppression has most likely reduced the frequency of large fires. Prescribed burning practices today target specific areas such as post-logging slash cleanup and fuels reduction under standing timber and are controlled at delineated boundaries relative to the more general burning of pre-settlement times.

Early settlers into nearby Cow Creek Valley indicated that the valley bottoms needed minimal clearing. This was most likely due to cultural practices of the indigenous people who annually burned the valleys during the summer and fall months. Some even described the valley as a giant wheat field, as in this narrative by George Riddle:

> It was near the first of November 1851 that we settled upon the land now known as Glenbrook Farms. At that time cow creek valley looked like a great wheat field. The Indians, according to their custom, had burned the grass during the summer, and early rains had caused a luxuriant crop of grass on which our immigrant cattle were fat by Christmas time… fortunately in our case the land was ready for the plow. There was no grubbing to do.

Bob Zybach, a forester and former owner of a logging business, in a 1994 interview with *Evergreen Magazine* states:

> We also have accounts describing the interior valleys, including the… Umpqua...Here the Indians burned hundred of thousand of acres annually, and the result was a nearly contiguous series of great prairies and oak savannas extending almost the entire length of the Cascade Mountains… I am not a proponent of the idea that fires came and went in cycles. Keep in mind that cultural fire was a daily occurrence in this region for thousands of years. Indians cooked on these fires, and they warmed themselves with fire. They also burned seasonally, in the spring and fall, to clear away trees and underbrush and to stimulate the growth of wildlife forage. It is reasonable to assume many of the catastrophic forest fires for which we find evidence were probably set by Indians intent on clearing land, controlling the spread of Douglas-fir, and creating habitat for wildlife.

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3. Current Conditions

This chapter explores the current conditions of the South Umpqua River Watershed in terms of instream, riparian, and wetland habitats, water quality, water quantity, and fish populations. Background information for this chapter was compiled from the following sources: the *Oregon Watershed Assessment Manual* (Watershed Professionals Network, 1999), the *Watershed Stewardship Handbook* (Oregon State University Extension Service, 2002), and the *Fish Passage Short Course Handbook* (Oregon State University Extension Service, 2000). Additional information and data are from the following groups' documents, websites, and specialists: the USDI Bureau of Land Management, the Oregon Department of Environmental Quality, the Oregon Department of Fish and Wildlife, the Douglas Soil and Water Conservation District, the US Geological Survey, and the Oregon Water Resources Department.

Key Questions

- In general how are the streams, riparian areas, and wetlands within the South Umpqua River Watershed functioning?
- How is water quality in terms of temperature, surface water pH, dissolved oxygen, and other parameters?
- What are the consumptive uses and instream water rights in the watershed, and what are their impacts on water availability?
- What are the flood trends within the watershed?
- What is the distribution and abundance of various fish species, what are the habitat conditions, and where are fish passage barriers?

3.1. Stream function

3.1.1. Stream morphology

Channel morphology[26]

Large disturbance events, such as floods, typically dominate stream channel morphology processes. The stream gradient and channel confinement govern the behavior of water flow through the channel in these peak flow events. These characteristics most significantly influence the character of the stream substrate, the stream's ability to maintain fish populations, and the effectiveness of riparian and in-channel enhancement projects. Narrow valleys and steep slopes force water through channels at high velocities, in which only large particles like gravel, cobbles, and boulders can be deposited. However, confined channels, though they have faster peak flows, maintain a more stable stream position than, for instance, the migrating meandering streams of a large floodplain. This section discusses the channel morphology of the South Umpqua River Watershed. Information in this section has been summarized from the following documents: *Oregon Watershed Assessment Manual* (Watershed Professional Network, 1999) and *Going with the Flow: Understanding Effects of Land Management on Rivers, Floods, and Floodplains* (Ellis-Sugai and Godwin, 2002).

[26] Kristin Anderson and John Runyon of BioSystems, Inc., provided the text and Table 3-1 for this section.

The Oregon Watershed Enhancement Board (OWEB) has developed a system for classifying streams based on their physical attributes that has implications for the ecology of these streams. This system, called the Channel Habitat Type system, uses features of stream gradient, valley shape, channel pattern, channel confinement, stream size, position in drainage, and substrate. Table 3-1 lists the channel habitat types that are found in the South Umpqua River Watershed along with examples of streams that fall into each.

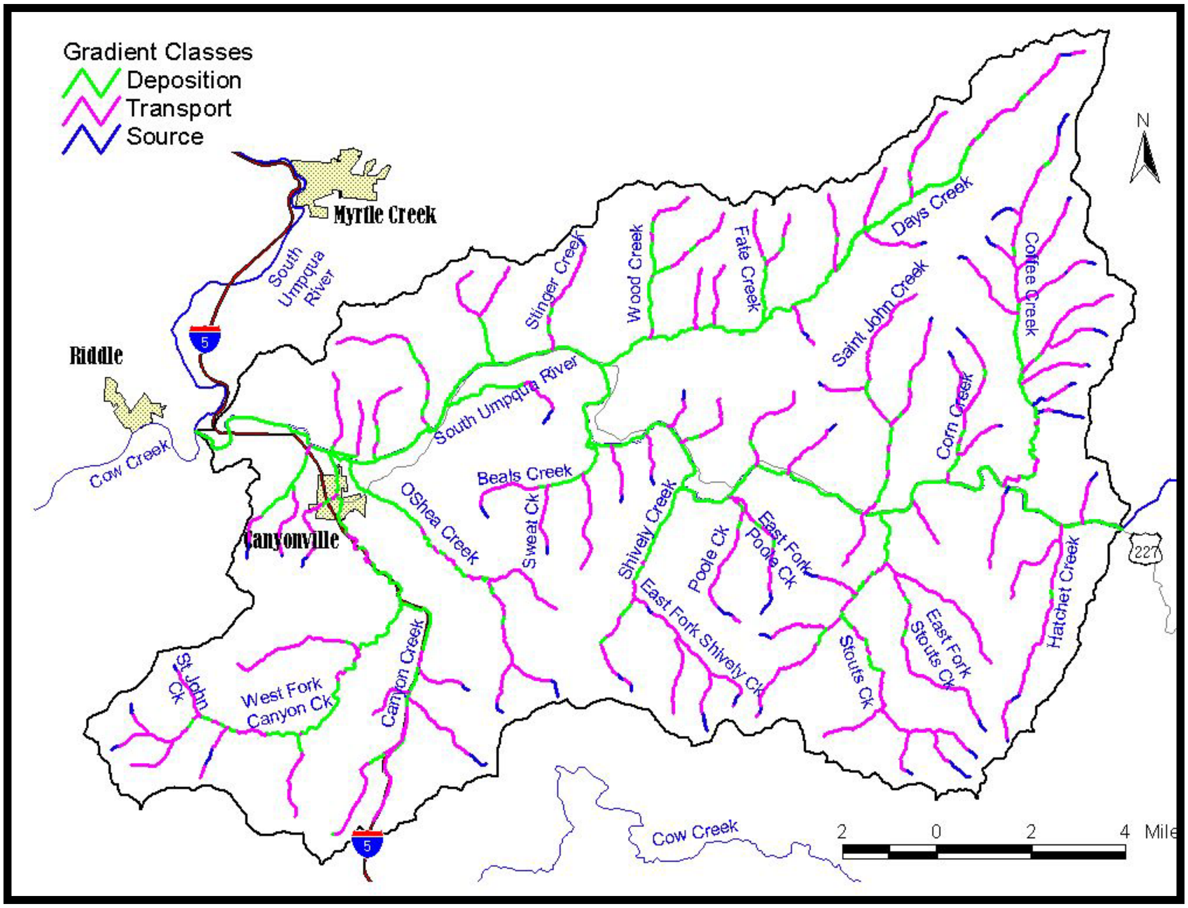
Channel Habitat Type	**Example within watershed**	**Restoration opportunities**
Low gradient large floodplain	South Umpqua River south of confluence with Days Creek	Because of the migrating nature of these channels, restoration opportunities such as shade and bank stability projects on small side channels may be the best option for improvement.
Low gradient medium floodplain	Days Creek near confluence with Green Gulch	Because of the migrating nature of these channels, restoration opportunities such as shade and bank stability projects on small side channels may be the best option for improvement.
Low gradient small floodplain	Days Creek between confluences of Fate Creek and May Creek	Because of the migrating nature of these channels, restoration efforts may be challenging. However, because of their small size, projects at some locations would be successful.
Low gradient moderately confined	Wood Creek in lower reaches	These channels can be very responsive to restoration efforts. Adding large wood to channels in forested areas may improve fish habitat, while stabilizing stream banks in non-forested areas may decrease erosion.
Low gradient confined	Beals Creek, Coffee Creek lower reaches	Though these channels are not often responsive, riparian planting projects may improve water temperature and erosion issues.
Moderate gradient moderately confined	Granite Creek	These channels are among the most responsive to restoration projects. Adding large wood to channels in forested areas may improve fish habitat, while stabilizing stream banks in non-forested areas may decrease erosion.
Moderate gradient confined	Shively Creek downstream of confluence with East Fork Shively Creek	Though these channels are not often responsive, riparian planting projects may improve water temperature and erosion issues.

Moderate gradient headwater	East Fork Stouts Creek headwaters	These channels are often moderately responsive to restoration. Riparian planting projects may improve water temperature and erosion issues.
Moderately steep narrow valley	Sweat Creek	Though these channels are not often responsive, riparian planting projects may improve water temperature and erosion issues.
Steep narrow valley and very steep headwater	Shively Creek uppermost reaches	Though these channels are not often highly responsive, the establishment of riparian vegetation along stable banks may address water temperature problems.

Table 3-1: Channel habitat types and examples within the South Umpqua River Watershed.

Ellis-Sugai and Godwin (2002) also look at streams in terms of their position in the watershed. Streams in steep headwaters (often 20% slope or greater) are source streams, adding sediment and wood to the stream system. They have high-energy flows, no floodplain, and are prone to landslides. Transport streams have medium gradients, often between 3% and 20% slopes. They often have small meanders and floodplains. They carry sediment and wood during times of large flows and store them during low flows. In the downstream reaches of watersheds lie depositional streams. The low gradients, large floodplains, and meanders of these streams dissipate the energy of flows and allow sediments and wood to settle out of low flows and be stored in these reaches of the streams for long periods. These depositional streams are the most sensitive to changes in the watershed. For instance, changes to sediment supply make the biggest impact in these lower reaches. Map 3-1 and Table 3-2 show the distribution and percent of streams within each gradient class.

Most streams tributary to the South Umpqua River within the watershed are mature streams that have incised the landscape and now have a moderate to low stream gradient. The uppermost headwater reaches are the only steep gradient areas. The steeper gradient segments of streams are source streams, providing sediment and wood; they are also above the anadromous fish zone. Shade and other riparian projects may help improve those stream reaches. Streams south of the South Umpqua River and from St. John Creek eastward are mostly moderate gradient moderately confined channels. These reaches function as transport streams, both storing and delivering sediment and wood downstream. These streams also are in areas where the overall landscape is fairly steep, increasing debris flow hazards. Adding large wood, stabilizing banks by planting trees, and improving shade in these reaches may be helpful for the stream system. Days Creek and the South Umpqua River both have floodplains. The floodplain of the South Umpqua River broadens considerably downstream of Days Creek. These broad, low-gradient reaches lend themselves to complex aquatic habitat with large wood, coarse sediment, pools, bars, and side channels. However, these reaches are difficult to enhance, as the meandering nature of the streams makes bank stability projects likely to fail, so special care should be given to project selection and planning. Stinger Gulch, Wood Creek, and Green Gulch north of the South Umpqua River, and Stouts Creek and East Fork Stouts Creek in the southeastern portion of the watershed all lie in areas where there are highly erodible granite rocks. These areas would benefit from vegetation plantings to improve bank stability.



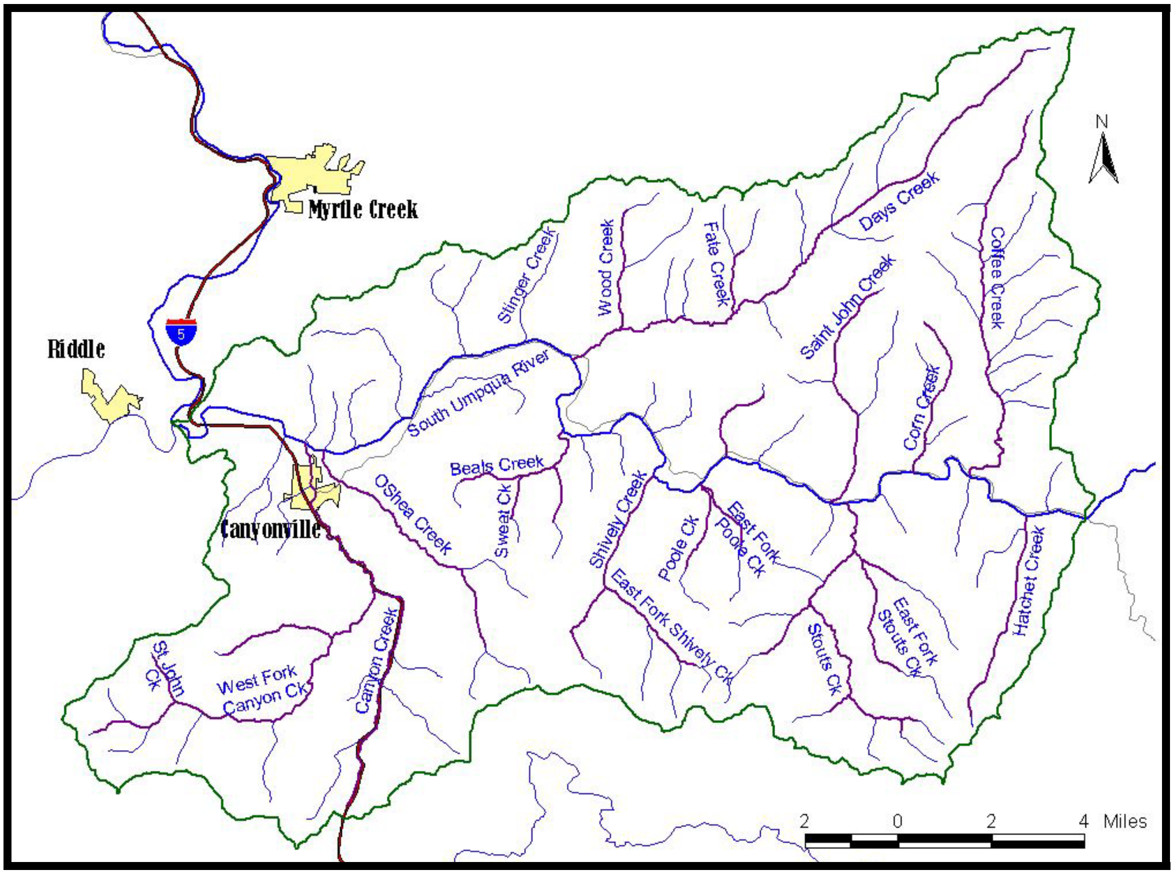
Map 3-1: Stream gradients in the South Umpqua River Watershed.

Gradient class	Stream miles in the watershed	% Total
Source	13.3	5.4%
Transport	147.4	59.3%
Deposition	87.8	35.3%
Total	248.5	100.0%

Table 3-2: South Umpqua River Watershed stream miles within each gradient class.

Stream habitat surveys

Since 1992, the Oregon Department of Fish and Wildlife (ODFW) has conducted stream habitat surveys throughout the Umpqua Basin. The purpose of these surveys is to gather basic data about Umpqua Basin streams, and to compare current stream conditions to the habitat needs of salmonids and other fish. During the summers of 1992 through 1996, 98.7 stream miles were surveyed in the South Umpqua River Watershed (see Map 3-2). There are a total of 248.5 stream miles on Map 3-2; therefore, approximately 40% of South Umpqua River Watershed streams have been surveyed.[27] Each stream was divided into reaches based on channel and riparian habitat characteristics for a total of 84 reaches averaging 1.1 miles in length. Appendix 2 provides a map detailing the stream reaches.



Map 3-2: **Streams surveyed for fish habitat in the South Umpqua River Watershed.**

For each stream, surveyors measured a variety of pre-determined habitat variables. Since a primary purpose of the stream habitat surveys was to evaluate the stream's current condition compared to fish habitat needs, ODFW developed habitat benchmarks to interpret stream measurements that pertain to fish habitat. This assessment includes nine measurements that have been grouped into four categories: pools, riffles, riparian areas

[27] See section 1.2.5 for more information about the stream map.

and large instream woody material. Table 3-3 provides the habitat measurements included in each category.

Habitat characteristic	Measurements used for rating habitat quality	Benchmark values		
		Good	**Fair**	**Poor**
Pools	1. **Percent area in pools:** percentage of the creek area that has pools 2. **Residual pool depth:** depth of the pool (m), from the bottom of the pool to the bottom of the streambed below the pool a) small streams b) large streams	1. > 30 2a. > 0.5 2b. > 0.8	1. 16-30 2a. 0.5 - 0.3 2b. 0.8 - 0.5	1. <16 2a. < 0.3 2b. < 0.5
Riffles	1. **Width to depth ratio:** width of the active stream channel divided by the depth at that width 2. **Percent gravel in the riffles:** percentage of creek substrate in the riffle sections of the stream that are gravel 3. **Percent sediments** (silt, sand, and organics) **in the riffles:** percentage of creek substrate in the riffle sections of the stream that are sediments	1. ≤ 20.4 2. ≥ 30 3. ≤ 7	1. 20.5-29.4 2. 16-29 3. 8-14	1. ≥ 29.5 2. ≤ 15 3. ≥ 15
Riparian	1. **Dominant riparian species:** hardwoods or conifers 2. **Percent of the creek that is shaded** a) for a stream with width < 12m (39 feet) b) for a stream with width > 12m	1. large diameter conifers 2a. > 70 2b. > 60	1. medium diameter conifers & hardwoods 2a. 60 – 70 2b. 50 – 60	1. small diameter hardwoods 2a. < 60 2b. < 50
Large Woody Material in the Creek	1. **Number of wood pieces**[28] per 100m (328 feet) of stream length 2. **Volume of wood** (cubic meters) per 100m of stream length	1. > 19.5 2. > 29.5	1. 10.5-19.5 2. 20.5-29.5	1. < 10.5 2. < 20.5

Table 3-3: Stream habitat survey benchmarks.

[28] Minimum size is six-inch diameter by 10 ft length or a root wad that has a diameter of six inches or more.

Stream habitat benchmarks rate the values of the components of the survey in four categories: excellent, good, fair, and poor. For the purpose of this watershed assessment, "excellent" and "good" have been combined into one "good" category. Table 3-3 provides parameters used to develop the benchmark values.

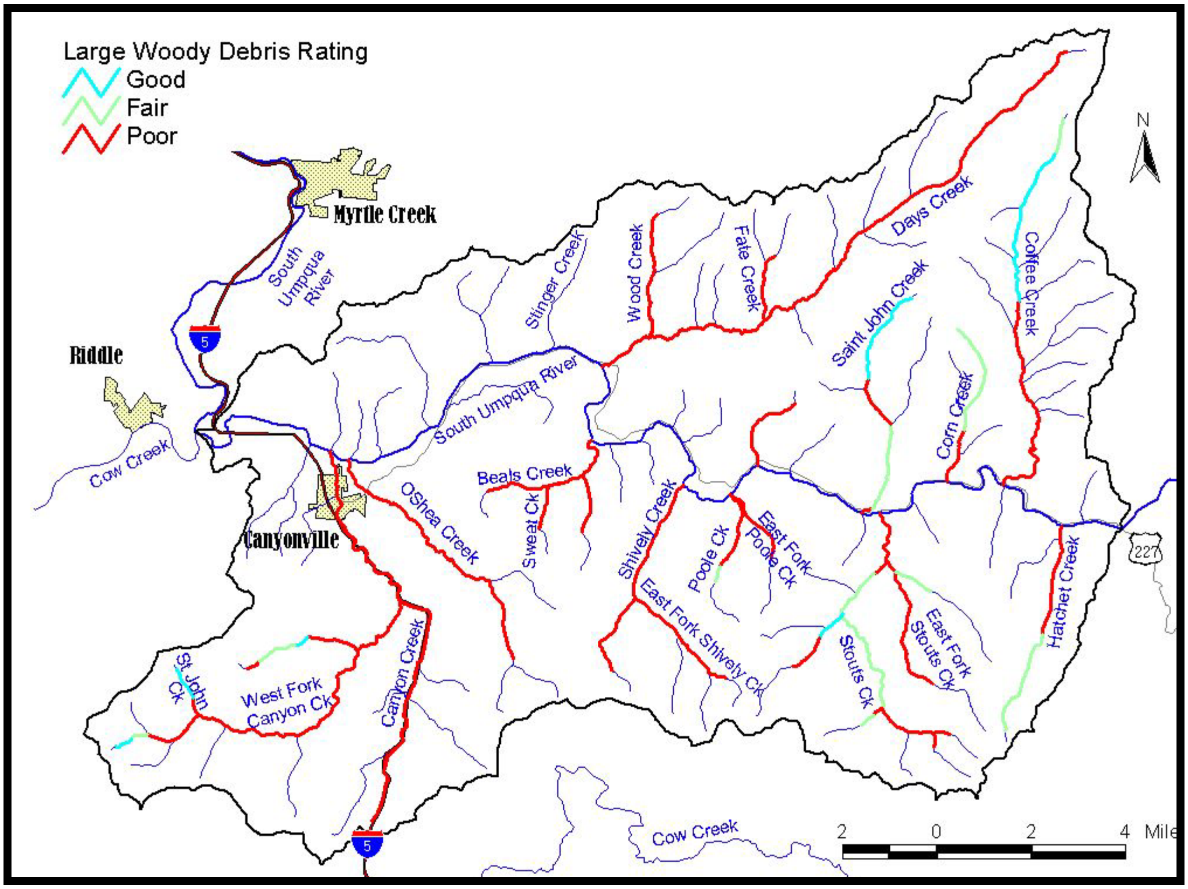
For this assessment, UBWC and ODFW staff simplified the stream data by rating the habitat categories by their most limiting factors. For example, there are two components that determine the pools rating: percent area in pools and residual pool depth. If a reach of a small stream had 50% of its area in pools, then according to Table 3-3, it would be classified as good for percent area in pools. If average pool depth on the same reach were 0.4 meters in depth, this reach would have fair residual pool depth. This reach's classification for the pools habitat category would be fair. Most habitat categories need a combination of components to be effective, and therefore are rated by the most limiting factor, which is pool depth in this example.

The benchmark ratings should not be viewed as performance values, but as guides for interpretation and further investigation. Streams are dynamic systems that change over time, and the stream habitat surveys provide only a single picture of the stream. For each habitat variable, historical and current events must be considered to understand the significance of the benchmark rating. Take, for example, a stream reach with a poor rating for instream large wood. Closer investigation could uncover that this stream is located in an area that historically never had any large riparian trees. Failing to meet the benchmark for instream large wood might not be a concern because low instream wood levels might be the stream's normal condition. On the other hand, meeting a benchmark might not mean all is well. A stream reach in an historically wooded area could meet its benchmark for large instream wood because a logging truck lost control and dumped its load in the stream. In this example, meeting the large wood benchmark is not sufficient if that stream reach has no natural sources of woody material other than logging truck accidents.

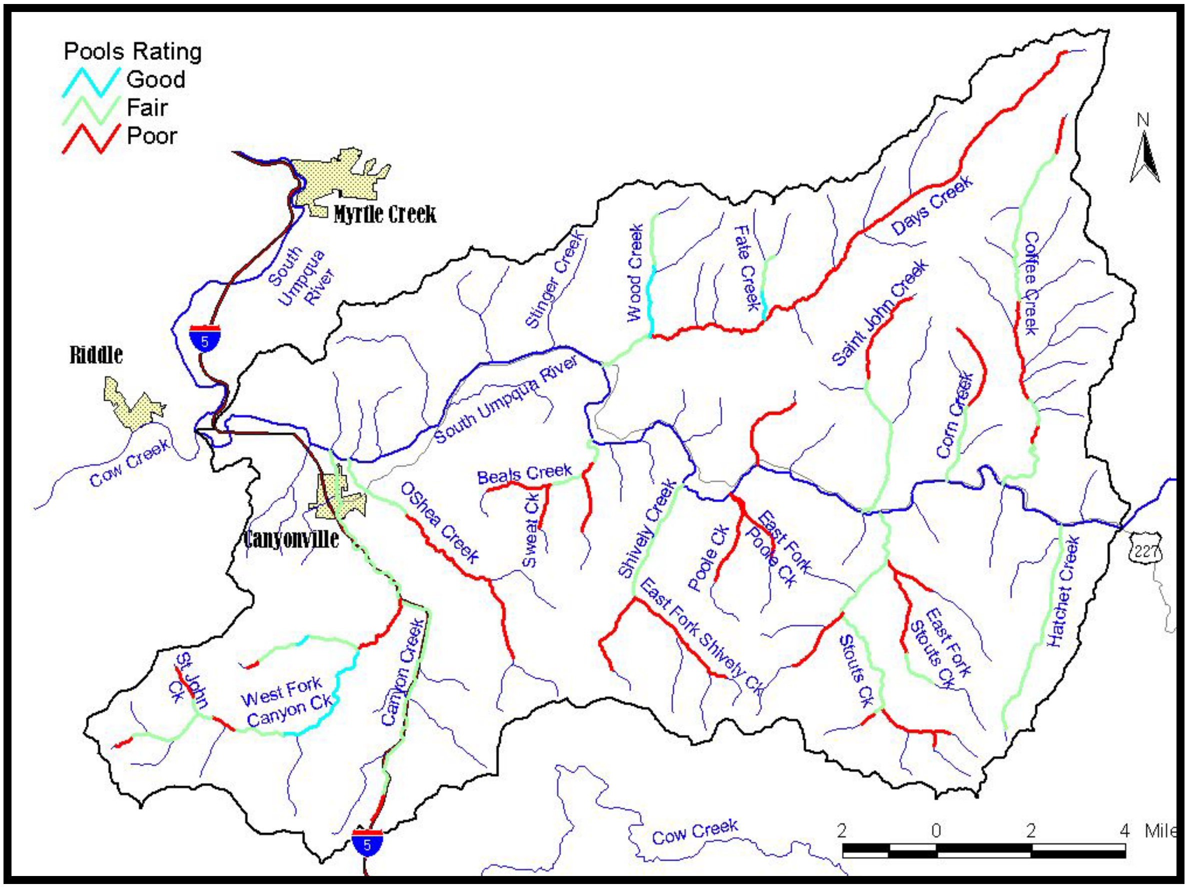
<u>Overview of conditions</u>

Looking at the historical and the recent conditions is necessary to fully understand the value of each reach's benchmark rating. Conducting this type of study for every reach within the South Umpqua River Watershed is beyond the scope of this assessment. Instead, it looks for patterns within the whole watershed and along the stream length to provide a broad view and help determine trends that might be of concern.

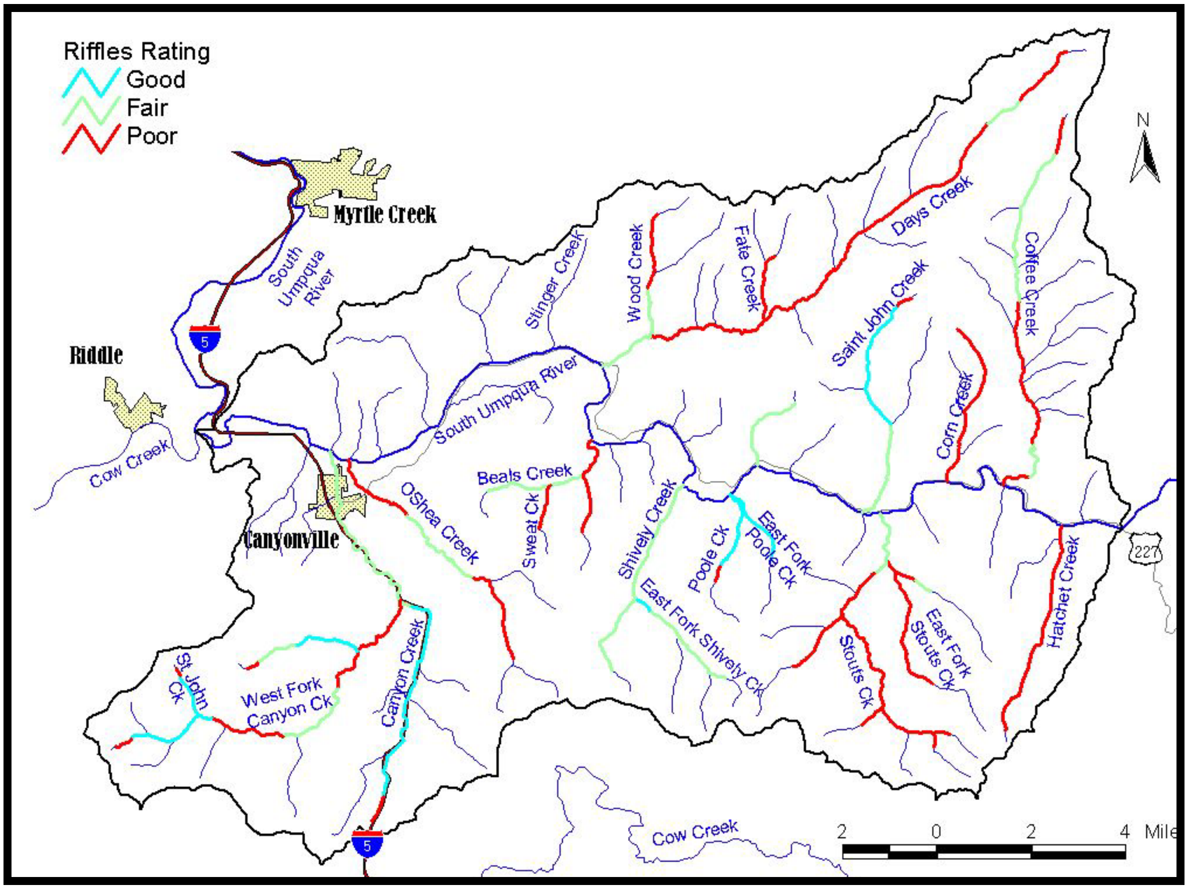
Of the 84 surveyed stream reaches, only five rate as fair or good in all four categories (6.0%). Sixty-four stream reaches (76.2%) have at least two categories rate as poor. Looking at Map 3-3, it is striking three-fourths of all reaches rate as poor for large woody material. Over 90% of pools rate as poor or fair (see Map 3-4), and almost half of riffles rate as poor (see Map 3-5). Finally, approximately one third of riparian areas rate as poor (see Map 3-6). Ratings and land uses by stream reach are provided in Appendix 2 and Appendix 3.



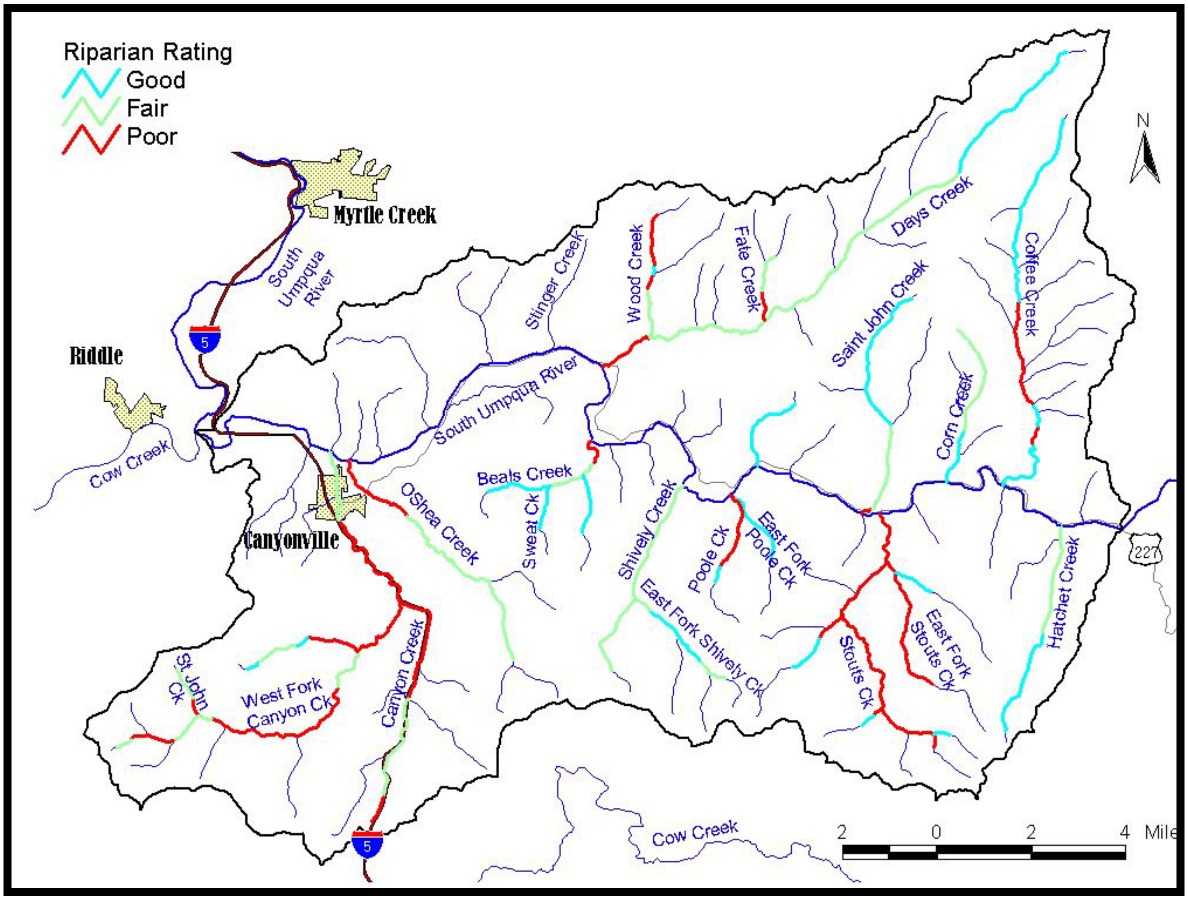
Map 3-3: Stream habitat survey large woody debris ratings for the South Umpqua River Watershed.



Map 3-4: Stream habitat survey pools ratings for the South Umpqua River Watershed.



Map 3-5: **Stream habitat survey riffles ratings for the South Umpqua River Watershed.**



Map 3-6: Stream habitat survey riparian ratings for the South Umpqua River Watershed.

3.1.2. Stream connectivity

Stream connectivity refers to the ability of resident and anadromous fish, as well as other aquatic organisms, to navigate the stream network. The stream system becomes disconnected when natural and human-made structures such as waterfalls, log jams, and dams, inhibit fish passage. Although some stream disconnect is normal, a high degree of disconnect can reduce the amount of suitable spawning habitat available to salmonids. This, in turn, reduces the stream system's salmonid productivity potential. Poor stream connectivity can increase juvenile and resident fish mortality by blocking access to other critical habitat, such as rearing grounds and cool tributaries during the summer months.[29]

For this assessment, fish passage barriers are structures that completely block all fish passage. A juvenile fish passage barrier permits adult passage but blocks all young fish. Structures that allow some adults or some juvenile fish to pass are referred to as obstacles. Although a single obstacle does not prevent passage, when there are multiple obstacles, fish can expend so much energy in their passage efforts that they may die or be unable to spawn or feed. This assessment reviews the known distribution and abundance

[29] See section 3.3.2 for more information about stream temperature.

of three common human-made fish passage barriers and obstacles: irrigation ditches, dams, and culverts.

Irrigation ditches
Irrigation ditches without fish wheel screens are primarily a problem for juvenile fish.[30] When the water diversion is in place, young fish swim into the ditches in search of food. When the diversion to the ditch is removed, the young fish left in the ditch cannot return to the stream network and will eventually die. At the writing of this assessment, no unscreened irrigation ditches in the South Umpqua River Watershed had been identified as significant juvenile fish passage barriers.

Dams
In the central Umpqua Basin, most dams on larger streams are push-up dams used to create pools to pump irrigation water.[31] These dams are only used during the summer months, and pose no passage barrier to fish during the winter. Dams can be barriers or obstacles to fish passage if the distance from the downstream water surface to the top of the dam (the "drop") is too far for fish to jump. Whether or not a fish can overcome this distance depends on three factors: the size of the fish, the height of the drop, and the size of the pool at the base of the dam, which is where fish gain momentum to jump. If the pool is two feet deep, it is generally believed that adult fish can surmount a two-foot high dam or less, while juvenile fish can overcome a height of 0.5 feet or less. As pool depth decreases or height increases, fish have difficulty jumping high enough to pass over. Win Walker Dam on West Fork Canyon Creek and Oshea Creek Dam on Oshea Creek are complete barriers to fish passage. The Oregon Water Resources Department, the Douglas Soil and Water Conservation District, and the UBWC are not aware of any other dams in the South Umpqua River Watershed that are barriers or obstacles to adult or juvenile fish passage.

Culverts
Culverts can be a barrier or obstacle to fish passage if the distance from the downstream water surface to the culvert outfall is too far for fish to jump. Just as with dams, it is generally believed that adult fish can reach a culvert outlet that is two feet or less from the downstream water, while juvenile fish overcome a height of 0.5 feet or less, if there is a two-foot deep pool at the outfall.

Unlike dams, water velocity within the culvert poses another potential fish passage barrier. In natural stream systems, fish are able to navigate high velocity waters by periodically resting behind rocks and logs or in pools. Smooth-bottomed culverts offer no such protection, and water velocities can prevent some or all fish from passing through the pipe. Fish may face an additional velocity barrier at the upstream end of a culvert if it has been placed so that the stream flows sharply downward into the culvert entrance. In general, smooth-bottomed culverts at a 1% gradient or more are obstacles to

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[30] Fish wheel screens are self-cleaning screens that prevent fish from entering an irrigation ditch while passing floating debris that may prevent water flow.
[31] Some landowners may have dams on small tributaries to provide water for wildfire control, provide water for livestock, or for landscape aesthetics.

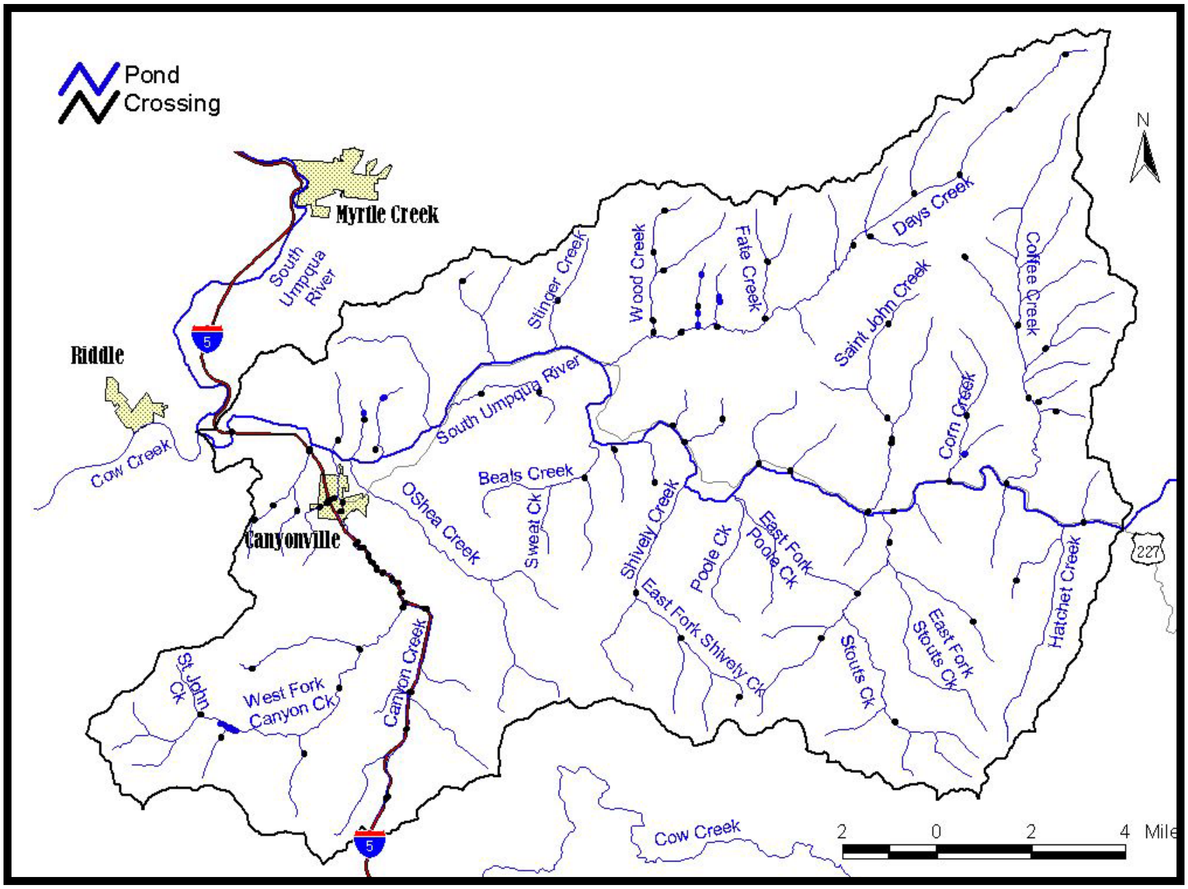
fish passage. Culverts that are partially buried underground or built to mimic a natural streambed provide greater protection and allow fish passage at steeper gradients and higher water velocities.

It is important to note that culverts may be fish passage obstacles or barriers for only part of the year. As water levels change, so do pool depth, drop distance, and water velocity. A culvert with a five-foot drop in the summer may be easily navigated in the winter. High winter water flows can increase pool size and reduce jumping distance. However, high flows can also increase water velocities, making culverts impassable.

Map 3-7 shows road/stream crossings within the South Umpqua River Watershed. Culverts are the most common method of passing a road over a stream; however, bridges and hardened crossings are used as well. Map 3-7 also shows instream “ponds” within the South Umpqua River Watershed. These ponds are areas within the stream channel where the flow is very wide in a localized area with a sudden narrowing in flow at the downstream end. These ponds are usually formed when something is blocking streamflow, such as an irrigation dam, beaver dam, clogged culvert, or log jam. It is unknown at this time how many of the road/stream crossings or pond-forming structures are fish passage barriers or obstacles. However, ODFW fish habitat biologist Sam Dunnavant states there are culverts blocking fish passage on Stinger Creek, Beals Creek, and Fate Creek. There may addition fish passage barriers on Morgan Creek, Upper Days Creek, East Fork Shively Creek, Corn Creek, and Coffee Creek.

Currently, the Umpqua Basin Fish Access Team (UBFAT) is working on identifying and prioritizing fish passage-limiting culverts, as well as other fish passage barriers and obstacles, on public and private land throughout the Umpqua Basin. Future prioritization will focus on identifying the fish passage barriers that will give the highest cost-to-benefit ratio, such as culverts blocking fish access near the mouths of streams that are within the distribution of salmonids.[32] A document summarizing the results of this project will be available in 2004.

[32] See section 3.5.2 for information about anadromous and resident salmonid distribution within the South Umpqua River Watershed.



Map 3-7: Road/stream crossings and "ponds" in the South Umpqua River Watershed.

3.1.3. Channel modification[33]

For the purpose of this assessment, "channel modification" is defined as any human activity designed to alter a stream's flow or its movement within the floodplain, such as building riprap, dredging, or vegetative bank stabilization. Although placing structures like boulders or logs in a stream alters the channel, this type of work is done to improve aquatic habitat conditions and is not intended to alter the stream's path. As such, instream structure placement projects are not considered channel modification activities for this assessment.

In Oregon, the state has the authority to regulate all activities that modify a stream's active channel. The active channel is all the area along a stream that is submerged during normal high waters. Even if the entire stream is within a landowner's property, the active channel, like the water within it, is regulated by public agencies, and channel modification projects can only be done with a permit.[34] History has shown that channel

[33] Information in section 3.1.3 is primarily from interviews by the author with Douglas Soil and Water Conservation District staff.

[34] Under the Oregon Removal/Fill Law (ORS 196.800-196.990), removing, filling, or altering 50 cubic yards or more of material within the bed or banks of the waters of the state or any amount of material

modification activities are often detrimental to aquatic ecosystems and to other reaches of the same stream. Streams naturally meander; attempts to halt meandering can alter aquatic habitats in localized areas and cause serious erosion or sedimentation problems further downstream. Although channel modification projects can still be done with a permit, obtaining a permit can be a lengthy process.

Historical channel modification projects
Quantifying historical channel modification activities is difficult because no permits were issued, and the evidence is hidden or non-existent. According to the Douglas Soil and Water Conservation District staff, the majority of past channel modification activities were removing gravel bars from the stream and bank stabilization. Property owners removed gravel bars to sell the gravel as aggregate, to reduce water velocities, and "to put the creek where it belongs." Gravel bars are not stationary, and during every flood event gravel is washed away and replaced by upstream materials.[35] Consequently, a gravel bar in the same location was often removed every year.

Bank stabilization concerns any material added to the stream's bank to prevent erosion and stream meandering. The term "riprap" refers to bank stabilization done with any handy material including tires, car bodies, railroad ties, rocks, and cement. Frequently, riprap becomes buried by sediment only to be exposed years later when a stream alters its path. During the 1996 Douglas County area floods, many past bank stabilization projects were exposed as sediment was washed away. In some cases, entire car bodies used for riprap were found stranded in the middle of streams that had drastically changed course.

Current channel modification projects
There is concrete riprap on Canyon Creek before the confluence with West Fork Canyon Creek. On the South Umpqua River, a bank barb project was done near the confluence with Morgan Creek. The Douglas Soil and Water Conservation District, the Oregon Water Resources Department, and the Umpqua Basin Watershed Council are not aware of any additional channel modification projects in the South Umpqua River Watershed. Landowners and stream restoration professionals report that non-permitted channel modification activities still occur throughout the Umpqua Basin. In many cases, the people involved are unaware of the regulations and fines associated with non-permitted channel modification projects and the effects on aquatic systems.

3.1.4. Stream function key findings and action recommendations

Stream morphology key findings

- A wide variety of stream channel habitat types are found in the watershed, and different enhancement opportunities exist.
- Most streams within the South Umpqua River Watershed have low gradients with few stream miles in the source areas, where most large woody material is recruited into

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within Essential Habitat streams or State Scenic Waterways requires a permit from the Division of State Lands. Waters of the state include the Pacific Ocean, rivers, lakes, most ponds and wetlands, and other natural bodies of water. Tree planting in the active stream channel, and timber harvesting in some circumstances, can be done without a permit.

[35] In general, a gravel bar that has no grass or other vegetation is very unstable.

the stream system. This may naturally limit instream large woody material abundance.
- Stream habitat surveys suggest that lack of large woody material, poor riffles, and poor or fair pools limit fish habitat in surveyed streams.

Stream connectivity key findings
- Dams and culverts that are barriers and/or obstacles to fish reduce stream connectivity, affecting anadromous and resident fish productivity in the South Umpqua River Watershed. More information about fish passage barriers will be available from UBFAT in 2004.

Channel modification key findings
- There are few examples of permitted channel modification projects in the South Umpqua River Watershed.
- Many landowners may not understand the detrimental impacts of channel modification activities or may be unaware of active stream channel regulations.

Stream function action recommendations
- Where appropriate, improve pools and riffles while increasing instream large woody material by placing large wood and/or boulders in streams with channel types that are responsive to restoration activities and have an active channel less than 30 feet wide.[36]
- Encourage land use practices that enhance or protect riparian areas:
  - Protect riparian areas from livestock-caused browsing and bank erosion by providing stock water systems and shade trees outside of the stream channel and riparian zones. Fence riparian areas as appropriate.
  - Plant native riparian trees, shrubs, and understory vegetation in areas with poor or fair riparian areas.
  - Manage riparian zones for uneven-aged stands with large diameter trees and younger understory trees.
- Maintain areas with good native riparian vegetation.
- Encourage landowner participation in restoring stream connectivity by eliminating barriers and obstacles to fish passage. Restoration projects should focus on barriers that, when removed or repaired, create access to the greatest amount of fish habitat.
- Increase landowner awareness and understanding of the effects and implications of channel modification activities through public outreach and education.

3.2. Riparian zones and wetlands

3.2.1. Riparian zones

For the purpose of this assessment, the vegetation immediately adjacent to a stream is the stream's riparian zone. Riparian zones influence stream conditions in many ways. Aboveground vegetation can provide shade, reduce flood velocities, and add nutrients to

[36] Thirty feet is the maximum stream width for which instream log and boulder placement projects are permitted.

the stream. Roots help prevent bank erosion and stream meandering. Trees and limbs that fall into streams can increase fish habitat complexity and can create pools. Insects that thrive in streamside vegetation are an important food source for fish.

What constitutes a "healthy" riparian area, however, is dependent on many factors. Although many large diameter conifers and hardwoods provide the greatest amount of shade and woody debris, many streams flow through areas that do not support large trees or forests. In some areas, current land uses may not permit the growth of "ideal" vegetation types. Conclusions about stream riparian zone conditions should take into consideration location, known historical conditions, and current land uses. Therefore, this assessment's riparian zone findings should be viewed as a guide for interpretation and further investigation and not as an attempt to qualify riparian conditions.

Riparian zone classification methodology
Digitized aerial photographs were used to determine riparian composition of the South Umpqua River Watershed. Right and left streambanks were divided into reaches based on vegetative changes.[37] The reaches were measured and classified using three vegetation composition parameters: dominant vegetation or feature, buffer width, and cover. Table 3-4 outlines the classifications for each parameter. Findings for each parameter for the South Umpqua River and tributaries within the watershed are discussed below. Appendix 4, Appendix 5, and Appendix 6 have data by percent for the South Umpqua River, Days Creek, Days Creek tributaries, Canyon Creek, Canyon Creek tributaries, all other tributaries, potential anadromous salmonid streams, potential cutthroat streams, and non-salmonid streams.[38]

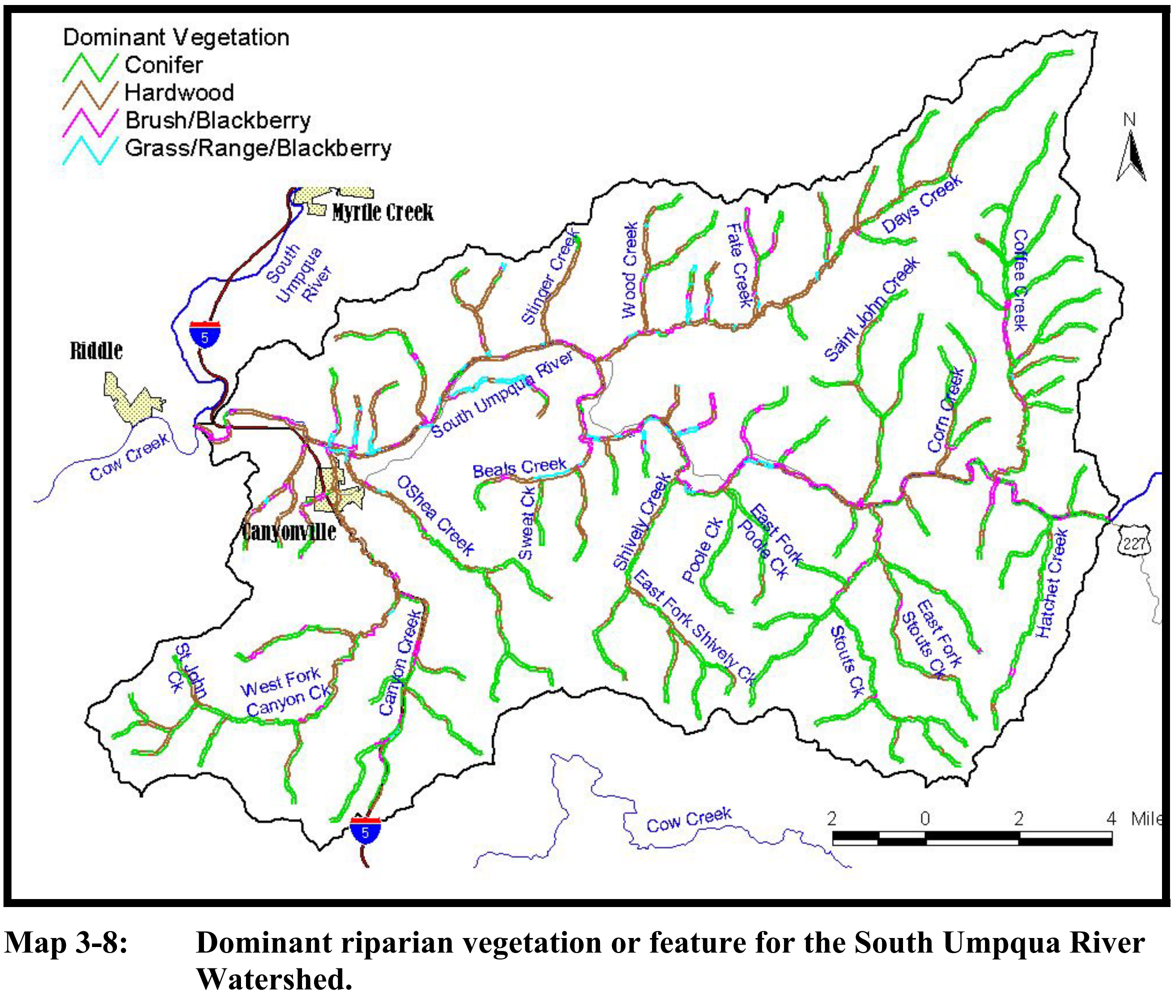
Riparian zone parameters	**Parameter attributes** Reaches are classified by the most dominant (>50% cover) characteristic
Dominant vegetation or feature	• Conifer trees • Hardwood trees • Brush/blackberry • Range/grass/blackberry • No vegetation (roads, bare ground, etc.) • Infrastructure (bridges and culverts)
Buffer width	• No trees • 1 tree width • 2+ tree widths
Cover	• No cover • <50% cover • >50% cover

Table 3-4: Riparian zone classification for the South Umpqua River Watershed.

[37] Stream banks were labeled as "left" or "right" from the perspective of standing in the middle of the creek looking downstream.
[38] See 3.5.2 for more information about salmonid distribution within the South Umpqua River Watershed.

Dominant vegetation or feature

The dominant streamside vegetation or features affect ecological functions by providing different levels of shade and bank stability as well as different types of nutrients and wildlife habitat. For this assessment, the dominant vegetation or feature is evaluated using six attributes. Trees are split into two groups: conifers and hardwoods. Although all tree types provide shade and large woody debris, large conifers decompose very slowly and are less likely than hardwoods to wash downstream. Brush/blackberry constitutes short broad plants. Blackberries are not given a separate category because these plants are frequently intertwined with other shrubs and difficult to differentiate. Range and grass includes blackberries because a predominantly range or grass riparian zone frequently has a thin strip of blackberries close to the stream bank. Areas of no vegetation include streamside roads and railroads and non-road related bare ground and rock. Infrastructure indicates areas where the stream passes under a bridge or culvert. Map 3-8 shows the three most common vegetation types for South Umpqua River Watershed streams. Appendix 4 has the percent of all vegetation or features by the South Umpqua River for all stream categories.



Map 3-8: Dominant riparian vegetation or feature for the South Umpqua River Watershed.

For all streams, conifers, hardwoods, and brush/blackberry are the most common vegetation types (see Table 3-5). These are the most common vegetation types by salmonid habitat type as well (see Table 3-6). The South Umpqua River's riparian area is predominantly hardwoods and brush/blackberry. Canyon Creek, Days Creek, and all other tributaries are predominantly hardwoods and conifers. Potential anadromous salmonid streams have riparian areas that are mostly conifers and hardwoods, while cutthroat streams have conifer-dominated riparian areas.

	Conifers		**Hardwoods**		**Brush/blackberry**	
Streams	%	Riparian miles[39]	%	Riparian miles	%	Riparian miles
South Umpqua River	15.3%	8.7	48.2%	27.3	28.3%	16.0
Canyon Creek	26.1%	5.1	52.5%	10.3	11.9%	2.3
Canyon Ck tributaries	62.8%	35.6	29.6%	16.8	5.1%	2.9
Days Creek	36.6%	10.6	55.7%	16.2	4.6%	1.3
Days Ck tributaries	48.0%	19.0	35.4%	14.0	9.6%	3.8
All other tributaries	63.6%	187.2	26.6%	78.2	5.8%	17.0

Table 3-5: Predominant vegetation types by stream in the South Umpqua River Watershed.

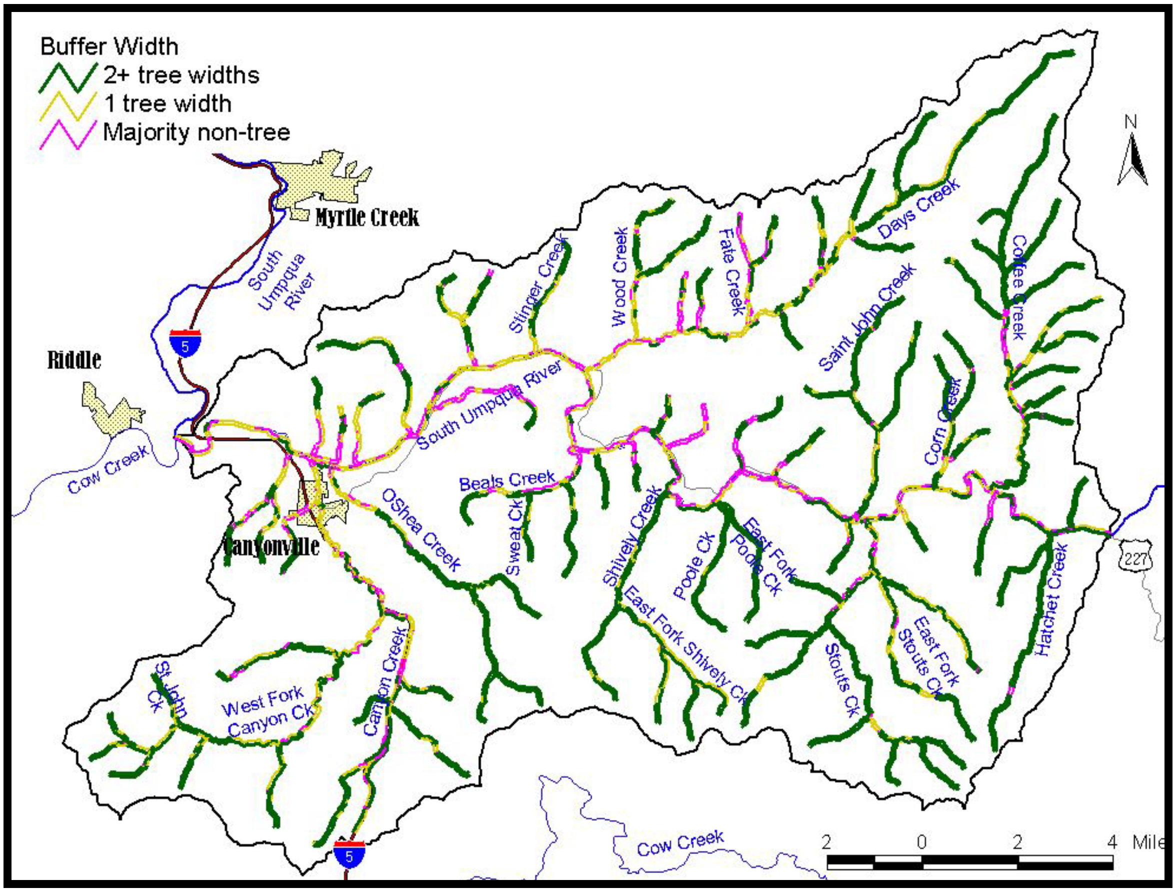
	Conifers		**Hardwoods**		**Brush/blackberry**	
Potential salmonid habitat	%	Riparian miles	%	Riparian miles	%	Riparian miles
Anadromous	40.2%	100.9	41.9%	105.1	12.8%	32.2
Cutthroat	62.8%	124.2	26.7%	52.8	5.1%	10.1
No salmonids	86.5%	41.1	10.4%	4.9	2.6%	1.2

Table 3-6: Predominant vegetation types by salmonid habitat in the South Umpqua River Watershed.

Buffer width

Riparian areas with wide bands of trees provide habitat and migration corridors for wildlife. As the number of trees in close proximity to the stream increases, so does the likelihood that some trees will fall into the stream, creating fish habitat and forming pools. Wide tree buffers also increase stream shading, creating a microclimate with cooler temperatures compared to other reaches within the same stream. Buffer width is classified as having no trees, one tree width, or a width of two or more trees. Map 3-9 shows buffer width findings for the South Umpqua River Watershed. Appendix 5 provides data by percent for all stream categories.

[39] Riparian miles are the total measured distance for right and left streambanks.



Map 3-9: Riparian buffer widths for the South Umpqua River Watershed.

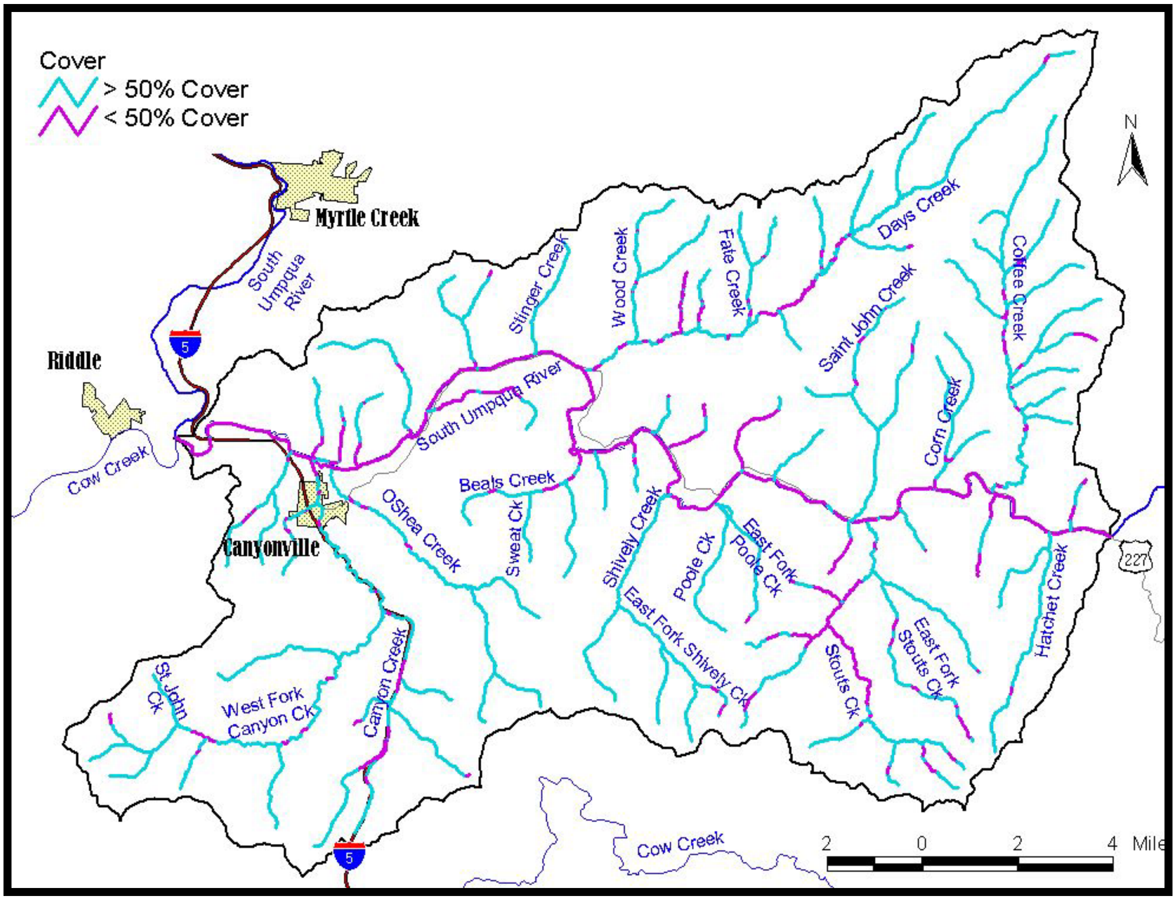
The South Umpqua River's riparian buffers are predominantly one tree wide (48.4%, 27.4 riparian miles) or have no trees (36.5%, 20.7 riparian miles). Over half of Canyon Creek's buffers are one tree wide (52.2%, 10.2 riparian miles). Days Creek's buffers are predominantly two or more trees wide (48.1%, 14.0 riparian miles) and one tree wide (44.2%, 12.9 riparian miles). Other tributaries have 73.9% (217.6 riparian miles) of riparian buffers that are two or more trees wide. Almost half of potential anadromous salmonid streams have riparian zones that are two or more trees wide (47.6%, 119.8 riparian miles). Cutthroat streams and are dominated by buffers that are two trees wide or greater (84.5%, 83.6 riparian miles).

Cover

The ultimate source of stream heat is the sun, either by direct solar radiation or by ambient air and ground temperature around the stream.[40] Blocking the amount of direct solar energy reaching the stream surface reduces warming rates. Streams with complete cover receive the least direct solar radiation, and are therefore preferred in the Umpqua Basin, where many streams are 303(d) listed for high temperature.[41] Cover is dependent on stream width and riparian vegetation. Shrubs and grasses can provide substantial

[40] See section 3.3.2 for more information about stream temperature.
[41] See section 3.3.1 and Table 3-9 for more information about 303(d) listed streams.

cover for small, narrow streams. Larger streams can be partially shaded by vegetation and completely shaded by infrastructure. In very wide streams, only bridges provide complete coverage. This assessment looks at the percent of the total stream width that is covered by trees or infrastructure. Map 3-10 shows the stream reaches that have greater than 50% cover and less than 50% cover. Appendix 6 shows the percent cover for all stream categories.



Map 3-10: Percent cover for the South Umpqua River Watershed.

Due to the great width of the South Umpqua River, 99.1% (26.6 stream miles) of the river is less than half covered by vegetation or infrastructure. The areas that are mostly covered are under bridges. Almost three-fourths of Canyon Creek (7.3 stream miles) and 77.1% (11.2 stream miles) of Days Creek are mostly covered by vegetation or infrastructure; all tributaries are at least 80% covered. Potential anadromous salmonid streams are predominantly shaded by vegetation or infrastructure (77.7%, 62.0 stream miles), but over a third (47.5 stream miles) are less than half covered. This is because the South Umpqua River is within anadromous salmonid distribution. Almost 85% (83.6 stream miles) of potential cutthroat streams are mostly covered.

3.2.2. Wetlands[42]

The hydrology of wetlands and stream-associated wetlands is often complex and interconnected. A watershed-based approach to wetlands assessment is critical to ensure that the whole ecosystem is reviewed. The purpose of this section is to review current wetlands locations and attributes, historical wetlands, and opportunities for restoration. Background information for this section was compiled from the following groups' documents, websites, and specialists: the Oregon Division of State Lands, US Environmental Protection Agency, US Fish and Wildlife Service, and Wetlands Conservancy. Additional information was compiled from *Wetland Plants of Oregon and Washington* (Guard, 1995).

Overview of wetland ecology

When discussing wetlands, it is helpful to clarify terms and review ecological functions in order to facilitate a mutual understanding. The following section provides a brief description of wetland ecology.

<u>What is a wetland?</u>

In general, wetlands are a transitional area between terrestrial and aquatic ecosystems, where the water table is usually at or near the surface of the land, or the land is covered by shallow water. The following three attributes must be found together to establish the existence of a regulated wetland:

1. Under normal circumstances there is inundation or saturation with water for two weeks or more during the growing season; [43]
2. The substrate is predominantly undrained hydric soil as indicated by the presence of features such as dull colored or gleyed (gray colors) soils, soft iron masses, oxidized root channels, or manganese dioxide nodules; and
3. At least periodically, the land supports predominantly hydrophytic (water-loving) vegetation.

<u>Function and values</u>

In the past, wetlands were regarded as wastelands and considered nuisances. As early as 1849 with the enactment of the Swamp Act, wetlands removal was encouraged. Wetlands were feared as the cause of malaria and malignant fever. However, research over the years has led to a greater appreciation of the many important ecological functions that wetlands perform.

Of the many functions and benefits of wetlands, different ones will be important to different communities depending upon their goals for wetland protection and restoration. Some of the many functions and benefits of wetlands include:

- Flood prevention - wetlands are able to absorb water from runoff during storms and gradually release the water that would otherwise flow quickly downstream.

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[42] Jeanine Lum of Barnes and Associates, Inc., contributed section 3.2.2.
[43] The growing season in Douglas County is from March 1 through October 31.

- Water filtration - wetlands improve water quality by acting as sediment basins. Wetland vegetation is able to filter and reduce excess nutrients such as phosphorous and nitrogen.
- Ground water recharge - water that is held in wetlands can move into the subsurface soil, thus recharging the groundwater.
- Stream bank stabilization - wetlands and associated vegetation slow the movement of water and help slow erosion of stream banks.
- Fish and wildlife habitat - many species depend on wetlands for food, spawning and rearing.

<u>Background on the Clean Water Act and National Wetlands Inventory</u>
Section 404 of the federal Clean Water Act requires that anyone planning to place dredged or fill material into waters of the United States, including wetlands, must first obtain a permit from the U.S. Army Corp of Engineers. Established (ongoing) and normal farming, ranching, and forestry activities are exempt. The Emergency Wetlands Resources Act of 1986 requires the U.S. Fish and Wildlife Service (USFWS) to inventory and map wetlands in the United States. This mapped inventory is called the National Wetlands Inventory (NWI).

Nationally, an estimated 46 million acres, or 50% of the original wetlands area, have been lost to clearing, filling, draining and flood control since the 1600s. In 1997, the USFWS reported an 80% reduction in wetlands loss during the period 1986 to 1996, as compared to the decade prior. Although the nation has not met the goal of no net loss of wetlands, it has slowed the rate of wetlands loss.

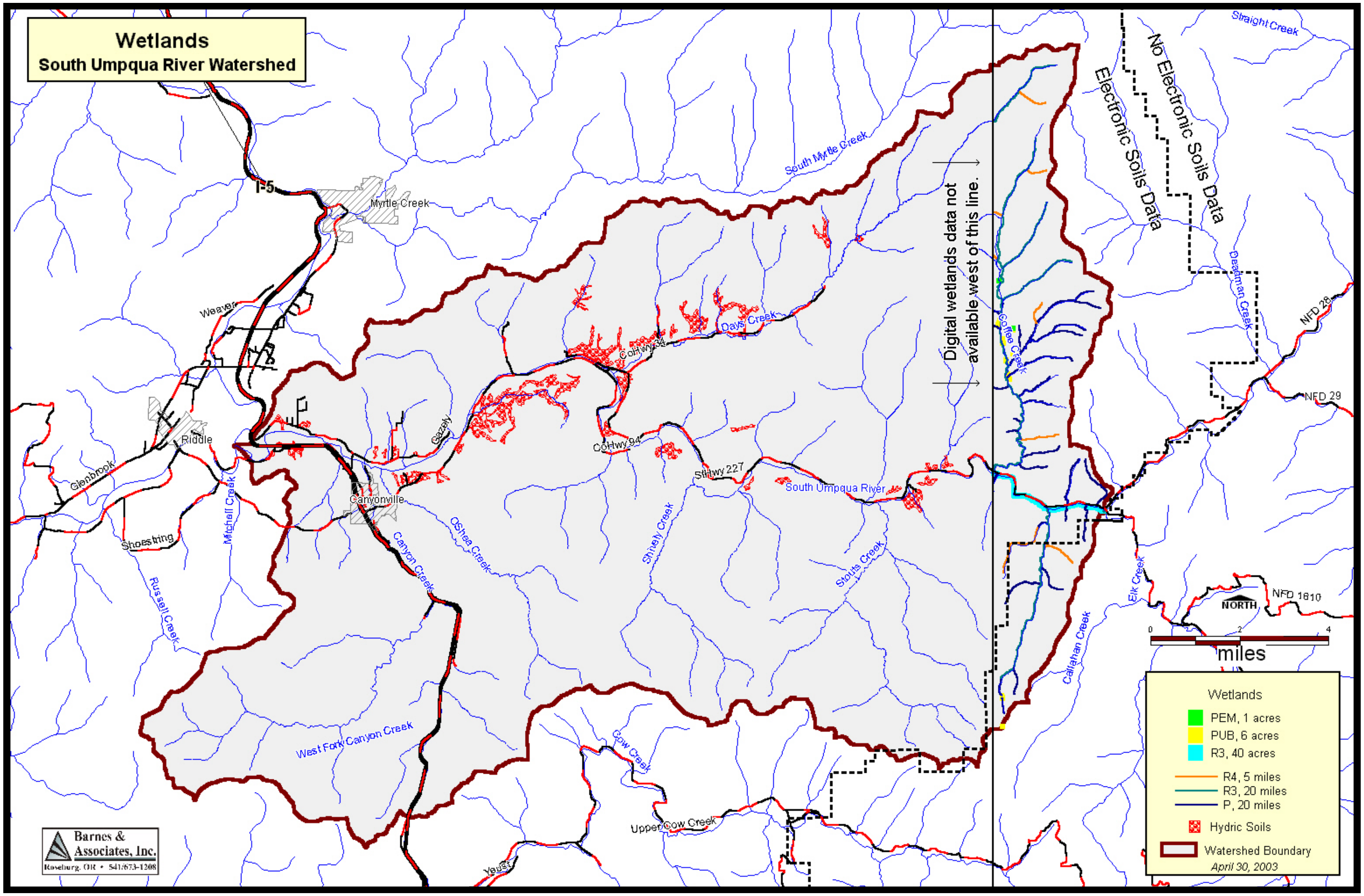
<u>Types of wetlands</u>
A wetland that holds water all year round is the easiest wetland to recognize and the one most people understand as a wetland. Another type of wetland is the ephemeral wetland, or a wetland that holds water for only a few days, weeks, or months during the year. The timing and duration of water are important factors that dictate which plants and wildlife will use a particular wetland.

NWI classifies wetlands based on guidelines established by Cowardin and others (1979). The "palustrine" system classification includes all nontidal wetlands dominated by trees, shrubs, emergents (erect, rooted, non-woody plants), mosses or lichens. It groups the vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and prairie potholes. The palustrine wetland also includes the small, shallow, permanent or intermittent water bodies often called ponds. Bodies of water that are lacking such vegetation and are less than 20 acres in size are included in this category.

The "riverine" system classification includes wetlands within a channel, except those dominated by trees, shrubs, and persistent emergents. Wetlands within a channel that are dominated by vegetation are classified as "palustrine" and appear on Map 3-11 as line data labeled "P." Table 3-7 is a summary of codes and descriptions used in the NWI. Data are displayed in Map 3-11.

System	Class	Brief description
P=Palustrine	EM=emergent	Dominated by rooted herbaceous plants, such as cattails and grass.
	SS=scrub-shrub	Dominated by shrubs and saplings less than 20 feet in height.
	FO=forested	Dominated by trees taller than 20 feet in height.
	UB=unconsolidated bottom	No vegetation evident at the water surface, with mud or exposed soils.
R=Riverine	R3=upper perennial	Channels that flow throughout the year, characterized by high gradient and fast water velocity.
	R4=intermittent	Channels that contain flowing water only part of the year.

Table 3-7: National Wetlands Inventory wetlands codes and descriptions.



Map 3-11: South Umpqua River Watershed wetlands.

Description of current wetlands in the South Umpqua River Watershed
A review of the NWI data shows the main channel of the South Umpqua River and its major tributaries of Canyon, Coffee, Oshea, Shively, and Stouts Creeks are classified as riverine (stream-associated wetland) systems which periodically or continuously contain flowing water.[44] Portions of land adjacent to the South Umpqua River, designated primarily as beach bars, are seasonally flooded. Here surface water is present for an extended period, especially early in the growing season, but is absent by the end of the growing season in most years. The water table can vary from saturation at the surface to well below the ground surface after flooding ceases.

Most of the wetlands in the watershed fall in the riverine system of the South Umpqua River, occur primarily on private land, and are zoned agricultural. This is a common trend in rural valley bottoms as the fertile land was attractive to early settlers and subsequent landowners. Most of the agricultural practices extend right up to the edge of the stream bank or wetland.

Most of the palustrine wetlands are farm ponds, scattered throughout the watershed where livestock are grazed. They are typically deep and constructed to hold water all year. These ponds have been diked and dammed and, in some cases, have impacted the flow of water to and from wetlands. Herbert's Pond, located five miles east of Canyonville, was not dammed for livestock grazing. It was formerly a log pond at the former site of Herbert Lumber Company sawmill. It was converted to a wetland in 1949 for public recreational fishing of warm water species.

NWI maps denote several small wetlands along the Coffee Creek. This area has been mined extensively for gold since 1855. These excavated sites have altered the creek hydrology and store water.

Historical wetlands and changes in the South Umpqua River Watershed
There is little specific reference in historical records to wetlands in the South Umpqua River Watershed. However, approximately 38% by area of Oregon's wetlands have been drained, diked or filled since European settlement. In western Oregon specifically, 53% of the original wetlands acreage has been lost to development or converted to other uses (Wetlands Conservancy, 2003).

One indicator of possible historical wetlands is the area of hydric soils adjacent to existing wetlands. Hydric soils are formed under conditions of saturation, flooding or ponding of sufficient duration during the growing season to develop anaerobic conditions in the upper part of the soil profile. There are approximately 1,700 acres of hydric soils in the watershed as displayed in Map 3-11. These soils are represented by seven soil map units and occur on floodplains, terraces, fans, and mountains. In general, the soil units

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[44] Wetlands data for this watershed is available electronically for only the USGS 7.5 minute quadrangles of Deadman Mountain, Tiller, and Richter Mountain. This "digital" area falls in the eastern portion of the watershed. Approximately 17,371 acres, or 12% of the watershed area, were analyzed and mapped with this digital data. The balance of the South Umpqua River Watershed was analyzed using paper NWI maps from the Oregon Division of State Lands.

are described as clayey, poorly-drained, with low permeability and a high water table present during late fall, winter, and spring.

After review of the hydric soils as displayed in Map 3-11 and NWI data, it is apparent the NWI is only a fraction of the area designated as hydric soils. As mentioned earlier, wetland vegetation and certain hydrologic conditions must be present in order to meet the federal and state wetland definitions. Historical settlement and long-term agricultural use of this land probably affected any original wetland hydrology.

Restoration opportunities in the South Umpqua River Watershed
Wetland loss and degradation is caused by human activities that change wetland water quality, quantity, and flow rates, increase pollutant inputs, and change species composition as a result of disturbance and introduction of non-native species. Although one of the functions of wetlands is to absorb pollutants and sediments from the water, there is a limit to their capacity to do so.

The primary agricultural use of wetlands in the watershed is grazing of domestic animals that often congregate in stream-associated wetlands and other wetlands during dry and hot periods. Best management practices can reduce the impact of livestock in the wetlands and riparian areas. Off-channel watering, hardened crossings, irrigation, livestock exclusion (part or all of the year), and providing shade away from these areas are examples of improvements that can be implemented to minimize damage to the wetlands.

There is opportunity for enhancement and protection of wetlands including ash groves along the South Umpqua River in the Morgan Creek area. Bank stabilization and riparian planting can increase habitat value along the targeted creek. Landowner interest, land use, current condition, and threats to the site are considerations in deciding which sites have merit as a wetland project.

Opportunities exist for landowners to participate in incentive, cost-share, and/or grant awarding programs that encourage good land stewardship and benefit wetlands. Although each program varies with its incentives and eligibility, landowners share these common concerns:

- Lack of awareness of available programs.
- Overwhelming program choices: "which one is best for me?"
- Concern about hidden agendas and "fine print."
- Anxiety over bureaucracy and contracts: "not worth the effort."
- Fear of the loss of privacy on land or the discovery of threatened or endangered species on the property.

Russ and Sandy Lyon, landowners in the Days Creek area, have actively participated in agency programs that has benefited their ranch operation and enhanced riverine wetlands. Their successes, positive experience, and enthusiasm could be "harnessed" to lead other landowners to similar practices.

Some wetland projects are undertaken for the specific purpose of compensating for the damage or destruction to another wetland area. Recent reports shows that nearly two-thirds of all mitigation projects fail to meet performances standards (Mockler, 2003). Planning, monitoring, and long-term management, important for all wetland activities, are especially important for wetland mitigation projects. Lack of measurable goals, monitoring and corrective adaptive management have been identified as some problems with mitigation wetlands in Douglas County.

Recommendations

Nearly all of the wetlands in the South Umpqua Watershed are found on private land along the South Umpqua River. Much of this area is currently grazed or used for hay production. Landowner "buy-in" and voluntary participation must be fostered if wetland conservation is to be successful in the watershed. The following recommendations can help realize this goal.

Increase awareness of wetland conservation

Develop opportunities to increase awareness of what defines a wetland, its functions and benefits. This is a fundamental step in creating landowner interest and developing landowner appreciation for wetland conservation. Identify or establish various peer related demonstration projects as opportunities to educate stakeholders.

Address landowner concerns

Establish an approachable "one-stop shop" or clearinghouse to assist landowners in enrolling in programs that can benefit wetlands and meet landowner goals. A friendly and "non-governmental" atmosphere can reduce some of the previously identified landowner concerns. A central site can identify and coordinate partners, streamline landowner paperwork, and facilitate leveraging of money and in-kind services often needed for a successful project. Combining local programs with national programs gives flexibility and maximizes dollars. For example, a landowner could receive a tax exemption under the local Wildlife Habitat Conservation and Management Program, receive technical assistance in planning and cost share from the Natural Resources Conservation Service, and receive grant monies from Partners for Wildlife and Ducks Unlimited.

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Rob Burns, US Fish and Wildlife Service
Rolando Espinosa, Bureau of Land Management
Walt Gayner, Douglas Soil and Water Conservation District
Milton Herbert, Herbert Lumber Company
Sandy Lyon, landowner, Days Creek
Scott Robbins, USDA Natural Resources Conservation Service

3.2.3. Riparian zones and wetlands key findings and action recommendations

Riparian zones key findings

- The South Umpqua River's riparian area is predominantly hardwoods and brush/blackberry. Canyon Creek, Days Creek, and all other tributaries are predominantly hardwoods and conifers.
- Potential anadromous salmonid streams have riparian areas that are mostly conifers and hardwoods, while cutthroat streams have conifer-dominated riparian areas.
- The South Umpqua River's riparian buffers are predominantly one tree wide or have no trees. Over half of Canyon Creek's buffers are one tree wide, while Days Creek's buffers are predominantly one tree wide or greater. Almost three-fourths of other tributaries have riparian buffers that are two trees wide or greater.
- Almost half of potential anadromous salmonid streams have riparian zones that are two trees wide or greater. Cutthroat streams and are dominated by buffers that are two trees wide or greater.
- Due to the great width of the South Umpqua River, almost the entire river within the watershed is exposed to direct sunlight. The areas that are mostly covered are under bridges. Canyon Creek, Days Creek, and other tributaries are mostly shaded by vegetation or infrastructure.
- Potential anadromous salmonid streams are predominantly shaded by vegetation or infrastructure, but over a third are less than half covered. This is because the South Umpqua River is within anadromous salmonid distribution. Almost 85% of potential cutthroat streams are mostly covered.

Wetlands key findings[45]

- Historical settlement, development, and long-term agricultural use of the South Umpqua River Watershed have probably affected the original wetland hydrology.
- Most of the remaining wetlands in the South Umpqua River Watershed are found on private land.
- Landowner "buy-in" and voluntary participation must be fostered if wetland conservation is to be successful in the watershed.
- There is opportunity for enhancement and protection of wetlands, including ash groves along the South Umpqua River in the Morgan Creek area.

Riparian zones and wetlands action recommendations

- Where canopy cover is less than 50%, establish wide buffers of native trees (preferably conifers) and/or shrubs, depending upon local conditions. Priority areas are fish-bearing streams for which more than 50% canopy cover is possible.
- Identify riparian zones dominated by grass, brush, and blackberry and convert these areas to native trees (preferably conifers) and/or shrubs, depending on local conditions.
- Where riparian buffers are one tree wide or less, encourage buffer expansion by planting native trees (preferably conifers) and/or shrubs, depending on local conditions.
- Maintain riparian zones that are two or more trees wide and provide more than 50% cover.
- Encourage best management practices that limit wetland damage, such as off-channel watering, hardened crossings, livestock exclusion (part or all of the year), and providing stream shade.
- Develop opportunities to increase awareness of what defines a wetland, its functions and benefits. This is a fundamental step in creating landowner interest and developing landowner appreciation for wetland conservation.
- Identify or establish various peer-related demonstration projects as opportunities to educate stakeholders.
- Establish an approachable "one-stop shop" or clearinghouse to assist landowners in enrolling in programs that can benefit wetlands and meet landowner goals.

3.3. Water quality

3.3.1. Stream beneficial uses and water quality impairments

The Oregon Water Resources Department (OWRD) has established a list of designated beneficial uses for surface waters, including streams, rivers, ponds, and lakes. Beneficial uses are based on human, fish, and wildlife activities associated with water. This assessment focuses on the designated beneficial uses for flowing water, i.e. streams and rivers. Table 3-8 lists all beneficial uses for streams and rivers within the Umpqua Basin.

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[45] Jeanine Lum of Barnes and Associates, Inc., contributed the wetlands key findings and action recommendations.

Beneficial Uses	
Public domestic water supply	Private domestic water supply
Industrial water supply	Irrigation
Livestock watering	Boating
Aesthetic quality	Anadromous fish passage
Commercial navigation and transportation	Resident fish and aquatic life
Salmonid fish spawning	Salmonid fish rearing
Wildlife and hunting	Fishing
Water contact recreation	Hydroelectric power

Table 3-8: Beneficial uses for surface water in the Umpqua Basin.

The Oregon Department of Environmental Quality (ODEQ) has established water quality standards for the designated beneficial uses. These standards determine the acceptable levels or ranges for water quality parameters, including temperature, dissolved oxygen, and pH. Water quality standards set by ODEQ are reviewed and updated every three years. ODEQ monitors streams and stream reaches throughout Oregon, and streams or reaches that are not within the standards are listed as "water quality impaired."[46] The list of impaired streams is called the "303(d) list," after section 303(d) of the 1972 Clean Water Act. For each stream on the 303(d) list, ODEQ determines the total maximum daily load (TMDL) allowable for each parameter.[47] Streams can be de-listed once TMDL plans are complete, when monitoring shows that the stream is meeting water quality standards, or if evidence suggests that a 303(d) listing was in error.

Table 3-9 shows the South Umpqua River Watershed streams included in the 2002 final 303(d) list that require TMDL plans.[48] This table is not a comprehensive evaluation of all water quality concerns in the South Umpqua River Watershed. There are many streams and stream segments that have not been monitored by ODEQ, or for which additional information is needed to make a listing determination.

To evaluate water quality in the South Umpqua River Watershed, seven water quality parameters are reviewed in this section. These parameters are temperature, pH, dissolved oxygen, nutrients, bacteria, sedimentation and turbidity, and toxics. ODEQ monitoring data was used and evaluated using ODEQ water quality standards or OWEB recommended levels.

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[46] ODEQ can also use data collected by other agencies and organizations to evaluate water quality.

[47] Total maximum daily load plans are limits on pollution developed when streams and other water bodies do not meet water quality standards. TMDL plans consider both human-related and natural pollution sources.

[48] Streams that are water quality limited for habitat modification and flow modification do not require TMDL plans. In the South Umpqua River Watershed, these streams are: Beals Creek (habitat), Canyon Creek (flow) Days Creek (habitat and flow), Oshea Creek (flow), St. John Creek (flow), Shively Creek (habitat), and the South Umpqua River (habitat and flow).

Stream or stream segment	Parameter(s)	Year listed	Stream miles listed	Season
Beals Creek	Aquatic growth			
Canyon Creek	Temperature	2002	0 – 6.2	Sept 15 – May 31
Coffee Creek	Temperature	2002	1.8 – 4.7	Summer
Days Creek	Temperature	2002	0 – 10	Summer
				Sept 15 – May 31
			10 – 13.9	Sept 15 – May 31
East Fork Shively Creek	Temperature	2002	0 – 3.5	Sept 15 – May 31
East Fork Stouts Creek	Temperature	1998	0 – 4.9	Summer
		2002	0 – 4.9	Sept 15 – May 31
Fate Creek	Temperature	1998	0 – 2.5	Summer
		2002	0 – 2.5	Sept 15 – May 31
Lavadoure Creek	Temperature	2002	0 – 2.2	Sept 15 – May 31
				Summer
Shively Creek	Temperature	2002	0 – 5.2	Sept 15 – May 31
South Umpqua River	Temperature	1998	57.7 – 102.2	Summer
		2002	15.9 – 57.7	Sept 15 – May 31
	Fecal coliform	1998	15.9 – 57.7	Summer
				Winter/spring/fall
	Biological criteria	1998	15.9 – 57.7	Not listed
	pH	1998	15.9 – 57.7	Summer
			57.7 – 102.2	Summer
	Aquatic weeds or algae	1998	15.9 – 57.7	Summer
	Chlorine	1998	0 – 51	All year
Stouts Creek	Temperature	1998	0 – 7.9	Summer
West Fork Canyon Creek	Temperature	2002	0 – 8.8	Summer
				Sept 15 – May 31

Table 3-9: ODEQ water quality limited streams in the South Umpqua River Watershed. [49]

3.3.2. Temperature

Importance of stream temperature

Aquatic life is temperature-sensitive and requires water that is within certain temperature ranges. The Umpqua Basin provides important habitat for many cold-water species, including salmonids. When temperature exceeds tolerance levels, cold-water organisms such as salmonids become physically stressed and have difficulty obtaining enough

[49] 303(d) listing information is from the ODEQ website http://www.deq.state.or.us. Select "water quality," "303(d)" list," "review the final 2002 303(d) list," and "search integrated report by waterbody name, parameter, and/or list date."

oxygen.[50] Stressed fish are more susceptible to predation, disease, and competition by temperature tolerant species, which in the case of salmonids might be bass. For all aquatic life, prolonged exposure to temperatures outside tolerance ranges will cause death. Therefore, the beneficial uses affected by temperature are resident fish and aquatic life, and salmonid spawning and rearing.

Temperature limits vary depending upon species and life cycle stage. Salmonids are among the most sensitive fish, and so ODEQ standards have been set based on salmonid temperature tolerance levels. From the time of spawning until fry emerge, 55°F (12.8°C) is the maximum temperature criterion. For all other life stages, the criterion is set at 64°F (17.8°C). Temperatures 77°F (25°C) or higher are considered lethal.

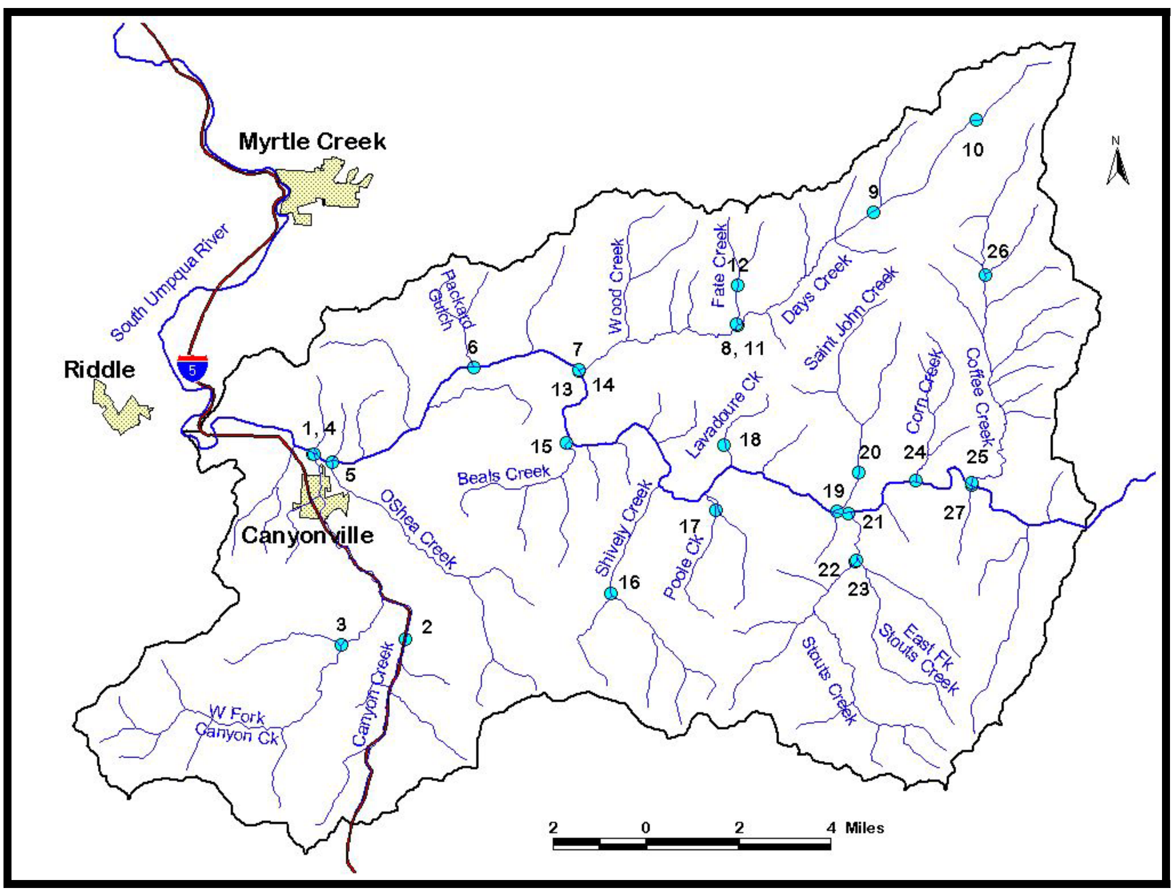
Stream temperature fluctuates by time of year and time of day. In general, water temperature during the winter and most of spring (between November and May) is well below both the 55°F and 64°F standards, and is not an issue. In the summer and fall months, water temperature can exceed the 64°F standard and cause streams to be water quality limited. In the South Umpqua River Watershed, eleven streams are 303(d) listed for temperature at various times of year.

In 1999, the Umpqua Basin Watershed Council (UBWC) undertook a study on stream temperature for the entire South Umpqua sub-basin to determine temperature trends for the South Umpqua River and its tributaries, including streams in the South Umpqua River Watershed (the Smith report).[51] Continuously sampling sensors were placed at 119 locations within the sub-basin, of which 27 were within the South Umpqua River Watershed. Temperature data from June 24, 1999, through September 13, 1999, are reviewed in this assessment. Table 3-10 and Map 3-12 show the locations of the monitoring sites within the watershed.

[50] Cold water holds more oxygen than warm water; as water becomes warmer, the concentration of oxygen decreases.
[51] Copies of this study "South Umpqua Watershed Temperature Study, 1999" by Kent Smith are available at the UBWC office.

Site name	Site #	Site name	Site #
Canyon Ck at mouth	1	S Umpqua below Beals Ck	15
Upper Canyon Ck	2	Upper Shively Ck	16
W Fork Canyon Ck	3	Poole Ck near mouth	17
S Umpqua above Canyon Ck	4	Lavadoure Ck near mouth	18
Oshea Ck at mouth	5	St. John Ck at mouth	19
S Umpqua at Packard Gulch	6	Upper St. John Ck	20
Days Ck at mouth	7	Stouts Ck at mouth	21
Days Ck above Fate Ck	8	Stouts Ck above E Fork	22
Days Ck (upper)	9	E Fork Stouts Ck	23
Upper Days Ck	10	Corn Ck at mouth	24
Fate Ck at mouth	11	Coffee Ck at mouth	25
Upper Fate Ck	12	Upper Coffee Creek	26
S Umpqua above Days ck	13	S Umpqua above Coffee Ck	27
Alcove above Days Ck at mouth	14		

Table 3-10: Temperature monitoring sites name and identification number for the South Umpqua River Watershed.



Map 3-12: Temperature monitoring sites within the South Umpqua River Watershed.

Figure 3-1shows the seven-day moving average maximum temperatures for the South Umpqua River.[52] Appendix 7 has the same data for the watershed's tributaries. Table 3-11 has the number of days and percent of days for which seven-day moving average maximum temperatures exceeded 64°F. Results show that seven-day moving average maximum temperatures in the South Umpqua River were above 64°F each monitoring day. Two Days Creek monitoring sites exceeded the 64°F standard every day of the study. Most sites near stream headwaters, such as Upper Coffee Creek and Poole Creek, were below 64°F every monitoring day.

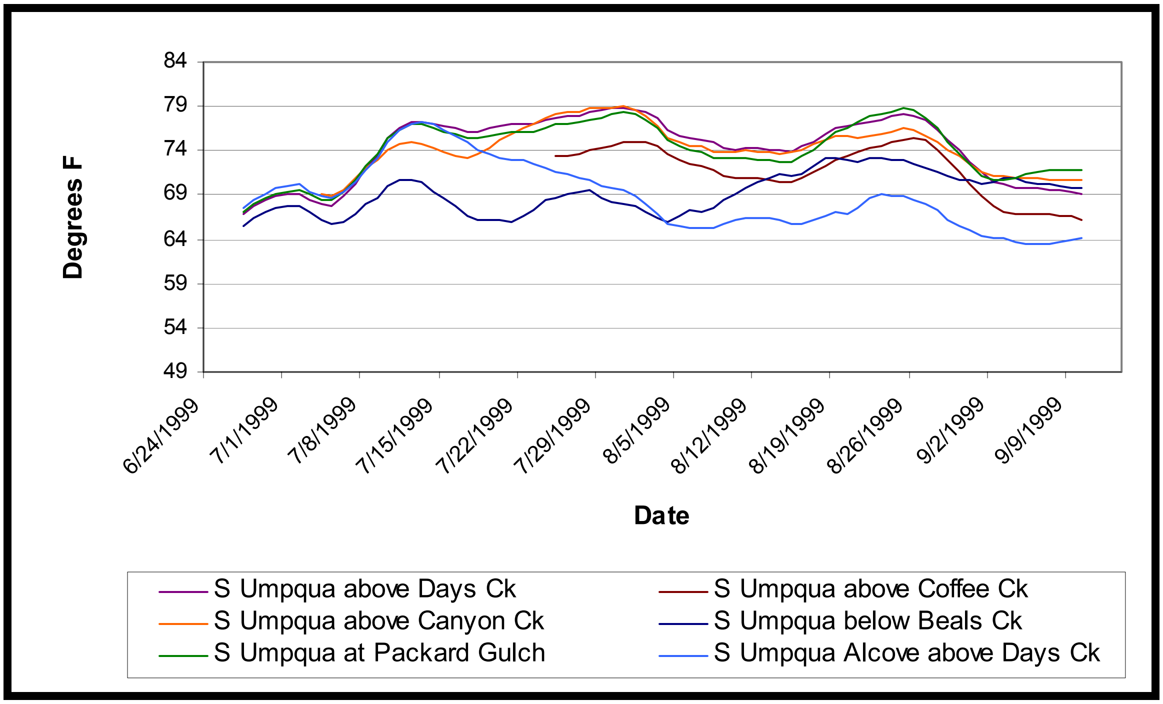


Figure 3-1: Summer temperature trends for the South Umpqua River within the South Umpqua River Watershed.

[52] The seven-day moving average is an average of the maximum temperatures of a given day, the three preceding days, and the three days that follow.

Site name	Site #	# days sampled	# days >64	% days >64
S Umpqua above Coffee Ck	27	48	48	100.0%
S Umpqua above Canyon Ck	4	69	69	100.0%
S Umpqua below Beals Ck	15	76	76	100.0%
S Umpqua at Packard Gulch	6	76	76	100.0%
S Umpqua above Days ck	13	76	76	100.0%
Days Ck at mouth	7	62	62	100.0%
Days Ck above Fate Ck	8	76	76	100.0%
Alcove above Days Ck at mouth	14	76	70	92.1%
Stouts Ck above E Fork	22	79	66	83.5%
Lavadoure Ck near mouth	18	79	66	83.5%
Canyon Ck at mouth	1	70	55	78.6%
Oshea Ck at mouth	5	69	54	78.3%
Stouts Ck at mouth	21	76	55	72.4%
St. John Ck at mouth	19	76	53	69.7%
Coffee Ck at mouth	25	76	53	69.7%
W Fork Canyon Ck	3	79	38	48.1%
Corn Ck at mouth	24	76	36	47.4%
Days Ck (upper)	9	76	15	19.7%
Fate Ck at mouth	11	76	6	7.9%
E Fork Stouts Ck	23	79	2	2.5%
Upper Canyon Ck	2	79	0	0.0%
Upper Shively Ck	16	79	0	0.0%
Poole Ck near mouth	17	79	0	0.0%
Upper St. John Ck	20	79	0	0.0%
Upper Fate Ck	12	79	0	0.0%
Upper Coffee Creek	26	79	0	0.0%
Upper Days Ck	10	79	0	0.0%

Table 3-11: Number of days and percent of days for which seven-day moving average maximum temperatures exceeded 64°F in the South Umpqua River Watershed.

Data suggest that throughout the South Umpqua River sub-basin, tributary streams have the potential to be at cooler temperatures:

> Analysis of the data with respect to the location in the watershed indicated that the tributary streams tended to be [approximately] 10°F cooler than the larger South Umpqua River. Charting the data with respect to the distance from the ridge of each stream indicated that the maximum temperature of the coldest streams tended to increase about 0.58°F per downstream mile. [This] suggests that many of the similarly sized

tributary streams have the potential to be at cooler temperatures (Smith, 2000, p. 1).

Influences on stream temperature

The ultimate source of stream heat is the sun, either by direct solar radiation or by ambient air and ground temperature around the stream, which are also a result of solar energy.[53] Groundwater has the least exposure to solar energy, and therefore is at the coolest temperature (52°F in the Umpqua Basin). Since groundwater accounts for a large proportion of a stream's flow at the headwaters, streamflow is generally coolest at the headwaters. When groundwater enters a stream and become surface water, it is exposed to solar energy and will become warmer until it reaches equilibrium with ambient temperatures and direct solar radiation levels. As solar energy inputs change, such as at night, so do the ambient and stream temperatures.

If solar energy were the only influence on stream warming, it would be expected that stream temperature would increase at a smooth and steady rate until the stream was in equilibrium with solar energy inputs. However, stream temperature at a given location is influenced by two factors: the temperature of the upstream flow and local conditions. As upstream flow reaches a given stream location, factors such as stream morphology and riparian buffer conditions can affect warming rates. For example, the Smith report indicates that when upstream flow enters a reach that is highly exposed to direct solar radiation, the flow in that reach is usually warmer than would be expected from the upstream flow's temperature.

Figure 3-2 shows stream temperature difference on August 28, 1999 (a very warm day), and July 3, 1999 (a very cool day). The lines are stream temperature, and the bars are the stream temperature difference between the warmest and coolest day. Many of the streams with the greatest temperature difference, such as Canyon Creek at the mouth, have little or no shade.

[53] Friction adds a very small amount of heat to streams. Geothermal heat is a minor factor in the Umpqua Basin.

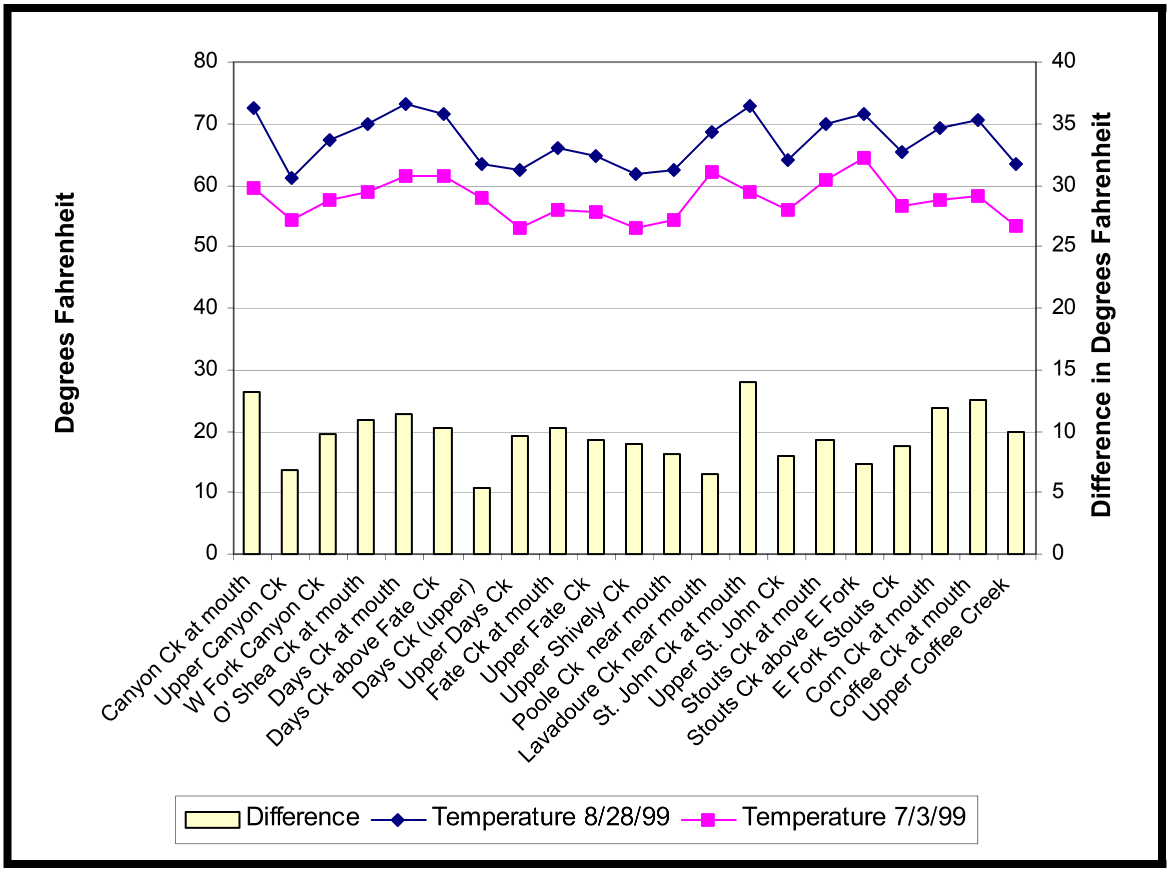


Figure 3-2: Temperature difference for monitoring sites in the South Umpqua River Watershed.

Localized groundwater influx and tributary flow can reduce stream temperatures. When groundwater enters a stream, it mixes with the warmer upstream surface flow until temperature equilibrium is reached. As the proportion of groundwater increases, so will the cooling effect. Groundwater has the greatest influence on small and medium-sized streams. This is partially because groundwater constitutes a greater proportion of small streams' flow. As a result, cooler flow from small tributaries entering larger streams can, like groundwater influx, reduce stream temperature at that location. In some cases, this may also occur when a tributary is practically dry. Evidence from the Smith report suggests that in some cases tributaries with gravel-dominated streambeds permit cooler subsurface water to pass into the mainstem, even when the stream has no surface flow. Smith suggests that the lower reaches and mouths of small and medium-sized tributaries, and reaches within warm streams that have high groundwater influx and shade, may provide important shelter for fish during the summer months.

Management implications

An important implication of Smith's studies is that prevailing stream temperatures on small streams can be strongly influenced by local conditions. Local stream temperature management restoration projects may be very effective in improving stream temperature conditions in many small streams in the Umpqua Basin.[54]

3.3.3. Surface water pH

The hydrogen ion concentration of a liquid, which determines acidity or alkalinity, is expressed using pH. A logarithmic scale that ranges from one to 14 measures pH. On this scale, a pH of seven is neutral, more than seven is alkaline, and less than seven is acidic.

The beneficial uses affected by high or low pH levels are resident fish and aquatic life, and water contact recreation. When pH levels exceed the stream's normal range, water can dissolve the protective mucous layer on aquatic organisms such as fish, amphibians, and mollusks. Without a healthy protective layer, fish and other animals become more susceptible to diseases. Also, pH affects nutrients, toxics, and metals within the stream. Changes in pH can alter the chemical form and affect availability of nutrients and toxic chemicals, which can harm resident aquatic life and be a human health risk. In mining areas, there is the potential for both low pH levels and the presence of heavy metals. This is an issue because metal ions shift to more toxic forms in acidic water, which is a concern for both wildlife and humans.

Physical and biological factors cause surface and groundwater pH to normally be slightly alkaline or acidic. The chemical composition of rocks and rainfall will influence pH. Respiration and photosynthesis are normal metabolic processes of aquatic organisms that change pH. Carbon dioxide (CO_2) is produced during respiration and used for photosynthesis. The level of dissolved CO_2 in a stream raises and lowers pH. Normally, there is a balance between instream metabolic processes and a natural chemical buffering system that prevents streams from becoming too acidic or alkaline from changes in CO_2 levels. However, stream inputs that increase or decrease respiration and photosynthesis by aquatic organisms can indirectly shift pH by changing CO_2 levels. For example, nitrogen and phosphorus from organic matter such as feces and urine, or from inorganic chemicals such as fertilizers, encourage algae growth in the summer and can result in algae "blooms." When a stream's algae population grows, so does the degree to which CO_2 is produced and used. When CO_2 levels in water are high, carbonic acid is produced resulting in pH levels that are harmful to aquatic life.

In an attempt to differentiate between the natural variability of surface water pH and the changes caused by other factors, ODEQ established a range of acceptable pH levels for river basins or for specific bodies of water. In the Umpqua Basin, the acceptable pH range is 6.5 to 8.5. When 10% or more of pH measurements from the same stream are outside of the 6.5 to 8.5 range, the stream is designated water quality limited.

Between July, 1959, and November, 2002, pH was sampled 337 times in the South Umpqua River Watershed. Of these samples, 31 (9.2%) were outside the 6.5 to 8.5 range. Table 3-12 shows the sampling locations, the number of samples taken at each site, and the number and percent of samples exceeding water quality standards. More

[54] From Kent Smith's "Thermal Transition in Small Streams Under Low Flow Conditions" (2002).

than 10% of pH samples exceeded water quality standards at three sites along the South Umpqua River: at the confluence with the Days Creek Cutoff Road (10.4%), 0.25 miles upstream of the Canyonville outfall (33.3%), and below the confluence with Elk Creek (33.3%).[55] All of the South Umpqua River within the watershed is 303(d) listed for pH. Stouts Creek had one out of three samples exceed pH standards, but is not 303(d) listed for pH.

Location within the South Umpqua River Watershed	# of samples	# outside pH standards	%
S. Umpqua at Gazely Road bridge	60	2	3.3%
S. Umpqua at Days Ck	31	1	3.2%
S. Umpqua at Days Ck Cutoff Road	221	23	10.4%
S. Umpqua 0.25 mile upstream of Canyonville outfall	3	1	33.3%
Beals Ck at stream mile 0.6	3	0	-
S. Umpqua 180 ft upstream of Canyonville outfall	1	0	-
S. Umpqua at Canyonville outfall	1	0	-
Canyon Ck 60 ft upstream of mouth	1	1	100.0%
S. Umpqua 100 ft downstream of Canyonville outfall	1	0	-
S. Umpqua 300 ft downstream of Canyonville Outfall	1	0	-
S. Umpqua-Canyonville sewage treatment plant effluent	2	0	-
S. Umpqua-Canyonville wastewater treatment plant	1	0	-
West Fork Canyon Ck 3.5 miles west of I-5	1	0	-
Days Ck at Hwy 227 bridge	2	0	-
Stouts Ck	3	1	33.3%
South Umpqua below Elk Ck	3	2	66.7%
South Umpqua at Stouts Ck Road bridge	1	0	-
East Fork Poole Creek	1	0	-

Table 3-12: South Umpqua River Watershed pH sampling locations and results.

3.3.4. Dissolved oxygen

In the Umpqua Basin, cold-water aquatic organisms are adapted to waters with high amounts of dissolved oxygen. Salmonid eggs and smolts are especially sensitive to dissolved oxygen levels. If levels drop too low for even a short period of time, eggs, smolts, and other aquatic organisms will die. Therefore, the beneficial uses most affected

[55] Data are from ODEQ's Laboratory Analytical Storage and Retrievable (LASAR) database. All ODEQ data are available via the website www.deq.state.or.us. Select "water quality" and "Laboratory Analytical Storage and Retrievable Database – Monitoring Data."

by dissolved oxygen are resident fish and aquatic life, salmonid fish spawning, and salmonid fish rearing.

The amount of oxygen that is dissolved in water will vary depending upon temperature, barometric pressure, flow, and time of day. Cold water dissolves more oxygen than warm water. As barometric pressure increases, so does the amount of oxygen that can dissolve in water. Flowing water has more dissolved oxygen than still water. Aquatic organisms produce oxygen through photosynthesis and use oxygen during respiration. As a result, dissolved oxygen levels tend to be highest in the afternoon when algal photosynthesis is at a peak, and lowest before dawn after organisms have used oxygen for respiration.

Since oxygen content varies depending on many factors, ODEQ has many dissolved oxygen criteria. ODEQ's standards specify oxygen content during different stages of salmonid life cycles and for gravel beds. Standards change based on differences in elevation and stream temperature. During months when salmon are spawning, ODEQ uses 11 mg/l as the dissolved oxygen standard for South Umpqua River. For the rest of the year, the standard is eight mg/l.

Table 3-13 shows dissolved oxygen sampling locations and results from July, 1959, through November, 2002, at 18 sampling sites within the watershed. Nineteen out of 457 samples (4.2%) did not meet water quality standards. Although four sites had more than 10% of samples fail to meet the dissolved oxygen standard, these sites were only sampled once or twice.[56] No streams are 303(d) listed for dissolved oxygen in the South Umpqua River Watershed.

Location within the South Umpqua River Watershed	**# of samples**	**# outside pH standards**	**%**
S. Umpqua at Gazely Road bridge	99	6	6.1%
S. Umpqua at Days Ck	90	0	0.0%
S. Umpqua at Days Ck Cutoff Road	244	8	3.3%
S. Umpqua 0.25 mile upstream of Canyonville outfall	3	0	-
Beals Ck at stream mile 0.6	3	0	-
S. Umpqua 180 ft upstream of Canyonville outfall	1	0	-
S. Umpqua at Canyonville outfall	1	1	100.0%
Canyon Ck 60 ft upstream of mouth	1	0	-
S. Umpqua 100 ft downstream of Canyonville outfall	1	0	-
S. Umpqua 300 ft downstream of Canyonville Outfall	1	0	-
S. Umpqua-Canyonville sewage treatment plant effluent	2	2	100.0%

[56] Data are from ODEQ's Laboratory Analytical Storage and Retrievable (LASAR) database.

Location within the South Umpqua River Watershed	# of samples	# outside pH standards	%
S. Umpqua-Canyonville wastewater treatment plant	1	0	-
West Fork Canyon Ck 3.5 miles west of I-5	1	0	-
Days Ck at Hwy 227 bridge	2	0	-
Stouts Ck	3	0	-
South Umpqua below Elk Ck	2	1	50.0%
South Umpqua at Stouts Ck Road bridge	1	1	100.0%
East Fork Poole Creek	1	0	-

Table 3-13: Dissolved oxygen sampling locations and results for the South Umpqua River Watershed

3.3.5. Nutrients

The beneficial uses affected by nutrients are aesthetics or "uses identified under related parameters."[57] This means that a stream may be considered water quality limited for nutrients if nutrient levels adversely affect related parameters, such as dissolved oxygen, that negatively impact one or more beneficial uses, such as resident fish and aquatic life.

Possible nutrient sources include feces and urine from domestic and wild animals, wastewater treatment plant effluent, failing septic system waste, and fertilizers. As stated in section 3.3.3, high nutrient levels during the summer encourage the growth of algae and aquatic plants. Excessive algal and vegetative growth can result in little or no dissolved oxygen, and interfere with water contact recreation, such as swimming. Also, certain algae types produce by-products that are toxic to humans, wildlife, and livestock, as occurred in Diamond Lake in the summer of 2002.[58]

Currently, there are no Umpqua Basin-based ODEQ values for acceptable stream nutrient levels and no streams that are 303(d) listed for nutrients in the South Umpqua River Watershed. Therefore, this assessment used the OWEB recommended standards for evaluating nutrient levels in the watershed. OWEB recommends using 0.05 mg/l for total phosphorus, and 0.3 mg/l for total nitrate (including nitrites and nitrates).

Table 3-14 shows total nitrate sampling locations and results for monitoring sites within the South Umpqua River Watershed from October, 1976, through November, 2002. Table 3-15 shows the same information for total phosphorus from January, 1977, through November, 2002. Five out of 285 nitrate samples (1.8%) exceeded 0.3 mg/l. Four of 200 phosphorus samples (2.0%) exceeded 0.05 mg/l.[59] These data suggest that nutrients do not limit water quality in the South Umpqua River Watershed.

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[57] From ODEQ's *Oregon's Approved 1998 303(d) Decision Matrix* (1998).
[58] Diamond Lake is within the Umpqua National Forest in the extreme eastern portion of the Umpqua Basin.
[59] Data are from ODEQ's Laboratory Analytical Storage and Retrievable (LASAR) database.

Location within the South Umpqua River Watershed	# of samples	# outside pH standards	%
S. Umpqua at Gazely Road bridge	19	0	-
S. Umpqua at Days Ck Cutoff Road	243	0	-
S. Umpqua 0.25 mile upstream of Canyonville outfall	3	0	-
Beals Ck at stream mile 0.6	3	0	-
S. Umpqua 180 ft upstream of Canyonville outfall	1	0	-
S. Umpqua at Canyonville outfall	1	1	100.0%
Canyon Ck 60 ft upstream of mouth	3	1	33.3%
S. Umpqua 100 ft downstream of Canyonville outfall	1	0	-
S. Umpqua 300 ft downstream of Canyonville Outfall	1	0	-
S. Umpqua-Canyonville sewage treatment plant effluent	2	2	100.0%
S. Umpqua-Canyonville wastewater treatment plant	1	1	100.0%
West Fork Canyon Ck 3.5 miles west of I-5	1	0	-
Days Ck at Hwy 227 bridge	1	0	-
Stouts Ck	1	0	-
South Umpqua below Elk Ck	2	0	-
South Umpqua at Stouts Ck Road bridge	1	0	-
East Fork Poole Creek	1	0	-

Table 3-14: Nitrate/nitrite sampling locations and results for the South Umpqua River Watershed.

Location within the South Umpqua River Watershed	**# of samples**	**# outside pH standards**	**%**
S. Umpqua at Gazely Road bridge	8	0	-
S. Umpqua at Days Ck Cutoff Road	169	1	0.6%
S. Umpqua 0.25 mile upstream of Canyonville outfall	3	0	-
Beals Ck at stream mile 0.6	3	0	-
S. Umpqua 180 ft upstream of Canyonville outfall	1	0	-
S. Umpqua at Canyonville outfall	1	1	100.0%
Canyon Ck 60 ft upstream of mouth	3	0	-
S. Umpqua 100 ft downstream of Canyonville outfall	1	0	-
S. Umpqua 300 ft downstream of Canyonville Outfall	1	0	-
S. Umpqua-Canyonville sewage treatment plant effluent	2	1	50.0%
S. Umpqua-Canyonville wastewater treatment plant	1	1	100.0%
West Fork Canyon Ck 3.5 miles west of I-5	1	0	-
Days Ck at Hwy 227 bridge	1	0	-
Stouts Ck	1	0	-
South Umpqua below Elk Ck	2	0	-
South Umpqua at Stouts Ck Road bridge	1	0	-
East Fork Poole Creek	1	0	-

Table 3-15: Total phosphorus sampling locations and results for the South Umpqua River Watershed.

3.3.6. Bacteria

Bacteria are present in all surface water. In general, resident bacteria are not harmful to the overall aquatic environment or to most human uses. However, ingestion of fecal bacteria such as *Escherichia coli* (*E. coli*) can cause serious illness or death in humans. The presence of fecal bacteria indicates a potential vector for other human diseases, such as cholera and giardiasis ("beaver fever"). Water contact recreation is the beneficial use most affected by bacteria. Private and public drinking water supplies are not affected because water filtration systems are able to remove harmful microorganisms.

There are many possible sources of *E. coli* and other fecal bacteria in water. Common sources include failing septic systems and aquatic warm-blooded animals, such as waterfowl and beaver. Upland areas with concentrated fecal waste, such as stockyards and kennels, are also bacteria sources; during rain events, high levels of bacteria may be washed down into streams.

According to ODEQ, a stream is considered water quality limited for bacteria when one of two events occurs: 1) 10% of two or more samples taken from the same stream have *E. coli* concentrations exceeding 406 bacteria per 100 ml of water; and 2) the average *E. coli* concentration of five samples taken within a 30-day period exceeds 126 bacteria per 100 ml of water.

Figure 3-3 shows the most probable number (MPN) of bacteria taken from monitoring sites within the South Umpqua River Watershed from March through August, 2002. Within the watershed, one out of 16 samples (6.3%) exceeded water quality standards.[60] The South Umpqua River is 303(d) listed for fecal coliform all year from stream mile 15.9 (the confluence with Roberts Creek) to stream mile 57.7 (the confluence with Days Creek). Bacterial monitoring data from outside the South Umpqua River Watershed contributed to the river's 303(d) listing. Additional monitoring is necessary to determine if South Umpqua River Watershed tributaries have water quality limiting bacteria levels.

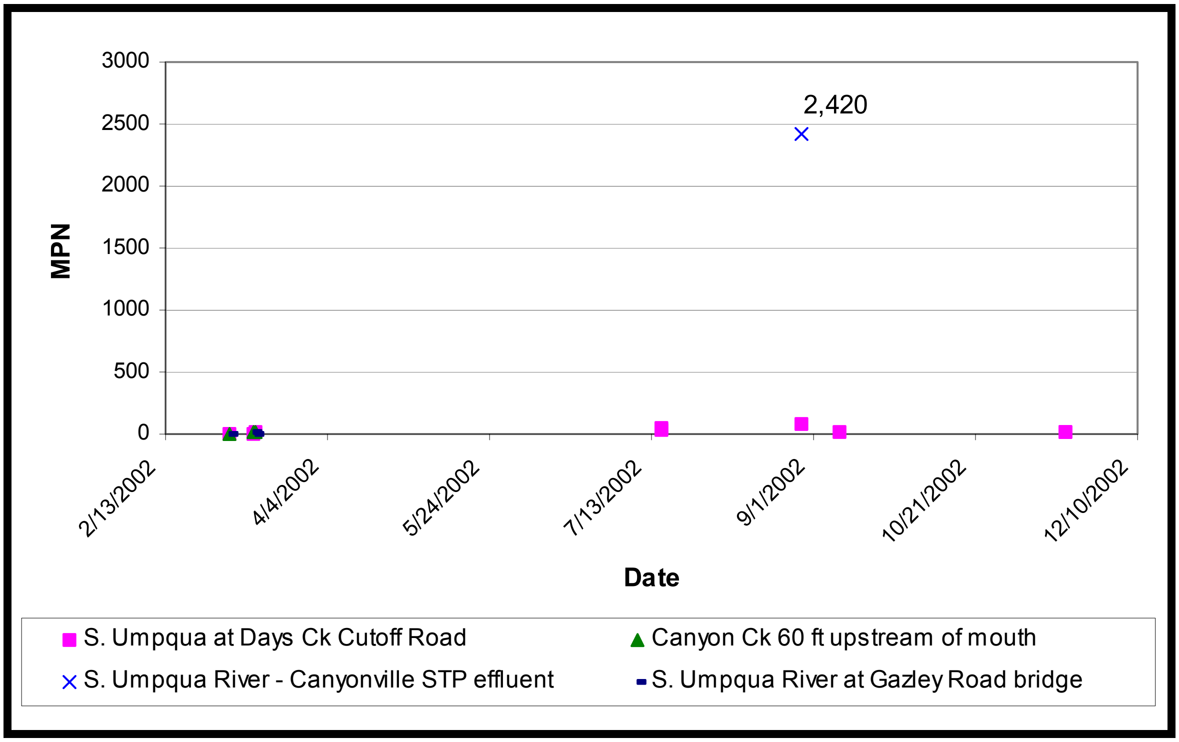

Figure 3-3: Bacteria levels at locations within the South Umpqua River Watershed.

3.3.7. Sedimentation and turbidity

Sediment is any organic or inorganic material that enters the stream and settles to the bottom. When considering water quality, this assessment is specifically referring to very fine particles of organic or inorganic material that have the potential of forming streambed "sludge." The beneficial uses affected by sedimentation are resident fish and aquatic life, and salmonid fish spawning and rearing. Salmonids need gravel beds for

[60] Data are from ODEQ's Laboratory Analytical Storage and Retrievable (LASAR) database.

spawning. Eggs are laid in a gravel-covered nest called a "redd." Water is able to circulate through the gravel, bringing oxygen to the eggs. The sludge layer resulting from stream sedimentation does not allow water circulation through the redd and will suffocate salmonid eggs. Although there are many aquatic organisms that require gravel beds, others, such as the larvae of the Pacific lamprey, thrive in sludgy streams.

Turbidity is closely related to sediment because it is a measurement of water clarity. In many cases, high turbidity indicates a large amount of suspended sediment in a stream. Small particles such as silt and clay will stay suspended in solution for the longest amount of time. Therefore, areas with soils comprised of silt and clay are more likely to be turbid than streams in areas with coarser soil types. Also, turbidity levels can rise during a storm event. This is because rapidly moving water has greater energy than slower water. During storms, upland material is washed into the stream from surface flow, which adds sediment to the system.

The beneficial uses affected by turbidity are resident fish and aquatic life, public and private domestic water supply, and aesthetic quality. As turbidity increases, it becomes more difficult for sight-feeding aquatic organisms to see, impacting their ability to search for food. High levels of suspended sediment can clog water filters and the respiratory structures in fish and other aquatic life. Suspended sediment is a carrier of other pollutants, such as bacteria and toxins, which is a concern for water quality in general. Finally, clear water is simply more pleasant than cloudy water for outdoor recreation and enjoyment.

Sediment is considered to be water quality limiting if beneficial uses are impaired. ODEQ determines impairment by monitoring changes in aquatic communities (especially macroinvertebrates, such as insects), changes in fish populations, or by using information from non-ODEQ documents that use standardized protocols for evaluating aquatic habitat and fish population data. Currently, ODEQ monitors streams for total suspended solids, which indicates sedimentation. At the writing of this assessment, neither ODEQ nor OWEB has established criteria for these data. There are currently no streams in the South Umpqua River Watershed 303(d) listed for sedimentation. More data are needed to determine if sedimentation is a problem in the watershed.

Turbidity is measured by passing a light beam through a water sample. As suspended sediment increases, less light penetrates the water. Turbidity is recorded in NTUs (nephelometric turbidity units), and high NTU values reflect high turbidity. According to ODEQ, turbidity is water quality limiting when NTU levels have increased by more than 10% due to an on-going operation or activity, such as dam releases or irrigation. To date, there are no streams in the South Umpqua River Watershed that are 303(d) listed for turbidity.

OWEB recommends using 50 NTUs as the turbidity evaluation criteria for watershed assessments. At this level, turbidity interferes with sight-feeding aquatic organisms and provides an indication of the biological effect of suspended sediment. One out of 282

(0.4%) South Umpqua River Watershed turbidity samples exceeded 50 NTUs.[61] Additional monitoring is necessary to determine if turbidity levels are of concern in tributaries.

Sediment delivery processes[62]
Erosion is a natural process, but it can become a problem in watersheds when it is accelerated by human activities. An increased amount of erosion that fish are not adapted to can be harmful to their populations by decreasing dissolved oxygen levels, decreasing sunlight penetration leading to degraded plant growth, and filling in spawning gravels. Certain human manipulations of the landscape are common causes of increased erosion. These include the construction of roads and their subsequent modification of fluvial (stream) processes, the removal of vegetation such as timber harvesting, crop and range agriculture, and residential development. Many of these human modifications occur in the South Umpqua River Watershed. With good management, the impact of these practices can be minimized. This section identifies several factors that are important to sediment delivery processes.

Without further field verification and analysis using GIS, a more in-depth and detailed report on sediment processes within the watershed is beyond the scope of this screening-level assessment. This assessment reviews five potential sources of stream sedimentation and turbidity in the watershed: roads and culverts, slope and debris flow potential, soils, urban drainage, and burns.

<u>Roads and culverts</u>
As is the case in many watersheds, sediment delivery from dirt and gravel roads is a leading cause of increased sediment in stream systems. Road sediment production and delivery involves many factors and processes such as road surface type, ditch infeed lengths, proximity to nearest stream channel, condition of road, and level and type of use the road system receives. Since complete road data for the watershed are not available, specific values for sediment delivery from the road system are not included in this assessment. Rather, this assessment looks at the current state of road types, road to stream proximity and slope, and culverts.[63]

Roads can be divided into two types: surfaced and unsurfaced. Surfaced roads are ones that have been paved or rocked. Unsurfaced roads are dirt roads. Unsurfaced roads are much more likely to erode and fail than surfaced roads. There are 1,022.0 miles of roads in the South Umpqua River Watershed. These are broken into nine classes (see Table 3-16).

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[61] Data are from ODEQ's Laboratory Analytical Storage and Retrievable (LASAR) database.
[62] Kristin Anderson and John Runyon of BioSystems, Inc., contributed the introductory text for this section.
[63] Tim Grubert and John Runyon of BioSystems, Inc., contributed this paragraph.

Surface type	Road miles	% total
Surfaced		
• Federal roads (paved)	27.2	2.7%
• State roads (paved)	0.0	-
• County/other (paved)	59.7	5.8%
• Major gravel	394.6	38.6%
• Minor gravel or spur	174.0	17.0%
Total surfaced	**655.5**	**64.1%**
Unsurfaced		
• Major dirt road	211.9	20.7%
• Minor dirt road	99.1	9.7%
Total unsurfaced	**311.0**	**30.4%**
Other		
• Unknown	9.1	0.9%
• Closed	46.4	4.5%
Total other	**55.5**	**5.4%**

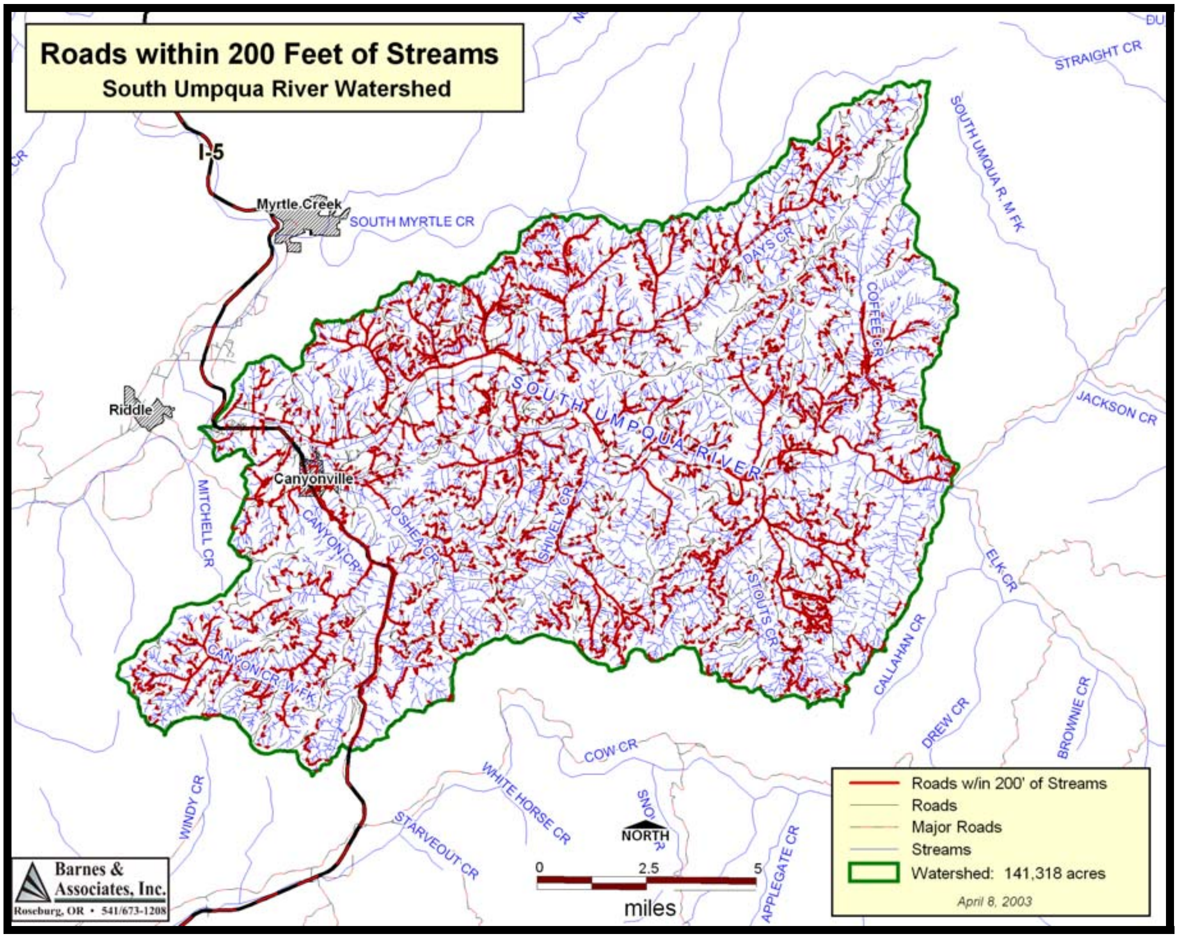
Table 3-16: Miles and percent of South Umpqua River Watershed roads by class.

The closer a road is to a stream, the greater the likelihood that road-related runoff contributes to sedimentation. In the South Umpqua River Watershed, there are 445.9 miles of roads (43.6% of 1,022.0 total miles) within 200 feet of streams (see Map 3-13). Of these, 292.1 miles (65.5%) are surfaced roads, 128.5 miles (28.8%) are unsurfaced roads, and 25.4 miles (5.7%) are unknown or closed.

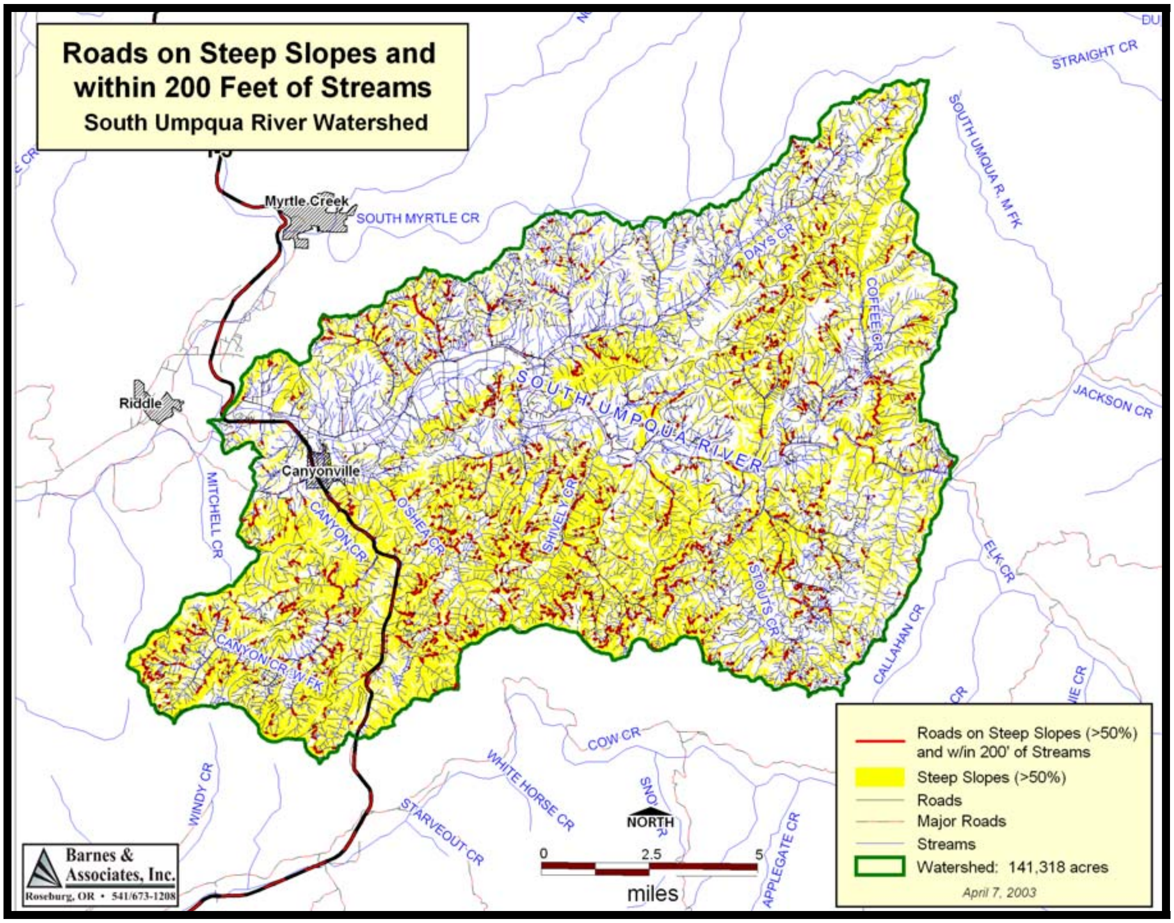
Roads on steep slopes have a greater potential for erosion and/or failure than roads on level ground. There are approximately 78.8 miles of roads (7.7% of 1,022.0 total miles) located on a 50% or greater slope and within 200 feet of a stream (see Map 3-14). Of these roads on steep slopes, 52.9 miles (67.1%) are surfaced, 22.1 miles (28.0%) are unsurfaced, and 3.8 miles (4.8%) are unknown or closed. An analysis of road conditions near streams is necessary to determine how much stream sedimentation is attributable to road conditions.

Like roads, culverts can contribute to stream sedimentation when they are failing. Culverts often fail when the pipe is too narrow to accommodate high streamflows, or when the pipe is placed too high or too low in relation to the stream surface. In the latter cases, the amount of flow overwhelms the culvert's drainage capacity, and water floods around and over the culvert, eroding the culvert fill, road, and streambank. At this time, it is unknown how many crossing are culverts and how many culverts are failing.[64]

[64] See section 3.1.2 for a discussion of current culvert identification and restoration efforts in the Umpqua Basin.



Map 3-13: South Umpqua River Watershed roads within 200 feet of a stream.



Map 3-14: South Umpqua River Watershed roads within 200 feet of a stream and on slopes greater than 50%.

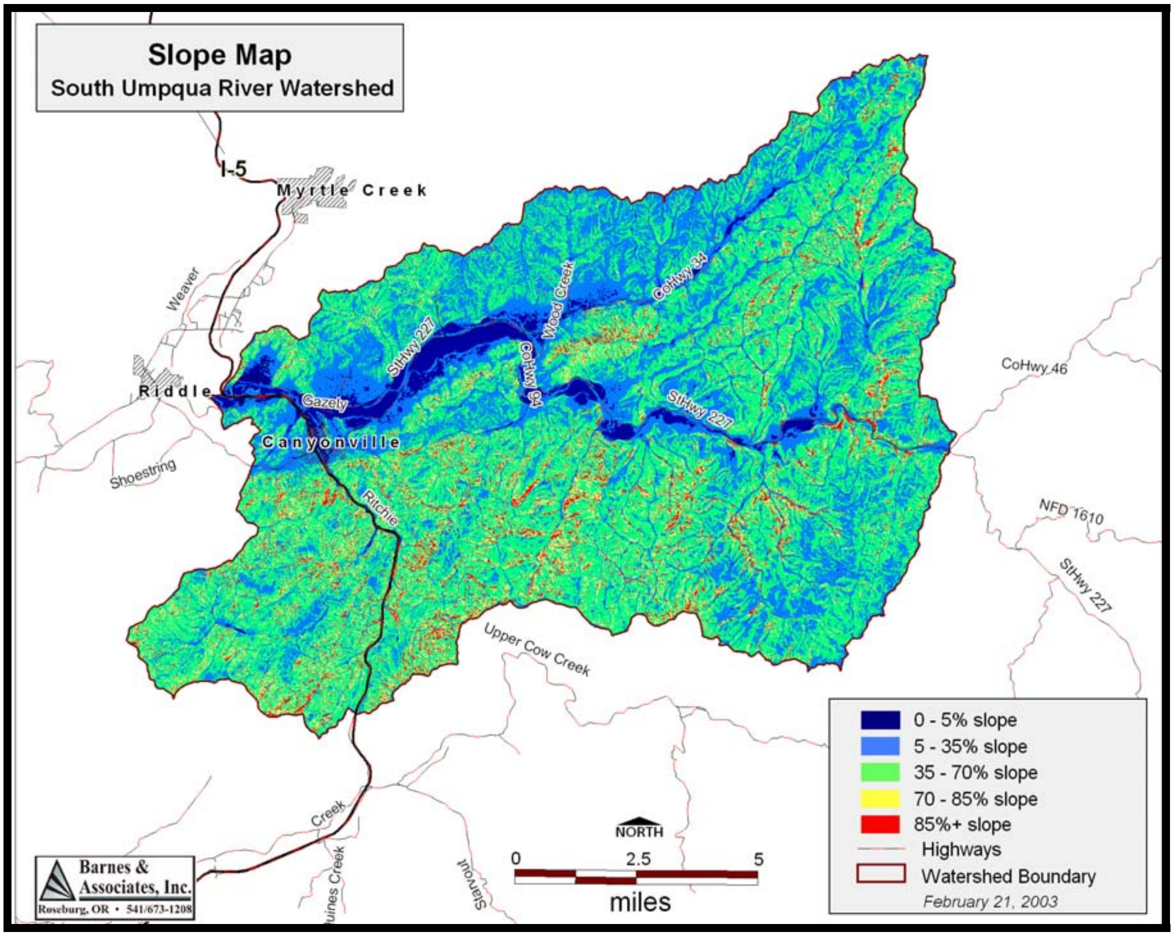
Slope and debris flow potential[65]

Steep slopes provide greater energy to runoff and therefore have more power to deliver sediment to streams. Slope is an important consideration to sediment delivery, both in long-term erosion processes and in catastrophic events. Map 3-15 shows the slope throughout the watershed. Relatively steep slopes can be seen throughout the watershed with a generally southwest-northeast orientation. The southern portion of the watershed has consistently steeper sloped areas and fewer floodplains.

The slope of land will clearly influence the hazards for catastrophic slope failure and mass sediment delivery downslope. Physical characteristics of geologic units have also been shown to influence the occurrence of debris flows (e.g., Graham, 1985, and Lane, 1987). The Oregon Department of Forestry (ODF, 2000) identified areas that may naturally be prone to debris flows. Using slope steepness, geologic units, stream channel confinement, geomorphology, and historical information on debris flows, they created coarse scale maps of moderate, high, and extreme natural debris flow hazards. While this

[65] Kristin Anderson and John Runyon of BioSystems, Inc., contributed this section's text.

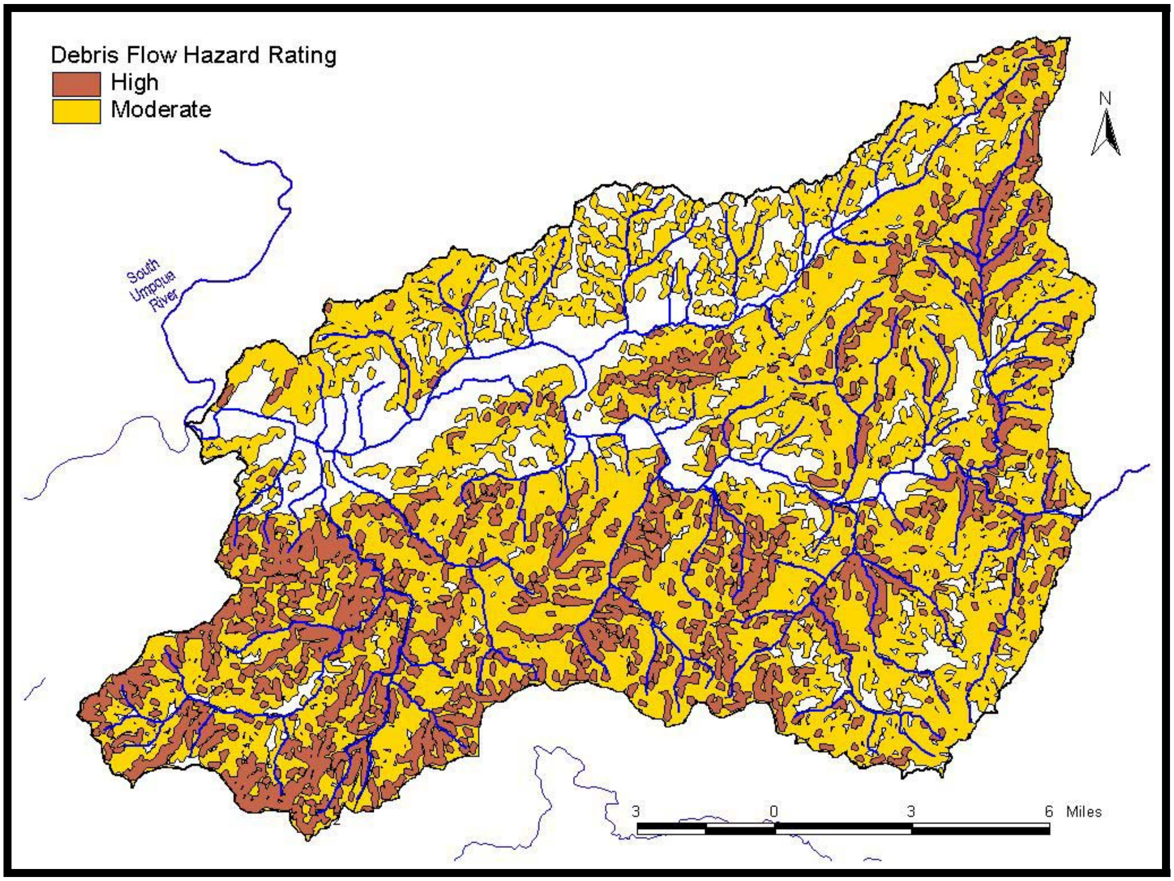
information is not intended for localized management decisions, it is a tool to locate areas where further field investigations may be pertinent when determining management plans.



Map 3-15: Percent slope for the South Umpqua River Watershed.

Natural debris flow hazards as determined by ODF in the South Umpqua River Watershed are shown in Map 3-16. This ODF study will very soon be superceded by a much more refined debris hazard mapping effort. For purposes of planning and localized hazard identification, this forthcoming study will be much more valuable. Information regarding this new data will be available at Nature of the Northwest in Portland, Oregon. Mass wasting, or the downslope movement of materials, causes significant and sometimes catastrophic sediment delivery to streams. An original, updated mapping study of landslide areas using aerial photos would provide valuable information about past and potential landslides in the watershed.[66]

[66] Information on upcoming data and landslide mapping provided by R. J. Hofmeister (Oregon Department of Geology and Mineral Industries, verbal communication, 2003).



Map 3-16: Natural debris flow hazard areas in the South Umpqua River Watershed as outlined in a coarse scale study by ODF.

Soils[67]

Certain characteristics of soils within a watershed play an important role in erosion and storm runoff, both of which impact watersheds. Rapid runoff from rain events can cause pulses of concentrated pollutants and sediment throughout stream systems, ultimately impacting fish populations and the overall health and function of stream systems. Both erosion potential and hydrologic soils grouping are qualities of soils that can give some indication of areas prone to experiencing hydrologic processes that may negatively impact stream characteristics. Information in this section has been summarized from the following documents: *Oregon Watershed Assessment Manual* (Watershed Professional Network, 1999); *Soil Resource Inventory* (Umpqua National Forest, 1976); and *Technical Release 55* (USDA, 1986).

K Factor and surface erosion potential

The K factor, or soil erodibility, is a measure of detachability of the soil, infiltration, runoff, and the transportability of sediment that has been eroded from the soil. Texture (the relative percentage of different grain sizes within the soil), organic matter, structure,

[67] Kristin Anderson and John Runyon of BioSystems, Inc., contributed the text, tables, and maps for this section.

and permeability of the soil determine the K factor value assigned to a soil. In general, soils with high infiltration rates (and thus low runoff rates), low detachability, and low transportability are least likely to erode, and are given low K factor values (USDA Agriculture Research Service National Sedimentation Laboratory, 2003). K factor values typically range from zero to 0.6 (Pacific Northwest National Laboratory, 2003). K factor values for soils are determined in the Natural Resources Conservation Service's soil survey process.

Within the South Umpqua River Watershed, a portion of the area lies within the Umpqua National Forest (UNF), and the UNF does its own soil survey work. Like the K factor variable used by the NRCS, the surface erosion potential is a measure of the potential for erosion based upon characteristics of the soil. The surface erosion potential rating indicates the potential annual soil losses to streams as a result of surface erosion. Estimates are based on the percent of gravel and rock cover, horizon depth textures, permeability, detachability, slope steepness, and maximum precipitation intensity in the area. The ratings are shown in Table 3-17.

Surface erosion potential rating	Maximum potential surface erosion (tons/acre/year)
Low	0-10
Moderate	10.1-25
High	25.1-40

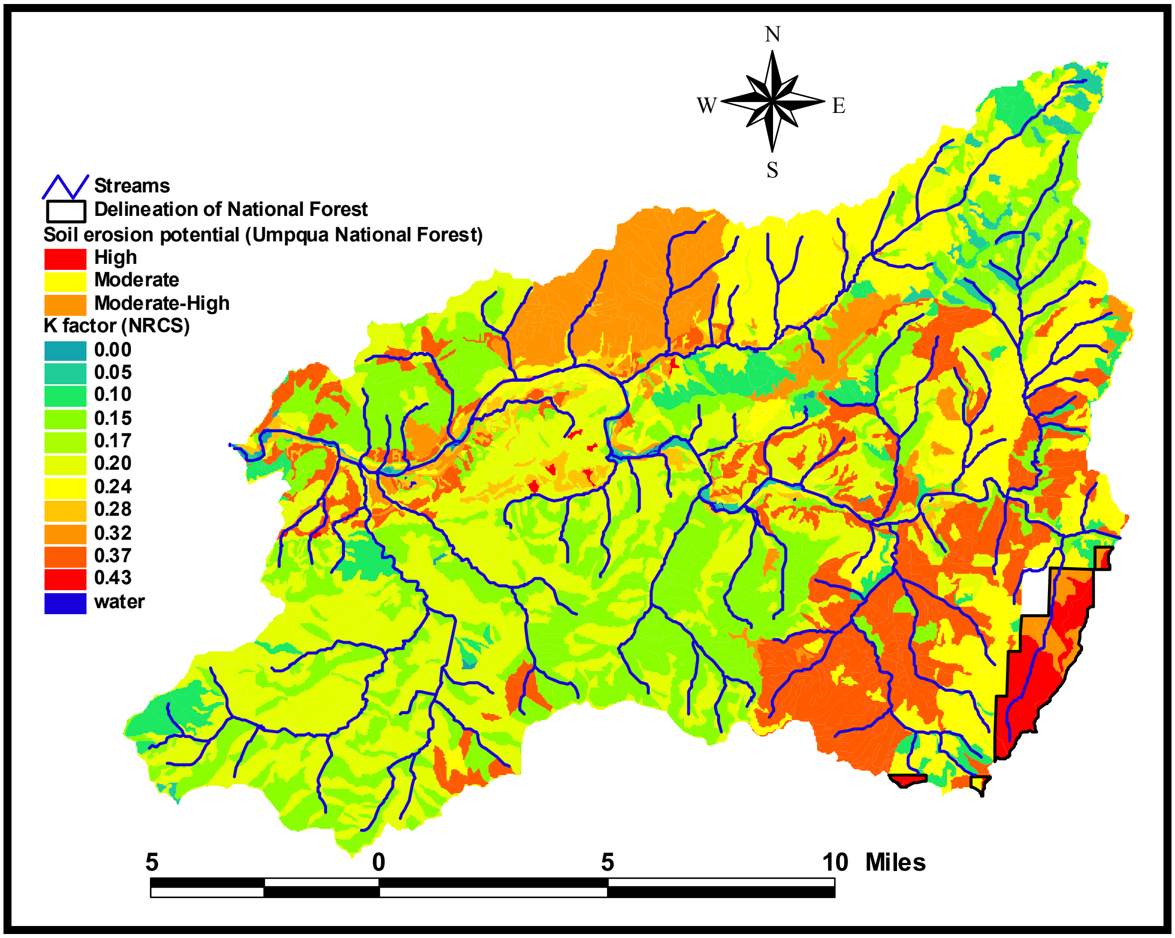
Table 3-17: Soil erosion potential ratings as assigned by the Umpqua National Forest.[68]

Map 3-17 depicts the K factor adjusted for the effect of rock fragments of the surface layer of soil (NRCS) and soil erosion potential (UNF) within the South Umpqua River Watershed. A large portion of the watershed has moderate to high erosion potential, with particularly erosive areas located in the northwestern and southeastern portions of the watershed. Much of the highly erodible soils area exists where the deeply weathered intrusive granite lies. Like many features related to geology within the watershed, areas of high and moderate to high soil erodibility appear to be oriented in a generally southwest-northeast fashion (see section 1.2.4 and Appendix 1 for more geologic information).

As can be seen in Map 3-17, an apparent discrepancy in data from the NRCS and the UNF exists. Since soil erosion potential and K factor are not the exact same measure, they cannot be compared directly. Also, it is not uncommon for field measurements to vary with the procedures of those persons or agencies collecting the data. Thus, the measurements can be best used as a relative scale. Additionally, a small gap exists between data of the NRCS and the UNF. Because information was collected prior to some of the spatial technology we now have, coordination of boundary lines between the two agencies was more difficult, and this is one likely reason for the gap. Alternatively,

[68] From the Umpqua National Forest's Soil Resource Inventory (1976).

the gap may be in an area at the edge of the UNF that is a private land holding. These private holdings were not part of the soil study.[69]



Map 3-17: Soil erosion potential and K factor for the South Umpqua River Watershed.

Hydrologic Soils

Hydrologic soil groupings (HSG) are a categorization of soils by their runoff potential and infiltration capacity. In these groupings, group A represents soils with the lowest runoff potential and the highest infiltration rate, while group D is on the opposite end of the spectrum, having high runoff potential and a low infiltration rate. The runoff potential and infiltration rate of soils influence runoff from precipitation. With greater amounts of runoff, more erosion and higher peak flows are likely to occur, with the possibility of large pulses of sediment to streams.

Table 3-18 provides descriptions of the hydrologic soil groups. Map 3-18 shows the distribution of hydrologic soils in the South Umpqua River Watershed. Within the UNF, the same hydrologic soil groupings were used as in the NRCS classification. However, a

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[69] Explanations given by Steve Campbell (NRCS, verbal communication, 2003) and Don Morrison (Umpqua National Forest, verbal communication, 2003).

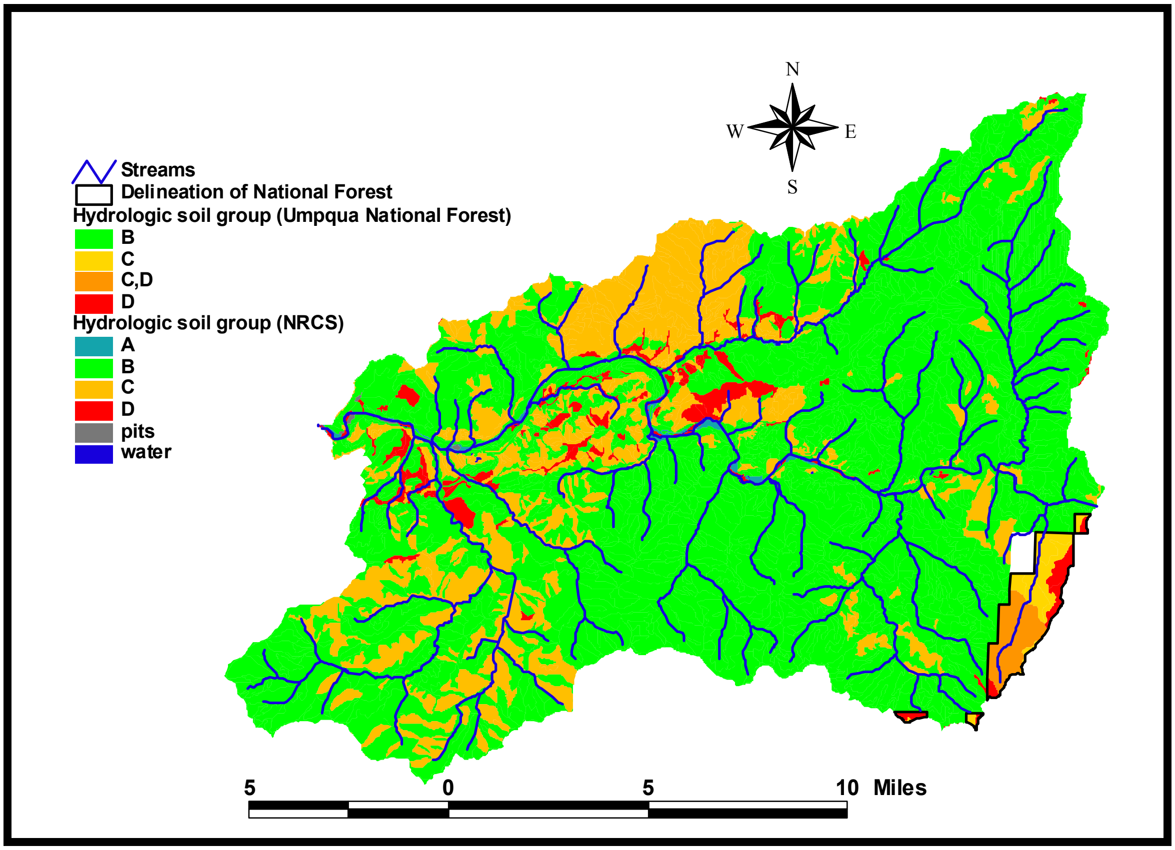
discrepancy between measurements by the NRCS and the UNF seems apparent; the data from each source are best interpreted relative to other data within each source's area.

The majority of the South Umpqua River Watershed has soils in the B hydrologic soils group (see Map 3-18), which has moderate infiltration rates. Soils with lower infiltration rates and higher runoff potential are found in the western half of the watershed and the southeastern-most reach of the watershed. These areas may be more prone to delivering sediment and faster runoff than other areas.

HSG	Soil Description
A	Have low runoff potential and high infiltration rates even when thoroughly wetted; consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (greater than 0.30 in/hr).
B	Have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures; have a moderate rate of water transmission (0.15-0.30 in/hr).
C	Have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture; have a low rate of water transmission (0.05-0.15 in/hr).
D	Have high runoff potential; have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material; have a very low rate of water transmission (0-0.05 in/hr).

Table 3-18: Hydrologic soil group descriptions.[70]

[70] From USDA Technical Release 55 (1986).



Map 3-18: Hydrologic soils map of the South Umpqua River Watershed.

Urban drainage

In cities and towns, sediment enters streams from storm water systems. Urban development results in high amounts of impervious surfaces concentrated in a small area.[71] As a result, rainfall is no longer absorbed by the soil or stored in wetlands, leading to heightened peak streamflows and shortened lag times (time from rainfall to peak streamflow) following rain events. To prevent flooding, cities have extensive storm water systems that convey runoff from streets and other paved areas to nearby rivers, streams, and/or lakes.

> Different types of land within an urban setting produce different amounts of sediment. Residential neighborhoods produce the least amount of sediment per square mile. Commercial areas produce moderate loads of sediment, and heavy industrial areas produce even higher amounts. The highest amounts occur in areas that are actively being developed. Earth disturbances and bared surfaces usually make sediment production the highest within a town, albeit the sediment production usually decreases once the construction is complete (Oregon Watershed Assessment Manual, p. VI-27).

[71] Impervious surfaces are ones that do not permit water infiltration, such as roads, roofs, and compacted soil.

Table 3-19 shows the dominant land use and estimated percent of total impervious surfaces for 10 cities in the central Umpqua Basin. “Residential” is the dominant land use for all cities except the City of Canyonville, which is mostly urban. Approximately 35% of the City of Canyonville is impervious. More research is needed to determine the degree to which Canyonville and other cities contribute to stream sediment.

Urban Growth Boundary	% commercial, industrial or residential area	Dominant type of land use	Estimate of % total impervious area
Canyonville	78%	Urban	35%
Drain	76%	Residential	36%
Glendale	90%	Residential	27%
Myrtle Creek	74%	Residential	34%
Oakland	88%	Residential	38%
Riddle	67%	Residential	21%
Roseburg	75%	Residential	42%
Sutherlin	76%	Residential	38%
Winston	39%	Residential	18%
Yoncalla	93%	Residential	48%

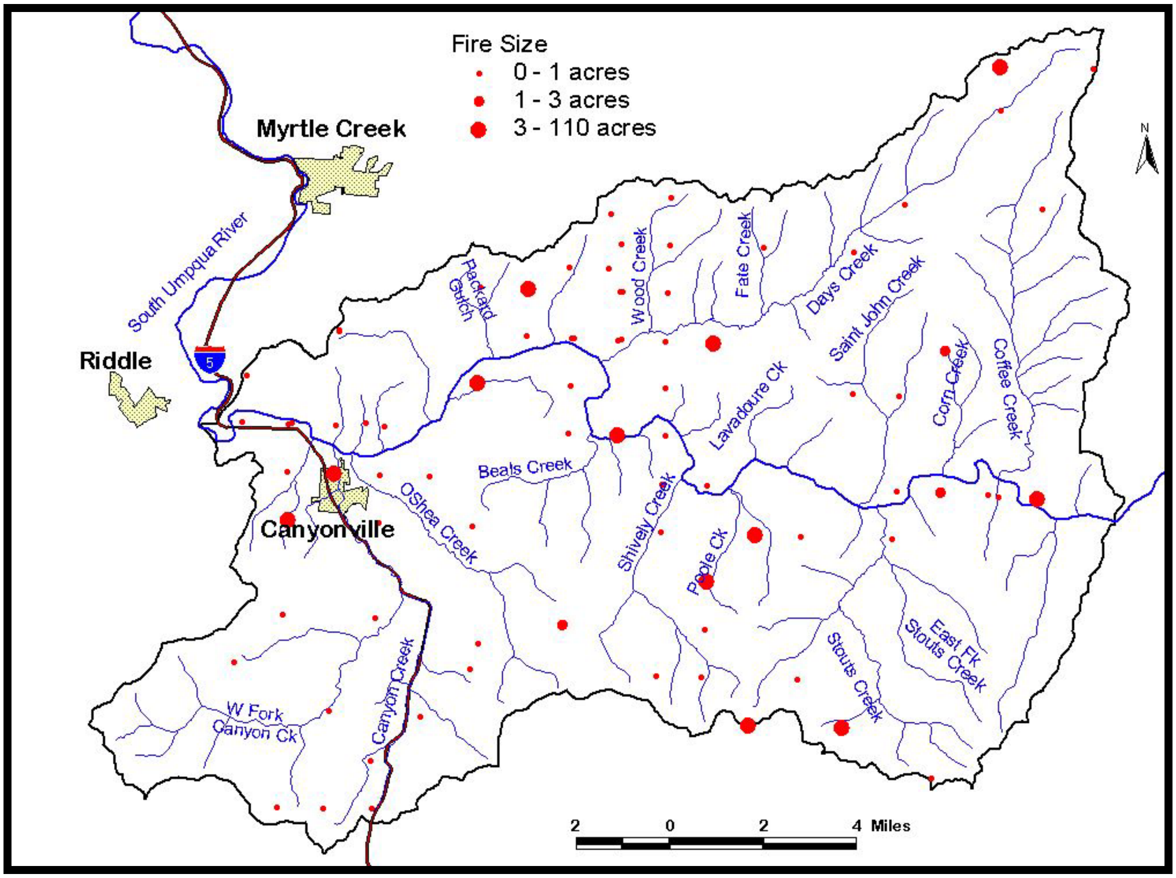
Table 3-19: Dominant land use and estimated percent impervious area for seven cities in the central Umpqua Basin.[72]

Burns

Burned areas erode more easily than unburned areas because of the lack of vegetative cover and abundance of fine material, such as ash. Map 3-19 and Figure 3-4 show wildfire location, size, and acres burned per year for non-permitted (accidental) fires in the South Umpqua River Watershed from 1991 through 2001.[73] UBWC staff members were unable to locate quantitative data on burn/stream proximity and therefore the potential for stream sedimentation from burns cannot be evaluated.

[72] Barnes and Associates, Inc., provided the data in Table 3-19.

[73] Data are from the Douglas Forest Protective Association (DFPA).



Map 3-19: Wildfire location and size in the South Umpqua River Watershed.

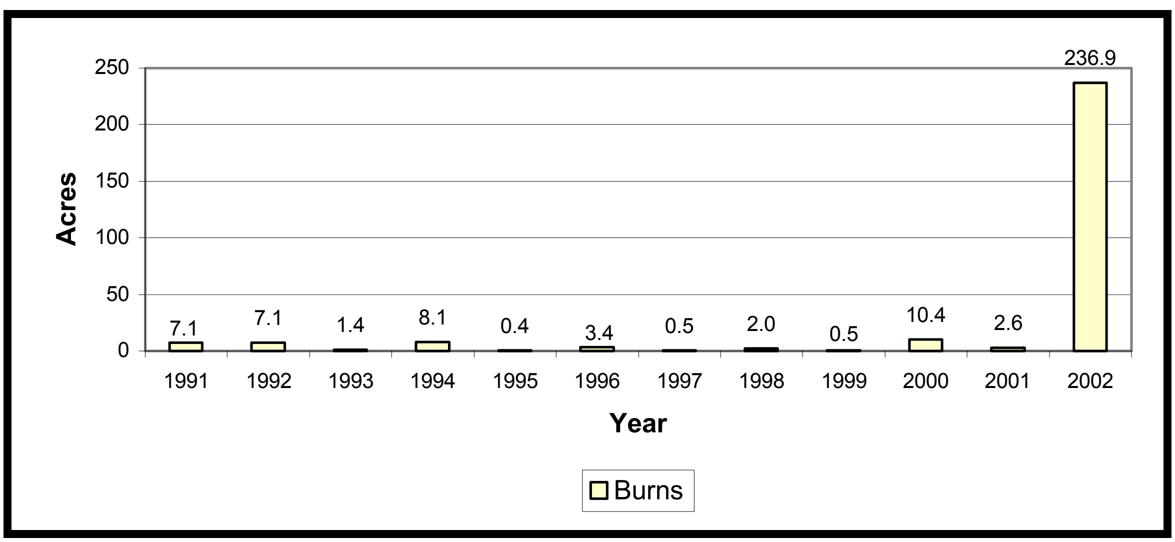


Figure 3-4: Acres burned by year for the South Umpqua River Watershed.

3.3.8. Toxics

Toxics are a concern for residential fish and aquatic life and for drinking water. A variety of substances can be toxic, including metals, organic chemicals, and inorganic chemicals. Toxics are not defined by substance type, but rather by their effects on humans, fish, wildlife, and the environment. According to ODEQ:

> Toxic substances shall not be introduced above natural background levels in the waters of the state in amounts, concentrations, or combinations [that] may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare, [or are detrimental to] aquatic life, wildlife, or other designated beneficial uses (p. 22).[74]

The South Umpqua River from the mouth to Canyonville is 303(d) listed for chlorine. Ammonia is a potential concern.[75] A general description of these toxics and ODEQ's water quality monitoring findings are provided below.

Chlorine

In 1998, the South Umpqua River was listed for chlorine. According to ODEQ, TMDL plan development for the river showed chlorine toxicity associated with major discharges from Canyonville to the mouth of the river. The beneficial uses affected by this toxicity are resident fish and aquatic life, anadromous fish passage, and drinking water. The Hach Corporation, which develops products for testing water quality, also provides educational information about various chemicals. Below is a description of chlorine from the Hach Corporation website (http://www.hach.com):[76]

> Chlorine is a greenish-yellow gas that dissolves easily in water. It has a pungent, noxious odor that some people can smell at concentrations above 0.3 parts per million. Because chlorine is an excellent disinfectant, it is commonly added to most drinking water supplies in the US…Chlorine is also used as a disinfectant in wastewater treatment plants and swimming pools. It is widely used as a bleaching agent in textile factories and paper mills, and it's an important ingredient in many laundry bleaches.

As shown in Table 3-20, chlorine is toxic to fish and aquatic life in very small concentrations. Chlorine becomes more toxic in low pH levels and in combination with other toxics, such as cyanide and ammonia.

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[74] From ODEQ's *Oregon's Approved 1998 303(d) Decision Matrix* (1998).

[75] Toxics listing criteria and data are from the ODEQ website http://www.deq.state.or.us. Select "water quality," "303(d)" list," "review the final 2002 303(d) list," and "search integrated report by waterbody name, parameter, and/or list date."

[76] Select "visit H2OU," and then "educator resources," and "important water quality factors."

Amount of total chlorine (mg/l)	Effects on fish and aquatic life
0.006	Kills trout fry in two days.
0.01	Recommended maximum for all fish and aquatic life.
0.01	Kills chinook salmon and coho salmon.
0.01-0.05	Oysters have difficulty pumping water through their bodies.
0.02	Maximum brook and brown trout can withstand.
0.05	Maximum amount that can be tolerated by young Pacific salmon in the ocean.
0.1	Kills most marine plankton.
0.25	Only the hardiest fish can survive.
0.37	Maximum fish can tolerate.
1.0	Kills oysters.

Table 3-20: Effects of chlorine on fish and aquatic life.[77]

Ammonia
ODEQ TMDL plan development showed possible ammonia toxicity in the South Umpqua River from the mouth to Canyonville. Ammonia can come from numerous sources. In nature, ammonia is formed by the action of bacteria on proteins and urea. The Kentucky Department of Natural Resources' River Assessment Monitoring Project summarizes ammonia sources and environmental impacts:

> About three-fourths of the ammonia produced in the United States is used in fertilizers either as the compound itself or as ammonium salts such as sulfate and nitrate. Large quantities of ammonia are used in the production of nitric acid, urea, and nitrogen compounds. It is used in the production of ice and in refrigerating plants. "Household ammonia" is an aqueous solution of ammonia. It is used to remove carbonate from hard water. Since ammonia is a decomposition product from urea and protein, it is found in domestic wastewater. Aquatic life and fish also contribute to ammonia levels in a stream.
>
> NH_3 is the principal form of toxic ammonia. It has been reported toxic to fresh water organisms at concentrations ranging from 0.53 to 22.8 mg/l. Plants are more tolerant of ammonia than animals, and invertebrates are more tolerant than fish. Hatching and growth rates of fishes may be affected. In the structural development, changes in tissues of gills, liver, and kidneys may also occur.[78]

[77] From the Hach Corporation website http://www.hach.com.
[78] From the website http://water.nr.state.ky.us/ww/ramp/default.htm. Select "what we are testing for" and "ammonia."

Like nitrates, ammonia may result in excessive plant growth, which in turn depletes oxygen levels. The danger ammonia poses for fish depends on the water temperature and pH along with the dissolved oxygen and carbon dioxide levels. In general, ammonia becomes more toxic as pH increases or water becomes warmer.

3.3.9. Water quality key findings and action recommendations

Temperature key findings

- Results show that seven-day moving average maximum temperatures in the South Umpqua River were frequently above 64°F. Days Creek is the only tributary that had seven-day moving average maximum temperatures exceed 64°F every day. Consistently high stream temperatures would limit salmonid rearing in these reaches.
- Most monitoring sites located in the upper reaches of tributaries had seven-day moving average maximum temperature below 64°F every monitoring day.
- Warmer sites often lack shade. Increasing shade on small and medium-sized streams will reduce stream warming rates and improve habitat for salmonids.
- Groundwater and tributary flows can contribute to stream cooling. Gravel-dominated tributaries may permit cooler subsurface flows when surface flows are low.
- Fish may find shelter from high summer temperatures in the lower reaches and mouths of small and medium-sized tributaries and in reaches within warm streams that have proportionately high groundwater influx and shade.

Surface water pH, dissolved oxygen, nutrients, bacteria, and toxics key findings

- Temperature and the levels of pH, nutrients, and dissolved oxygen are interrelated. In the South Umpqua River, pH levels violate water quality standards. Nutrient and dissolved oxygen levels do not appear to limit water quality in the South Umpqua River Watershed.
- Bacteria sampling within the South Umpqua River Watershed does not consistently exceed water quality standards. Monitoring data from outside the South Umpqua River Watershed contributes to the river's 303(d) listing. Additional monitoring is necessary to determine if South Umpqua River Watershed tributaries have water quality-limiting bacteria levels.
- Chlorine levels exceed water quality standards in the South Umpqua River; ammonia levels are a potential concern.

Sedimentation and turbidity key findings

- Turbidity data indicate that usual turbidity levels in the South Umpqua River Watershed should not affect sight-feeding fish like salmonids.
- Areas of moderate to high soil erodibility and runoff potential lie in large areas in the northwest and southeast parts of the South Umpqua River Watershed where deeply weathered granite rocks are located.
- Steep to moderately steep slopes are found through the watershed. Particularly high slopes exist in the south and southwest portions of the watershed.
- The combination of steep slope along with poorly managed, erosion-inducing human modifications such as roads, timber harvesting, agriculture, and residential development can make areas prone to greatly increased erosion.

- Runoff from impervious surfaces, including roads and roofs, can increase sediment loads to streams.
- In the Umpqua Basin, more studies are needed to determine the impacts of roads, culverts, landslides, burns, soil type, and urban conditions on sedimentation and turbidity.

Water quality action recommendations

- Continue monitoring the South Umpqua River Watershed for all water quality conditions. Expand monitoring efforts to include small tributaries.
- Identify stream reaches that may serve as "oases" for fish during the summer months, such as at the mouth of small or medium-sized tributaries. Protect or enhance these streams' riparian buffers and, when appropriate, improve instream conditions by placing logs and boulders within the active stream channel to create pools and collect gravel.
- In very warm streams or where pH is a problem, increase shade by encouraging wide riparian buffers and managing for full canopies.
- Encourage landowner practices that will maintain the South Umpqua River Watershed's low bacteria and nutrient levels:
    - Limit livestock stream access by providing stock water systems and shade trees outside of the stream channel and riparian zones. Fence riparian areas as appropriate.
    - Relocate structures and situations that concentrate domestic animals near streams, such as barns, feedlots, and kennels. Where these structures cannot be relocated, establish dense and wide riparian vegetation zones to filter fecal material.
    - Repair failing septic tanks and drain fields.
    - Use wastewater treatment plant effluent for irrigation.
    - Reduce chemical nutrient sources.
- Where data show that stream sediment or turbidity levels exceed established water quality standards, identify sediment sources such as urban runoff, failing culverts or roads, landside debris, construction, or burns. Take action to remedy the problem or seek assistance through organizations such as the UBWC, the Douglas Soil and Water Conservation District, and the Natural Resources Conservation Service.
- Use the refined debris flow hazard data (soon available at Nature of the Northwest in Portland) to identify landslide-sensitive areas.
- In areas with high debris flow hazards and/or with soils that have high K factor values and are in the C or D hydrologic group (primarily the western half of watershed), encourage landowners to identify the specific soil types on their properties and include soils information in their land management plans.
- Use proper management practices, such as controlling road runoff from improper drainage, to control erosion in sensitive areas of the watershed.
- Cooperate with ODEQ as necessary to document and reduce contamination by chlorine and ammonia.

3.4. *Water quantity*

3.4.1. Water availability[79]

Data from the Oregon Water Resources Department (OWRD) has been used to determine water availability in the South Umpqua River Watershed. Availability is based on streamflow, consumptive use, and instream water rights. The amount of water available for issuance of new water rights is determined by subtracting consumptive use and the instream water rights from streamflow. In most of the Umpqua Basin, including the South Umpqua River Watershed, there is no water available for new water rights from "natural" streamflow during the summer.[80]

To analyze water availability, OWRD has divided the Umpqua Basin into water availability units, or WABs. The South Umpqua River Watershed consists of five WABs: Days Creek (#303), Coffee Creek (#297), Oshea Creek (#338), Canyon Creek (#294), and the South Umpqua River (#71192). Figure 3-5 shows surface water availability for the South Umpqua River WAB. Appendix 8 shows surface water availability graphs all other WABs.

The solid yellow area on Figure 3-5 is the 50% exceedence, or average, streamflow in cubic feet per second (cfs). The dark blue line represents the cfs for instream water rights, and the red line and corresponding numbers are the estimated consumptive use. The light blue line represents the expected streamflow, which is calculated by subtracting consumptive use from the average streamflow. In this WAB, instream water rights exceed average streamflow in October. Expected streamflow is close to average streamflow all year.

Oregon law provides a mechanism for temporarily changing the type and place of use for a certificated water right by leasing the right to an instream use. Leased water remains in-channel and benefits streamflows and aquatic species. The water right holder does not have to pay pumping costs, and, while leased, the instream use counts as use under the right for purposes of precluding forfeiture.

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[79] David Williams, the Oregon Water Resources Department Watermaster for the Umpqua Basin, contributed the background text for section 3.4.1. Water availability data are from OWRD's Water Availability Report System database (http://www.wrd.state.or.us/).

[80] In some circumstances, domestic water rights can be obtained if there is no other source of water on a property. Contact the Water Resources Department for more information.

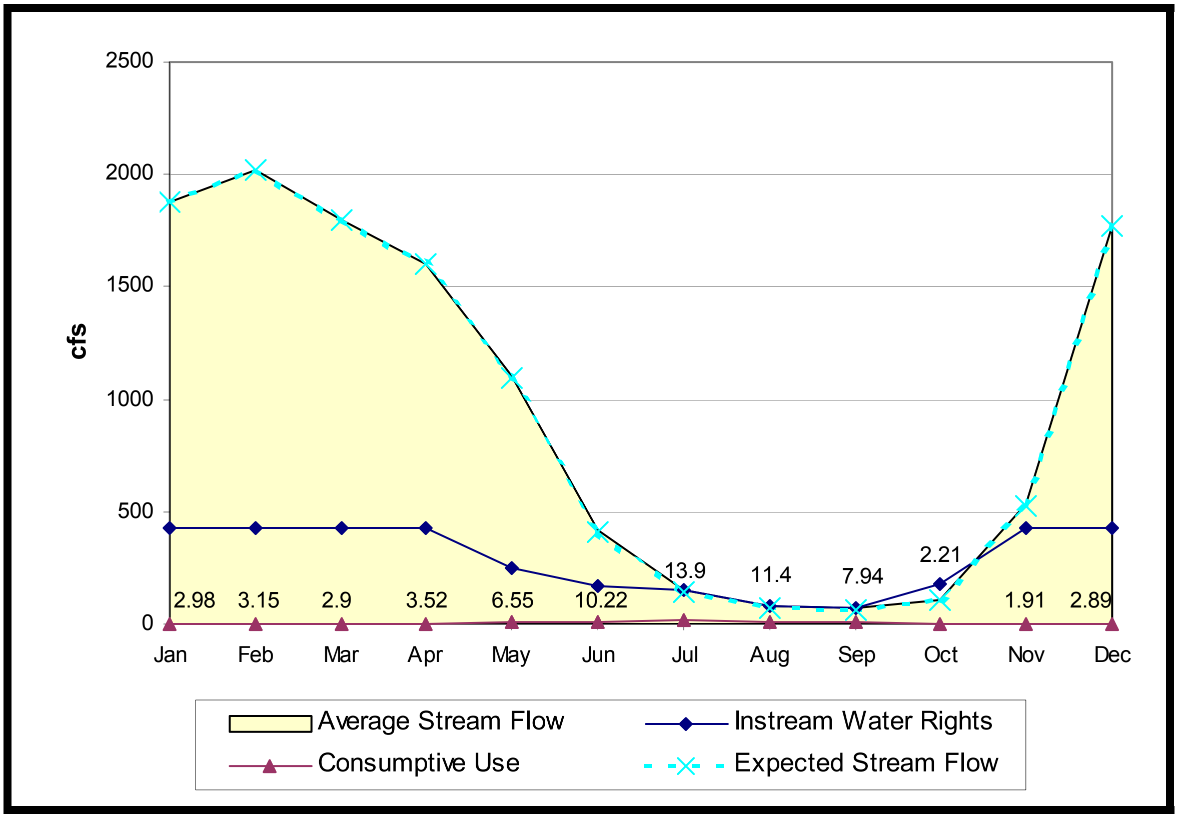


Figure 3-5: Water availability in the South Umpqua River WAB (#71192).

3.4.2. Water rights by use

Table 3-21 shows consumptive use by category for the total South Umpqua River Watershed, the South Umpqua River, and all tributaries excluding the Days Creek system.[81] Table 3-22 shows the same data for Days Creek and its tributaries. Appendix 9 lists the possible uses included in each category. Table 3-21 and Table 3-22 show uncanceled water rights and do not indicate actual water consumption.[82]

"Irrigation" is the largest use of water for the total watershed, the South Umpqua River, and all tributaries. "Mining" and "municipal" are the second and third largest water uses for the total watershed, and all mining and municipal rights are from tributaries, excluding the Days Creek system. For the South Umpqua River within the watershed, "industrial" and "domestic" are the second and third largest water uses, together accounting for 5.2% of all water rights from the river. In the Days Creek system, "domestic" and "livestock" are the two largest uses after "irrigation." There are no rights secured for recreation, power, or wildlife uses in the South Umpqua River Watershed.

[81] Water rights data are available from OWRD's Water Rights Information System database available at http://www.wrd.state.or.us/.

[82] Uncanceled water rights include: 1) valid rights, which are ones that have not been intentionally canceled and the beneficial use of the water has been continued without a lapse of five or more consecutive years in the past 15 years; and 2) rights that are subject to cancellation due to non-use. For more information about water rights, contact the Oregon Water Resources Department.

	TOTAL		South Umpqua		S. Umpqua tribs excluding Days Ck	
Use	Cubic feet/sec	% Total	Cubic feet/sec	% South Umpqua	Cubic feet/sec	% S. U. tributaries
Agriculture	0.00	-	0.00	-	0.00	-
Domestic	1.72	2.3%	0.67	1.8%	0.88	2.7%
Irrigation	65.08	87.2%	35.98	94.0%	25.80	78.4%
Industrial	1.42	1.9%	1.32	3.4%	0.10	0.3%
Fish	0.29	0.4%	0.25	0.7%	0.02	0.1%
Livestock	0.16	0.2%	0.03	0.1%	0.11	0.3%
Municipal	2.08	2.8%	0.00	-	2.08	6.3%
Mining	3.91	5.2%	0.00	-	3.91	11.9%
Misc.[83]	0.02	<0.1%	0.02	<0.1%	0.01	<0.1%
Total	**74.67**	**100%**	**38.26**	**100%**	**32.90**	**100%**

Table 3-21: Water rights by use for the total watershed, the South Umpqua River, and tributaries excluding the Days Creek system.[84]

	Days Creek		Days Creek tributaries	
Use	Cubic feet/sec	% Days Creek	Cubic feet/sec	% Days tributaries
Agriculture	0.00	-	0.00	-
Domestic	0.08	4.2%	0.09	5.5%
Irrigation	1.78	95.2%	1.52	92.7%
Industrial	0.00	-	0.00	-
Fish	0.00	-	0.02	1.2%
Livestock	0.01	0.5%	0.01	0.6%
Municipal	0.00	-	0.00	-
Mining	0.00	-	0.00	-
Misc.	0.00	-	0.00	-
Total	**1.86**	**100%**	**1.64**	**100%**

Table 3-22: Water rights by use for Days Creek and its tributaries.

3.4.3. Streamflow and flood potential

Three US Geological Survey stream gauges have collected data within the South Umpqua River Watershed. The gauge on the South Umpqua River at Days Creek (#14308600) was active from 1975 through 1990. The Days Creek at Days Creek gauge (#14308700) was active from 1955 through 1972. Both gauges collected average monthly streamflow, annual average streamflow, and peak flow data. The Canyon Creek at Canyonville gauge (#14308900) collected peak flow data from 1951 through 1966. The gauge on the South Umpqua River near Tiller (#14308000) has been in operation since 1910 and consistently

[83] For the South Umpqua River its tributaries, the "miscellaneous" category refers to fire protection.
[84] Percents do not add to totals due to rounding.

collecting data since 1940. Although this gauge is outside the watershed boundary, it is included for comparison and to provide additional information about streamflow in the South Umpqua River Watershed area.

Monthly flow

Figure 3-6 charts the monthly historical average flow for the South Umpqua River at Days Creek and at Tiller. Figure 3-7 shows average monthly flow for Days Creek at Days Creek. As would be expected from climate information in section 1.2.6, all three gauge locations have the greatest average flow during the winter months. The South Umpqua River's streamflow is higher at Days Creek than Tiller; however, at both sites the river's flow has dropped below 100 cfs during the summer months. In August, average monthly streamflow for Days Creek at Days Creek is 1.01 cfs (see); in 1961, streamflow at this gauge was 0.05 cfs.

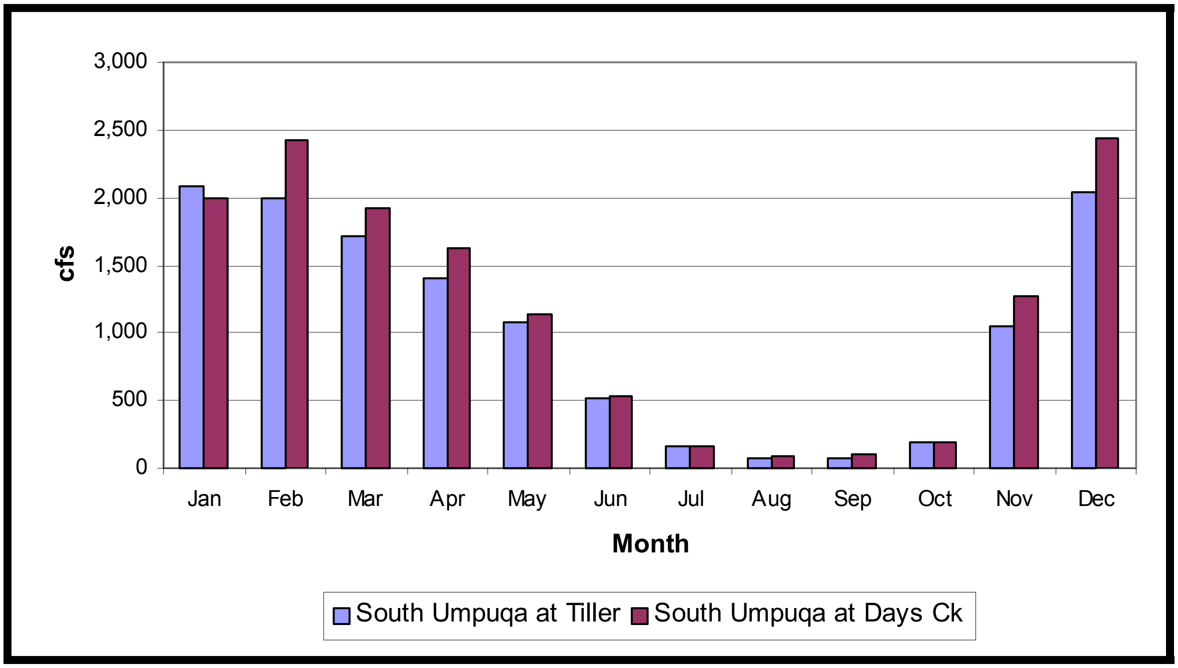


Figure 3-6: Average monthly streamflow for the South Umpqua River at Days Creek (gauge #14308600) and for the South Umpqua River at Tiller (gauge #14308000).

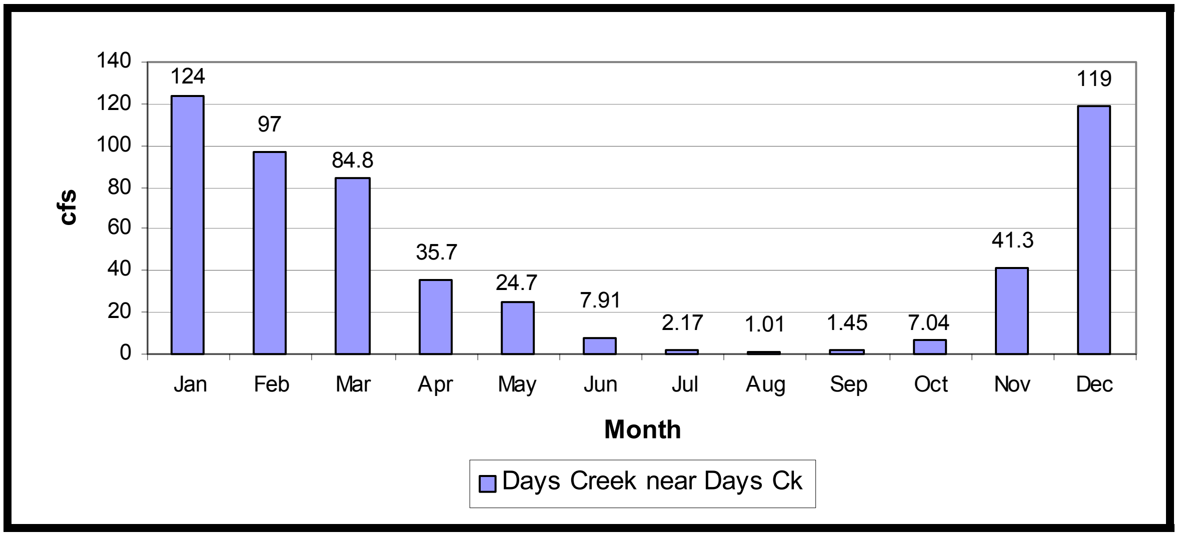


Figure 3-7: Average monthly streamflow for Days Creek at Days Creek (gauge #14308700).

Annual average streamflow and peak flow

Figure 3-8 and Figure 3-9 shows peak flow data and average annual streamflow for the South Umpqua River at Tiller and at Days Creek beginning in water year 1940.[85] Average annual streamflow and peak flow events vary from year to year. Although in general, peak flow trends follow overall annual average streamflow trends, there are exceptions; 1996 had the highest average annual streamflow recorded to date for the South Umpqua River at Tiller (1,197 cfs), but the peak flow was only slightly above average.

[85] Data are shown by water year. Water years begin October 1 and end September 30. Therefore, a flood event in December, 2001 will be recorded in the 2002 water year.

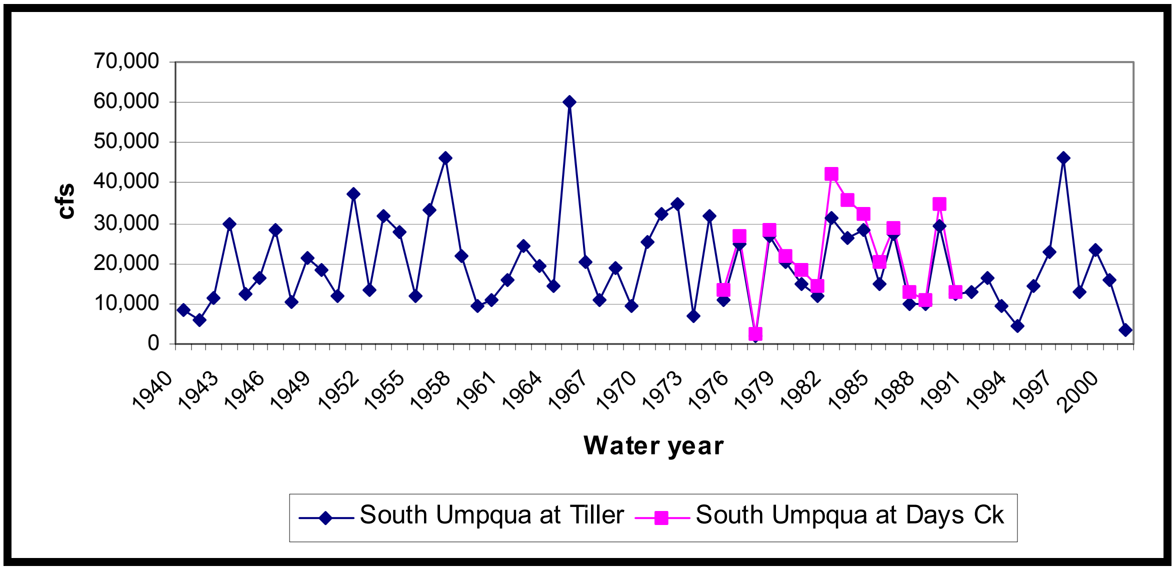


Figure 3-8: Annual peak flow for the South Umpqua River at the confluence with Days Creek (gauge #14308600) and for the South Umpqua River near Tiller (gauge #14308000).

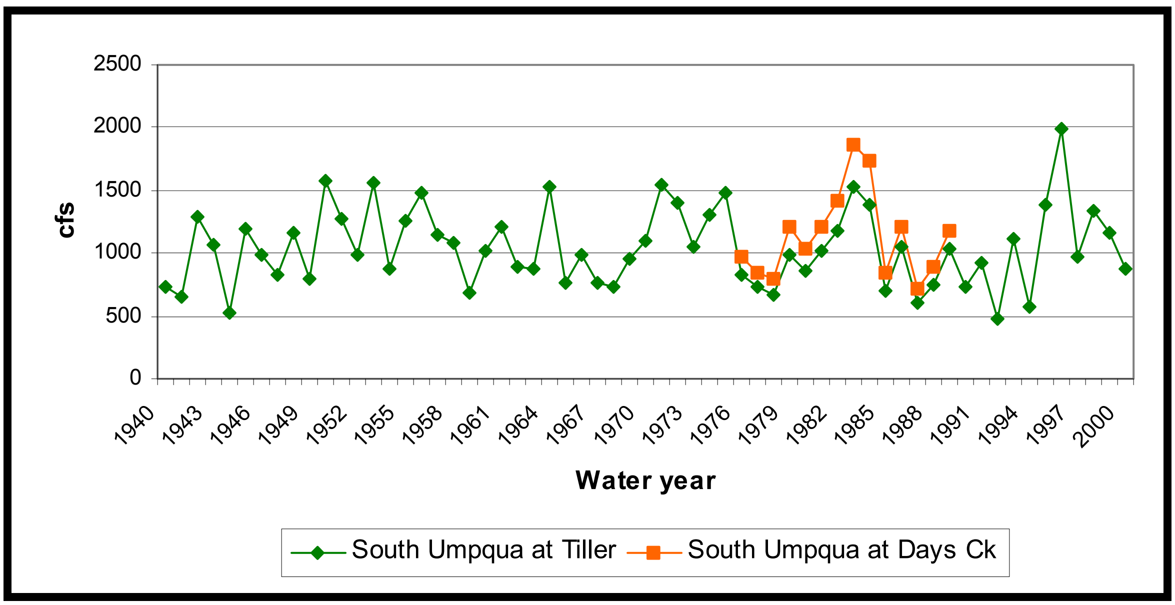


Figure 3-9: Average annual streamflow for the South Umpqua River at the confluence with Days Creek (gauge #14308600) and for the South Umpqua River near Tiller (gauge #14308000).

Figure 3-10 shows Days Creek at Days Creek and Canyon Creek at Canyonville peak flow data. From the streams' proximity to one another, it would be expected that their peak events would follow a similar trend. Although this is generally true, there are many differences in the creeks' peak flows during the periods of record. For example, the highest peak events for Days Creek's occurred in 1956 with 3,450 cfs. However, in

1956, Canyon Creek's peak event was below average. Differences such as this one are most likely due to rainstorms that occurred over one stream system and not the other.

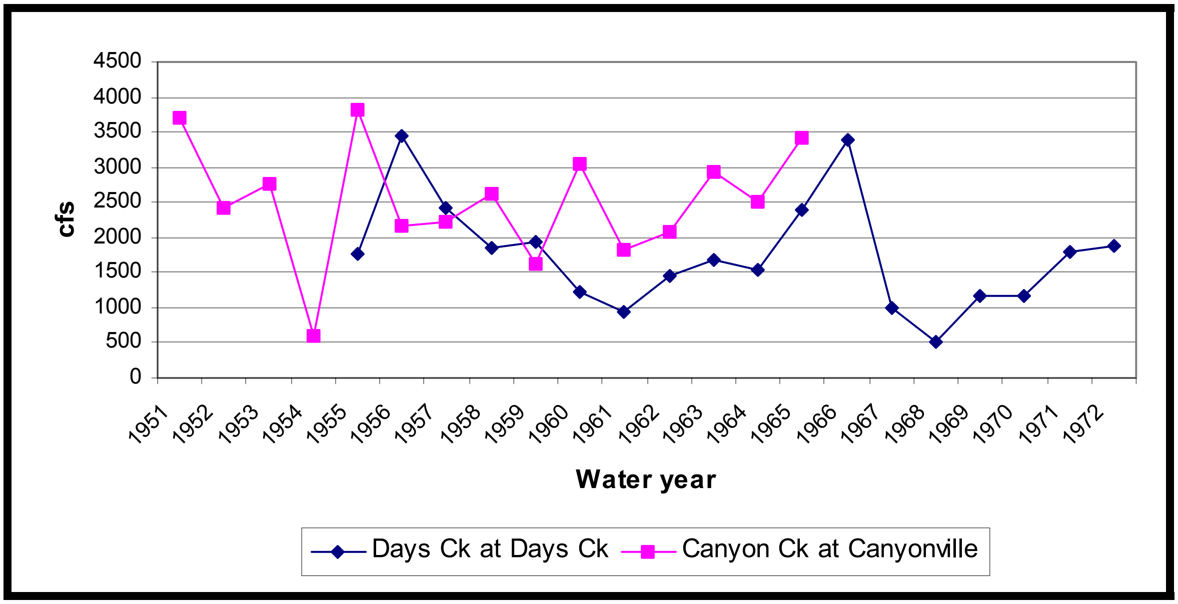


Figure 3-10: Annual peak flow for Days Creek at Days Creek (gauge #14308700) and for Canyon Creek at Canyonville (gauge #14308900).

Influences on flood potential

Approximately 36% of the South Umpqua River Watershed is within the transient snow zone (TSZ) (see Map 1-4). In the TSZ, snow can accumulate in areas with open canopies such as meadows, burned areas, and timber harvest units. When warmer rain falls on the accumulated snow, the snow quickly melts and can result in high runoff levels and peak streamflows. Streams with headwaters in the TSZ zone, such as Coffee Creek, are more susceptible to rain-on-snow events than lower elevation streams.

Road density can also influence peak flows. Table 3-23 shows the miles of road per square mile for surfaced and unsurfaced roads. Paved roads are impermeable to water, and rock or dirt roads are somewhat permeable. When it rains or accumulated snow on road surfaces melts, water that is not absorbed will flow off the road. The soil and vegetation surrounding the road may absorb the runoff. If the surrounding area is unable to absorb the excess water, and if the road is close to a stream, then the excess water flows into the stream, resulting in high peak flows. The relationship between roads, streams, and peak flows is dependent on many factors, and the influence of roads on streamflow and peak events is debatable.

Road type	Road miles/ square mile
Paved	0.4
Gravel	2.6
Dirt	1.4
Total	4.4

Table 3-23: Miles of road per square mile for surfaced and unsurfaced roads in the South Umpqua River Watershed.

3.4.4. Water quantity key findings and action recommendations

Water availability and water rights by use key findings

- In all five South Umpqua River Watershed WABs, instream water rights are close to or exceed average streamflow during one or more months of the year.
- During the summer, there is no “natural” streamflow available for new water rights.
- “Irrigation” is the largest use of water for the total watershed, the South Umpqua River, and all tributaries. “Mining” and “municipal” are the second and third largest water uses for the watershed as a whole.

Streamflow and flood potential key findings

- Within the watershed, the South Umpqua River’s flow has dropped below 100 cfs during the summer months. In August, average monthly streamflow for Days Creek at Days Creek is 1.01 cfs.
- No flooding trends were determined from the records to date.
- The degree to which road density and the TSZ influence flood potential in the South Umpqua River Watershed is unknown at this time.

Water quantity action recommendations

- o Reduce summer water consumption through instream water leasing and by improving irrigation efficiency.
- o Educate landowners about proper irrigation methods and the benefits of improved irrigation efficiency.
- o Continue monitoring peak flow trends in the watershed. Try to determine the role of vegetative cover, flooding, road density, and the TSZ on water volume.

3.5. Fish populations

3.5.1. Fish presence

The South Umpqua River Watershed is home to many fish species. Table 3-24 lists the fish species in the watershed that have viable, reproducing populations. Some warm water fish, including largemouth bass (*Micropterus salmoides)*, yellow perch (*Perca flavescens*), and bluegill (*Lepomis macrochirus*) may also reside in the watershed. These fish are introduced to the South Umpqua River and tributaries through private ponds. Stream temperatures prevent many non-native species from establishing populations in small tributaries.

The Oregon Coast coho salmon was listed as a threatened species in 1998 under the Endangered Species Act of 1973. Currently, there are no other threatened or endangered aquatic species in the South Umpqua River Watershed. In January, 2003, various groups petitioned to protect the Pacific lamprey and western brook lamprey, as well as two other lamprey species, under the Endangered Species Act.

Common Name	***Scientific Name***
Steelhead	*Oncorhynchus mykiss*
Coho salmon	*O. kisutch*
Chinook (spring and fall)	*O. tshawytscha*
Cutthroat trout	*O. clarkii*
Umpqua chub	*Oregonichthys kalawatseti*
Western brook lamprey	*Lampetra richardsoni*
Pacific lamprey	*Lampetra tridentata*
Umpqua dace	*Rhinicthys cataractae*
Sculpin	*Cottus sp.*
Redside shiner	*Richardsonius balteatus*
Speckled dace	*Rhinicthys osculus*
Umpqua pikeminnow	*Ptychocheilus oregonensise*
Largescale sucker	*Catostomus macrocheilus*
Smallmouth bass	*Micropterus dolomieu*
Brown bullhead	*Ameiurus nebulosus*

Table 3-24: Fish with established populations or runs within the South Umpqua River Watershed.

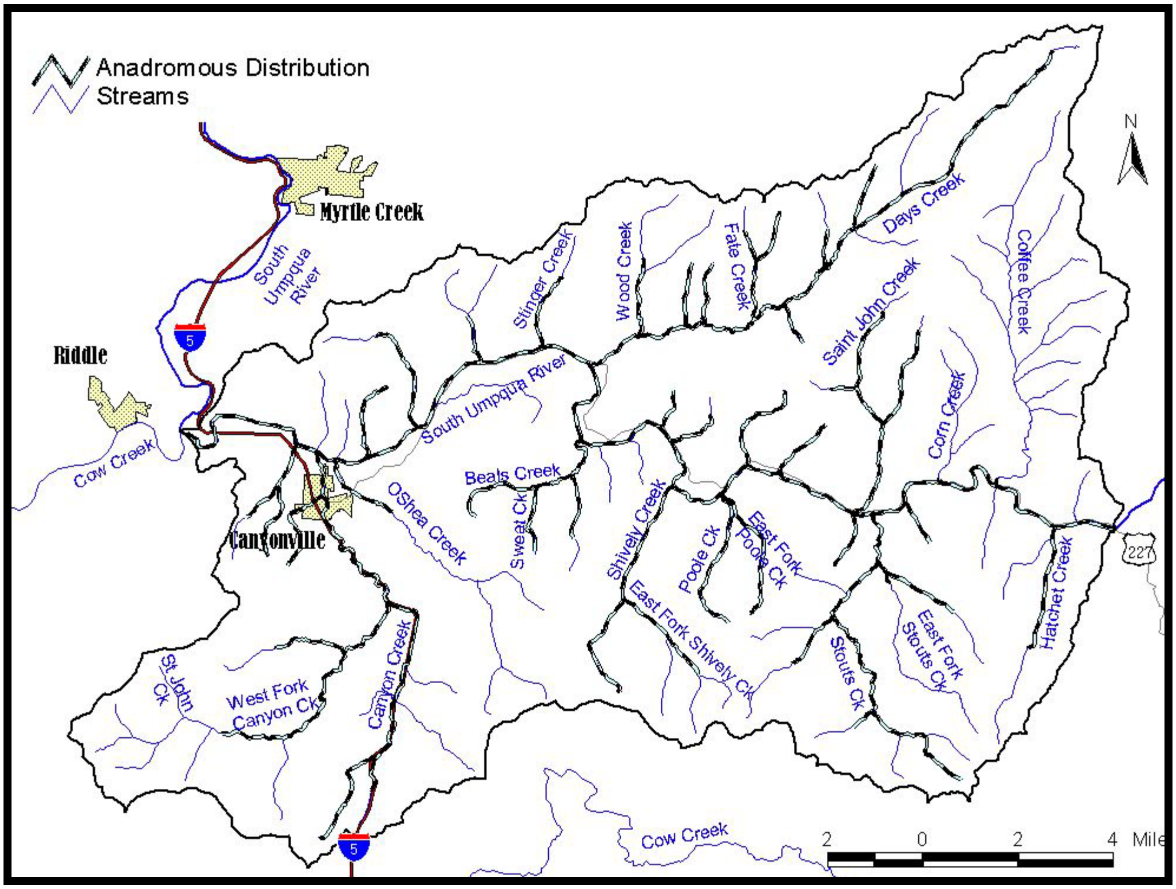
3.5.2. Fish distribution and abundance

Information on fish distribution and abundance within the South Umpqua River Watershed is limited to salmonids. Although non-salmonid fish species are important as well, there are insufficient accessible data on the location of these types of fish, and they could not be included in the assessment. More information about non-salmonid fish may be available in the future.

Anadromous salmonid distribution

The Oregon Department of Fish and Wildlife (ODFW) has developed anadromous salmonid distribution maps based on fish observations, assumed fish presence, and habitat conditions. Fish observations are the most accurate because ODFW personnel have seen live or dead fish in the stream. With assumed fish presence, streams or reaches are included in the distribution map because of their proximity to fish-bearing streams or reaches and adequate habitat. Also included on the map are streams that appear to have adequate habitat for a given salmonid, even if there have been no fish sightings and the stream is not near a fish-bearing stream. As of January, 2003, ODFW was in the process of revising the salmonid distribution maps to distinguish observed fish-bearing streams from the others. It is possible that some streams have been included in the distribution maps that do not have salmonid presence.

According to ODFW, anadromous salmonid distribution includes 137.0 stream miles within the South Umpqua River Watershed, or 55.1% of the total stream miles visible on the map below.[86] Map 3-20 shows the distribution of anadromous salmonids within the watershed and Table 3-25 lists the miles of stream used by each species.[87] Total stream miles with anadromous salmonids does not equal the sum of miles used by species because many species overlap (see Appendix 10). Coho and steelhead use many of the same stream reaches but at different times of the year.



Map 3-20: Anadromous salmonid distribution within the South Umpqua River Watershed.

	Steelhead	Coho	Spring chinook	Fall chinook
Miles	127.4	99.0	28.0	24.9
% total stream miles	51.2%	39.8%	11.3%	10.0%

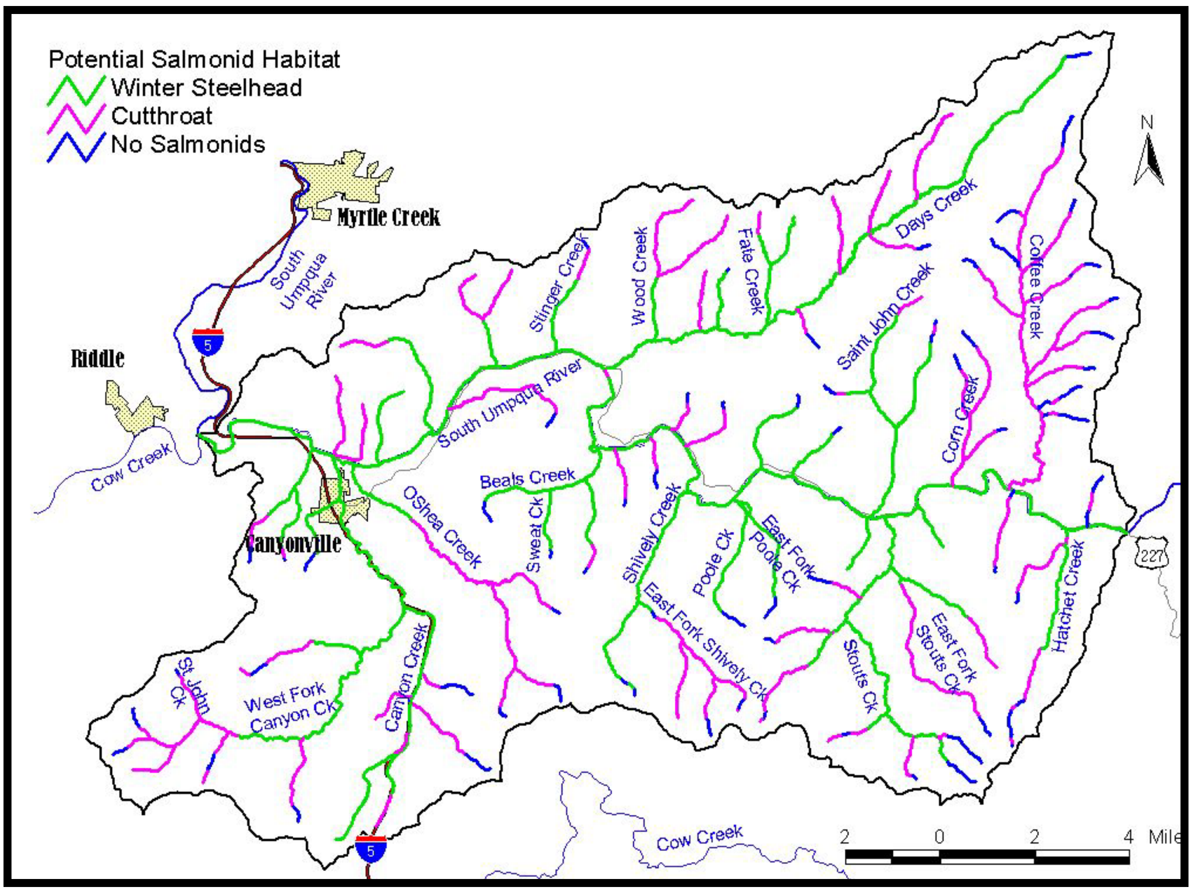
Table 3-25: Miles of stream supporting anadromous salmonids in the South Umpqua River Watershed.

86 See section 1.2.5 on page 21 for more information about the stream map and total stream miles.
87 Maps are available from the ODFW website http://www.streamnet.org/online-data/GISData.html.

Resident cutthroat distribution

There are no comprehensive data about resident cutthroat distribution in the Umpqua Basin. ODFW is compiling regional data and will develop maps indicating fish presence by stream. However, the project will not be completed until after this assessment is complete.

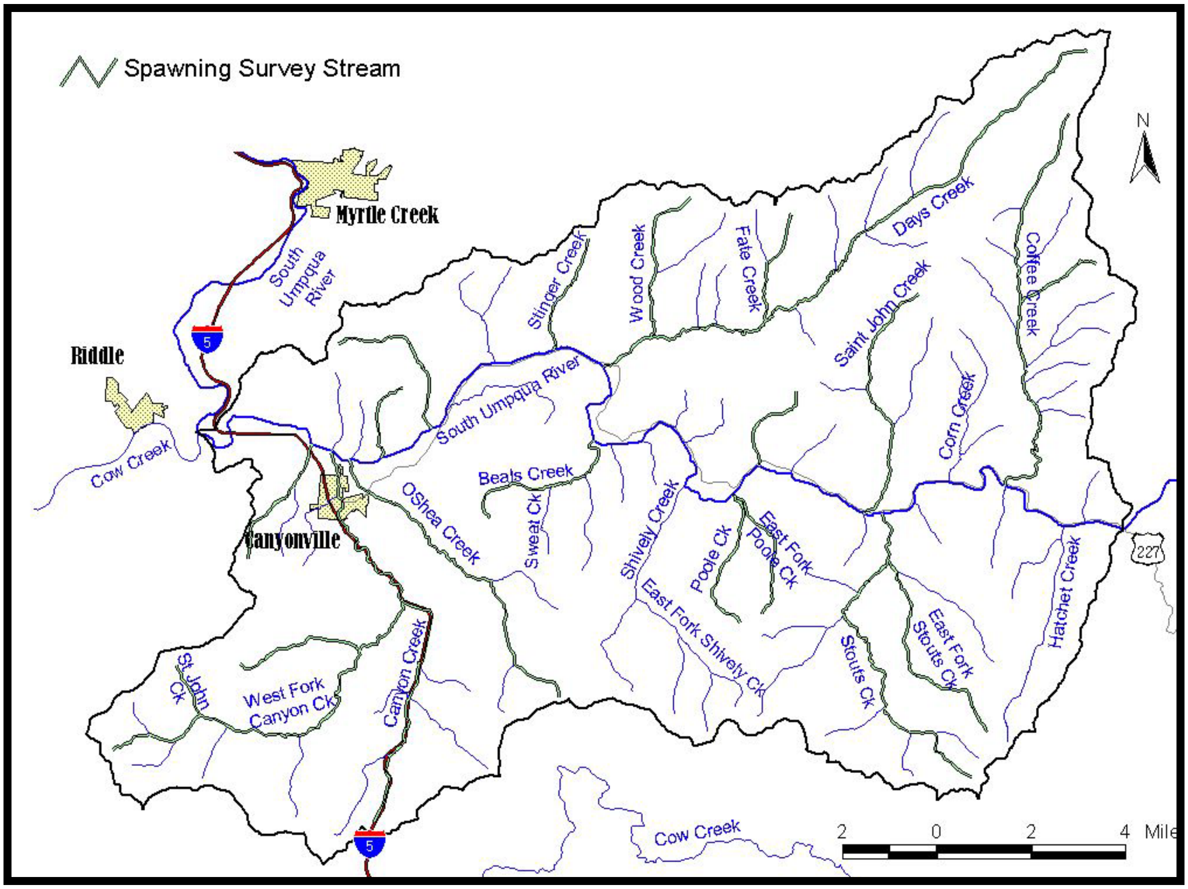
Although there is much overlap, anadromous salmonids generally prefer streams with a 0% to 4% gradient, whereas resident cutthroat trout prefer streams with a 4% to 15% gradient. Also, cutthroat trout are generally found beyond the range of winter steelhead.[88] Map 3-21 shows streams with gradients that are less than 15% and are beyond winter steelhead distribution. Streams such as Corn Creek may provide suitable habitat for cutthroat trout. However, there are many factors other than stream gradient that determine fish habitat suitability.



Map 3-21: **Potential resident and anadromous salmonid habitat in the South Umpqua River Watershed.**

[88] From Dave Harris, fish biologist, Oregon Department of Fish and Wildlife, Roseburg District Office.

Coho abundance
ODFW conducts coho spawning surveys throughout the Umpqua Basin.[89] Volunteers and ODFW personnel survey pre-determined stream reaches and count the number of live and dead coho. The same person or team usually does surveys every 10 days for two or three months. There are coho spawning data for the South Umpqua River Watershed from 1990 through 2001. Map 3-22 shows the surveyed stream reaches.



Map 3-22: South Umpqua River Watershed coho spawning survey locations.

Figure 3-11 and Figure 3-12 show the maximum number of live and dead coho seen per mile on a given day in the South Umpqua River Watershed. In some cases, the estimated total number of coho per mile is included as a red bar next to peak per mile count. Coho spawning fluctuates by stream and by year. Data for Stinger Gulch (reach one) and East Fork Stouts Creek (reach one) from 1990 through 1992 show a similar trend. Both streams had a small run in 1990, followed by a large 1991 run, and a moderate 1992 run. However, Small Creek (reach one) had no observed coho 1991 and six in 1992. More monitoring data are needed to draw conclusions about coho spawning in the watershed.

[89] Coho spawning survey data can be requested from the ODFW Corvallis Research Laboratory.

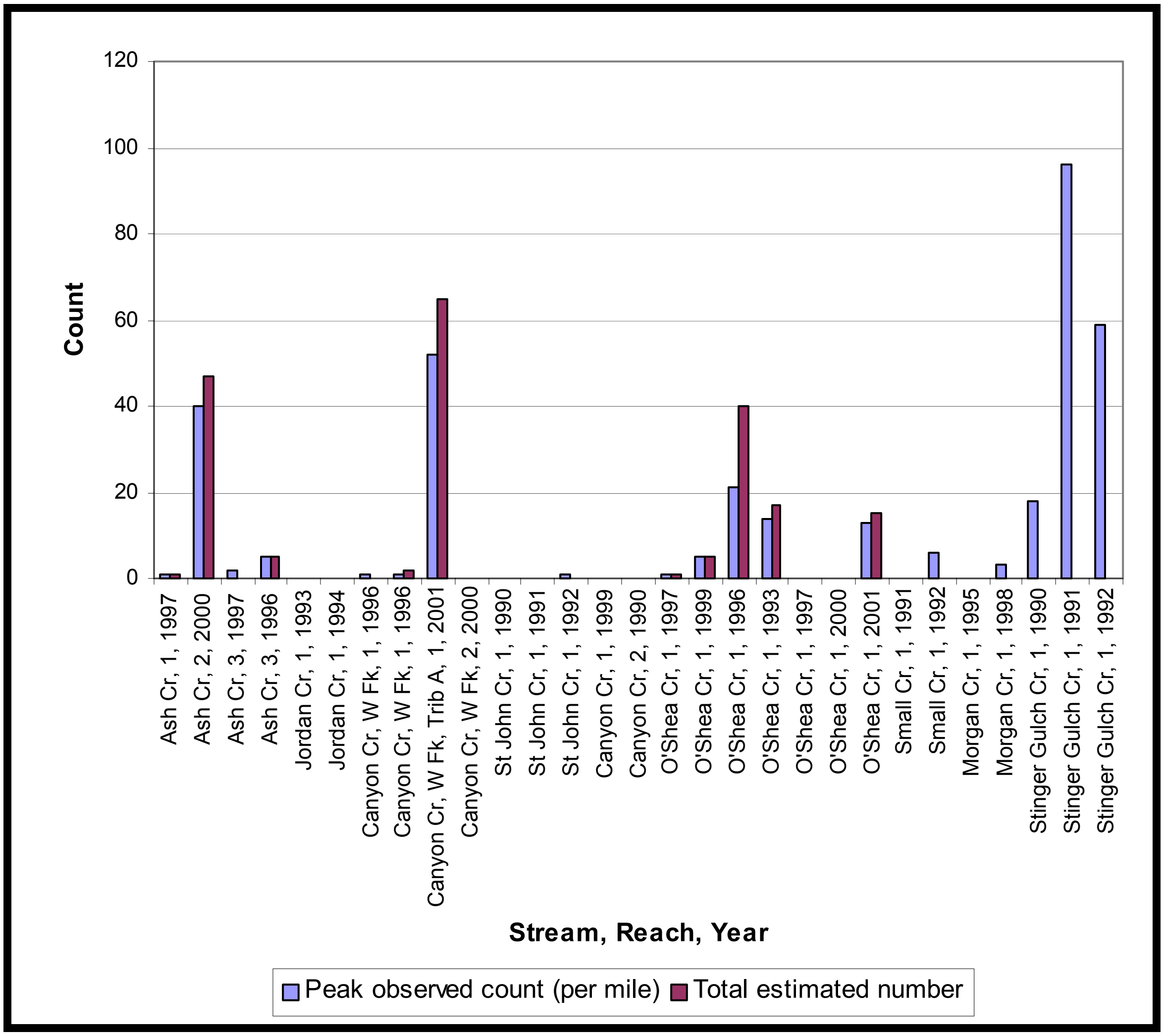


Figure 3-11: Coho spawning surveys for South Umpqua River tributaries from Cow Creek to Days Creek.

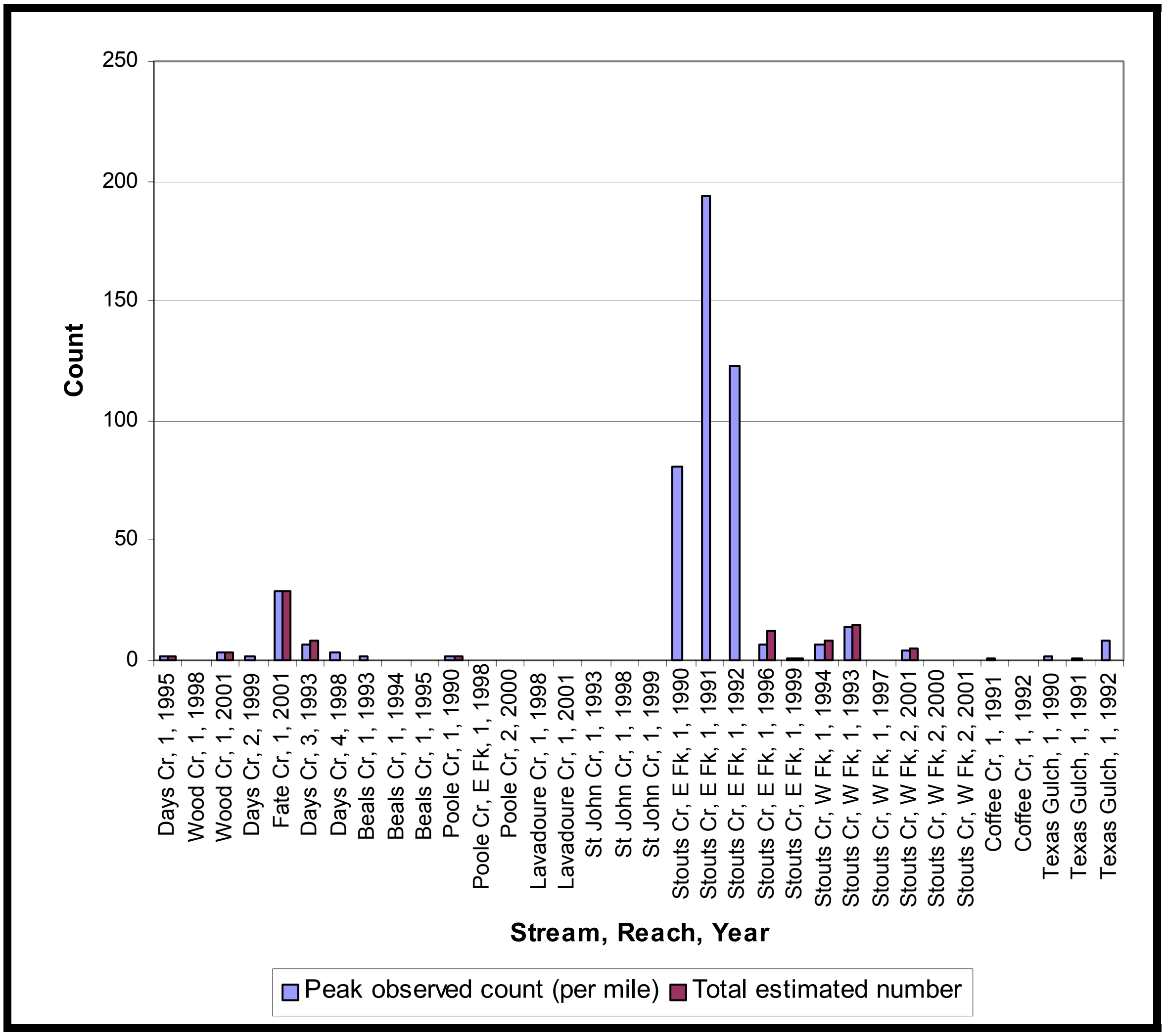


Figure 3-12: Coho spawning surveys for Days Creek and its tributaries and for South Umpqua River tributaries from Days Creek to Elk Creek.

During coho spawning surveys, surveyors record the presence of other salmonid species. Figure 3-13 and Figure 3-14 show the number of steelhead and chinook observed per mile in the South Umpqua River Watershed. In 1990, one chum was recorded in Stinger Gulch.

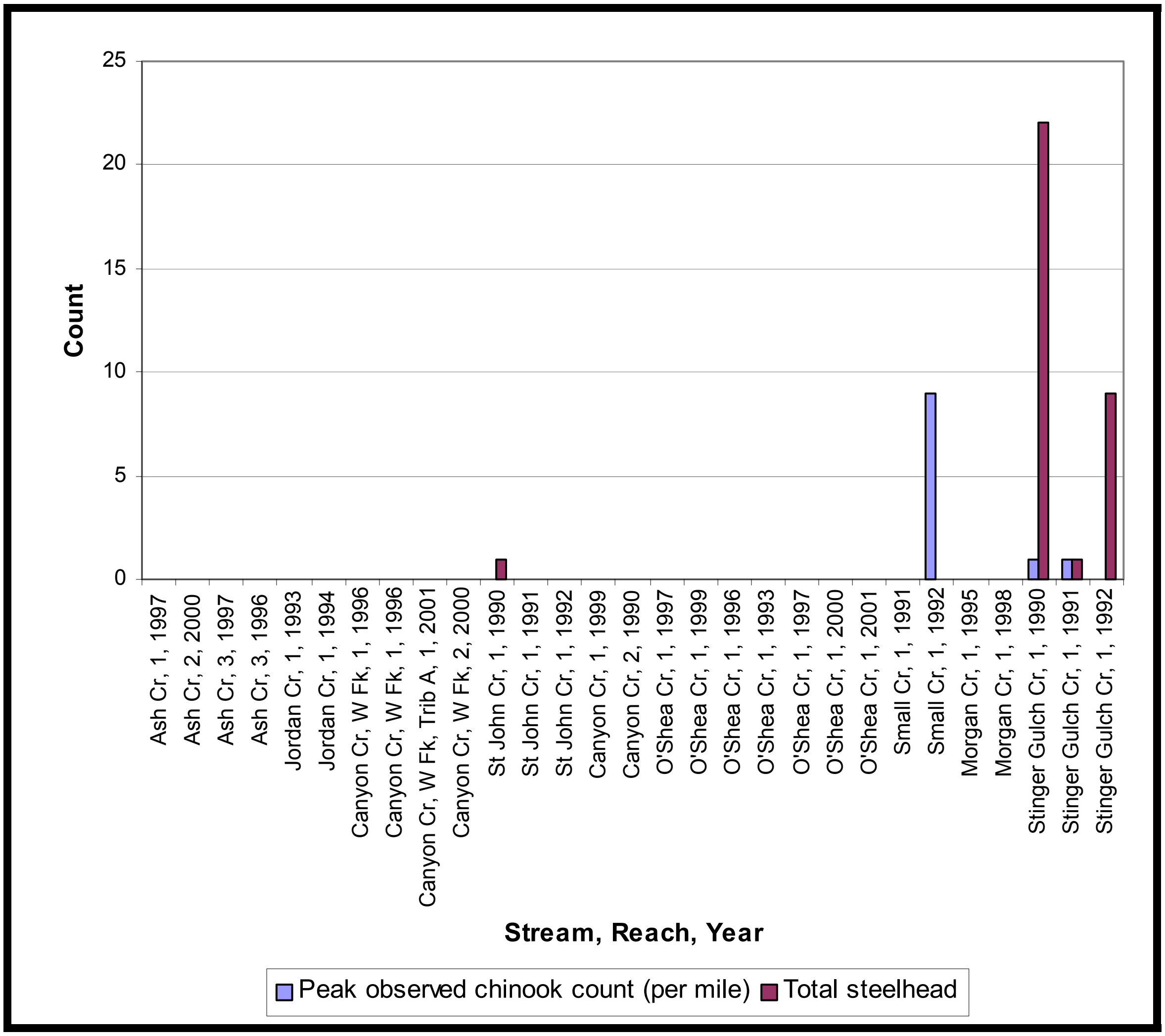


Figure 3-13: Chinook and steelhead counts for South Umpqua River tributaries from Cow Creek to Days Creek.

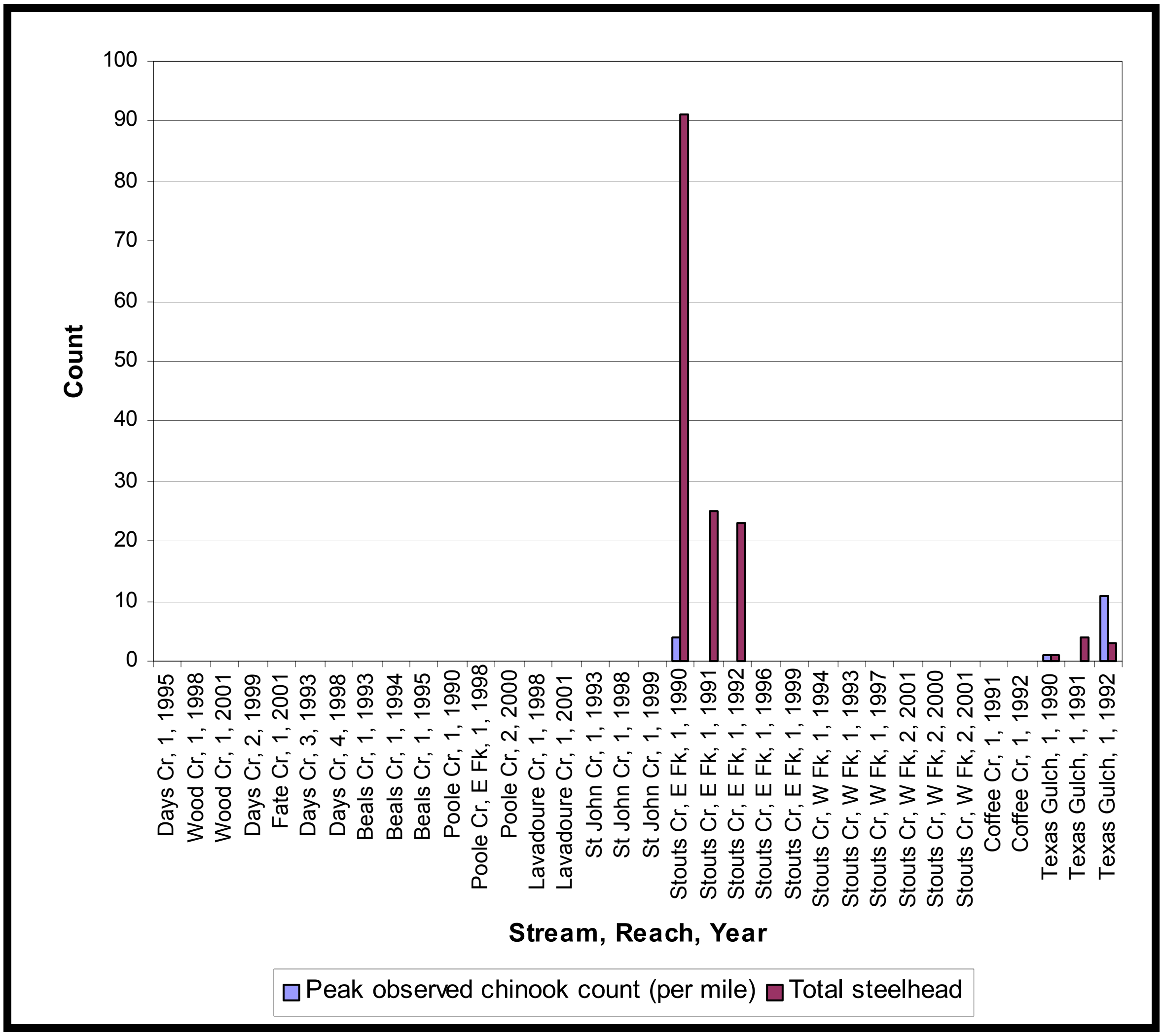


Figure 3-14: Chinook and steelhead counts for Days Creek and its tributaries and for South Umpqua River tributaries from Days Creek to Elk Creek.

Annual fall chinook counts

ODFW conducts annual aerial counts of fall chinook fish and fall chinook redds in the South Umpqua River and in Cow Creek.[90] The South Umpqua River is surveyed from the mouth to Milo, which is located approximately at the river's confluence with St. John Creek. Flights are normally made twice a year, both before and after the height of the run. Counts are based on the average count for both flights.

Fall chinook adult fish have been surveyed since 1983. From 1983 through 1997, ODFW fish surveyors divided the South Umpqua River into reaches based on permanent features that are visible from a helicopter, such as the confluence with Cow Creek. Therefore, these counts can be used to estimate chinook spawning in the South Umpqua River Watershed.

[90] Annual fall chinook count data can be requested from the Oregon Department of Fish and Wildlife Roseburg District Office.

Figure 3-15 shows annual fall chinook fish counts from 1983 through 2000 for the South Umpqua River Watershed and for the South Umpqua River from the mouth to Milo. There were no fish surveys conducted in 1985. From 1983 through 2000, an average of 8.1% of the fall chinook counted in the South Umpqua River were found within the South Umpqua River Watershed. In 1999, 19.1% of the South Umpqua River's documented fall chinook were within the watershed. In 1984, only 1.0% of the river's fall chinook were within the watershed. Figure 3-16 shows fall chinook counts by stream segment from 1983 through 1997, excluding 1985. Most of the fall chinook in the South Umpqua River Watershed were documented between the I-5 bridge and Days Creek.

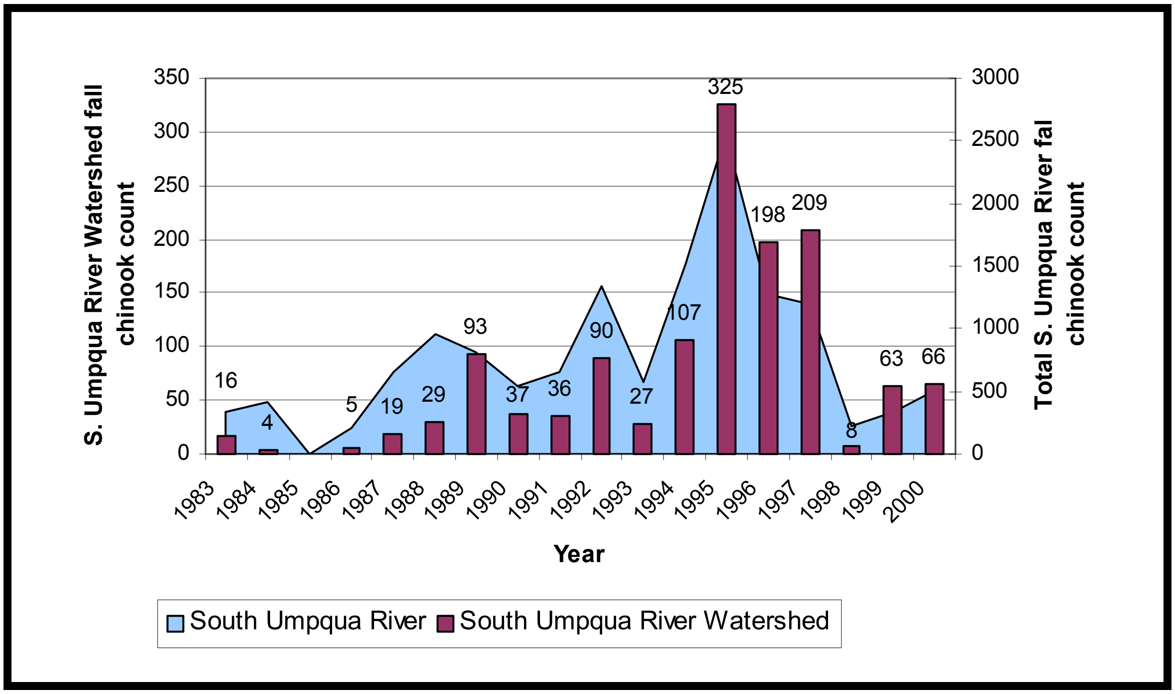


Figure 3-15: Total fall chinook fish counts for the South Umpqua River and for the South Umpqua River Watershed.

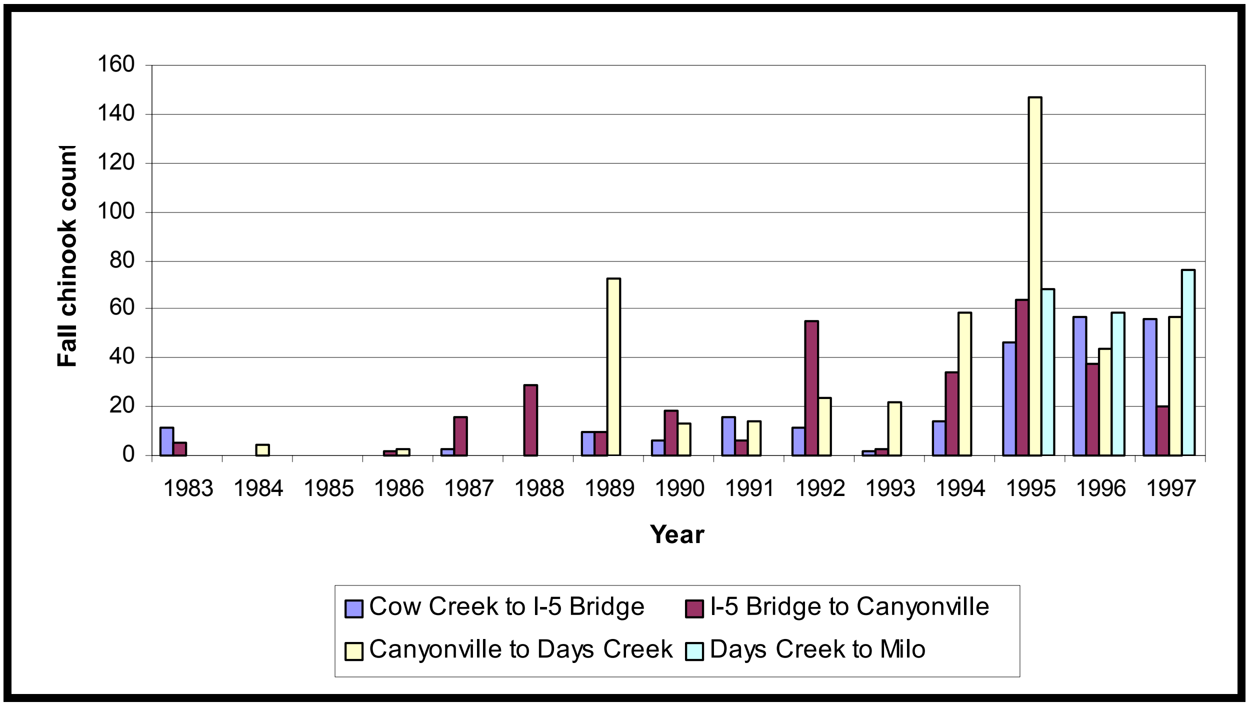


Figure 3-16: Fall chinook fish counts by stream segment in the South Umpqua River Watershed.

Figure 3-17 shows annual fall chinook redd count data for the South Umpqua River from 1978 through 2001. Fall chinook redd data are not reported by watershed or stream segment, so the number of redds counted in the South Umpqua River Watershed is unknown. The number of fall chinook redds counted in the South Umpqua River fluctuates each year. The highest count was in 1995 (2,549 redds). The lowest count was zero redds in 1979. Overall, the number of redds appears to be increasing, as indicated by black trend line in Figure 3-17.

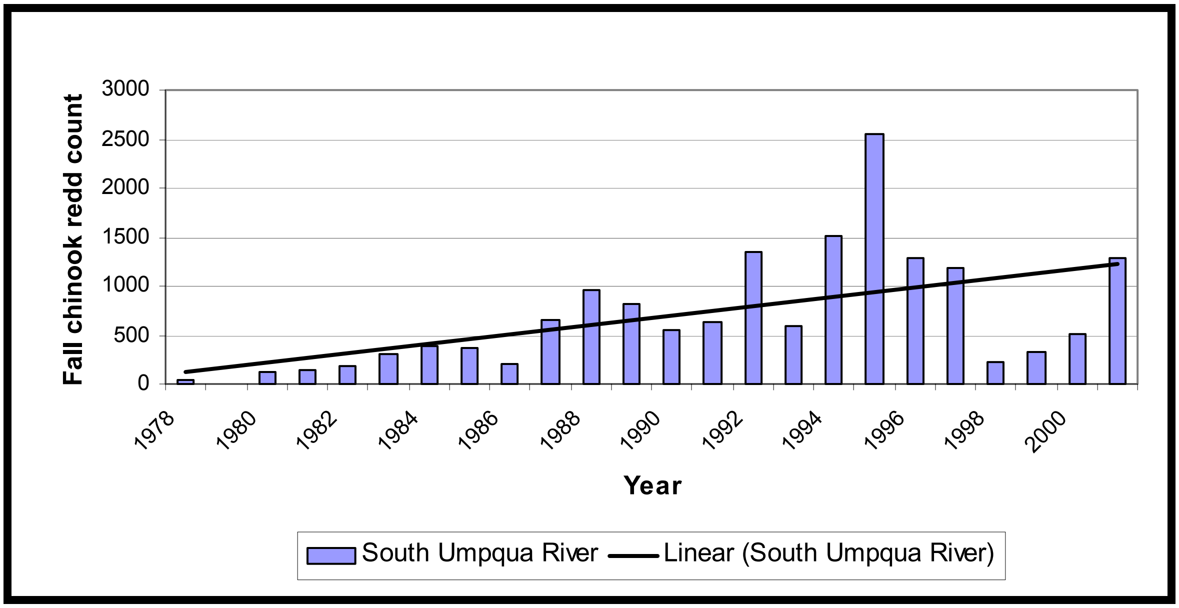


Figure 3-17: Annual fall chinook redd counts for the South Umpqua River.

From 1998 through 1999, the ODFW's Pacific Salmon Commission (PSC) undertook a study to calibrate fall chinook aerial redd counts to actual population levels using a mark-recapture experiment on the South Umpqua River. The study concluded that there are 3.86 adult fish for each counted redd. Figure 3-18 shows actual fall chinook fish and redd counts in the South Umpqua River, and the PSC fall chinook run size estimate. In 1995, there may have been nearly 10,000 fall chinook present in the South Umpqua River.

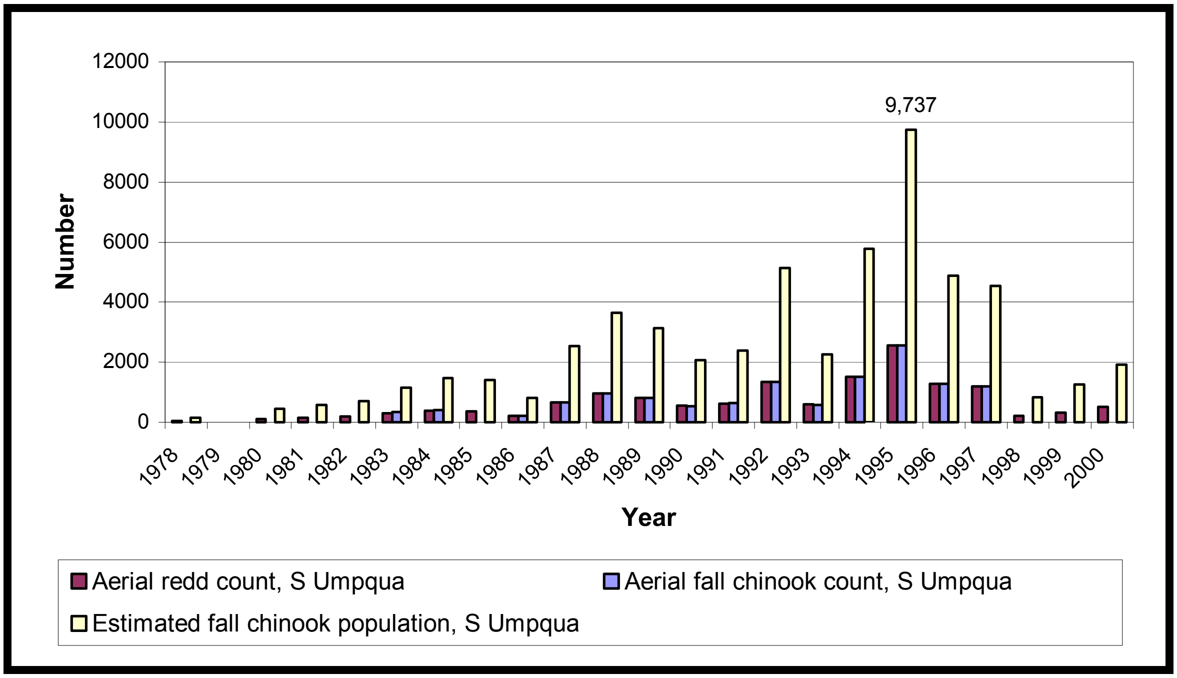


Figure 3-18: Estimated fall chinook population for the South Umpqua River.

Salmonid population trends
According to Dave Harris of the Oregon Department of Fish and Wildlife, adult salmonid returns throughout the Umpqua Basin increased from 1998 through 2002. This trend is due to greater numbers of wild and hatchery fish surviving to adulthood because of normal winter storm events (i.e. no major floods or landslides) and ocean conditions that favor survival and growth. When both of these limiting factors are favorable over several years or fish generations, the result is an increase in adult run sizes. This trend is expected to continue until there is a change in ocean conditions or winter freshwater events.

Activities that improve freshwater conditions for salmonids will also help increase fish runs. These activities include removing barriers to fish passage, increasing instream flows, and improving critical habitat in streams and estuaries. It is also important to continue gathering data about salmonids and educating the public.

3.5.3. Fish populations key findings and action recommendations

Fish populations key findings

- The anadromous fish species in the South Umpqua River Watershed with annual runs are coho, steelhead, spring and fall chinook, and Pacific lamprey. Cutthroat trout are the only resident salmonid.
- Although many South Umpqua River Watershed medium and large tributaries are within the distribution of one or more salmonid species, salmonid ranges have not been verified for each tributary.
- Brown bullhead, smallmouth bass, and possibly other non-native fish species have reproducing populations within the South Umpqua River. These fish are most likely

introduced to the river through private ponds. Stream temperatures are generally too cold for these species to establish reproducing populations in smaller tributaries.
- More quantitative data are needed to evaluate salmonid abundance and the distribution and abundance of non-salmonid fish in the watershed.
- On average, less than 10% of spawning fall chinook in the South Umpqua River system are found within the South Umpqua River Watershed.
- Most of the spawning fall chinook counted in the South Umpqua River Watershed are found between I-5 and Days Creek.
- The number of redds in the South Umpqua River system appears to be increasing.
- Although watershed-specific data show tremendous fluctuation in annual salmonid abundance, Umpqua Basin-wide data indicate that salmonid returns have improved. Ocean conditions are a strong determinant of salmonid run size; however, improving freshwater conditions will help increase salmonid fish populations.

Fish populations action recommendations

- Work with local specialists and landowners to verify the current and historical distribution of salmonids in tributaries.
- Support salmonid and non-salmonid distribution and abundance research activities in the watershed, especially at the local level.
- Encourage landowner and resident participation in fish monitoring activities.
- Conduct landowner education programs about the potential problems associated with introducing non-native fish species into Umpqua Basin rivers and streams.
- Encourage landowner participation in activities that improve freshwater salmonid habitat conditions.

4. Current Trends and Potential Future Conditions

This chapter evaluates the current trends and the potential future conditions that could affect important stakeholder groups in the watershed.

Key Questions

- What are the important issues currently facing the various stakeholder groups?
- How can these issues affect the future of each group?

4.1. Overview

There are many commonalities among the identified stakeholder groups. All landowners are concerned that increasing regulations will affect profits, and all have to invest more time and energy in the battle against noxious weeds. The non-industrial private landowners are concerned about the global market's effect on the sale of local commodities. These groups also struggle with issues surrounding property inheritance. Some groups are changing strategies in similar ways; community outreach is becoming increasingly important for both the Oregon Department of Environmental Quality (ODEQ) and industrial timber companies. Overall, the future of fish habitat and water quality conditions in the Umpqua Basin is bright. According to ODEQ, basin-wide conditions are improving and have the potential to get better.

4.2. Stakeholder perspectives[91]

4.2.1. City of Canyonville[92]

City growth

Over the past 10 years, the City of Canyonville has experienced very little growth because the city is unable to expand its urban growth boundary (UGB).[93] Canyon Mountain blocks growth to the south, and Cow Creek Band of the Umpqua Tribe of Indians sovereign lands block northern expansion. At this time, it is not economically feasible to grow to the east or west due to the costs associated with providing utilities to these areas; this situation is not expected to change anytime soon.

Because the UGB cannot be changed, there are very few new housing developments in Canyonville. Just off the Canyonville-Riddle road, there is an 88-unit park for upscale modular homes, which is currently half full. There is another small development off the Tiller Highway within the Canyonville city limits. Both developments target middle- and

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[91] It was not possible to develop a comprehensive viewpoint of the current trends and potential future conditions for the conservationist and environmentalist community in the Umpqua Basin. Therefore, this perspective is not included in section 4.2.

[92] This information is from Chuck Spindel, Mayor, City of Canyonville.

[93] The corporate city limit is the boundary where the city officially ends. The urban growth boundary delineates the area that sometime in the future could be annexed into the city to accommodate its 20-year projected population growth. Usually, areas within the UBG have access to city services like water, sewer, and electricity.

upper-middle income residents. Although the city would like to regentrify some of its older neighborhoods, to date it has been unable to secure the necessary funding.

Business and industry

The Seven Feathers Hotel Casino and Resort, which is operated by the Cow Creek Band of the Umpqua Tribe of Indians (the Cow Creeks), has been operating outside of the City of Canyonville since 1996. Seven Feathers is among the largest tourist attractions in southern Douglas County. The Cow Creeks plan to expand the Seven Feathers complex to include a 190-unit RV park, a rest stop, an interpretive center, and a recreational facility, such as a golf course or theme park. There are also plans to develop an on-site wastewater treatment system. If all goes well, this $28 million project will be complete in 2005.

The City of Canyonville benefits from its proximity to Seven Feathers. Seven Feathers employs many city residents, and the Cow Creeks have been generous contributors to the city's projects. At the forefront of the city's economic development strategy is increasing tourism by attracting Seven Feathers visitors to the city.

As the third oldest community in Oregon, Canyonville has a rich pioneer history. The city plans to renovate its downtown and public areas to reflect a pioneer theme, which it believes would attract tourists. Progress has been made towards this goal; the concessions stand and restrooms in Pioneer Park, where most city festivals are held, have been beautifully renovated to resemble pioneer-era buildings. There are plans to do the same work to Pioneer Park's pavilion and amphitheater.

To make Canyonville more visitor-friendly, the city has begun a project to extend its sidewalk system from Stanton Park, located north of the city, to the southern city limits. This would create safe pedestrian access from Seven Feathers to downtown Canyonville. The city also plans to repair older, failing roads. The city does not plan to diversify its downtown business composition; Canyonville officials believe that its established shops and restaurants are attractive to visitors.

In addition to increasing tourism, the city plans to attract an industrial facility to Canyonville. North of the city, there is an unoccupied lot zoned light industrial. By working with the South Umpqua Valley Economic Development group, Canyonville will advertise the lot's availability. The city has not specified what type of industry it would like to see established on the lot.

Utilities

The City of Canyonville has access to live flow and stored water from Canyon Creek and Oshea Creek (there are city-owned dams on both creeks). Prior to the construction of Win Walker Dam on Canyon Creek in 1983, the Oshea Creek reservoir supplied most of the city's water; now Win Walker Reservoir is the city's primary water source. The city is in the process of upgrading the water intake lines from Oshea Creek.

At this time, Canyonville's wastewater treatment plant can accommodate more connections, and the sewer lines are adequate for the city's needs; no renovations are planned in the near future. In 2002, Canyonville completed upgrades to its water intake facility. The facility is equipped with a computerized monitoring system and will sound an alarm in the event of a problem. Since there is very little population growth in Canyonville, the city is confident that water from Oshea Creek and Canyon Creek, the current wastewater treatment plant, and the new water intake facility will continue to meet the city's needs into the future.

The future of Canyonville

The events that will most likely have the greatest impact on the future of Canyonville are changes to the Seven Feathers Hotel Casino and Resort complex and policy changes that affect traffic on Interstate Five (I-5). The continued success of Seven Feathers will economically benefit Canyonville, and the city would lose jobs and income in the unlikely event that Seven Feathers closed its doors. In the future, the city plans to continue its mutually beneficial relationship with the Cow Creeks.

I-5 transects the City of Canyonville. In the hilly terrain in southern Douglas County, long haul truck-related accidents are common on I-5. Nationwide, trucking associations are trying to change the size and weight limits on long haul trucks. The city is concerned that increasing these limits would result in more truck-related accidents, road fatalities, and a higher probability of harmful chemical and product spills in the city.

In the distant future, the City of Canyonville would like to see its city-wide pioneer theme realized and support a thriving tourist industry. The city would also like to remain a small town where most people are retired or locally employed; Canyonville does not foresee itself becoming a bedroom community for bigger cities like Roseburg or Grants Pass. In short, the City of Canyonville hopes to achieve economic development without sacrificing its small town charm.

4.2.2. Agricultural landowners[94]

Farmers in the Umpqua Basin/Douglas County area produce a variety of agricultural goods, including corn, beans, alfalfa, peaches, strawberries, filberts, and grapes for wine. Livestock operations mostly raise beef cattle and sheep, with a small number of poultry operations.[95] Nine percent of the South Umpqua River Watershed is zoned for agriculture (see Map 1-8 on page 26). Almost all agricultural lands are privately held and most are located in valleys and lowlands.[96] Throughout the Umpqua Basin, the agricultural community could potentially have the greatest influence on fish habitat and water quality restoration. Barriers to farmer and rancher participation in fish habitat and

[94] The following information is primarily from interviews with Tom Hatfield, the Douglas County Farm Bureau representative for the Umpqua Basin Watershed Council, and Kathy Panner, a member of the Douglas County Livestock Association. Shelby Filley from the Douglas County Extension Service and Stan Thomas from the USDA Wildlife Services provided additional information.

[95] There are people who raise pigs, dairy cows, horses, llamas, and other animals, but few are commercial operators.

[96] Many farmers and ranchers are also forestland owners (see section 4.2.3).

water quality activities are limited time, limited money, and in many cases low awareness or understanding of restoration project requirements, benefits, and funding opportunities.

Agricultural producers

Local observation suggests that there are four types of agricultural producers in the Umpqua Basin/Douglas County area. The first group is people who have been very successful in purchasing or leasing large parcels of lands, sometimes thousands of acres, to run their operations. This group generates all their income from agricultural commodities by selling very large quantities of goods on the open market. The second group is medium- to large-sized operators who are able to support themselves by selling their products on the direct market (or "niche" market). This group is able to make a profit on a smaller quantity of goods by "cutting out the middlemen." The third group is smaller operators who generate some income from their agricultural products, but are unable to support themselves and so must have another income as well. The last group is "hobby" farmers and ranchers who produce agricultural goods primarily for their own enjoyment and have no plans in place to make agricultural production their primary income source. Agricultural hobbyists often produce their goods to sell or share with family and friends. In many cases, members of this group do not identify themselves as part of the agricultural community. Observation suggests that in Douglas County the few very large operators are continuing to expand their land base. At the same time, smaller operators who hold outside jobs and agricultural hobbyists are becoming more common.

Factors influencing farmers and ranchers

Weeds

One concern for farmers and ranchers is weeds. There are a greater variety and distribution of weeds now than there were 20 years ago, including gorse, Himalayan blackberry, a variety of thistles, and Scotch broom.[97] Many of these species will never be eradicated; some, like Himalayan blackberries, are too widespread, and others, like Scotch broom, have seeds that can remain viable for at least 30 years.

Weeds are a constant battle for farmers and ranchers. These plants often favor disturbed areas and will compete with crops and pastures for water and nutrients. Many weeds grow faster and taller than crops and compete for sunlight. On pasturelands, weeds are a problem because they compete with grass and reduce the number of livestock that the land can support. Some species are poisonous; tansy ragwort is toxic to cattle, horses, and most other livestock except sheep. Whereas foresters must battle weeds only until the trees are "free to grow," farmers and ranchers must constantly battle weeds every year. As a result, an enormous amount of time, effort, and money are invested for weed management, reducing profits and possibly driving smaller operators out of business.

Predators

Predators have always been a problem for ranchers. Cougar, coyote, and bear cause the most damage, but fox, bobcat, domestic dogs, and wolf/dog hybrids have also been

[97] Tansy ragwort is less common today than ten years ago due to the introduction of successful biological control methods.

documented killing and maiming livestock.[98] Prior to the 1960s, the US Department of Agriculture (USDA) handled all predator management in Douglas County. The county took over all predator control programs in the 1960s through 1999. Now, the USDA once again handles all predator management.

The populations of cougar and bear appear to be on the rise because of changes in predator control regulations.[99] These species are territorial animals. As populations increase, animals that are unable to establish territories in preferred habitat will establish themselves in less suitable areas, often around agricultural lands and rural residential developments. Some wildlife professionals believe that cougars are less shy than they have been in the past, and are becoming increasingly active in rural and residential areas. As cougar and bear populations continue to rise, so will predation by these species on livestock. It is also possible that incidents involving humans and predators will increase as well.

Contrary to popular belief, predators do not only kill for food. Local ranchers have lost dozens of sheep and cattle overnight to a single cougar. In these cases, only a few of the carcasses had evidence of feeding, indicating that the cougar was not killing livestock for food. Small animals like sheep are easy prey, so some ranchers are switching to cattle. However, local observation indicates that cougar, bears, and packs of coyote are quite capable of killing calves and adult cattle as well.

Loss of quality farmland

Due in part to the difficulties facing today's ranchers and farmers, many young people are favoring other careers over agriculture. As a result, many agricultural lands are sold out of the original families. In some cases, the land is purchased by other nearby farmers and ranchers, and remains in production.[100] Local observation suggests that new residents from outside of southwest Oregon purchase some of these agricultural lands. In the case of smaller operations, new owners are often unable to turn a profit. Some residents suggest this may be because the newcomers do not understand local conditions or the specific needs of the property and are therefore unable to manage it profitably. In other cases, family farms and ranches are purchased by developers and divided into smaller lots for hobby farms, or converted into residential developments and taken out of production entirely. Statewide, there were 18.1 million acres of farmland in 1980; this number dropped to 17.2 million acres in 2000. This averages to be a loss of 45,000 acres of Oregon farmland per year.[101]

[98] The last confirmed wild wolf sighting in Douglas County occurred in the late 1940s. Wolf/dog hybrids are brought to the Douglas County/Umpqua Basin area as pets or for breeding and escape or are intentionally released.

[99] Cougar populations have been increasing since protection laws were passed in the 1960s. Coyote, fox, bobcat, and other predator populations appear to be stable.

[100] The topography of the Umpqua Basin makes this area undesirable to large agricultural conglomerates.

[101] Data are from the 2000-2001 Oregon Agriculture and Fisheries Statistics publication compiled by the US Department of Agriculture. A farm is defined as a place that sells or would normally sell $1,000 worth of agricultural products.

Regulations
Another concern for ranchers and farmers is the threat of increasing regulations. Since the 1970s, farmers and ranchers have had to change their land management practices to comply with stricter regulations and policies such as the Endangered Species Act, the Clean Water Act, and the Clean Air Act. The costs associated with farming and animal husbandry have increased substantially, partially attributable to increased standards and restricted use of pesticides, fertilizers, and other products. More regulations could further increase production costs and reduce profits.

Market trends
Perhaps the most important influence on agricultural industries is market trends. In the United States, there are around 10 food-marketing conglomerates that control most of the agricultural market through their immense influence on commodity prices. These conglomerates include the "mega" food chains like Wal-Mart and Costco. Also, trade has become globalized, and US farmers and ranchers are competing with farmers in countries that have lower production costs because they pay lower wages, have fewer environmental regulations, and/or have more subsidies. The conglomerates are in fierce competition with one another and rely on being able to sell food at the lowest possible price. These food giants have no allegiance to US agriculture, and the strength of the dollar makes purchasing overseas products very economical. On the open market, US farmers and ranchers must sell their goods at the same price as their foreign competitors or risk being unable to sell their products at all. In many cases, this means US producers must sell their goods at prices below production costs. As a result, it is very difficult for all but the very largest producers to compete with foreign agricultural goods, unless they are able to circumvent the open market by selling their goods directly to local or regional buyers ("niche" marketing).

The future of local agriculture
The future of farmers and ranchers depends a lot on the different facets of these groups' ability to work together. The agricultural community tends to be very independent, and farmers and ranchers have historically had limited success in combining forces to work towards a common goal. By working together, Oregon's agricultural community may be able to overcome the issues described above. If not, it is likely that in the Umpqua Basin hobby farms and residential developments will replace profitable family farms and ranches.

4.2.3. Family forestland owners[102]

The term "family forestland" is used to define forested properties owned by private individuals and/or families. Unlike the term "non-industrial private forestland," the definition of "family forestlands" excludes non-family corporations, clubs, and other associations. Of the 141,575 acres in the watershed, approximately 24% are non-industrial private forestlands. Family forestlands most likely constitute a slightly smaller percent of the private non-industrial forests.

[102] The following information is from an interview with Bill Arsenault, President of the Douglas Small Woodland Owners Association and member of the Family Forestlands Advisory Committee, and from "Sustaining Oregon's Family Forestlands" (Committee for Family Forestlands, 2002).

Family forestlands differ from private industrial forests. Industrial timber companies favor expansive stands of even-aged Douglas-fir. Family forestlands are more often located in lower elevations, and collectively provide a mixture of young and medium-aged conifers, hardwood stands, and non-forested areas such as rangeland. Family forestland owners are more likely to manage their properties for both commercial and non-commercial interests such as merchantable timber, special forest products, biological diversity, and aesthetics.

Family forestland owners play a significant role in fish habitat and water quality restoration. Whereas most public and industrial timber forests are in upper elevations, family forestlands are concentrated in the lowlands and near cities and towns. Streams in these areas generally have low gradients, providing critical spawning habitat for salmonids. As such, issues affecting family forestland property management may impact fish habitat and water quality restoration efforts.

Family forestland owners

Who are Douglas County's family forestland owners? In Oregon, most family forestland owners are older; nearly one in three is retired and another 25% will reach retirement age during this decade. Douglas County woodland owners seem to follow this general trend. Local observation suggests that many family forestland owners in Douglas County are either connected to the timber industry through their jobs or are recent arrivals to the area. The impression is that many of the latter group left higher-paying jobs in urban areas in favor of Douglas County's rural lifestyle. In general, few family forestland owners are under the age of 35. It is believed that most young forestland owners inherit their properties or have unusually large incomes, since the cost of forestland and its maintenance is beyond the means of people just beginning their careers.

Factors influencing family forestlands

<u>Changing markets</u>

There are very few small private mills still operating in Douglas County, so timber from family forests is sold to industrial timber mills. Timber companies are driven by the global market, which influences product demand, competition, and production locations. As markets change, so do the size and species of logs that mills will purchase. Family forestland owners must continually re-evaluate their timber management plans to meet the mills' requirements if they want to sell their timber. For example, mills are now favoring smaller diameter logs; hence family forestland owners have little financial incentive to grow large diameter trees.

Another aspect of globalization is a growing interest in certified wood products as derived from sustainably managed forests. Many family forestland owners follow the Oregon Forest Practices Act and consider their management systems sustainable. The Committee for Family Forestlands is concerned that wood certification parameters do not take into account small forest circumstances and management techniques. They fear that wood certification could exclude family-forest-grown timber from the expanding certified wood products market. However, the long-term effect of wood certification is still unclear.

Ultimately the key to continued family forestland productivity is a healthy timber market. Although globalization and certification may change the way family forestland owners manage their timber, foreign log imports have kept local mills in operation, providing a place for family forestland owners to sell their timber. The long-term impact of globalization on forestland will depend on how it affects local markets.

Indirectly, changes in the livestock industry also influence family forestland owners. The livestock market is down and many landowners are converting their ranchlands to forests. Douglas County supports these efforts through programs that offer landowners low-interest loans for afforestation projects.[103] Should the market for livestock remain low, it is likely that more pastureland will be converted to timber.

Land management issues

Exotic weeds are a problem for family forestland owners. Species like Scotch broom, gorse, and blackberries can out-compete seedlings and must be controlled. Unlike grass and most native hardwoods, these exotic species require multiple herbicide applications before seedlings are free to grow, which raises the cost of site maintenance by about $200 per acre. The cost is not enough to “break the bank” but can narrow family forestland owners’ profit margins. The cost of weed control may increase if these exotic species and others such as Portuguese broom become more established in the Umpqua Basin.

Regulations

Many family forestland owners fear that increasing regulations will diminish forest management profitability. For example, some Douglas County forestland owners are unable to profitably manage their properties due to riparian buffer protection laws. Although most family forestland owners support sound management practices, laws that take more land out of timber production would further reduce the landowners’ profits. This would likely discourage continued family forestland management.

Succession/inheritance

Succession is a concern of many family forestland owners. It appears that most forestland owners would prefer to keep the property in the family; however, an Oregon-wide survey indicates that only 12% of private forestland owners have owned their properties since the 1970s. Part of this failure to retain family forestlands within the family unit may result from complex inheritance laws. Inheritors may find themselves overwhelmed by confusing laws and burdensome taxes and choose to sell the property. Statewide, over 20,000 acres of timberland leave family forestland ownership every year. Private industrial timber companies are the primary buyers. Although the land remains forested, private industrial timber companies use different management prescriptions than

[103] Afforestation is planting trees in areas that have few or no trees. Reforestation is planting trees in areas that recently had trees, such as timber harvest sites or burned forests. Contact the Douglas County Extension Forester for more information on this program.

do most family forestland owners. Other family forestlands have been converted to urban and residential development to accommodate population growth.

4.2.4. Industrial timber companies[104]

Most industrial timberlands are located in areas that favor Douglas-fir, tending to be hillsides and higher elevations.[105] Higher gradient streams provide important habitat for cutthroat trout. Riparian buffer zones in stream headwater areas may influence stream temperatures in lower gradients.

In the South Umpqua River Watershed, industrial timber companies own approximately 32% of the land base. These lands are intensively managed for timber production. For all holdings, timber companies develop general 10-year harvest and thinning schedules based on 45 to 60 year timber rotations, depending upon site indices.[106] The purpose of these tentative harvest plans is to look into the future to develop sustained yield harvest schedules. These harvest and thinning plans are very general, modified over time depending on market conditions, fires, regulatory changes, and other factors, but are always developed to maintain sustained timber yield within the parameters outlined by the Oregon Forest Practices Act.

Current land management trends

Land acquisition

Most industrial timber companies in the Umpqua Basin have an active land acquisition program. When assessing land for purchase, industrial timber companies consider site index along with the land's proximity to a manufacturing plant, accessibility, and other factors. The sale of large private forestlands is not predictable, and it would be difficult for timber companies to try to consolidate their holdings to a specific geographic area. However, most land holdings and acquisitions by timber companies tend to be where conditions favor Douglas-fir production. While purchasing and selling land is commonplace, land exchanges are rare.

Weeds

Noxious weeds are a concern for industrial timber managers. As with family forestlands, species such as Scotch broom, hawthorn, and gorse increase site maintenance costs. Weeds can block roads, adding additional costs to road maintenance. Some weeds are fire hazards; dense growth creates dangerous flash and ladder fuels capable of spreading fire quickly. To help combat noxious weeds, some industrial timber companies are working with research cooperatives to find ways of controlling these species.

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[104] The following information is primarily from an interview with Dick Beeby, Chief Forester for Roseburg Forest Product's Umpqua District, and Jake Gibbs, Forester for Lone Rock Timber and President of the Umpqua Chapter of the Society of American Foresters.

[105] Hillsides and higher elevations are often a checkerboard ownership of Bureau of Land Management administered lands (see section 4.2.5) and industrial timberlands.

[106] Site index is a term used to describe a specific location's productivity for growing trees. Specifically, it relates a tree's height relative to its age, which indicates the potential productivity for that site.

Fire management

Fires are always a concern for industrial timber companies. The areas at greatest risk are recently harvested and thinned units, because of the flammable undecayed slash (debris) left behind. Timber companies believe that the fire risk is minimized once slash begins to decay. Although many timber companies still use prescribed burning as a site management technique, it is becoming less common due to regulations and the associated cost versus risk factors.

Road maintenance

Although a good road system is critical to forest management, poorly maintained roads can be a source of stream sediment and undersized or damaged culverts can be fish passage barriers. Roads on industrial timberlands are inventoried and monitored routinely. Problems are prioritized and improvements scheduled either in conjunction with planned management activities or independently based on priority. Currently, most industrial timber companies repair roads so they do not negatively affect fish habitat and water quality, and failing culverts are replaced with ones that are fish-passage friendly. Road decommissioning is not common, but is occasionally done on old roads. When a road is decommissioned, it is first stabilized to prevent erosion problems, and then nature is allowed to take its course. Although these roads are not tilled or plowed to blend in with the surrounding landscape, over time vegetation is re-established. New roads are built utilizing the latest technology and science to meet forest management objectives while protecting streams and other resources.

Community outreach

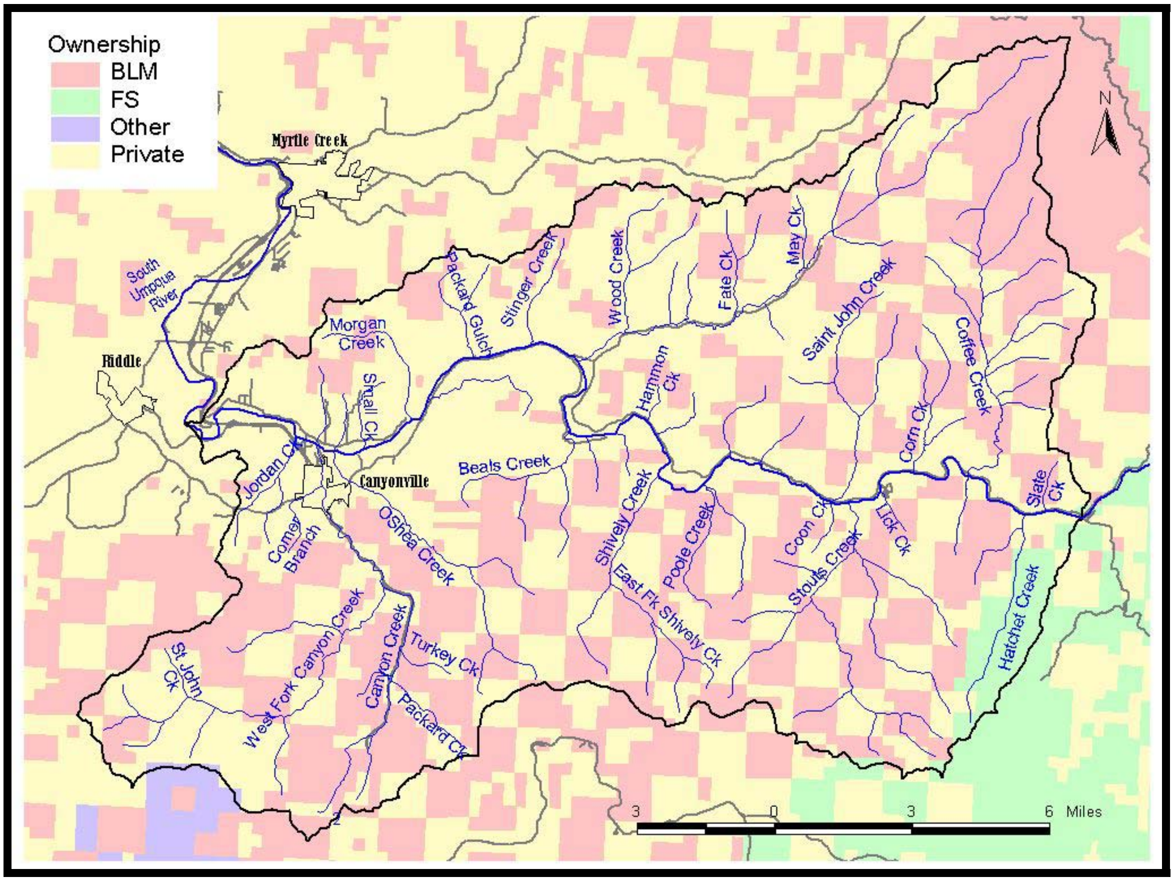
The population of Douglas County is growing. Local observation suggests that many new residents are retirees or transfer incomes from urban areas. Many of these new residents moved to the area for its "livability" and are not familiar with the land management methods employed by industrial timber companies. As a result, establishing and maintaining neighbor relations is becoming increasingly important. Many timber companies will go door-to-door to discuss upcoming land management operations with neighboring owners and address any questions or concerns that the owners may have. These efforts will continue as the rural population within the Umpqua Basin grows.

Regulations

Increased regulations will probably have the greatest impact on the future of industrial timber companies. Like family forestland owners, most industrial timber companies believe in following sound forest management principles and consider their current management systems sustainable. There is concern that the efforts and litigation that changed forest management methods on public lands will now be focused on private lands. Should forestry become unprofitable due to stricter regulations, industrial timber companies would be forced to move their businesses elsewhere, potentially converting their forestlands to other uses.

4.2.5. The Bureau of Land Management[107]

The Roseburg District Office of the Bureau of Land Management (BLM) administers a total of 425,588 acres of which most is within the Umpqua Basin and all is within Douglas County.[108] In the South Umpqua River Watershed, the BLM administers approximately 34% of the watershed (see Map 4-1).



Map 4-1: Location of BLM administered lands in the South Umpqua River Watershed.

The BLM and US Forest Service activities within the range of the Northern Spotted Owl follow the guidelines of the 1994 Northwest Forest Plan. In compliance with this policy, the Roseburg BLM's District Office developed a Record of Decision and Resource Management Plan in 1995.[109] The plan outlines the on-going resource management goals and objectives for lands administered by the BLM. All of the BLM's activities are

[107] The following information is from the Roseburg District of the Bureau of Land Management's 1995 Record of Decision and Resource Management Plan and the District's Annual Program Summary and Monitoring Report for fiscal year 2000 to 2001.

[108] Including 1,717 acres of non-federal land with federal subsurface mineral estate administered by the BLM.

[109] For copies of this document, contact the Bureau of Land Management Roseburg District Office at 777 Northwest Garden Valley Road, Roseburg, Oregon 97470.

guided by the resource management plan. This section summarizes the main points of the document.

General overview

The BLM Roseburg District Office's vision is that the "Bureau of Land Management will manage the natural resources under its jurisdiction in western Oregon to help enhance and maintain the ecological health of the environment and the social well-being of the human population." Ecosystem management is the strategy used by the Roseburg BLM to guide its vision:

> Ecosystem management involves the use of ecological, economic, social, and managerial principals to ensure the sustained condition of the whole. Ecosystem management emphasizes the complete ecosystem instead of individual components and looks at sustainable systems and products that people want and need. It seeks a balance between maintenance and restoration of natural systems and sustainable yield of resources (p. 18).

The BLM manages all its land using two primary management concepts outlined in the Northwest Forest Plan. The first is "Ecological Principles for Management of Late Successional Forests." One goal for this management concept is "to maintain late-successional and old-growth species habitat and ecosystems on federal lands." The second goal is "to maintain biological diversity associated with native species and ecosystems in accordance with laws and regulations."

The second management concept is the "Aquatic Conservation Strategy." This strategy was developed "to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands." A primary intent is to protect salmonid habitat on federal lands administered by the BLM through activities such as watershed restoration and protecting riparian areas.

Land use allocations and resource programs

As part of its strategy, the BLM has four land use allocations that are managed according to specific objectives and management actions/directions that contribute to the two primary management concepts. The first land use allocation is Riparian Reserves. These areas are managed to provide habitat for various wildlife species. The second is Late-Successional Reserves (LSR). These are managed to protect and enhance conditions of late-successional and old-growth forest ecosystems that provide habitat for many species such as the northern spotted owl. Third, Matrix Areas have multiple objectives, which include providing a sustainable supply of timber and other forest commodities, connecting late successional reserves, and providing habitat for organisms associated with young, mature, and older forests. The last land use allocation is Adaptive Management Areas, where the agency develops and tests new management approaches to integrate ecological health with other social parameters, such as economic stability. In the Roseburg BLM District, the Adaptive Management Area is located in the Little River Watershed. The BLM also manages for 20 specific resource programs such as wilderness, timber resources, rural interface areas, and noxious weeds. As with the land use allocations, there are specific objectives and management actions/directions for each of the resource programs that are congruent with the Northwest Forest Plan management concepts. [110]

Current trends

A requirement of the Roseburg District BLM's Resource Management plan is to publish a report on its annual activities. This document is called the Annual Program Summary and Monitoring Report.[111] It describes the BLM's accomplishments during the fiscal year, provides information about its budget, timber receipt collections, and payments to Douglas County.

Overall, the Roseburg BLM District is implementing the Northwest Forest Plan. The BLM met its goals for its land use allocations and for many of its resource programs, such as "water and soils" and "fish habitat." However, uncertainty surrounding the Survey and Manage standard, as well as on-going litigation, has affected the BLM's ability to implement some of its program elements.[112] For the third year in a row, the BLM's forest management and timber resource program did not come close to achieving its goal of sustainably harvesting 45 million board feet (MMBF) of timber. During fiscal years 1996 through 1998, the BLM came close to or exceeded its 45 MMBF goal. In 1999, harvests fell to 10 MMBF (22% of goal), and then dropped to 1.4 MMBF in 2000 (3% of goal). In 2001, harvest levels climbed slightly to 2.7 MMBF (6% of goal). Under the Resource Management Plan, more acres of BLM-administered forested lands are approaching late-successional stage than are being managed for timber.

Shortly after the completion of the Northwest Forest Plan, the American Forest Resource Council filed a lawsuit against the BLM. The major issues concerned the alleged inappropriate application of reserves and wildlife viability standards to Oregon and California Railroad lands (O&C lands).[113] In August, 2003, a settlement agreement was reached, including the following points:

- Within Northwest Forest Plan areas, the BLM and the US Forest Service will do their best efforts to annually offer 805 million board feet (MMBF) of timber from matrix lands.

- The BLM and USFS will offer thinning sales in Northwest Forest Plan Late Successional Reserve lands totaling 300 MMBF annually (100 MMBF for the BLM and 200 MMBF for the USFS).

[110] For specific information about land use allocations and management, see the BLM Roseburg District's Resource Management Plan.
[111] Copies of the Roseburg District BLM's Annual Program Summary and Monitoring Report from fiscal year 2001 are available through the Roseburg District Office.
[112] The Northwest Forest Plan's Survey and Manage standard requires that all agencies conduct surveys prior to any activities on public lands to identify resident species of which little is known (such as mosses, mollusks, and fungi) and develop appropriate management strategies. Depending on the specific species requirements, surveys for a project can take two years or more to complete.
[113] See footnote 22 on page 50 for more information on O&C lands.

- By 2008, the BLM will revise its land use plans in western Oregon. During this process, the BLM will develop alternatives that address a variety of issues, including at least one that will propose eliminating reserves on O&C lands, except where threatened or endangered species would be put at risk. This term is contingent upon funding.

Future of BLM management

The BLM's Resource Management Plan is the guide to all of the BLM's activities and is not subject to casual changes. There are three situations that may result in significant alterations to the current plan. First, major policy changes, such as modifying the Northwest Forest Plan, would require the BLM's Resource Management Plan to be updated so it corresponds with new policies. Second, landscape-wide ecological changes, such as a 60,000-acre fire or a landscape-wide tree disease outbreak, could require changes to the BLM's current plan. Finally, the Resource Management Plan is slated for evaluation in 2005. At that time, the current plan would be evaluated to ascertain if newer information or changed circumstances warranted an amendment or revision. In all cases, the public has the opportunity to review and comment on an amendment to or revision of the plan.

4.2.6. Oregon Department of Environmental Quality[114]

The Oregon Department of Environmental Quality (ODEQ) plays an important and unique role in fish habitat and water quality restoration. ODEQ's primary responsibility is to support stream beneficial uses identified by the Oregon Water Resources Department by:

- Establishing research-based water quality standards;
- Monitoring to determine if beneficial uses are being impaired within a specific stream or stream segment; and
- Identifying factors that may be contributing to conditions that have led to water quality impairment.

Approximately every three years, ODEQ reassesses its water quality standards and streams that are 303(d) listed as impaired. Throughout the development and reassessment of water quality standards, ODEQ attempts to keep the public involved and informed about water quality standards and listings. All sectors of the public, including land managers, academics, and citizens-at-large, are encouraged to offer input into the process. Water quality standards and 303(d) listings may be revised if comments and research support the change.

Current and future efforts

To fulfill its responsibilities into the future, ODEQ will continue to prioritize areas that are important for the various beneficial uses through their own research and the research of other groups. When these areas have been identified and prioritized, ODEQ will examine current land use practices to determine what changes, if any, will benefit

[114] The following information is primarily from an interview with Paul Heberling, a water quality specialist for the Oregon Department of Environmental Quality in Roseburg.

preserving and/or restoring resources. Also, ODEQ will continue its efforts to work with individuals, agencies, citizen groups, and businesses to encourage them to voluntarily improve fish habitat and water quality conditions.

ODEQ hopes that education and outreach will help residents understand that improving conditions for fish and wildlife also improves conditions for people. For example, well-established riparian buffers increase stream complexity by adding more wood to the stream channel. Increased stream complexity provides better habitat for fish. Buffers also help downstream water quality by trapping nutrients and preventing stream warming, which can lead to excessive algae growth and interfere with water contact recreation.

Potential hindrances to water quality restoration

One hindrance to ODEQ's work is the financial reality of many water quality improvement activities. In some cases, the costs associated with meeting current standards are more than communities, businesses, or individual can easily absorb. For example, excessive nutrients from wastewater treatment plants can increase nitrate and phosphate levels and result in water quality impairments. The cost for upgrading a wastewater treatment plant can run into tens of millions of dollars, and costs are usually passed on to the community through city taxes and higher utility rates. Upgrading septic systems to meet current standards can cost a single family in excess of $10,000, more than many low and middle-income rural residents can afford. People's interest in improving water quality often depends on the degree of financial hardship involved.

Another potential hindrance to ODEQ's work is budget cuts and staff reductions. There are two Healthy Stream Partnership positions assigned to the Umpqua Basin, which is approximately three million acres. Without sufficient funding or personnel, it is difficult for ODEQ to conduct its basin-wide monitoring activities and reassess current water quality standards and impaired streams.

Current and potential future water quality trends

In 1998, there were 1,067 streams or stream segments identified as failing to meet one or more of Oregon's water quality standards. Of these, approximately 10% were in the Umpqua Basin.[115] Table 4-1 shows by parameter the number of Umpqua Basin streams failing to meet water quality standards.

[115] See section 3.3.1 for 303(d) listed streams in the South Umpqua River Watershed.

Parameter	**# of listed streams or reaches**	**Parameter**	**# of listed streams or reaches**
Ammonia	1	Iron	4
Aquatic weeds/algae	3	Lead	3
Arsenic	4	Manganese	2
Biological criteria	7	Mercury	4
Cadmium	1	pH	14
Chlorine	2	Phosphorus	1
Copper	2	Sediment	7
Dissolved oxygen	7	Temperature	180
E. coli and fecal coliform	14	Total dissolved gas	4

Table 4-1: Number of Umpqua Basin 303(d) listed streams by parameter.

Accordingly, the focus for preservation and restoration efforts is directed toward improving stream temperature and bacterial levels to support the various beneficial uses. Improving stream temperature may provide the greatest cost-benefit ratio because temperature is a major factor in impacting or exacerbating other water quality parameters, including dissolved oxygen, pH, bacteria, and ammonia. Land management activities that reduce the rate of stream warming, such as establishing functional riparian buffers, can also improve other water quality parameters, such as sedimentation. Reducing bacteria levels is also a focus because of the serious human health risks associated with fecal bacteria. There is a clear rationale for activities that reduce bacteria levels, such as fixing failing septic systems and reducing the amounts of fecal wastes reaching streams from livestock, pets, and other sources.

Although many Umpqua Basin streams and reaches are water quality impaired, current trends indicate that conditions are improving. Data from ODEQ long term monitoring sites in the Umpqua Basin indicate that between 1989 and 1998, water quality conditions of many Umpqua Basin rivers and streams improved. The South Umpqua River at Melrose Road, Stewart Park Road, Winston, and Days Creek Cuttoff Road, as well as Cow Creek at the mouth, South Umpqua River at Umpqua, and the North Umpqua at Garden Valley Road, are listed as sites that have shown significant improvement. From these data, ODEQ believes that continuing to support beneficial uses through water quality improvement activities will insure a bright future for fish habitat and water quality in the Umpqua Basin.

5. Action Plan

The action plan summarizes key findings and action recommendations from all previous chapters, and identifies specific and general restoration opportunities and locations within the watershed. The Umpqua Basin Watershed Council, the Oregon Department of Fish and Wildlife, and the Douglas Soil and Water Conservation District developed the action plan for the South Umpqua River Watershed. Activities within the action plan *are suggestions for voluntary projects and programs*. The action plan should not be interpreted as landowner requirements or as a comprehensive list of all possible restoration opportunities.

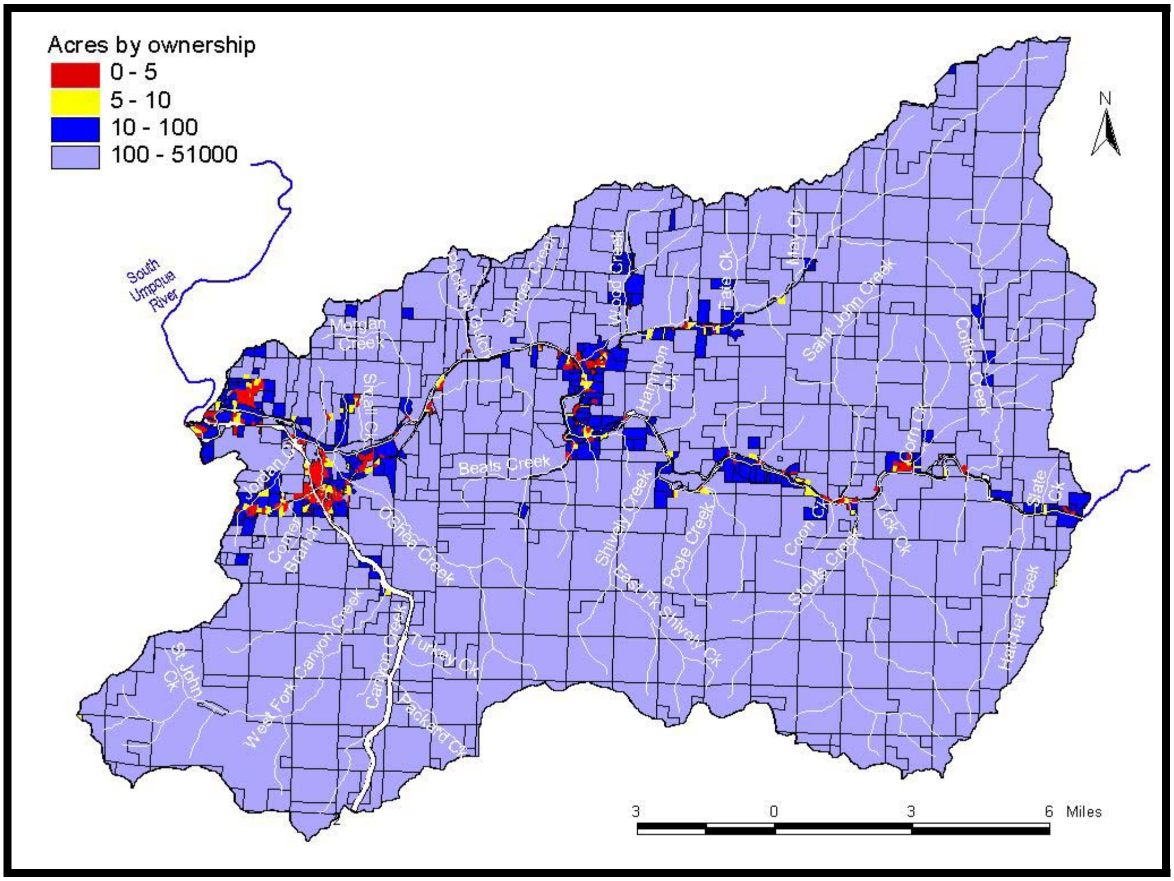
Key Questions

- Where are potential project location sites and activities in the watershed?
- How does property ownership affect restoration potential?

5.1. Property ownership and restoration potential

For some projects, such as eliminating fish passage barriers, the actual length of stream involved in implementing the project is very small. If only one culvert needs to be replaced, it doesn't make any difference if the participating landowner has 50 feet or a half mile of stream on the property. The benefits of other activities, such as riparian fencing and tree planting, increase with the length of the stream included in the project. Experience has shown that for the UBWC, conducting projects with one landowner, or a very small group of landowners, is the most efficient approach to watershed restoration and enhancement. Although working with a large group is sometimes feasible, as the number of landowners cooperating on a single project increases, so do the complexities and difficulties associated with coordinating among all the participants and facets of the project. For large-scale enhancement activities, working with one or a few landowners on a very long length of stream is generally preferred to working with many landowners who each own only a short segment of streambank.

Map 5-1 shows parcel size in acres by ownership in the South Umpqua River Watershed. Unlike Map 1-10 in section 1.3, all parcels owned by the same person, family, agency, group, etc., are colored to reflect total ownership size. For example, if a single family owns three five-acre parcels, all parcels will be colored dark blue to reflect the total ownership of 15 acres. This map indicates that many streams and stream segments in the South Umpqua River Watershed, such as Shively Creek, are good candidates for large-scale stream habitat restoration projects because they run through large ownerships. Other streams that mostly consist of smaller ownerships should be considered for smaller-scale restoration and enhancement activities, and for landowner education programs.



Map 5-1: Ownership size by acre for the South Umpqua River Watershed.

5.2. South Umpqua River Watershed key findings and action recommendations

5.2.1. Stream function

Stream morphology key findings

- A wide variety of stream channel habitat types are found in the watershed, and different enhancement opportunities exist.
- Most streams within the South Umpqua River Watershed have low gradients with few stream miles in the source areas, where most large woody material is recruited into the stream system. This may naturally limit instream large woody material abundance.
- Stream habitat surveys suggest that lack of large woody material, poor riffles, and poor or fair pools limit fish habitat in surveyed streams.

Stream connectivity key findings

- Dams and culverts that are barriers and/or obstacles to fish reduce stream connectivity, affecting anadromous and resident fish productivity in the South Umpqua River Watershed. More information about fish passage barriers will be available from UBFAT in 2004.

Channel modification key findings

- There are few examples of permitted channel modification projects in the South Umpqua River Watershed.
- Many landowners may not understand the detrimental impacts of channel modification activities or may be unaware of active stream channel regulations.

Stream function action recommendations

- o Where appropriate, improve pools and riffles while increasing instream large woody material by placing large wood and/or boulders in streams with channel types that are responsive to restoration activities and have an active channel less than 30 feet wide.[116]
- o Encourage land use practices that enhance or protect riparian areas:
  - ➢ Protect riparian areas from livestock-caused browsing and bank erosion by providing stock water systems and shade trees outside of the stream channel and riparian zones. Fence riparian areas as appropriate.
  - ➢ Plant native riparian trees, shrubs, and understory vegetation in areas with poor or fair riparian areas.
  - ➢ Manage riparian zones for uneven-aged stands with large diameter trees and younger understory trees.
- o Maintain areas with good native riparian vegetation.
- o Encourage landowner participation in restoring stream connectivity by eliminating barriers and obstacles to fish passage. Restoration projects should focus on barriers that, when removed or repaired, create access to the greatest amount of fish habitat.
- o Increase landowner awareness and understanding of the effects and implications of channel modification activities through public outreach and education.

5.2.2. Riparian zones and wetlands

Riparian zones key findings

- The South Umpqua River's riparian area is predominantly hardwoods and brush/blackberry. Canyon Creek, Days Creek, and all other tributaries are predominantly hardwoods and conifers.
- Potential anadromous salmonid streams have riparian areas that are mostly conifers and hardwoods, while cutthroat streams have conifer-dominated riparian areas.
- The South Umpqua River's riparian buffers are predominantly one tree wide or have no trees. Over half of Canyon Creek's buffers are one tree wide, while Days Creek's buffers are predominantly one tree wide or greater. Almost three-fourths of other tributaries have riparian buffers that are two trees wide or greater.
- Almost half of potential anadromous salmonid streams have riparian zones that are two trees wide or greater. Cutthroat streams and are dominated by buffers that are two trees wide or greater.
- Due to the great width of the South Umpqua River, almost the entire river within the watershed is exposed to direct sunlight. The areas that are mostly covered are under

[116] Thirty feet is the maximum stream width for which instream log and boulder placement projects are permitted.

bridges. Canyon Creek, Days Creek, and other tributaries are mostly shaded by vegetation or infrastructure.
- Potential anadromous salmonid streams are predominantly shaded by vegetation or infrastructure, but over a third are less than half covered. This is because the South Umpqua River is within anadromous salmonid distribution. Almost 85% of potential cutthroat streams are mostly covered.

Wetlands key findings[117]
- Historical settlement, development, and long-term agricultural use of the South Umpqua River Watershed have probably affected the original wetland hydrology.
- Most of the remaining wetlands in the South Umpqua River Watershed are found on private land.
- Landowner "buy-in" and voluntary participation must be fostered if wetland conservation is to be successful in the watershed.
- There is opportunity for enhancement and protection of wetlands, including ash groves along the South Umpqua River in the Morgan Creek area.

Riparian zones and wetlands action recommendations
- Where canopy cover is less than 50%, establish wide buffers of native trees (preferably conifers) and/or shrubs, depending upon local conditions. Priority areas are fish-bearing streams for which more than 50% canopy cover is possible.
- Identify riparian zones dominated by grass, brush, and blackberry and convert these areas to native trees (preferably conifers) and/or shrubs, depending on local conditions.
- Where riparian buffers are one tree wide or less, encourage buffer expansion by planting native trees (preferably conifers) and/or shrubs, depending on local conditions.
- Maintain riparian zones that are two or more trees wide and provide more than 50% cover.
- Encourage best management practices that limit wetland damage, such as off-channel watering, hardened crossings, livestock exclusion (part or all of the year), and providing stream shade.
- Develop opportunities to increase awareness of what defines a wetland, its functions and benefits. This is a fundamental step in creating landowner interest and developing landowner appreciation for wetland conservation.
- Identify or establish various peer-related demonstration projects as opportunities to educate stakeholders.
- Establish an approachable "one-stop shop" or clearinghouse to assist landowners in enrolling in programs that can benefit wetlands and meet landowner goals.

[117] Jeanine Lum of Barnes and Associates, Inc., contributed the wetlands key findings and action recommendations.

5.2.3. Water quality

Temperature key findings

- Results show that seven-day moving average maximum temperatures in the South Umpqua River were frequently above 64°F. Days Creek is the only tributary that had seven-day moving average maximum temperatures exceed 64°F every day. Consistently high stream temperatures would limit salmonid rearing in these reaches.
- Most monitoring sites located in the upper reaches of tributaries had seven-day moving average maximum temperature below 64°F every monitoring day.
- Warmer sites often lack shade. Increasing shade on small and medium-sized streams will reduce stream warming rates and improve habitat for salmonids.
- Groundwater and tributary flows can contribute to stream cooling. Gravel-dominated tributaries may permit cooler subsurface flows when surface flows are low.
- Fish may find shelter from high summer temperatures in the lower reaches and mouths of small and medium-sized tributaries and in reaches within warm streams that have proportionately high groundwater influx and shade.

Surface water pH, dissolved oxygen, nutrients, bacteria, and toxics key findings

- Temperature and the levels of pH, nutrients, and dissolved oxygen are interrelated. In the South Umpqua River, pH levels violate water quality standards. Nutrient and dissolved oxygen levels do not appear to limit water quality in the South Umpqua River Watershed.
- Bacteria sampling within the South Umpqua River Watershed does not consistently exceed water quality standards. Monitoring data from outside the South Umpqua River Watershed contributes to the river's 303(d) listing. Additional monitoring is necessary to determine if South Umpqua River Watershed tributaries have water quality-limiting bacteria levels.
- Chlorine levels exceed water quality standards in the South Umpqua River; ammonia levels are a potential concern.

Sedimentation and turbidity key findings

- Turbidity data indicate that usual turbidity levels in the South Umpqua River Watershed should not affect sight-feeding fish like salmonids.
- Areas of moderate to high soil erodibility and runoff potential lie in large areas in the northwest and southeast parts of the South Umpqua River Watershed where deeply weathered granite rocks are located.
- Steep to moderately steep slopes are found through the watershed. Particularly high slopes exist in the south and southwest portions of the watershed.
- The combination of steep slope along with poorly managed, erosion-inducing human modifications such as roads, timber harvesting, agriculture, and residential development can make areas prone to greatly increased erosion.
- Runoff from impervious surfaces, including roads and roofs, can increase sediment loads to streams.
- In the Umpqua Basin, more studies are needed to determine the impacts of roads, culverts, landslides, burns, soil type, and urban conditions on sedimentation and turbidity.

Water quality action recommendations

- o Continue monitoring the South Umpqua River Watershed for all water quality conditions. Expand monitoring efforts to include small tributaries.
- o Identify stream reaches that may serve as "oases" for fish during the summer months, such as at the mouth of small or medium-sized tributaries. Protect or enhance these streams' riparian buffers and, when appropriate, improve instream conditions by placing logs and boulders within the active stream channel to create pools and collect gravel.
- o In very warm streams or where pH is a problem, increase shade by encouraging wide riparian buffers and managing for full canopies.
- o Encourage landowner practices that will maintain the South Umpqua River Watershed's low bacteria and nutrient levels:
  - ➢ Limit livestock stream access by providing stock water systems and shade trees outside of the stream channel and riparian zones. Fence riparian areas as appropriate.
  - ➢ Relocate structures and situations that concentrate domestic animals near streams, such as barns, feedlots, and kennels. Where these structures cannot be relocated, establish dense and wide riparian vegetation zones to filter fecal material.
  - ➢ Repair failing septic tanks and drain fields.
  - ➢ Use wastewater treatment plant effluent for irrigation.
  - ➢ Reduce chemical nutrient sources.
- o Where data show that stream sediment or turbidity levels exceed established water quality standards, identify sediment sources such as urban runoff, failing culverts or roads, landside debris, construction, or burns. Take action to remedy the problem or seek assistance through organizations such as the UBWC, the Douglas Soil and Water Conservation District, and the Natural Resources Conservation Service.
- o Use the refined debris flow hazard data (soon available at Nature of the Northwest in Portland) to identify landslide-sensitive areas.
- o In areas with high debris flow hazards and/or with soils that have high K factor values and are in the C or D hydrologic group (primarily the western half of watershed), encourage landowners to identify the specific soil types on their properties and include soils information in their land management plans.
- o Use proper management practices, such as controlling road runoff from improper drainage, to control erosion in sensitive areas of the watershed.
- o Cooperate with ODEQ as necessary to document and reduce contamination by chlorine and ammonia.

5.2.4. Water quantity

Water availability and water rights by use key findings

- In all five South Umpqua River Watershed WABs, instream water rights are close to or exceed average streamflow during one or more months of the year.
- During the summer, there is no "natural" streamflow available for new water rights.
- "Irrigation" is the largest use of water for the total watershed, the South Umpqua River, and all tributaries. "Mining" and "municipal" are the second and third largest water uses for the watershed as a whole.

Streamflow and flood potential key findings

- Within the watershed, the South Umpqua River's flow has dropped below 100 cfs during the summer months. In August, average monthly streamflow for Days Creek at Days Creek is 1.01 cfs.
- No flooding trends were determined from the records to date.
- The degree to which road density and the TSZ influence flood potential in the South Umpqua River Watershed is unknown at this time.

Water quantity action recommendations

- o Reduce summer water consumption through instream water leasing and by improving irrigation efficiency.
- o Educate landowners about proper irrigation methods and the benefits of improved irrigation efficiency.
- o Continue monitoring peak flow trends in the watershed. Try to determine the role of vegetative cover, flooding, road density, and the TSZ on water volume.

5.2.5. Fish populations

Fish populations key findings

- The anadromous fish species in the South Umpqua River Watershed with annual runs are coho, steelhead, spring and fall chinook, and Pacific lamprey. Cutthroat trout are the only resident salmonid.
- Although many South Umpqua River Watershed medium and large tributaries are within the distribution of one or more salmonid species, salmonid ranges have not been verified for each tributary.
- Brown bullhead, smallmouth bass, and possibly other non-native fish species have reproducing populations within the South Umpqua River. These fish are most likely introduced to the river through private ponds. Stream temperatures are generally too cold for these species to establish reproducing populations in smaller tributaries.
- More quantitative data are needed to evaluate salmonid abundance and the distribution and abundance of non-salmonid fish in the watershed.
- On average, less than 10% of spawning fall chinook in the South Umpqua River system are found within the South Umpqua River Watershed.
- Most of the spawning fall chinook counted in the South Umpqua River Watershed are found between I-5 and Days Creek.
- The number of redds in the South Umpqua River system appears to be increasing.
- Although watershed-specific data show tremendous fluctuation in annual salmonid abundance, Umpqua Basin-wide data indicate that salmonid returns have improved. Ocean conditions are a strong determinant of salmonid run size; however, improving freshwater conditions will help increase salmonid fish populations.

Fish populations action recommendations

- o Work with local specialists and landowners to verify the current and historical distribution of salmonids in tributaries.
- o Support salmonid and non-salmonid distribution and abundance research activities in the watershed, especially at the local level.

- Encourage landowner and resident participation in fish monitoring activities.
- Conduct landowner education programs about the potential problems associated with introducing non-native fish species into Umpqua Basin rivers and streams.
- Encourage landowner participation in activities that improve freshwater salmonid habitat conditions.

5.3. Specific UBWC enhancement opportunities

UBWC staff members believe that within the South Umpqua River Watershed, Stouts Creek and Shively Creek are generally in good condition. Beals Creek, Upper Days Creek, Corn Creek, Coffee Creek, and Stouts Creek are the UBWC's top priority streams for projects within the watershed. Listed below are specific UBWC enhancement opportunities within the South Umpqua River Watershed. These recommendations are based on the assessment findings as well as the professional experience of UBWC, DSWCD, and ODFW staff members.

1. Actively seek out opportunities with landowners, businesses, and resident groups in key areas to enlist participation restoration projects and activities:
   - Remove/replace barriers to fish passage Stinger Gulch, Beals Creek, and Fate Creek.
   - Install efficient irrigation systems and encourage instream water leasing on streams with irrigation rights, such as the South Umpqua River.
   - Place fish habitat improving logs and boulders in Upper Days Creek, Beals Creek, Stouts Creek, Shively Creek and Coffee Creek.
   - Plant trees (especially conifers), remove blackberries, and fence riparian areas along Coffee Creek, Days Creek, Stinger Gulch, Wood Creek, and Beals Creek. Install upland stock water systems as appropriate.

2. Work with landowners on a case-by-case basis to create or improve wetlands, especially along the South Umpqua River in the Morgan Creek area.

3. Assist the Umpqua Basin Fish Access Team's evaluation of fish passage barriers and obstacles, especially on Morgan Creek, Upper Days Creek, East Fork Shively Creek, Corn Creek, and Coffee Creek.

4. Develop a page on the UBWC website that provides local information on wetlands and wetland conservation programs to help landowners enroll in programs that can benefit wetlands and meet landowner goals.

5. Develop educational materials and/or outreach programs to educate target audiences about fish habitat and water quality related issues:
   - Create educational brochures about bank erosion, the problems associated with channel modification, and the importance of riparian areas. These could be given to new landowners through real estate agents.

- Develop public service announcements about ways of improving or maintaining riparian and instream conditions, such as the benefits of riparian fencing and how to use fertilizers and pesticides in a stream-friendly fashion.
- Design engaging displays about fish passage barriers for community events, such as the Douglas County Fair.
- Give presentations at citizen groups about the benefits to landowners and to fish that result from upland stock water systems, off-channel shade trees, and instream water leasing.

6. Support local fish habitat and water quality research:
   - Train volunteers to conduct fish and water quality monitoring and research.
   - Provide equipment necessary for local water quality research and monitoring.
   - Survey long-term landowners and residents about historical and current fish distribution and abundance.
   - Encourage school and student participation in monitoring and research.
   - Collaborate with other organizations and agencies on monitoring projects, such as assisting ODEQ with monitoring South Umpqua River ammonia and chlorine levels below Canyonville.

7. Educate policy makers about the obstacles preventing greater landowner participation in voluntary fish habitat and water quality improvement methods.

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Appendices

Appendix 1: Additional geologic information. [119]

Geologic history

Setting the stage for continental collision

In the late Triassic and early Jurassic, the North American continent started moving westward across the earth, and in doing so, collided with the oceanic crust underlying the Pacific Ocean (see Appendix table I for relative time scale). This began the long process of subduction that has been occurring ever since. As oceanic crust collides with a continent, the oceanic crust descends, or subducts, beneath the continental crust due to its greater density. At the collision point, a trench forms, creating the setting for a great deal of deformation of sediments. As the ocean floor subducts, continental shelf and slope sediments that had been deposited off the shore of the continent are scraped off the underlying ocean crust and shoved into the edge of the continent. Islands or other belts of rocks that were associated with the oceanic plate collide into the continent and, because they will not sink, accrete to the edge of the continent (Alt and Hyndman, 2001).

Klamath Mountains history

The Klamath Mountains of Oregon were formed by the collision of many different belts of rocks, or terranes, into the continent over time ranging from the late Triassic to the late Cretaceous. Some of these rocks formed in an open oceanic environment, while others formed in a coastal environment. Volcanic islands crashed into the continent. Sediment that was constantly being deposited by rivers onto the continental shelf and slope were just as constantly being shoved onto the edge of the continent as they rode east on top of the oceanic floor. This accretion of many terranes and the intense faulting that occurs at the plate collision boundary makes the geology of the Klamath Mountains highly complex. Each terrane has distinct rocks and fossils. In the South Umpqua River Watershed, many different types of rocks of Jurassic and Cretaceous age including a chunk of oceanic crust were incorporated in the landscape. The collision of these rocks resulted in a great many faults that exist both at terrane boundaries and within individual terranes. In the beginning stages of the formation of the Klamath Mountains, the province was located much further east than it is today. It rotated into its current position by the early Cretaceous, and has been relatively stable since. Today, the contacts between the terranes are orientated in a southwest-northeast trend (Orr and Orr, 2000).

Western Cascades history

Starting around the beginning of the Oligocene epoch, the sinking of the oceanic crust beneath the continental margin began to spawn the Western Cascades. As the subducting slab sank to the hot mantle of the Earth, it began to heat up and melt, as well as melt rocks above it. Magma rose to the Earth's surface in eruptions that built the Cascades (Alt and Hyndman, 2001). Between eruptions, volcanic materials were quickly eroded

[119] Kristin Anderson and John Runyon of BioSystems, Inc., contributed the text and tables for Appendix 1. Terms such as "Jurassic" and "Cretaceous" refer to periods in the geologic/evolutionary timetable. However, the UBWC takes no position regarding the time periods with which these terms are associated and is using the terms to refer to natural processes and the relative order in which they occurred.

and washed into what was then a coastal plain to the west. Great thicknesses of deposits from volcanic eruptions and from erosion and subsequent deposition exist in the Western Cascades. The Western Cascades underwent significant periods of uplift during the Middle Miocene and more recently in the early Pliocene.

As more of the oceanic crust was consumed underneath the continent, the age of oceanic crust rocks that met the continent became progressively younger. Younger oceanic rocks are warmer, move more quickly, and are more buoyant. The popular theory for the shift of volcanic activity from the west to the east to later produce the High Cascades is that the more buoyant younger crust subducted at a lower angle, thus reaching a melting point farther inland (Orr and Orr, 2000).

Era	**Period**	**Epoch**
Cenozoic	Quaternary	Holocene
		Pleistocene
	Tertiary	Pliocene
		Miocene
		Oligocene
		Eocene
		Paleocene
Mesozoic	Cretaceous	
	Jurassic	
	Triassic	
Paleozoic	Permian	
	Pennsylvanian	
	Mississippian	
	Devonian	
	Silurian	
	Ordovician	
	Cambrian	
Precambrian		

Appendix table I: Geologic time scale (most recent to oldest – top to bottom).

Descriptions of geologic units from Walker and MacLeod (1991).
For explanation of terms within this table, refer to Jackson (1997).

Map symbol	Age	Geologic Unit Description
Qal	Holocene	**Alluvial deposits**: Sand, gravel, and silt forming floodplains and filling channels of present streams. In places includes talus and slope wash. Locally includes soils containing abundant organic material, and thin peat beds.
Qma	Holocene	**Mazama ash-flow deposits:** Rhyodacitic to andesitic ash-flow deposits related to climactic eruptions of Mount Mazama (Bacon, 1983).
Qt	Pleistocene	**Terrace, pediment, and lag gravels:** Unconsolidated deposits of gravel, cobbles, and boulders intermixed and locally interlayered with clay, silt, and sand. Mostly on terraces and pediments above present flood plains.
Tu	Miocene and Oligocene	**Undifferentiated tuffaceous sedimentary rocks, tuffs, and basalt:** Heterogeneous assemblage of continental, largely volcanogenic deposits of basalt and basaltic andesite, including flows of breccia, complexly interstratified with epiclastic and volcaniclastic deposits of basaltic to rhyodacitic composition. Includes extensive rhyodacitic to andesitic ash-flow and air-fall tuffs, abundant lapilli tuff and tuff breccia, andesitic to dacitic mudflow (lahar) deposits, poorly bedded to well bedded, fine- to coarse-grained tuffaceous sedimentary rocks, and volcanic conglomerate
Tfe	Oligocene and upper Eocene	**Fisher and Eugene Formations and correlative rocks:** Thin to moderately thick bedded, coarse- to fine- grained arkosic and micaceous sandstone and siltstone, locally highly pumiceous, of the marine Eugene Formation; and coeval and older andesitic lapilli tuff, breccia, water-laid and air-fall silicic ash of the continental Fisher and Colestin Formation; upper parts of the Fisher Formation apparently lap onto and interfinger with the Eugene Formation.
KJds	Lower Cretaceous and Upper Jurassic	**Dothan Formation and related rocks** (sedimentary rock)**:** Sandstone, conglomerate, greywacke, rhythmically banded chert lenses.
KJm	Lower Cretaceous and Upper Jurassic	**Myrtle Group**: Conglomerate, sandstone, siltstone, and limestone. Locally fossiliferous.
KJg	Cretaceous and Jurassic	**Granitic rocks:** Mostly tonalite and quartz diorite but including lesser amounts of other granitoid rocks.

Js	Jurassic	**Sedimentary rocks:** Black and gray mudstone, shale, siltstone, graywacke, andesitic to dacitic water-laid tuff, porcelaneous tuff, and minor interlayers and lenses of limestone and fine-grained sediments metamorphosed to phyllite or slate. Locally includes some felsite, andesite and basalt flows, breccia, and agglomerate. Marine invertebrate fauna indicates age range from Early Jurassic (Hettangian) to early Late Jurassic (Oxfordian).
Jv	Jurassic	**Volcanic rocks:** Lava flows, flow breccia, and agglomerate consisting dominantly of plagioclase, pyroxene, and hornblende porphyritic and aphyric andesite. Includes flow rocks that range in composition from basalt to rhyolite as well as some interlayered tuff and tuffaceous sedimentary rocks. Commonly metamorphosed to greenschist facies; locally foliated, schistose or gneissic. Considered to be accreted island-arc terrane.
Ju	Jurassic	**Ultramafic and related rocks of ophiolite sequences**: Predominantly harzburgite and dunite with both cumulate and tectonic fabrics. Locally altered to serpentinite. Includes gabbroic rocks and sheeted diabasic dike complexes. In southwest Oregon, locally includes small bodies of early Mesozoic or Late Paleozoic serpentinized and sheared ultramafic rocks, mostly in shear zones. Locally, volcanic and sedimentary rocks shown separately.

Glossary of terms[120]

Accretion: The addition of continental material to a pre-existing continent, usually at its edge and by the processes of convergent and transform motion.

Agglomerate: A mixture of coarse angular fragment of rock and finer-grained materials formed during a volcanic explosion.

Alluvial: Pertaining to the environments, actions, and products of rivers or streams.

Alluvium: An unconsolidated terrestrial sediment composed of sorted or unsorted sand, gravel, and clay that had been deposited by water.

Andesite: Fine-grained volcanic rock characterized by the presence of plagioclase feldspar.

Arkosic: Containing abundant feldspar minerals.

Banding: Bedding produced by deposition of different materials in alternating layers.

Basalt: A fine-grained, dark, mafic, extrusive igneous rock composed largely of plagioclase feldspar and pyroxene. It is the major rock of ocean basins.

Breccia: A coarse-grained, clastic rock composed of angular and broken rock fragments in a finer-grained matrix. It is usually sedimentary in origin, but may also be igneous (volcanic breccia).

Calcareous: Any rock that has enough carbonate material so that it reacts with hydrochloric (or any other strong) acid, producing bubbles of carbon dioxide. Usually, the carbonate material is calcite.

Chert: A sedimentary form of amorphous or extremely fine-grained silica, partially hydrous, found in concretions and beds.

Clay: Mineral particles less than 4 micrometers in diameter.

Conglomerate: A coarse-grained clastic sedimentary rock composed of rounded or sub-rounded fragments larger than two millimeters in diameter and cemented together.

Continental shelf: That part of the continental margin that is between the shoreline and the continental slope. Usually it extends vertically to a depth of about 600 feet. It is the zone where sunlight penetrates and is the most productive area of marine life in the ocean. It is characterized by its very gentle slope.

[120] These terms are mostly compiled from Allaby and Allaby (1999), Challinor (1978), Jackson (1997), and Orr and Orr (2000).

Continental slope: That part of the continental margin that lies between the continental shelf and the bottom of the ocean. Sunlight does not penetrate this area, and mostly it is home to scavengers. It is characterized by a relatively steep slope.

Convection: Bodily movement of material from one place (usually hotter) to another (usually colder). Often in sub-circular patterns called "convection cells."

Crust: The outermost layer of the earth. It includes the oceanic crust (about 5-10 miles thick) and the continental crust (50-75 miles thick). The bottom of the crust is the Mohorovicic Discontinuity ("Moho").

Debris avalanche: A fast downhill mass movement of soil and rock.

Deformation: Any change in shape or structure of a rock unit as a result of earth forces, on any scale.

Delta: A body of sediment deposited in an ocean or lake at the mouth of a stream.

Deltaic: Formed in a delta setting.

Diorite: A coarse-grained intermediate igneous rock composed essentially of plagioclase in excess of alkali feldspar, and mafic minerals.

Drainage basin: A region of land surrounded by divides and crossed by streams that eventually converge to one river or lake.

Epoch: One subdivision of a geologic period, often chosen to correspond to a stratigraphic series.

Era: A time period including several periods, but smaller than an eon. Commonly recognized eras are Precambrian, Paleozoic, Mesozoic, and Cenozoic.

Erosion: The set of all processes by which soil and rock are loosened and moved downhill or downwind.

Fault: A crack or fracture in the earth's surface across which there has been relative displacement. Movement along the fault can cause earthquakes or--in the process of mountain-building--can release underlying magma and permit it to rise to the surface.

Feldspar: The most important group of rock forming silicate minerals. Feldspar constitutes 60% of the Earth's crust.

Flood plain: A level plain of stratified alluvium on either side of a stream; submerged during floods.

Fluvial: Pertaining to streams and river deposits; produced by the action of flowing water.

Forearc basin: A sedimentary basin, usually elongate, lying between the volcanic arc and the shelf break in a convergent plate boundary zone.

Formation: A body of rock identified by lithic characteristics and stratigraphic position and is mappable at the earth's surface or traceable in the subsurface.

Geomorphology: The science of surface landforms and their interpretation on the basis of geology and climate**.**

Granite: A coarse-grained, intrusive igneous rock composed of quartz, orthoclase feldspar, sodic plagioclase feldspar, and micas. Also sometimes a metamorphic product.

Gravel: Sediment grains with diameters between two and 60 mm.

Graywacke: A quartz sandstone that includes noticeable amounts of mud and/or mica. Sometimes called a "dirty sandstone."

Group: Two or more formations in a stratigraphic column that formed by similar events or processes.

Hydraulic conductivity: A measure of the ability of a rock, sediment, or soil to permit fluids to flow through it.

Igneous: Rock or mineral crystallized from partly molten material, i.e. magma.

Intrusion: The process of emplacement of magma in pre-existing rock. Also, the term refers to igneous rock mass so formed within the surrounding rock.

Intrusive: Applied to a body of rock, usually igneous, that is emplaced within preexisting rocks.

Landslide: The rapid downslope movement of soil and rock material, often lubricated by groundwater, over a basal shear zone or along a sedimentary contact; also the tongue of stationary material deposited by such an event.

Lapilli: Small stony pieces of lava from two to 64 mm, falling as pyroclastic material, having been blown into the air in a volcanic eruption.

Lava: Magma that has reached the surface through a volcanic eruption. The term is most commonly applied to streams of liquid rock that flow from a crater or fissure. It also refers to cooled and solidified rock.

Limestone: A sedimentary rock composed principally of calcium carbonate ($CaCO_2$), usually as the mineral calcite.

Lithology: The systematic description of rocks, in terms of mineral composition and texture.

Lithosphere: The zone of brittle rock between the earth's surface and the asthenosphere (a zone of ductile deformation about 200 km below the surface). The lithosphere consists of the entire crust and a small portion of the uppermost mantle. It has an ultramafic igneous composition (mostly magnesium, silicon, and oxygen). The lithosphere forms the "plates" of plate tectonics.

Mafic: An igneous rock composed chiefly of one or more dark-colored minerals.

Magma: Molten rock material that forms igneous rocks upon cooling. Magma that reaches the surface is referred to as lava.

Mantle: The main bulk of the Earth, between the crust and core, ranging from depths of about 40 to 3480 kilometers. It is composed of dense mafic silicates and divided into concentric layers by phase changes that are caused by the increase in pressure with depth.

Mass movement: A downhill movement of soil or fractured rock under the force of gravity.

Metamorphic rocks: Rocks altered by heat and pressure causing recrystallization and loss of original characteristics.

Micaceous: Consisting of, containing, or pertaining to mica, which is a family of silicates of aluminum and potassium that form into thin elastic plates.

Mudstone: A hardened mud; a blocky or massive fine-grained sedimentary rock in which the proportions of clay and silt are approximately equal.

Ophiolite sequence: An assemblage of mafic and ultra-mafic igneous rocks with deep-sea sediments supposedly associated with divergent zones and the sea-floor environment.

Period: A major, worldwide, geologic time unit corresponding to a system such as the Cambrian Period.

Plagioclase: Soda-lime feldspar.

Plate tectonics: The theory that the earth's crust is broken into about 10 fragments (plates), which move in relation to one another, shifting continents, forming new ocean crust, and stimulating volcanic eruptions.

Pyroclastic: Applied to fragmentary materials produced by explosive volcanic action.

Relief: The vertical difference between the summit of a mountain and the adjacent valley or plain.

Rhythmic sedimentation: Cyclic deposition of sediments involving a circuitous sequence of conditions.

Runoff: The amount of rain water directly leaving an area in surface drainage, as opposed to the amount that seeps out as groundwater.

Sand: Mineral particles between 0.0625 mm and 2.0 mm in diameter.

Sandstone: A detrital sedimentary rock composed of grains from 0.0625 mm to 2.0 mm in diameter, dominated in most sandstones by quartz, feldspar, and rock fragments, bound together by a cement of silica, carbonate, or other minerals or a matrix of clay minerals.

Schist: A medium- to coarse-grained, foliated (layered) metamorphic rock created by regional metamorphism to medium or high temperatures and shearing pressures. Commonly, schists include quartz, feldspars, and micas, but mineral composition is not an essential factor in its definition. Schists are strongly foliated, with well-developed parallelism of more than 50% of the minerals present.

Sedimentary rock: A rock formed by the accumulation and cementation of mineral grains transported by wind, water, or ice to the site of deposition or chemically precipitated at the depositional site.

Sedimentation: The process of deposition of mineral grains or precipitates in beds or other accumulations.

Serpentine: Rock-forming minerals derived from alteration of magnesium-rich silica minerals; have a greasy or silky luster, a slightly soapy feel, are usually compact, and are commonly greenish in color.

Shale: A very fine-grained, thinly layered sedimentary rock composed of clay and/or silt grains. Shales break easily along their layering, especially along weathered surfaces. They feel smooth to the touch, not gritty.

Shearing: The motion of surfaces sliding past one another.

Silicic: Said of igneous rock or magma rich in silicon dioxide.

Silt: Mineral particles between four and 62 micrometers in diameter.

Siltstone: A fine-grained, layered sedimentary rock composed primarily of grains between 1/256 mm and 1/16 mm in size. Siltstones contain hard thin layers. They feel grittier than shales or mudstones.

Subduction: The process of consumption of a crustal plate at a convergent plate margin with one crustal plate descending beneath another.

Subduction zone: A dipping planar zone descending away from a trench and defined by high seismicity, interpreted as the shear zone between a sinking oceanic plate and an overriding plate.

Terrace: A step-like surface, bordering a valley floor or shoreline that represents the former position of a flood plain, or lake or sea shore.

Terrane: A suite of rocks bounded by fault surfaces that has been displaced from its point of origin.

Topography: The shape of the Earth's surface, above and below sea level; the set of landforms in a region; the distribution of elevations.

Trench: A narrow, elongate depression of the deep-sea floor, having steep sides and oriented parallel to the trend of an adjacent continent. It lies between the continental margin and the abyssal plain. Usually it forms the surficial trace of a subduction zone.

Tuff: A consolidated rock composed of pyroclastic (from a volcanic explosion) fragments and fine ash. If particles are melted slightly together from their own heat, it is a "welded tuff."

Tuffaceous: Composed by large amounts of tuff.

Ultramafic: A magnesium-rich igneous rock with less than 45% silica (silicon dioxide); typical composition of the Earth's mantle.

Volcanic arc (also island arc): A curved chain of volcanic islands rising from the deep-sea floor and near to a continent caused by subduction processes and occurring on the continent side of the subduction zone. Its curve generally is convex toward the open ocean.

Volcanigenic: Having a volcanic origin

Volcano: A vent in the surface of the Earth through which magma and associated gases and ash erupt; also, the form or structure (usually conical) that is produced by the ejected material.

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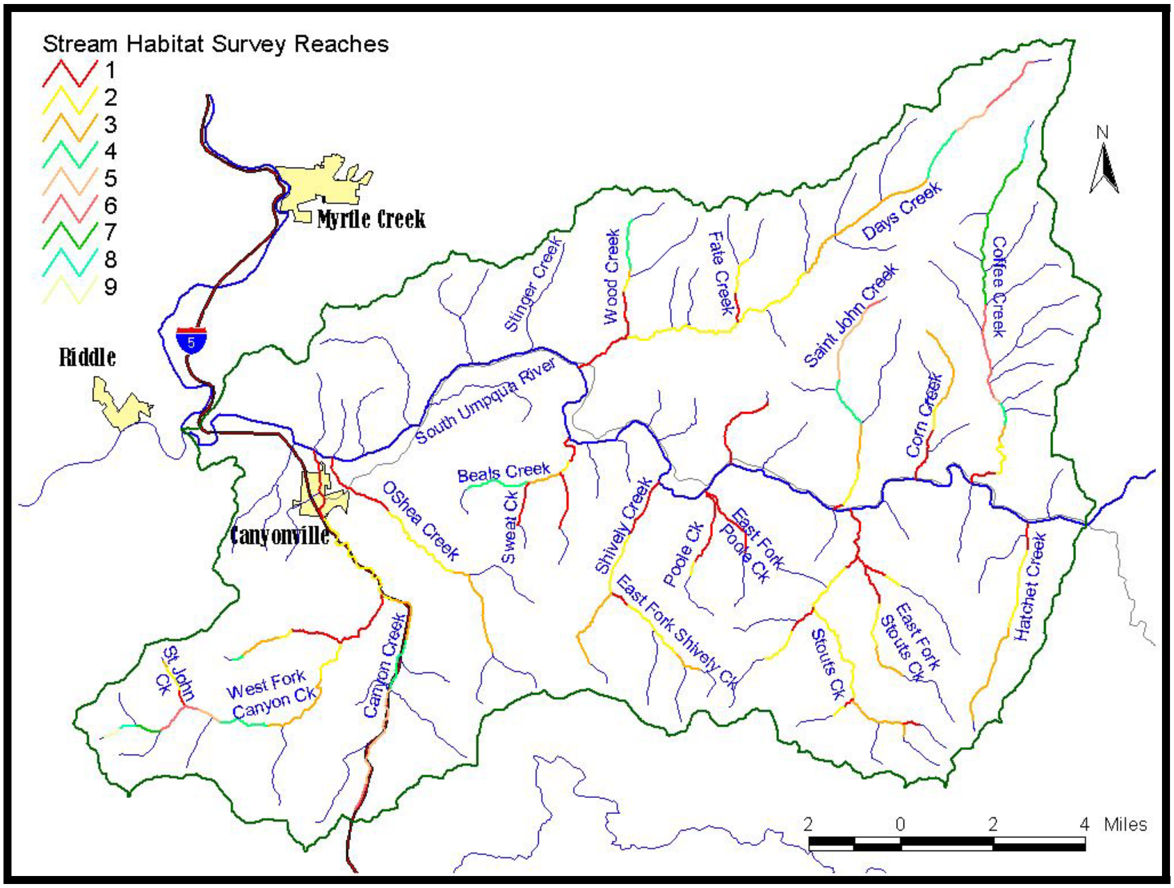
Appendix 2: Stream habitat surveys

Stream reaches surveyed by the Oregon Department of Fish and Wildlife



South Umpqua River Watershed ●●● = Good; ●● = Fair; ● = Poor

Stream	Reach	Pools	Riffles	Riparian Area	Large Woody Material
BEALS CREEK	1	●●	●	●	●
BEALS CREEK	2	●	●	●●	●
BEALS CREEK	3	●●	●●	●●	●
BEALS CREEK	4	●	●●	●●●	●
CANYON CREEK	1	●●	●●	●●	●
CANYON CREEK	2	●●	●●	●	●
CANYON CREEK	3	●●	●●●	●	●
CANYON CREEK	4	●●	●●●	●	●
CANYON CREEK	5	●●	●●●	●●	●
CANYON CREEK	6	●	●	●	●
COFFEE CREEK	1	●●	●	●●●	●
COFFEE CREEK	2	●●	●●	●●●	●
COFFEE CREEK	3	●	●	●	●

Stream	Reach	Pools	Riffles	Riparian Area	Large Woody Material
COFFEE CREEK	4	••	•	•••	•
COFFEE CREEK	5	••	•	•	•
COFFEE CREEK (UNSURVEYED)	6				
COFFEE CREEK	7	••	••	•••	•••
COFFEE CREEK	8	•	•	•••	••
CORN CREEK	1	••	•	•••	•
CORN CREEK	2	••	•	••	••
CORN CREEK	3	•	•	••	••
DAYS CREEK	1	••	••	•	•
DAYS CREEK	2	•	•	••	•
DAYS CREEK	3	•	•	••	•
DAYS CREEK	4	•	•	•••	•
DAYS CREEK	5	•	••	•••	•
DAYS CREEK	6	•	•	•••	•
E.FK.POOLE CREEK	1	•	•••	•••	•
E.FK.SHIVELY CREEK	1	•	•••	••	•
E.FK.SHIVELY CREEK	2	•	••	•••	•
E.FK.SHIVELY CREEK	3	•	••	••	•
EAST FORK STOUTS CREEK	1	•	•	•	•
EAST FORK STOUTS CREEK	2	•	•	•	•
EAST FORK STOUTS CREEK	3	••	•	•	•
FATE CREEK	1	•••	•	•	•
FATE CREEK	2	••	•	••	•
HATCHET CREEK	1	••	•	••	•
HATCHET CREEK	2	••	•	••	•
HATCHET CREEK	3	••	•	•••	••
LAVADOURE CREEK	1	•	••	•••	•
POOLE CREEK	1	•	•••	•	•
POOLE CREEK	2	•	•	•••	••
ST. JOHN CREEK	1	••	••	•	•
ST. JOHN CREEK	2	••	••	••	••
ST. JOHN CREEK	3	••	••	••	••
ST. JOHN CREEK	4	••	•••	•••	•
ST. JOHN CREEK	5	•	•••	•••	•••
ST. JOHN CREEK	6	•	•	•••	•••
ST. JOHN CREEK (CANYON)	1	••	•••	•	•
ST. JOHN CREEK (CANYON)	2	•	•••	••	•••
ST. JOHN CREEK (CANYON)	3	•	•	••	•••
SHIVELY CREEK	1	••	••	••	•
SHIVELY CREEK	2	••	••	••	•
SHIVELY CREEK	3	•	••	••	•
STOUTS CREEK	1	••	••	•	•
STOUTS CREEK	2	••	•	•	••
STOUTS CREEK	3	•	•	•	•
SWEAT CREEK	1	•	•	•••	•
W. FK. CANYON CREEK	1	•	•	•	•
W. FK. CANYON CREEK	2	•••	•	••	•

Stream	Reach	Pools	Riffles	Riparian Area	Large Woody Material
W. FK. CANYON CREEK	3	•••	••	•	•
W. FK. CANYON CREEK	4	••	•	•	•
W. FK. CANYON CREEK (UNSURVEYED)	5				
W. FK. CANYON CREEK	6	••	•••	••	•
W. FK. CANYON CREEK	7	••	•••	•	•
W. FK. CANYON CREEK	8	••	•••	•	••
W. FK. CANYON CREEK	9	•	•	••	•••
WOOD CREEK	1	•••	••	••	•
WOOD CREEK	2	•••	•	•	•
WOOD CREEK	3	•••	•	•••	•
WOOD CREEK	4	••	•	•	•
W. FK. CANYON CREEK TRIB #1	1	••	•••	•	•
W. FK. CANYON CREEK TRIB #1	2	•••	•••	•••	•••
W. FK. CANYON CREEK TRIB #1	3	••	••	••	••
W. FK. CANYON CREEK TRIB #1	4	•	•	•••	•
BEALS CREEK TRIB #1	1	•	•	•••	•
NORTHEAST FORK STOUTS CREEK	1	•	•	•••	••
NORTHEAST FORK STOUTS CREEK	2	•	••	•••	••
STOUTS CREEK TRIB #14	1	•	•	•••	•
STOUTS CREEK TRIB #16	1	••	•	•	•
STOUTS CREEK TRIB #16	2	•	•	•••	••
SOUTHWEST FORK STOUTS CREEK	1	•	•	•	•••
SOUTHWEST FORK STOUTS CREEK	2	•	•	•••	•
OSHEA CREEK	1	••	•	•	•
OSHEA CREEK	2	•	••	••	•
OSHEA CREEK	3	•	•	••	•

Appendix 3: Land use classifications for the ODFW stream habitat surveys

The Oregon Department of Fish and Wildlife classified the land use for each reach surveyed within the South Umpqua River Watershed. All categories have been included below, even those not applicable to the South Umpqua River Watershed.

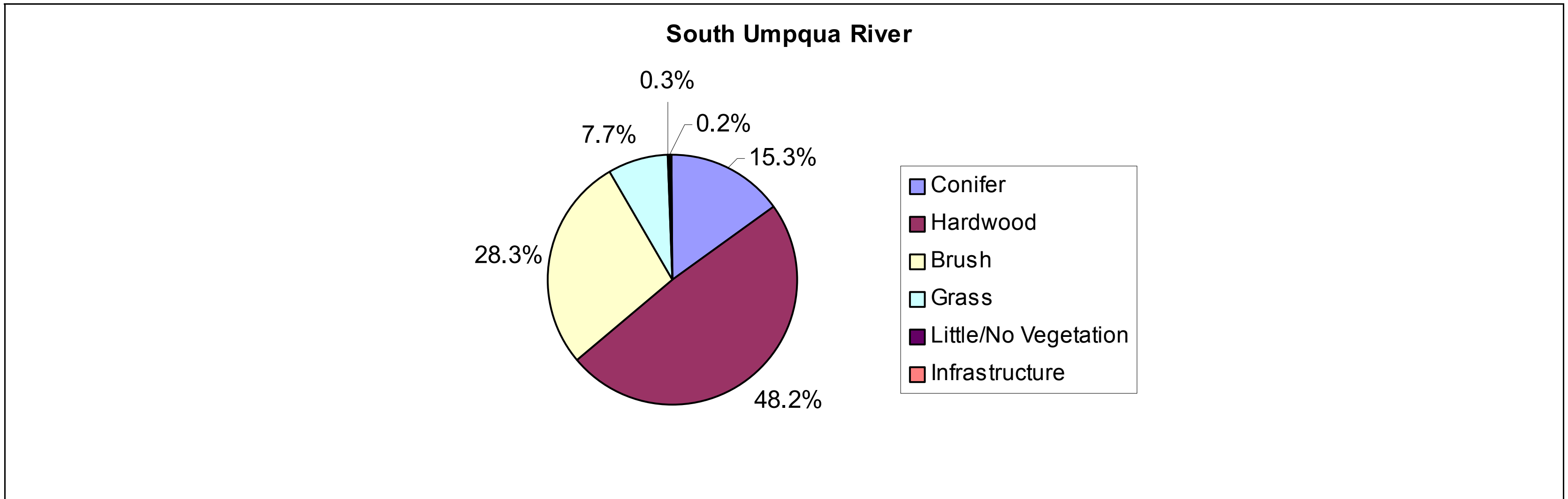
AG Agricultural crop or dairy land.
TH Timber harvest: active timber management including tree felling, logging, etc. Not yet replanted.
YT Young forest trees: can range from recently planted harvest units to stands with trees up to 15 cm dbh.
ST Second growth timber: trees 15-30 cm dbh within generally dense, rapidly growing, uniform stands.
LT Large timber: 30 to 50 cm dbh.
MT Mature timber: 50 to 90 cm dbh.
OG Old growth forest: many trees with 90+ cm dbh and plant community with old growth characteristics.
PT Partial cut timber: selection cut or shelterwood cut with partial removal of large trees. Combination of stumps and standing timber.
FF Forest fire: evidence of recent charring and tree mortality.
BK Bug kill: eastside forests with >60% mortality from pests and diseases.
LG Light grazing pressure: grasses, forbs, and shrubs present. Banks not broken down, animal presence obvious only at limited points such as water crossing. Cow pies evident.
HG Heavy grazing pressure: broken banks, well established cow paths. Primarily bare earth or early successional stages of grasses and forbs present.
EX Exclosure: fenced area that excludes cattle from a portion of rangeland.
UR Urban
RR Rural residential
IN Industrial
MI Mining
WL Wetland
NU No use identified

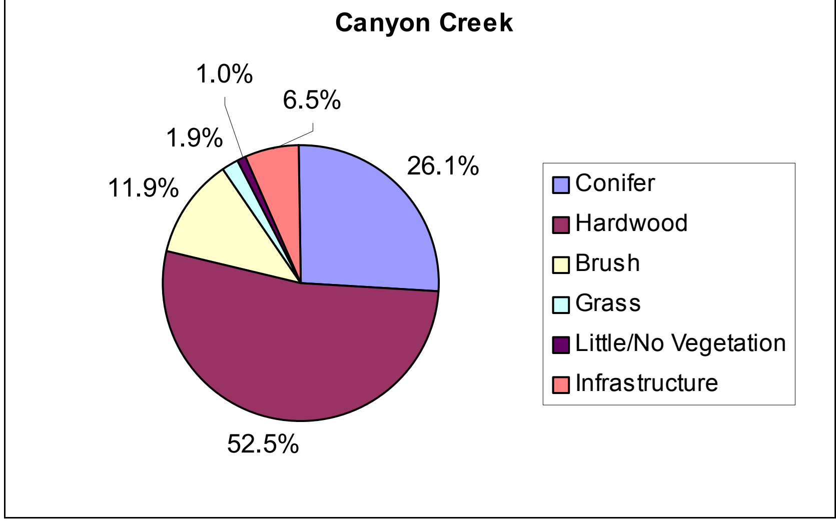
Stream	Reach	Primary Land Use	Secondary Land Use
BEALS CREEK	1	RR	IN
BEALS CREEK	2	HG	ST
BEALS CREEK	3	HG	ST
BEALS CREEK	4	HG	ST
CANYON CREEK	1	RR	IN
CANYON CREEK	2	ST	IN
CANYON CREEK	3	ST	YT
CANYON CREEK	4	ST	YT
CANYON CREEK	5	ST	YT
CANYON CREEK	6	ST	YT

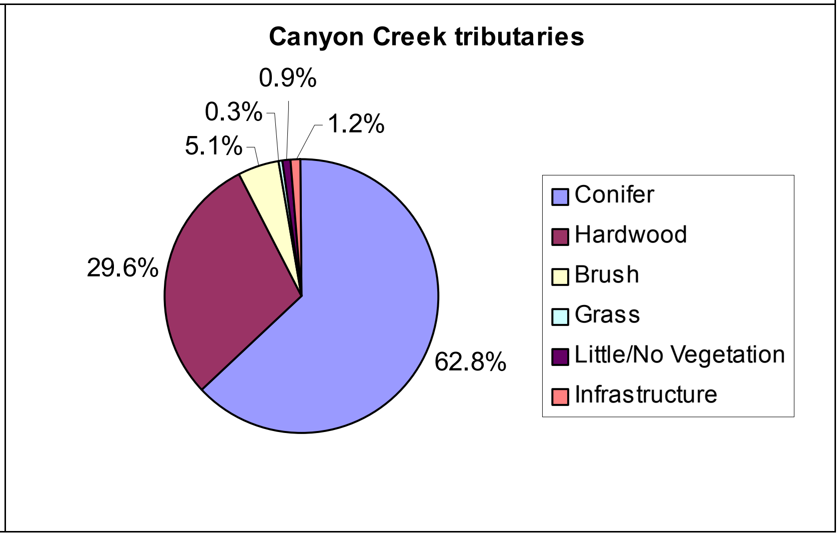
Stream	Reach	Primary Land Use	Secondary Land Use
COFFEE CREEK	1	PT	FF
COFFEE CREEK	2	ST	FF
COFFEE CREEK	3	LT	ST
COFFEE CREEK	4	MT	LT
COFFEE CREEK	5	LT	
COFFEE CREEK (UNSURVEYED)	6	MI	LG
COFFEE CREEK	7	OG	TH
COFFEE CREEK	8	OG	
CORN CREEK	1	RR	ST
CORN CREEK	2	ST	RR
CORN CREEK	3	LT	TH
DAYS CREEK	1	HG	RR
DAYS CREEK	2	HG	RR
DAYS CREEK	3	ST	HG
DAYS CREEK	4	ST	YT
DAYS CREEK	5	ST	YT
DAYS CREEK	6	OG	YT
E.FK.POOLE CREEK	1	ST	YT
E.FK.SHIVELY CREEK	1	ST	YT
E.FK.SHIVELY CREEK	2	ST	OG
E.FK.SHIVELY CREEK	3	ST	TH
EAST FORK STOUTS CREEK	1	ST	MI
EAST FORK STOUTS CREEK	2	TH	
EAST FORK STOUTS CREEK	3	PT	
FATE CREEK	1	HG	RR
FATE CREEK	2	YT	ST
HATCHET CREEK	1	ST	YT
HATCHET CREEK	2	ST	MT
HATCHET CREEK	3	ST	YT
LAVADOURE CREEK	1	FF	
POOLE CREEK	1	AG	ST
POOLE CREEK	2	ST	MT
ST. JOHN CREEK	1	UR	ST
ST. JOHN CREEK	2	ST	
ST. JOHN CREEK	3	ST	LT
ST. JOHN CREEK	4	ST	LT
ST. JOHN CREEK	5	ST	LT
ST. JOHN CREEK	6	YT	LT
ST. JOHN CREEK (CANYON)	1	TH	ST
ST. JOHN CREEK (CANYON)	2	TH	ST
ST. JOHN CREEK (CANYON)	3	TH	ST
SHIVELY CREEK	1	ST	TH
SHIVELY CREEK	2	ST	OG
SHIVELY CREEK	3	ST	
STOUTS CREEK	1	PT	RR
STOUTS CREEK	2	FF	TH
STOUTS CREEK	3	PT	RR
SWEAT CREEK	1	LG	ST
W. FK. CANYON CREEK	1	ST	AG
W. FK. CANYON CREEK	2	ST	LT
W. FK. CANYON CREEK	3	TH	YT

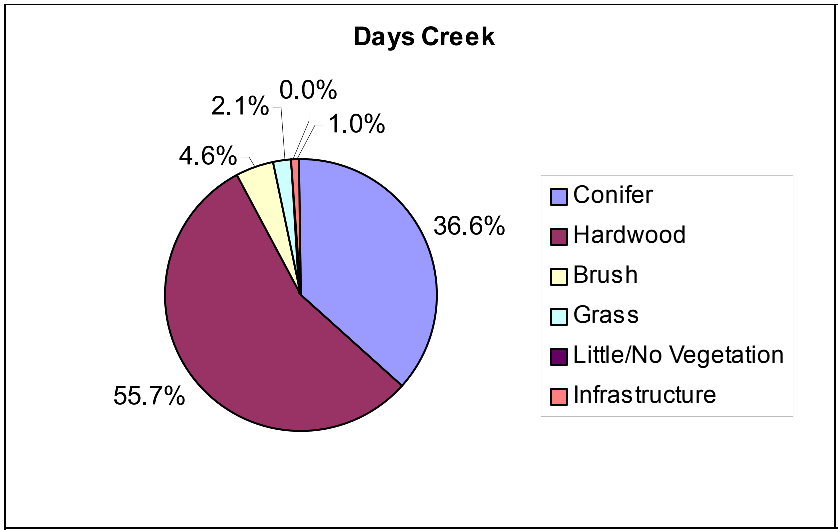
Stream	Reach	Primary Land Use	Secondary Land Use
W. FK. CANYON CREEK	4	ST	YT
W. FK. CANYON CREEK (UNSURVEYED)	5		
W. FK. CANYON CREEK	6	ST	TH
W. FK. CANYON CREEK	7	ST	TH
W. FK. CANYON CREEK	8	ST	TH
W. FK. CANYON CREEK	9	ST	TH
WOOD CREEK	1	LG	RR
WOOD CREEK	2	LG	YT
WOOD CREEK	3	YT	LG
WOOD CREEK	4	YT	ST
W. FK. CANYON CREEK TRIB #1	1	FF	ST
W. FK. CANYON CREEK TRIB #1	2	LT	FF
W. FK. CANYON CREEK TRIB #1	3	ST	LT
W. FK. CANYON CREEK TRIB #1	4	ST	LT
BEALS CREEK TRIB #1	1	ST	NU
NORTHEAST FORK STOUTS CREEK	1	FF	TH
NORTHEAST FORK STOUTS CREEK	2	ST	
STOUTS CREEK TRIB #14	1	OG	
STOUTS CREEK TRIB #16	1	FF	TH
STOUTS CREEK TRIB #16	2	PT	
SOUTHWEST FORK STOUTS CREEK	1	FF	TH
SOUTHWEST FORK STOUTS CREEK	2	ST	
OSHEA CREEK	1	AG	HG
OSHEA CREEK	2	ST	
OSHEA CREEK	3	ST	YT

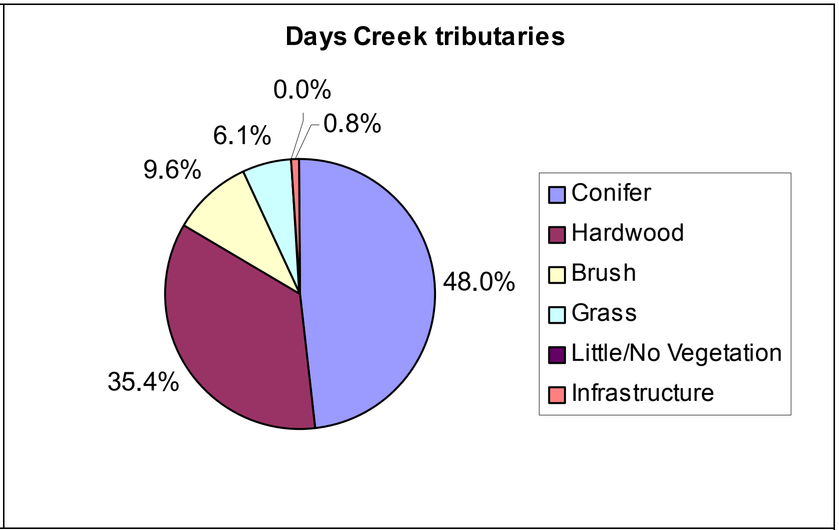
Appendix 4: Riparian vegetation and features

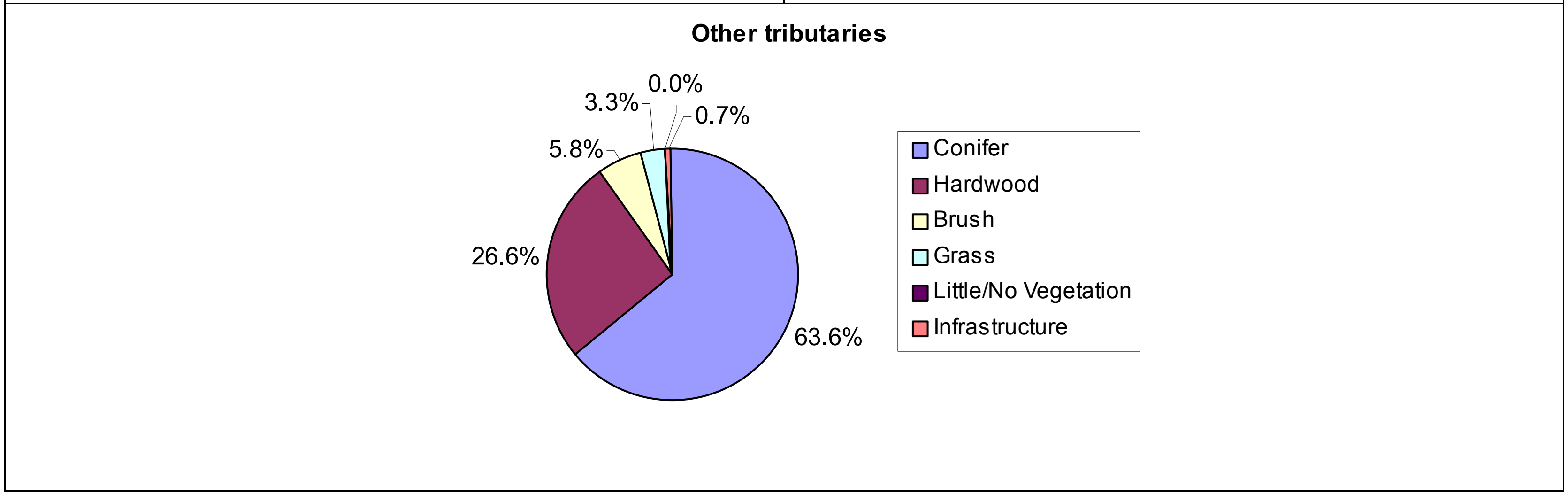


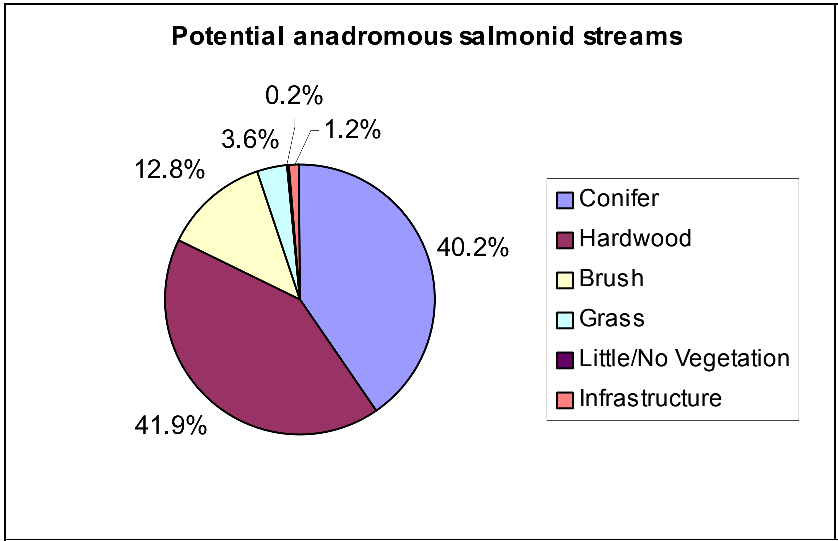


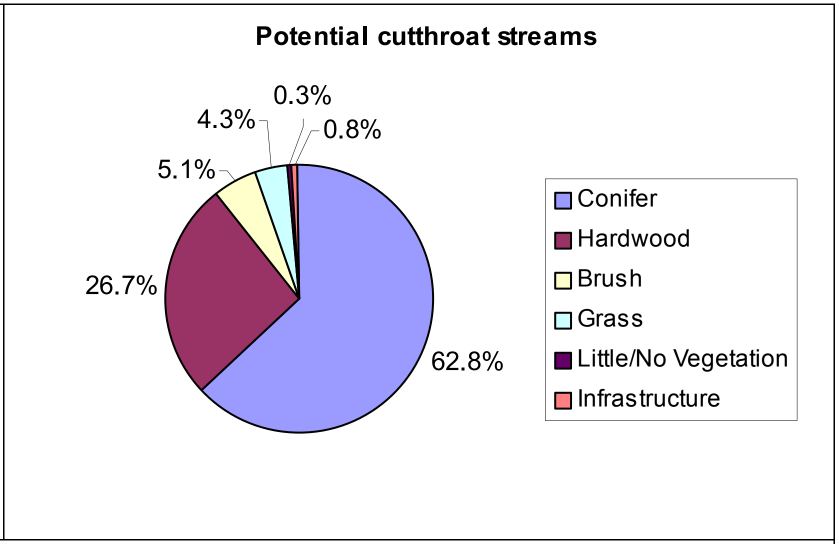


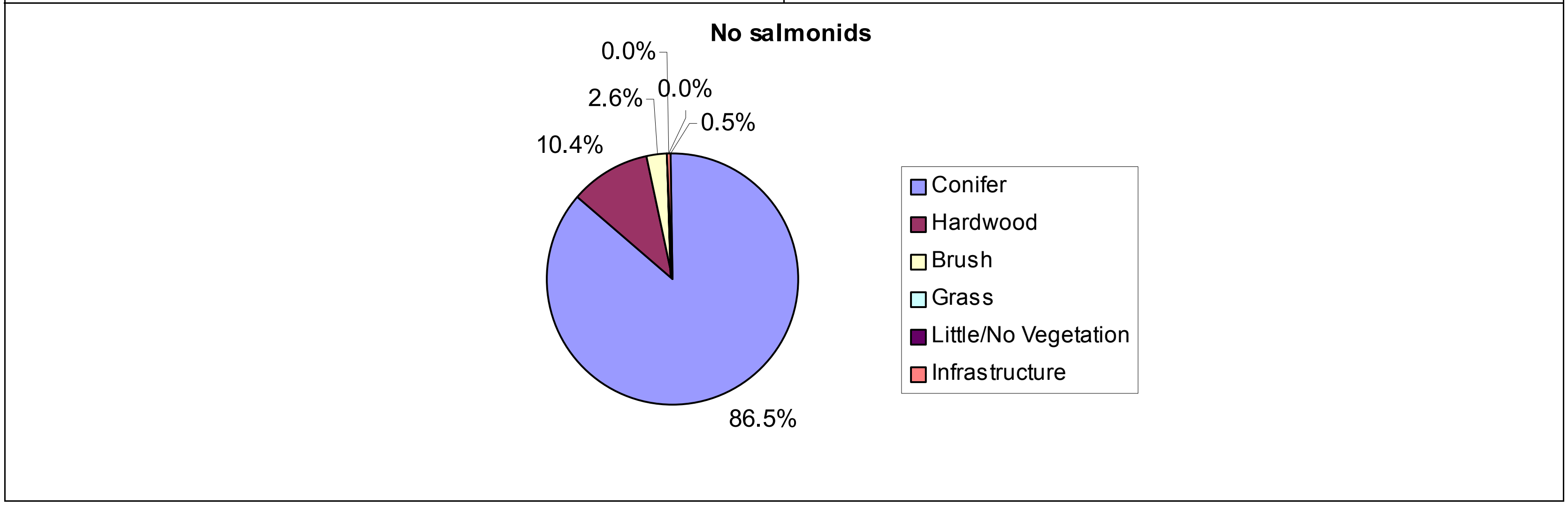

Days Creek
2.1%
0.0%
1.0%
4.6%
36.6%
55.7%
Conifer
Hardwood
Brush
Grass
Little/No Vegetation
Infrastructure


Days Creek tributaries
0.0%
0.8%
6.1%
9.6%
48.0%
35.4%
Conifer
Hardwood
Brush
Grass
Little/No Vegetation
Infrastructure

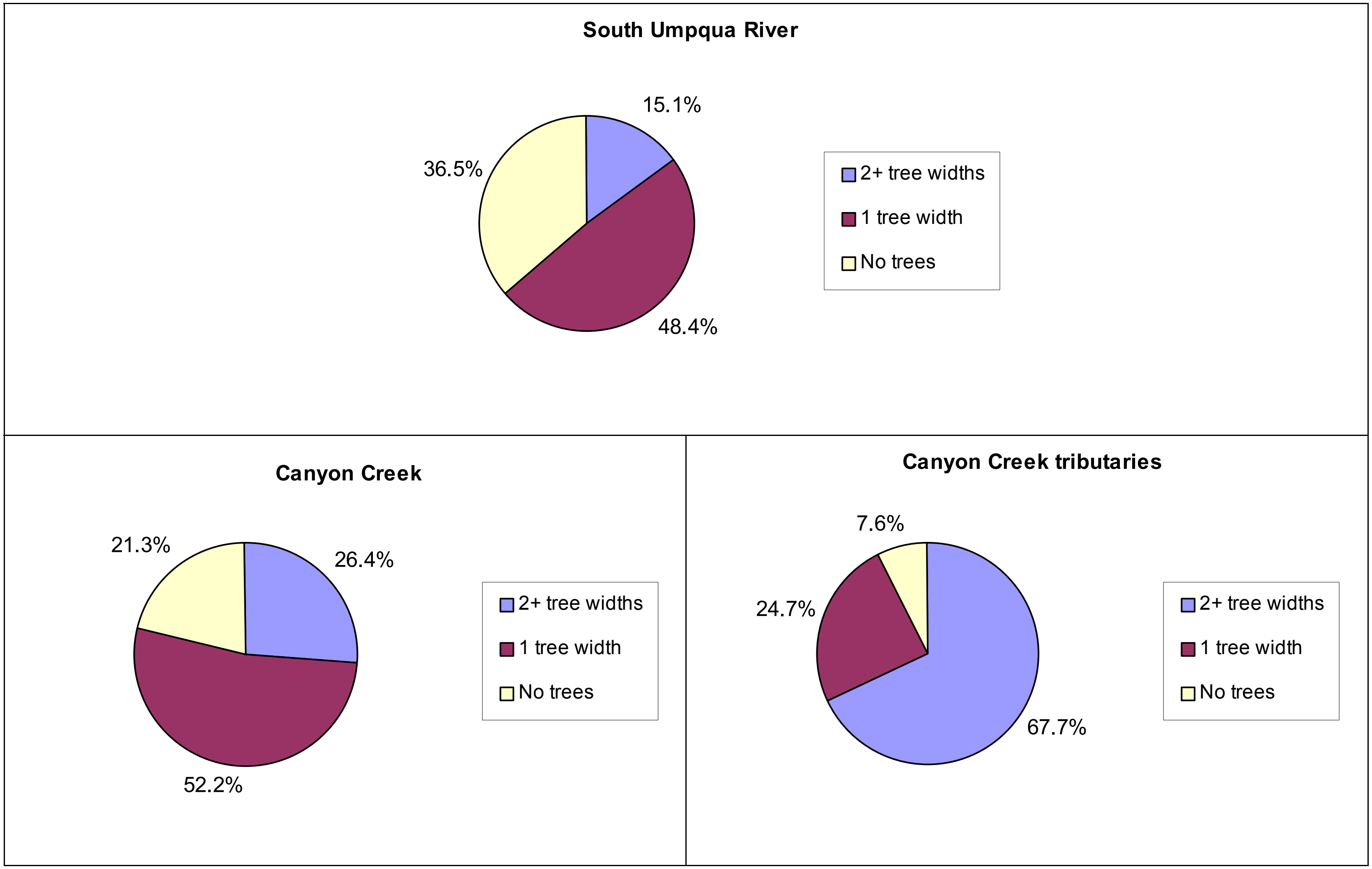

Other tributaries
0.0%
3.3%
0.7%
5.8%
26.6%
63.6%
Conifer
Hardwood
Brush
Grass
Little/No Vegetation
Infrastructure

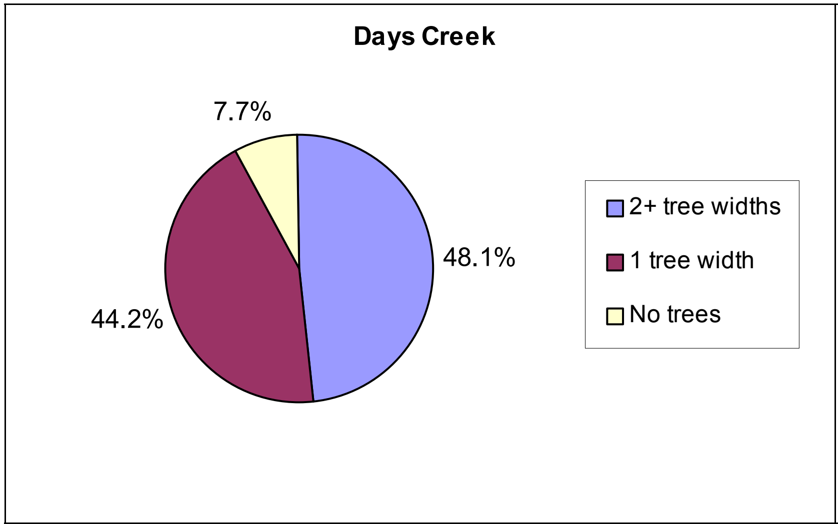

Potential anadromous salmonid streams
0.2%
3.6%
1.2%
12.8%
40.2%
41.9%
Conifer
Hardwood
Brush
Grass
Little/No Vegetation
Infrastructure

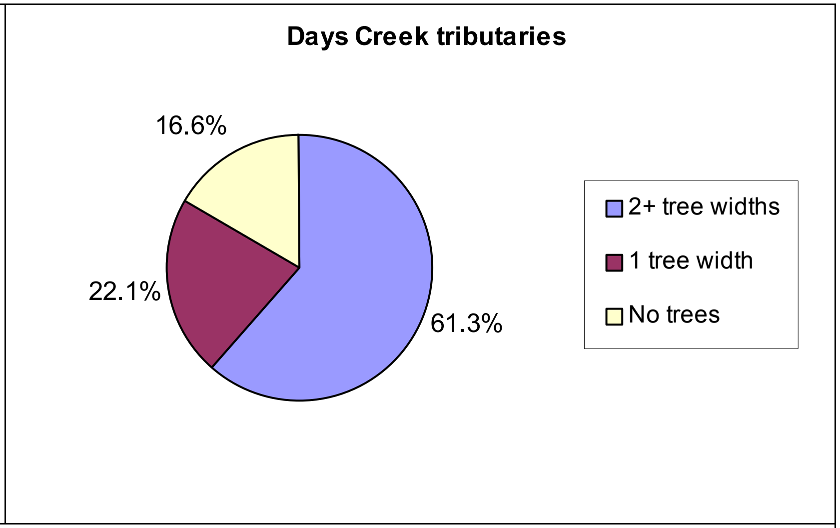

Potential cutthroat streams
0.3%
4.3%
0.8%
5.1%
26.7%
62.8%
Conifer
Hardwood
Brush
Grass
Little/No Vegetation
Infrastructure

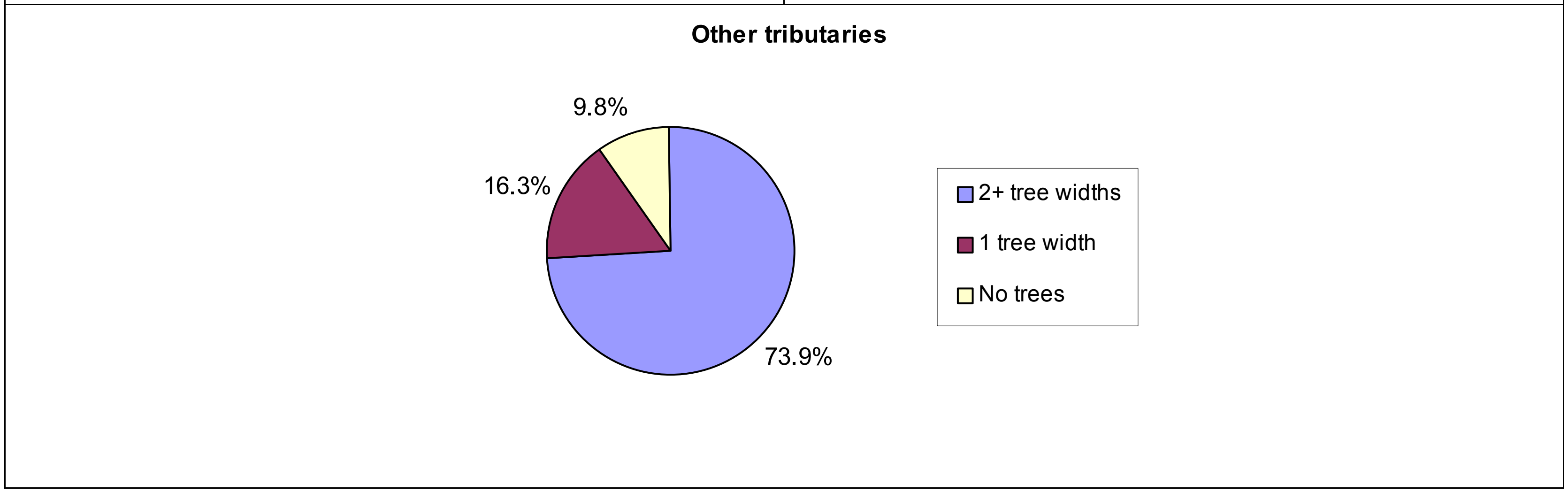

No salmonids
0.0%
2.6%
0.0%
0.5%
10.4%
86.5%
Conifer
Hardwood
Brush
Grass
Little/No Vegetation
Infrastructure

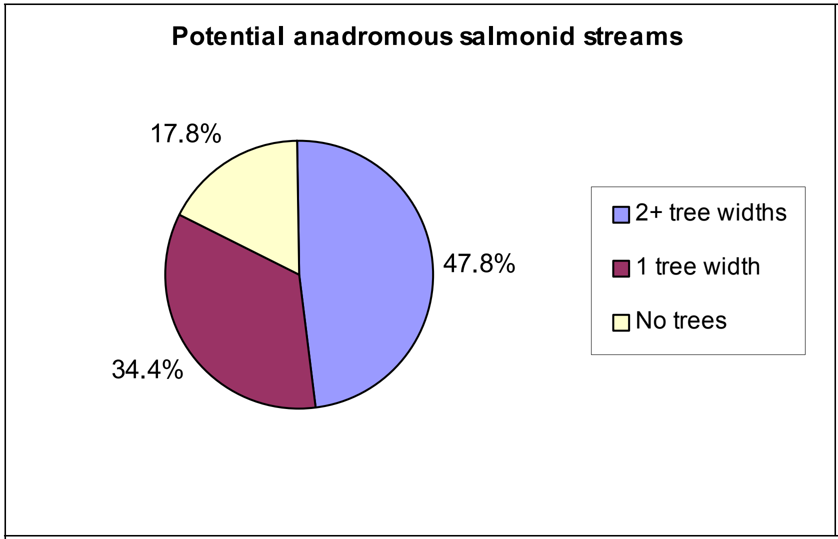
Appendix 5: Buffer width

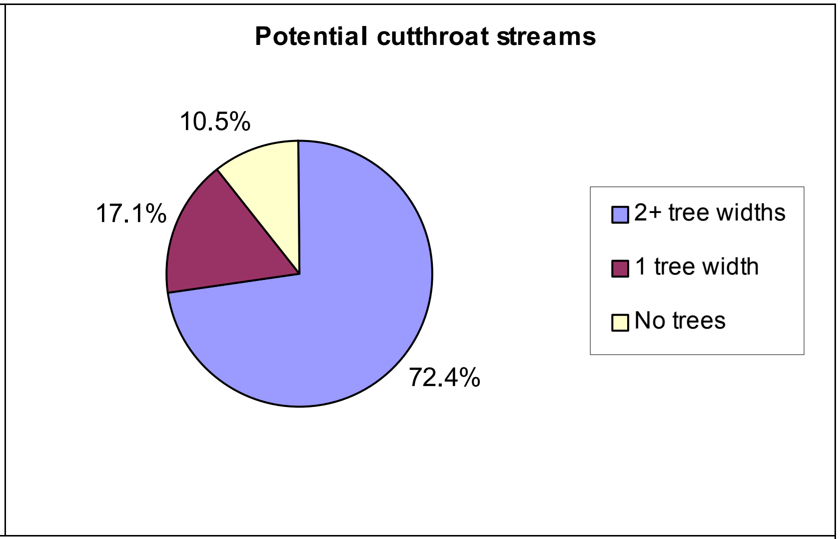


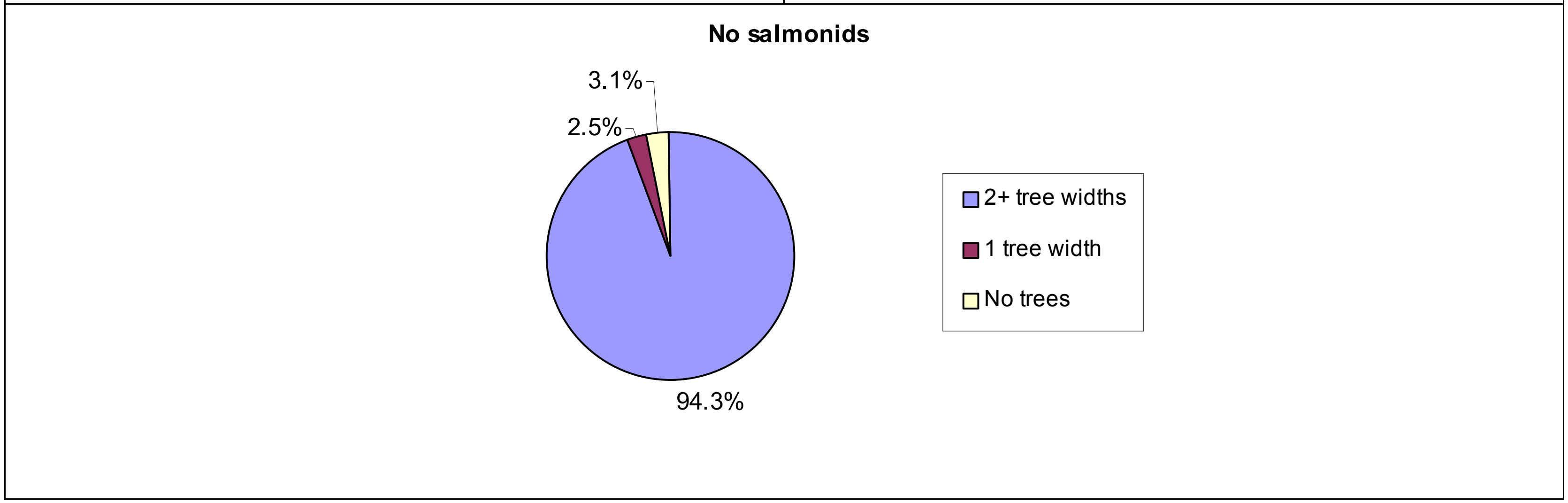

Days Creek
7.7%
48.1%
44.2%
2+ tree widths
1 tree width
No trees


Days Creek tributaries
16.6%
22.1%
61.3%
2+ tree widths
1 tree width
No trees

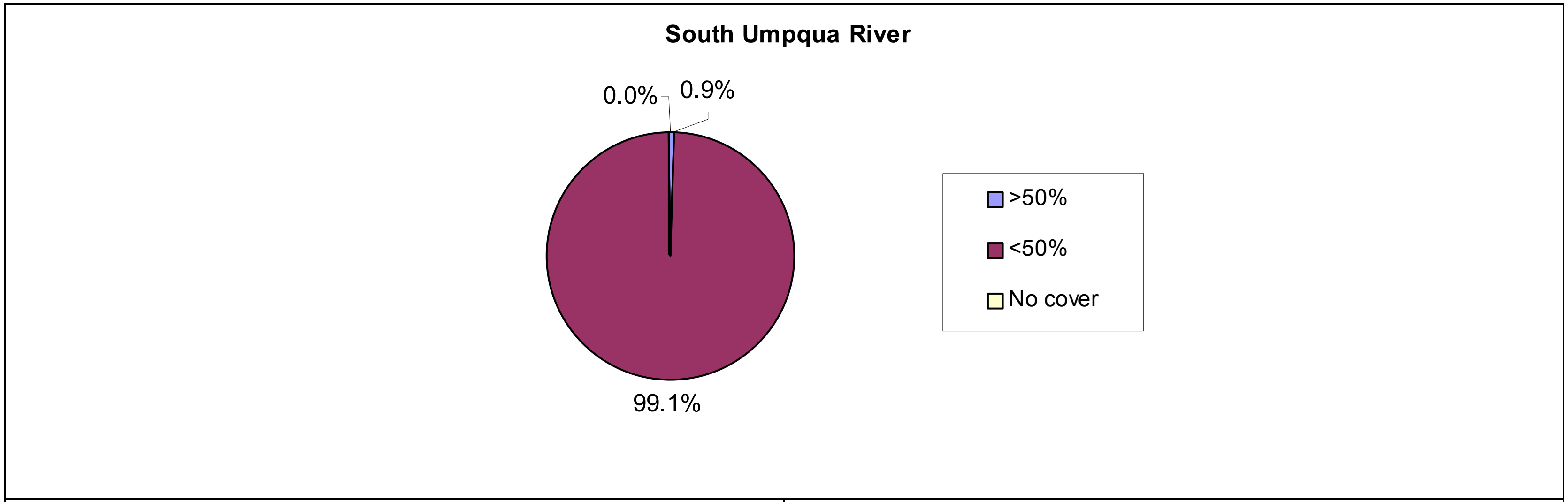

Other tributaries
9.8%
16.3%
73.9%
2+ tree widths
1 tree width
No trees

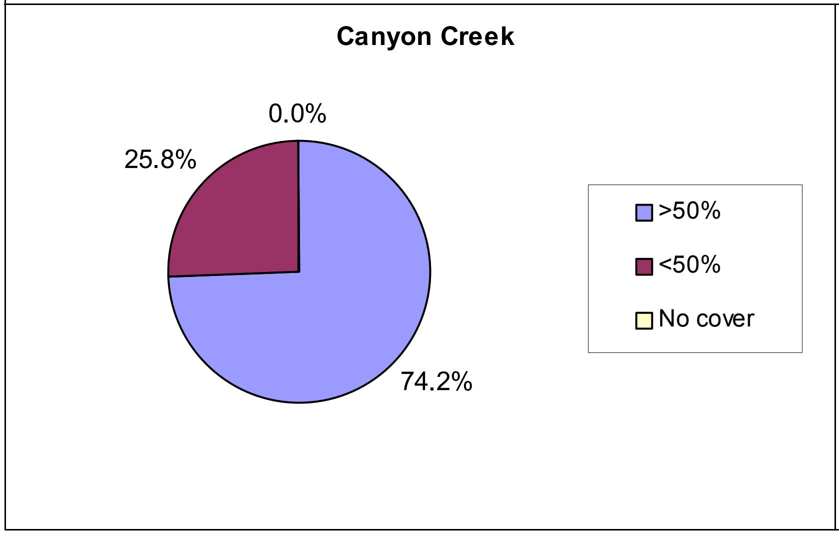

Potential anadromous salmonid streams
17.8%
47.8%
34.4%
2+ tree widths
1 tree width
No trees

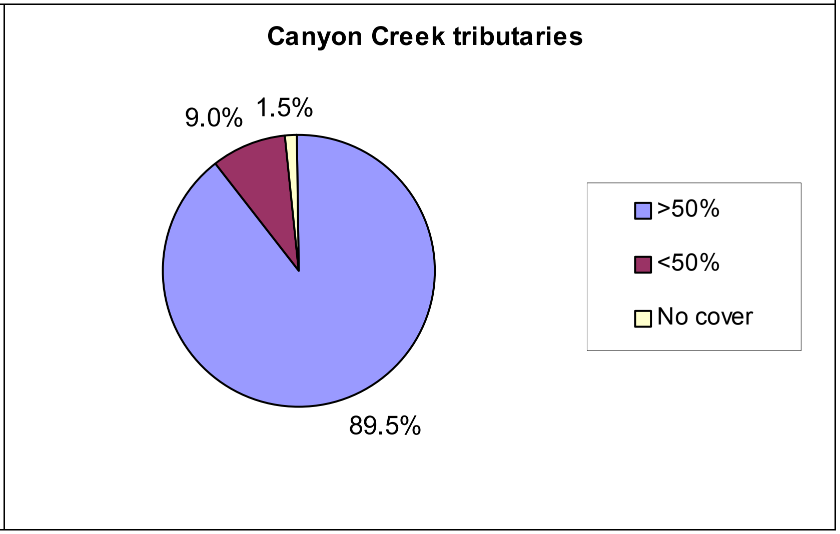

Potential cutthroat streams
10.5%
17.1%
72.4%
2+ tree widths
1 tree width
No trees


No salmonids
3.1%
2.5%
94.3%
2+ tree widths
1 tree width
No trees

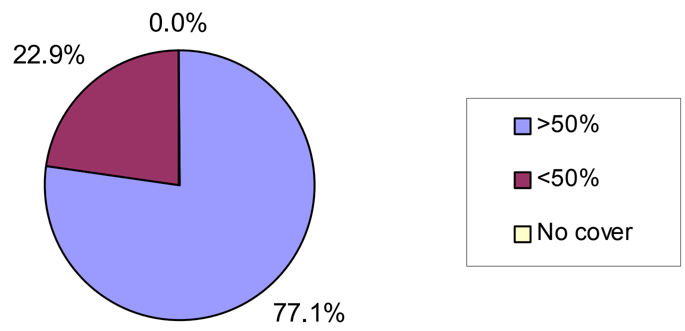
Appendix 6: Riparian cover



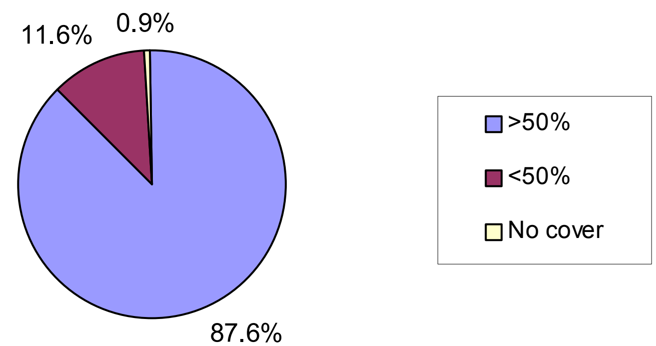




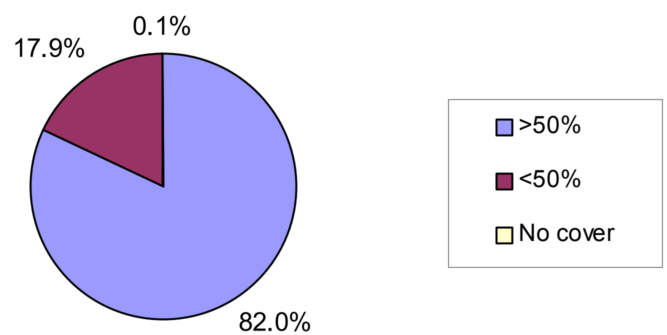
Days Creek

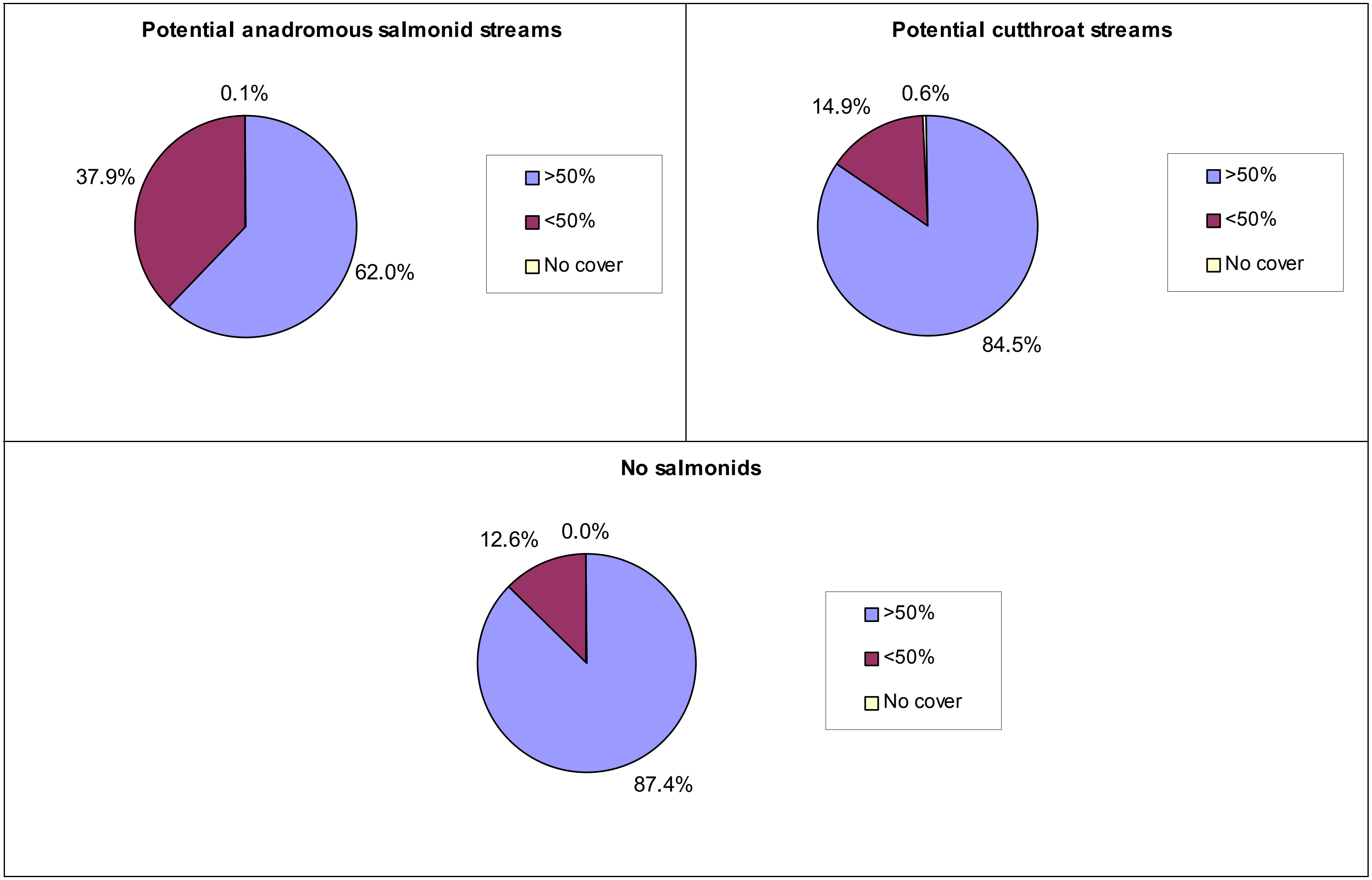


Days Creek tributaries



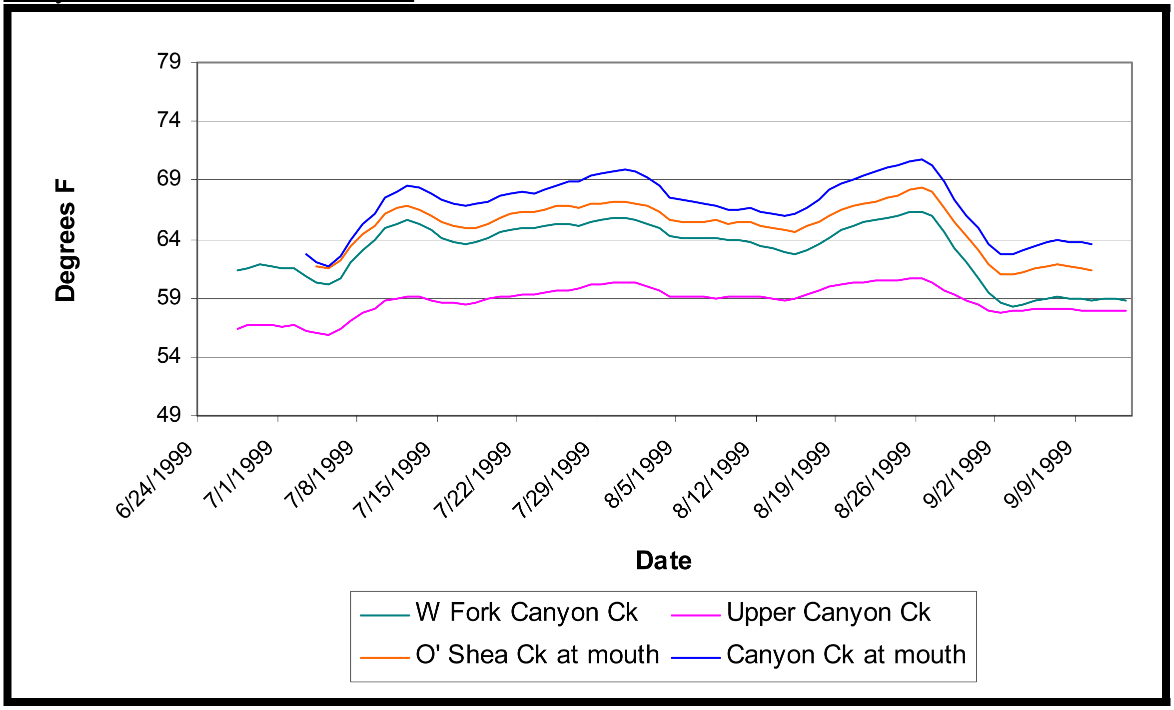
Other tributaries



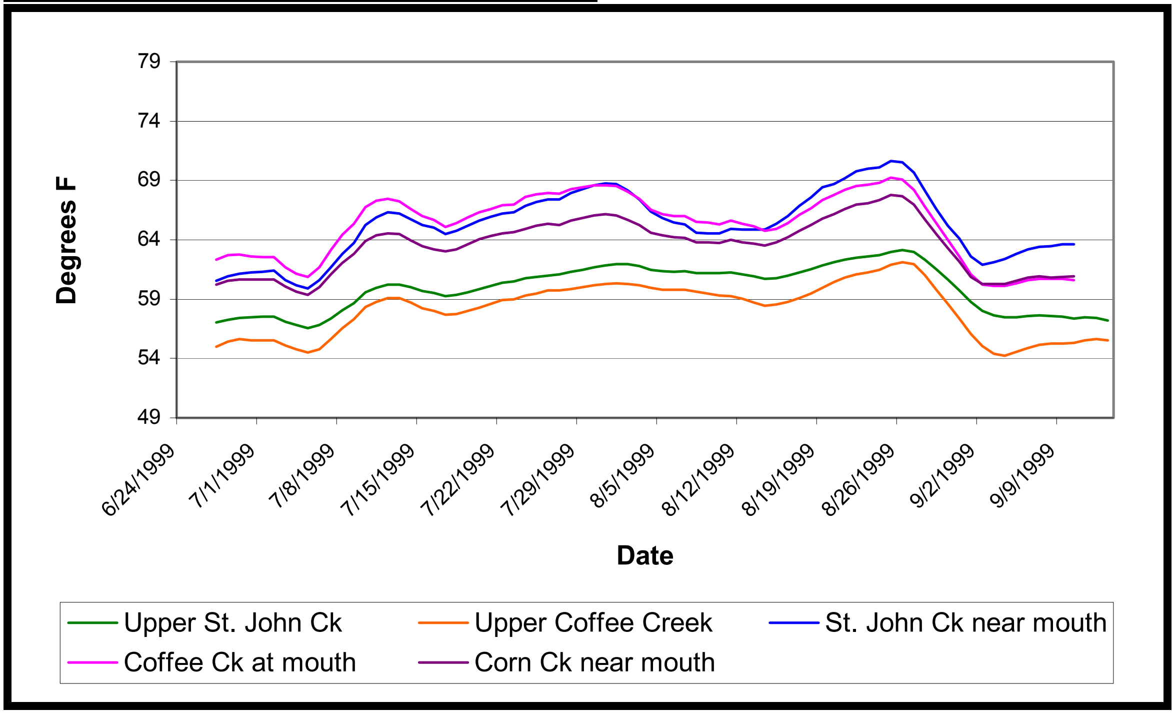

Potential anadromous salmonid streams
0.1%
37.9%
62.0%
>50%
<50%
No cover
Potential cutthroat streams
14.9%
0.6%
84.5%
>50%
<50%
No cover
No salmonids
12.6%
0.0%
87.4%
>50%
<50%
No cover

Appendix 7: South Umpqua River Watershed tributary temperature trends

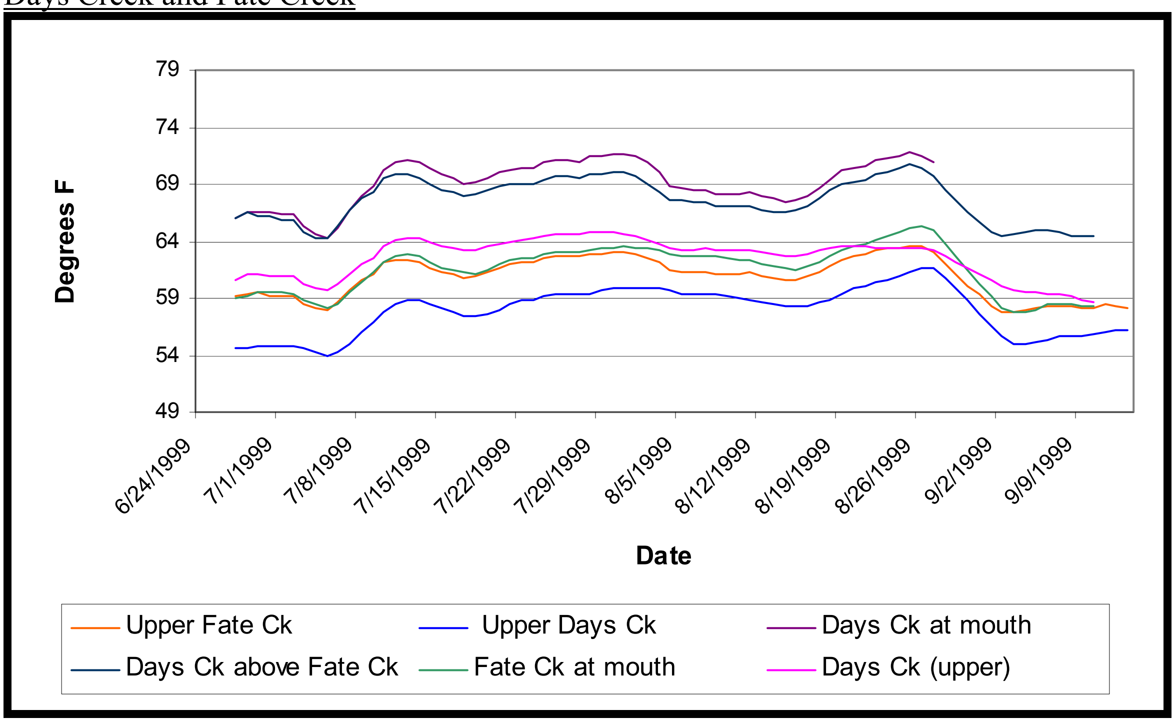
Canyon Creek and Oshea Creek



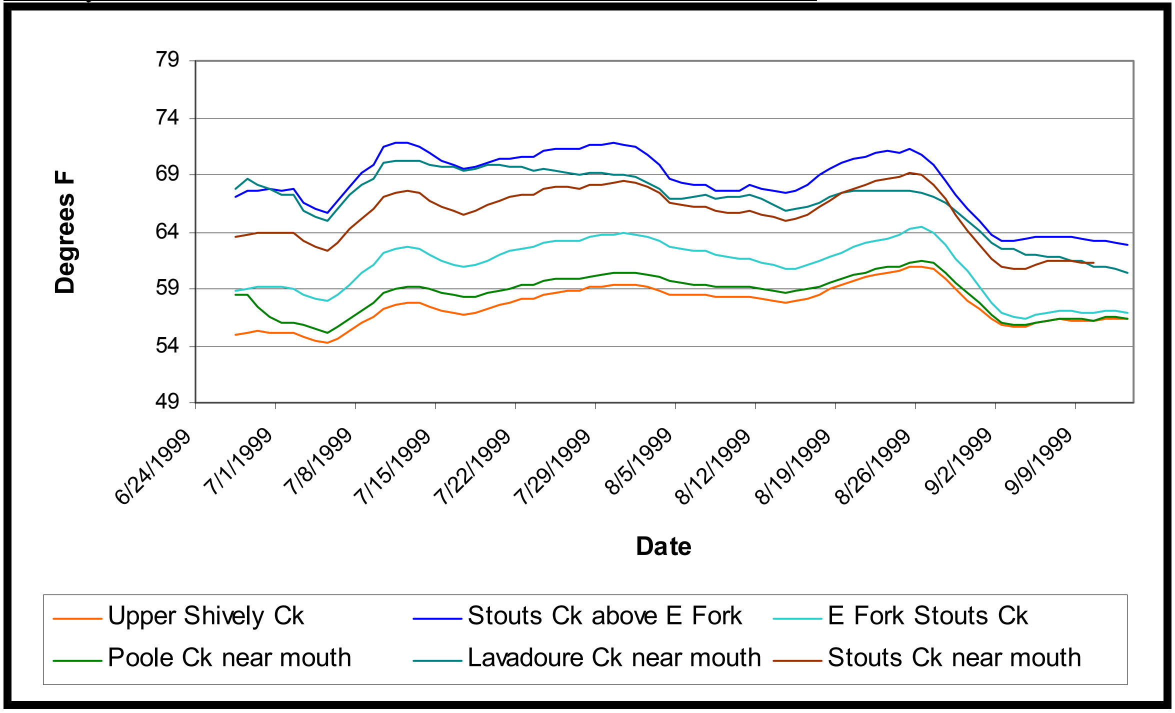
Coffee Creek, Corn Creek, and St. John Creek



Days Creek and Fate Creek

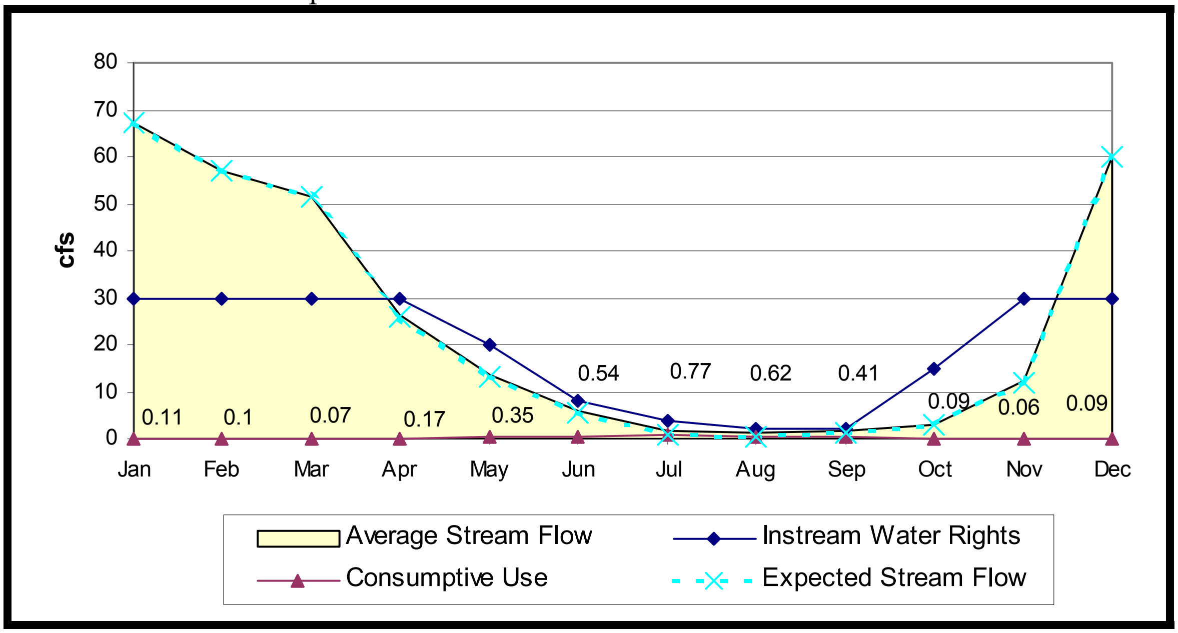


Shively Creek, Stouts Creek, Pool Creek, and Lavadoure Creek

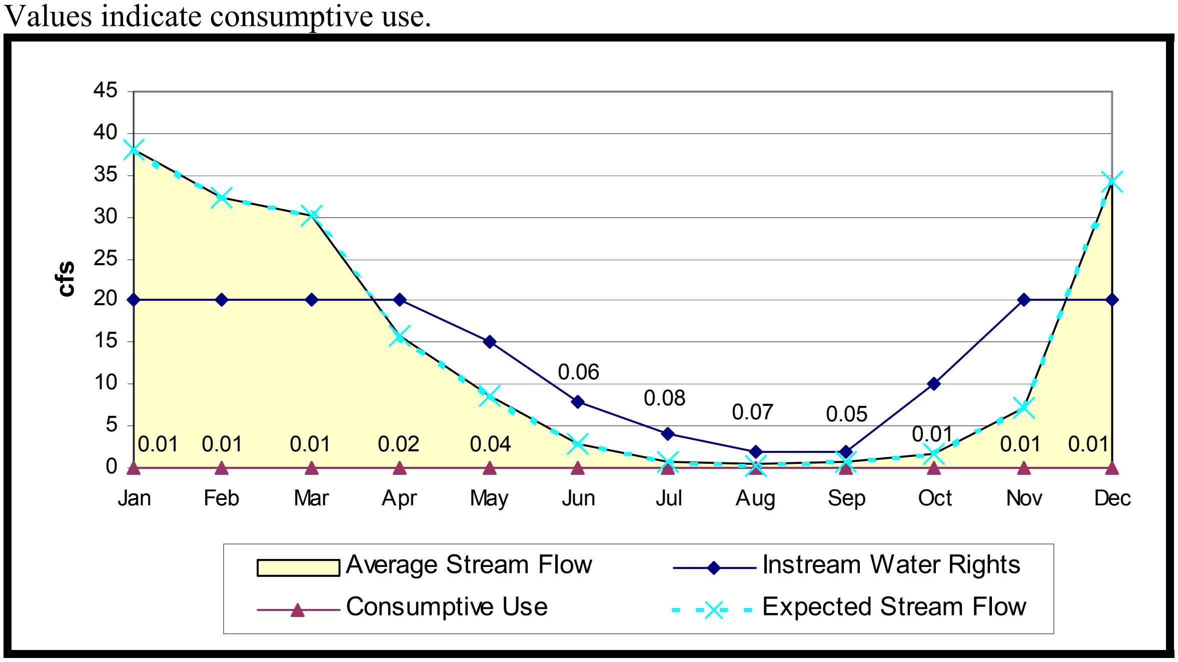


Appendix 8: Water availability graphs

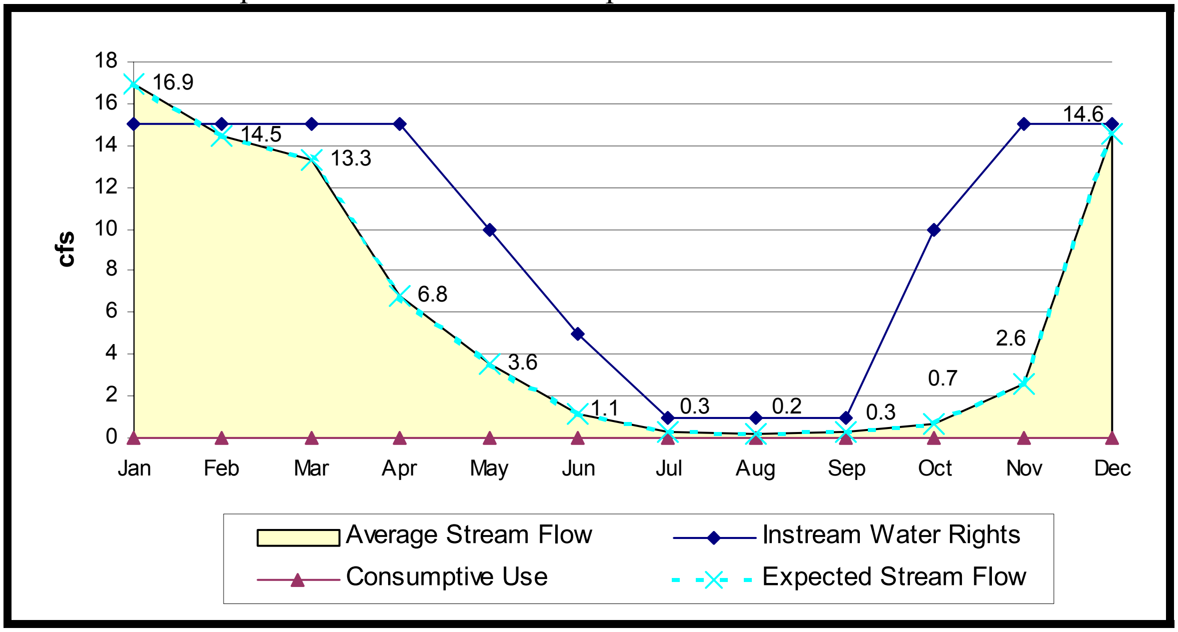
Days Creek (#303)
Values indicate consumptive use.



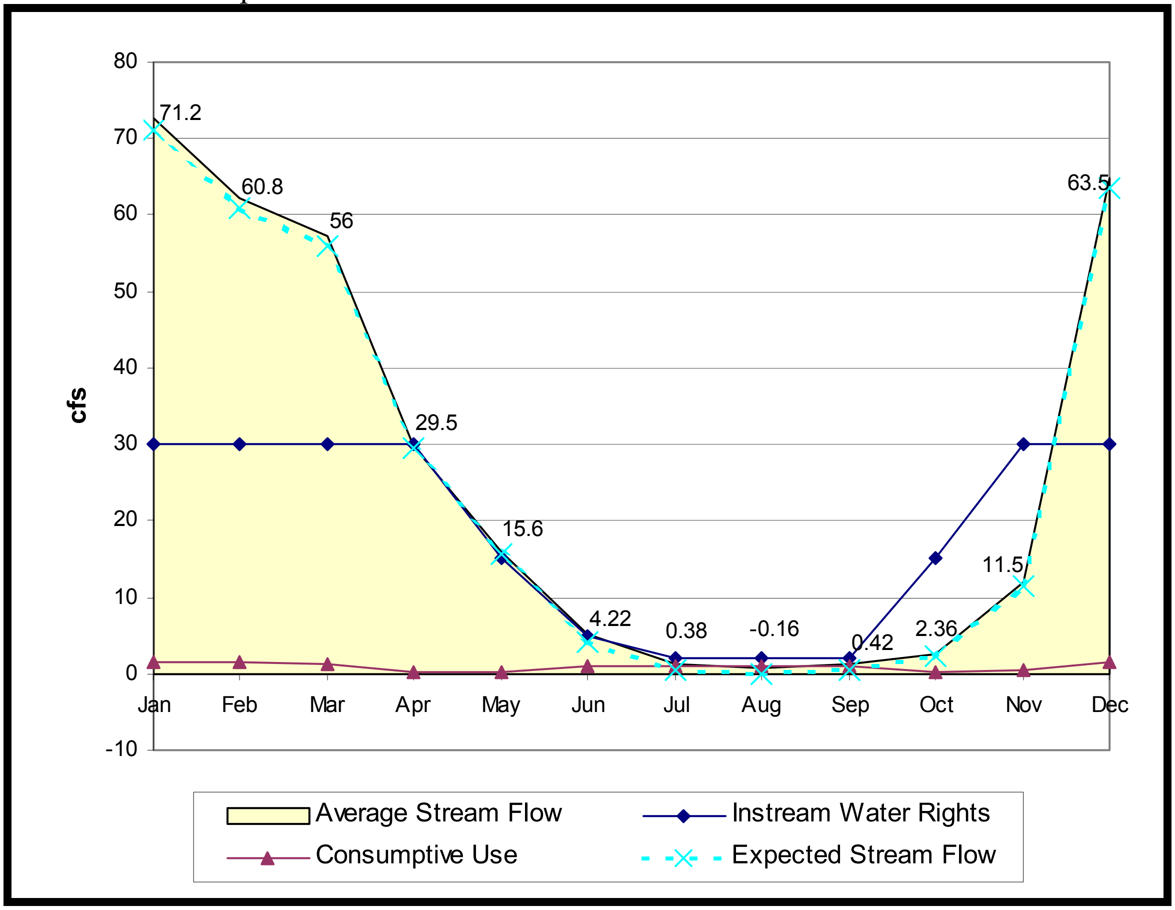
Coffee Creek (#297)
Values indicate consumptive use.



Oshea Creek (#338)
Values indicate expected streamflow. Consumptive use values are zero for all months.



Canyon Creek (#294)
Values indicate expected streamflow.



Appendix 9: Water use categories

There are eight general water use categories in the South Umpqua River Watershed. The table below lists the Oregon Water Resources Department uses that are included in each category. Not all uses occur in the South Umpqua River Watershed.

Irrigation
Primary and supplemental
Irrigation
Supplemental
Cranberries
Irrigation, domestic & stock
Irrigation & domestic
Irrigation & stock

Industrial
Geothermal
Manufacturing
Sawmill
Shop
Log deck
Commercial
Laboratory

Domestic
Domestic
Lawn and garden
Non-commercial
Stock
Group domestic
Restroom
School

Fish and Wildlife
Aquaculture
Fish
Wildlife

Municipal
Municipal
Quasi-municipal

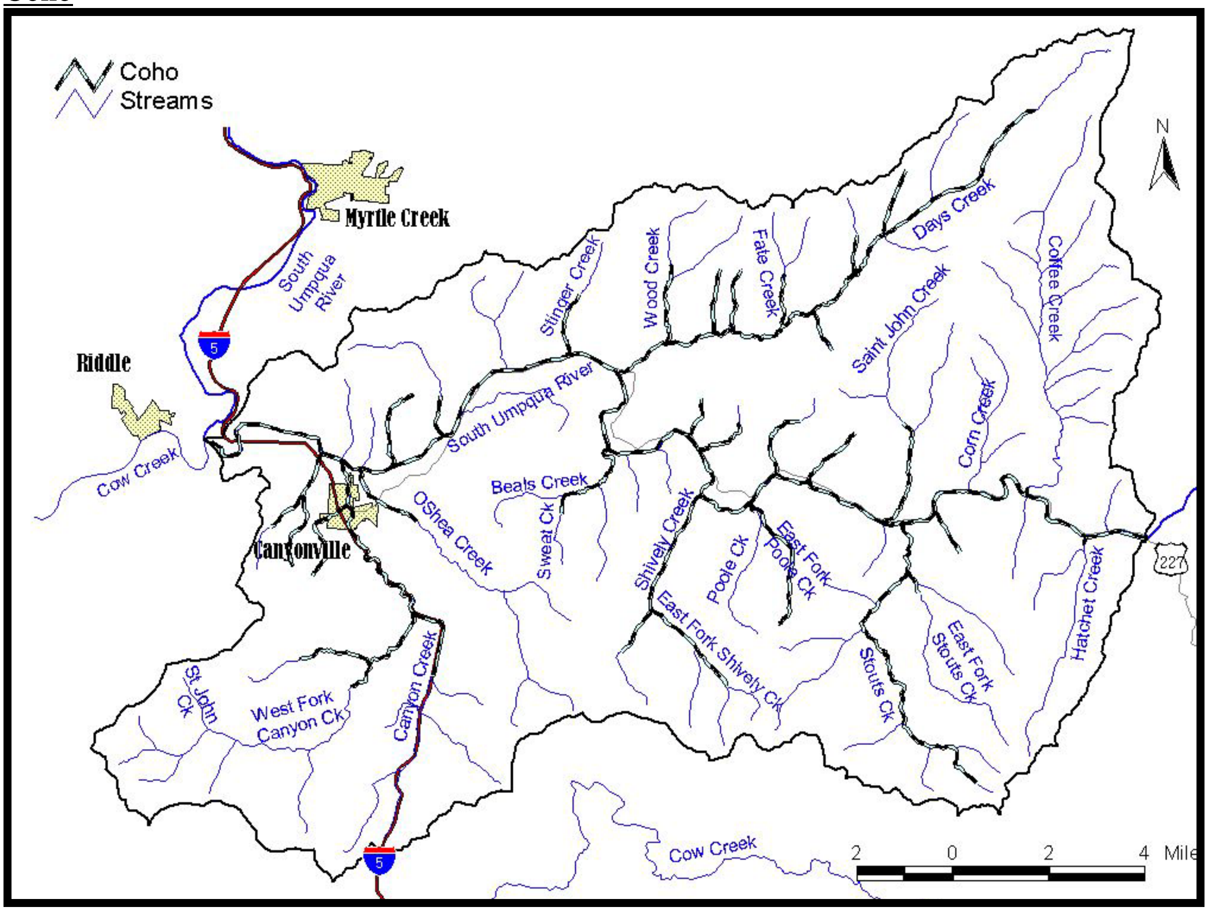
Recreation
Campground
Recreation
School

Agriculture
Agriculture
Cranberry harvest
Flood harvesting
All cranberry uses
Temperature control
Dairy barn
Frost protection
Greenhouse
Mint still
Nursery use

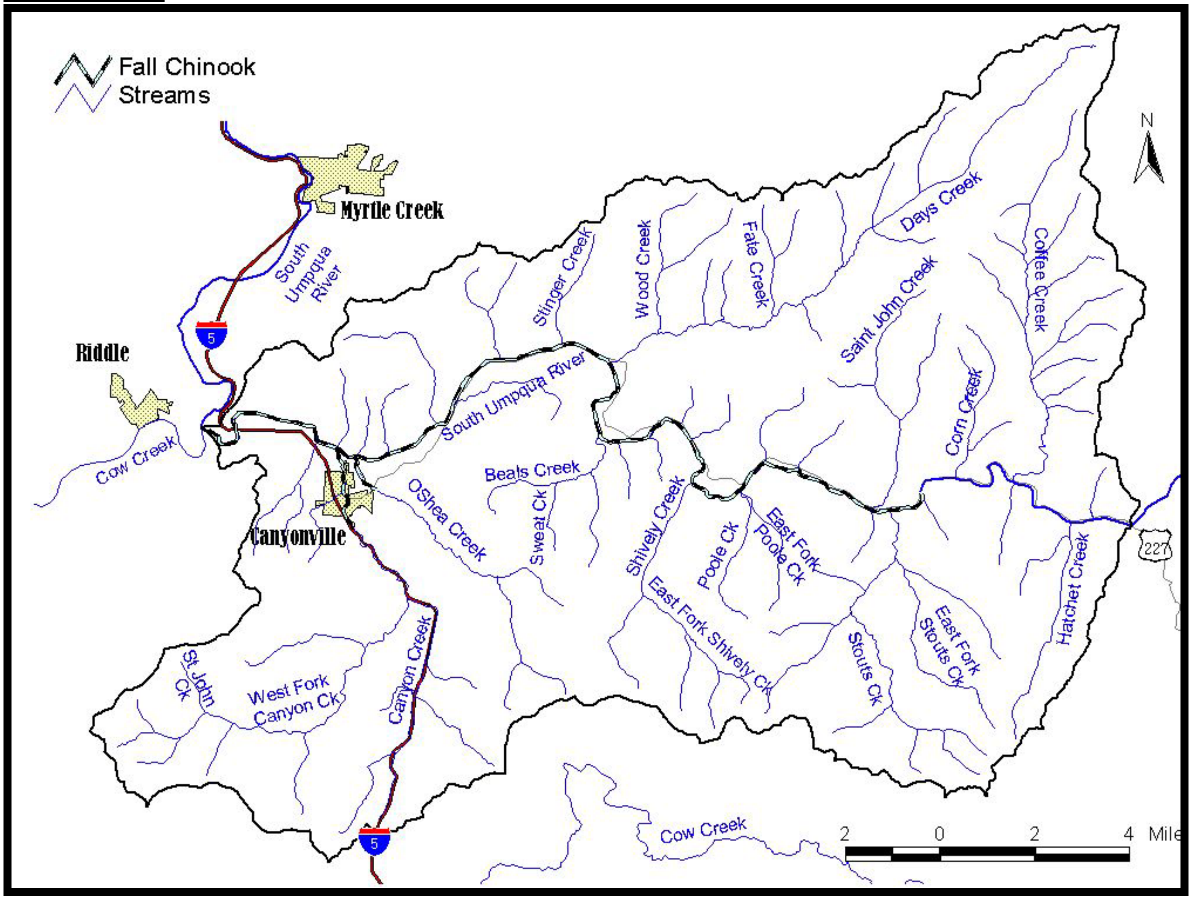
Miscellaneous
Air conditioning
Aesthetic
Forest management
Fire protection
Groundwater recharge
Pollution abatement
Road construction
Storage

Appendix 10: Anadromous salmonid distribution by species.

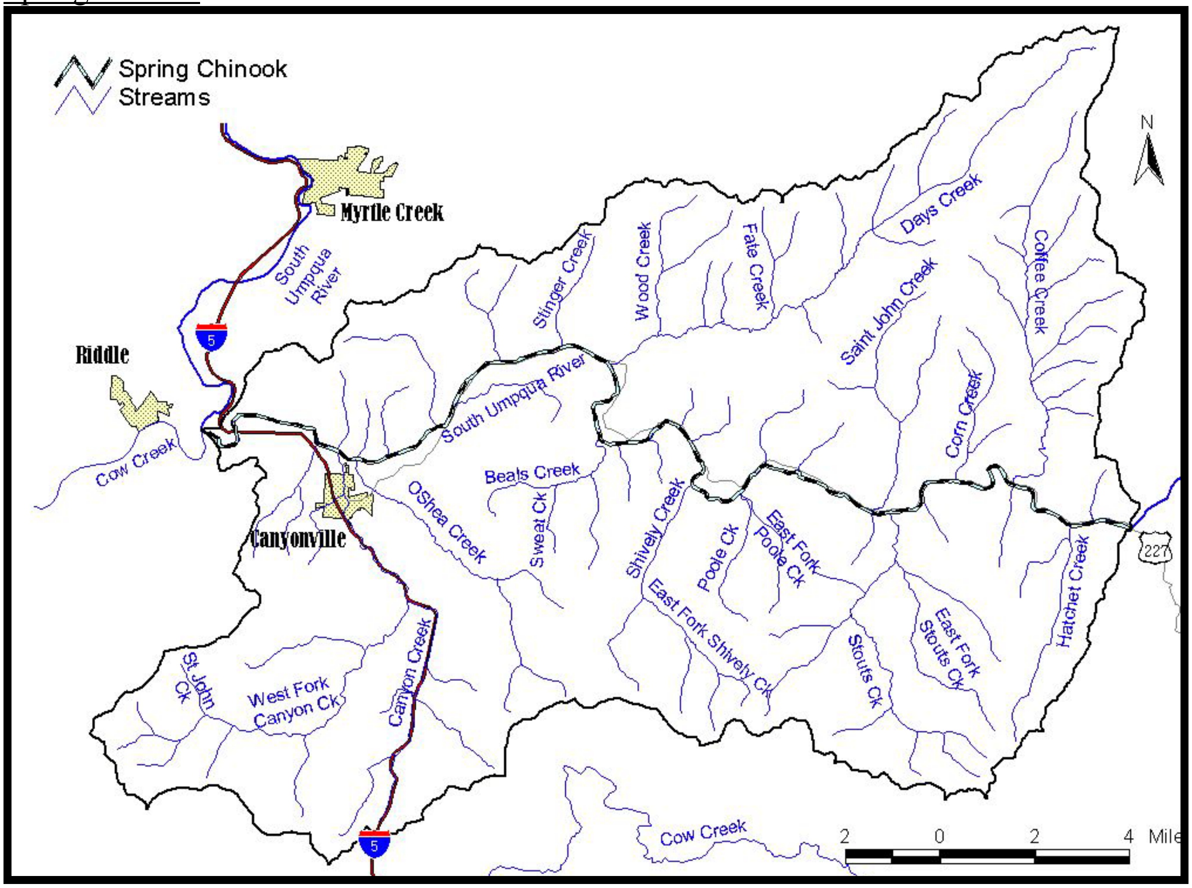
<u>Coho</u>



Fall chinook



Spring chinook



Winter steelhead