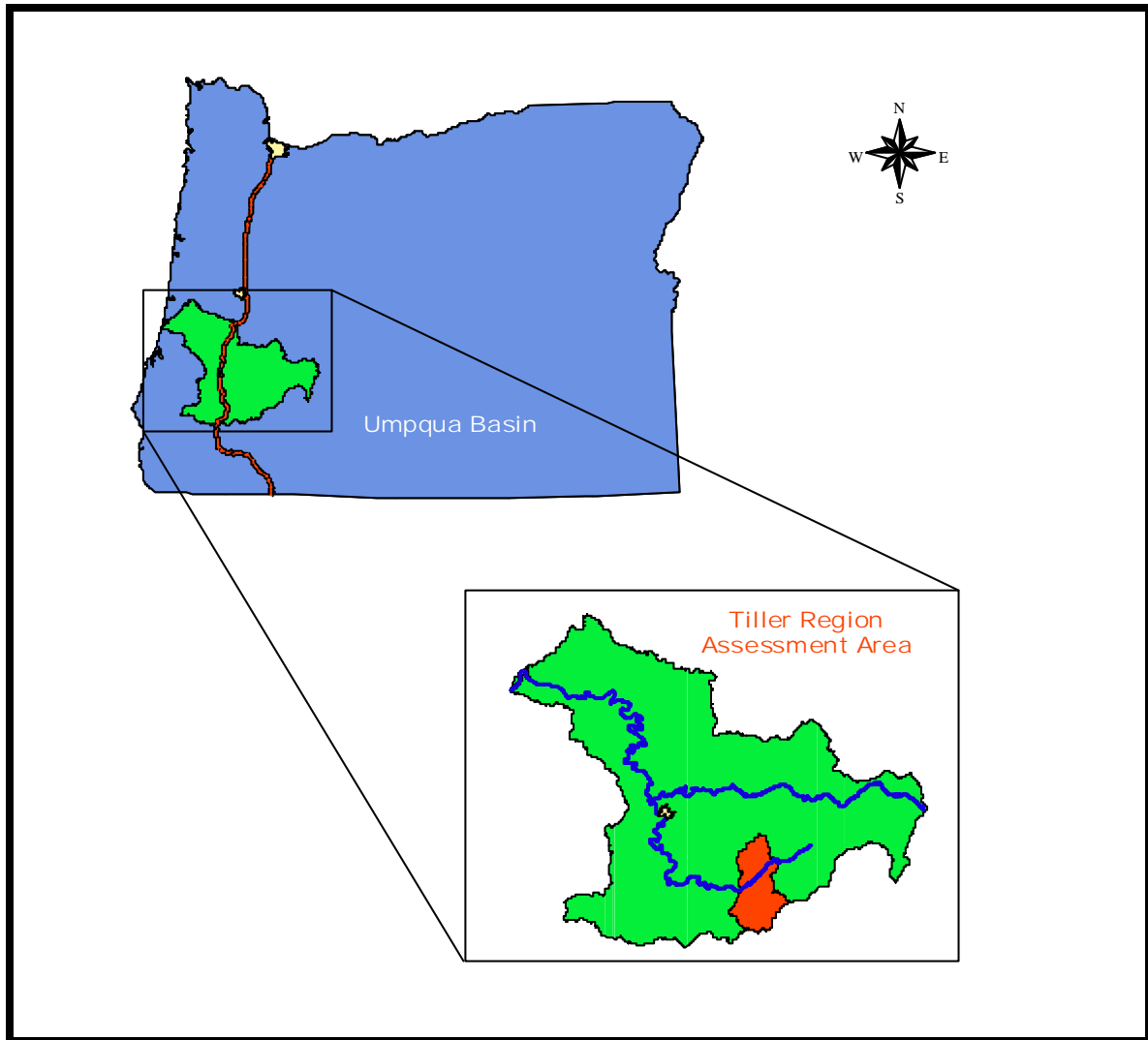


Tiller Region

Assessment and Action Plan



Prepared by Nancy A. Geyer for the
Umpqua Basin Watershed Council



November, 2003



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Prepared by

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November, 2003

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Publication citation

This document should be referenced as Geyer, Nancy A. Tiller Region 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 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 Umpqua National Forest, 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 assessment meetings:
 - Dave Williams, OWRD;
 - Kent Smith, InSight Consultants; and
 - Sam Dunnavant, ODFW.

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
RAWS	Remote Automatic Weather Station
UBWC	Umpqua Basin Watershed Council
UNF	Umpqua National Forest
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFS	United States Forest Service (also known as the USDA Forest Service)
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 Tiller Region in terms of fish habitat and water quality.

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 main stem. 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 Tiller Region in terms of its natural and human-made features, ownership and current land uses, and the communities within the region. 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), and the *Myrtle Creek Watershed Analysis (Draft)* (USDI Bureau of Land Management, 2002). Additional information is from the following sources' databases and staff: the USDA Forest 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 assessment and action plan document?
- How was the assessment developed?
- Where is the Tiller Region and what are its defining characteristics?
- What are the demographic, educational, and economic characteristics of Tiller Region residents?
- What is land ownership, use, and parcel size within the Tiller Region?

1.1. Purpose and development of the 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 assessment and action plan

The Tiller Region assessment has two goals:

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

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 Tiller Region 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 Tiller Region 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 Tiller Region and offer comments and suggestions for improvement.

Tiller Region landowners and residents met for five meetings from May through September, 2003. A total of 31 people attended one or more meetings, with an average of 7.4 participants per meeting. Meeting participants included ranchers, family forestland owners, industrial timber company employees, and land management agency personnel.

1.2. Tiller Region description

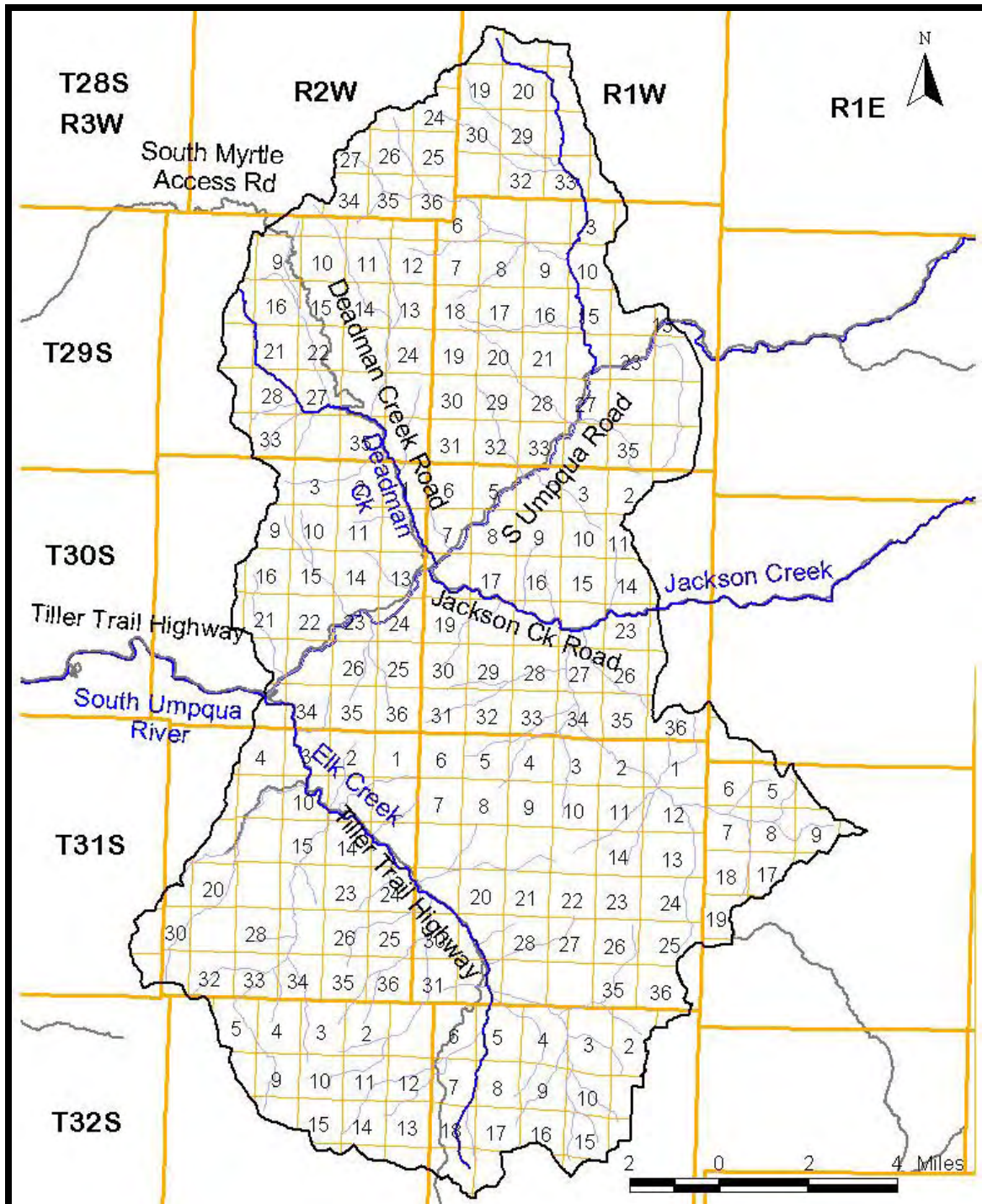
1.2.1. Location, size, and major features

The Tiller Region is located in Douglas County, Oregon, and is 151,137.3 acres (see Map 1-1). The region stretches a maximum of 26.1 miles north to south and 14.7 miles east to west. The Tiller Trial Highway and the South Umpqua River Road are major roads within the region. The only population centers are Tiller and Drew. Tiller is located at the confluence of the South Umpqua River and Elk Creek. Drew is located near Camp Creek, between Drew Creek and Joe Hall Creek.⁴

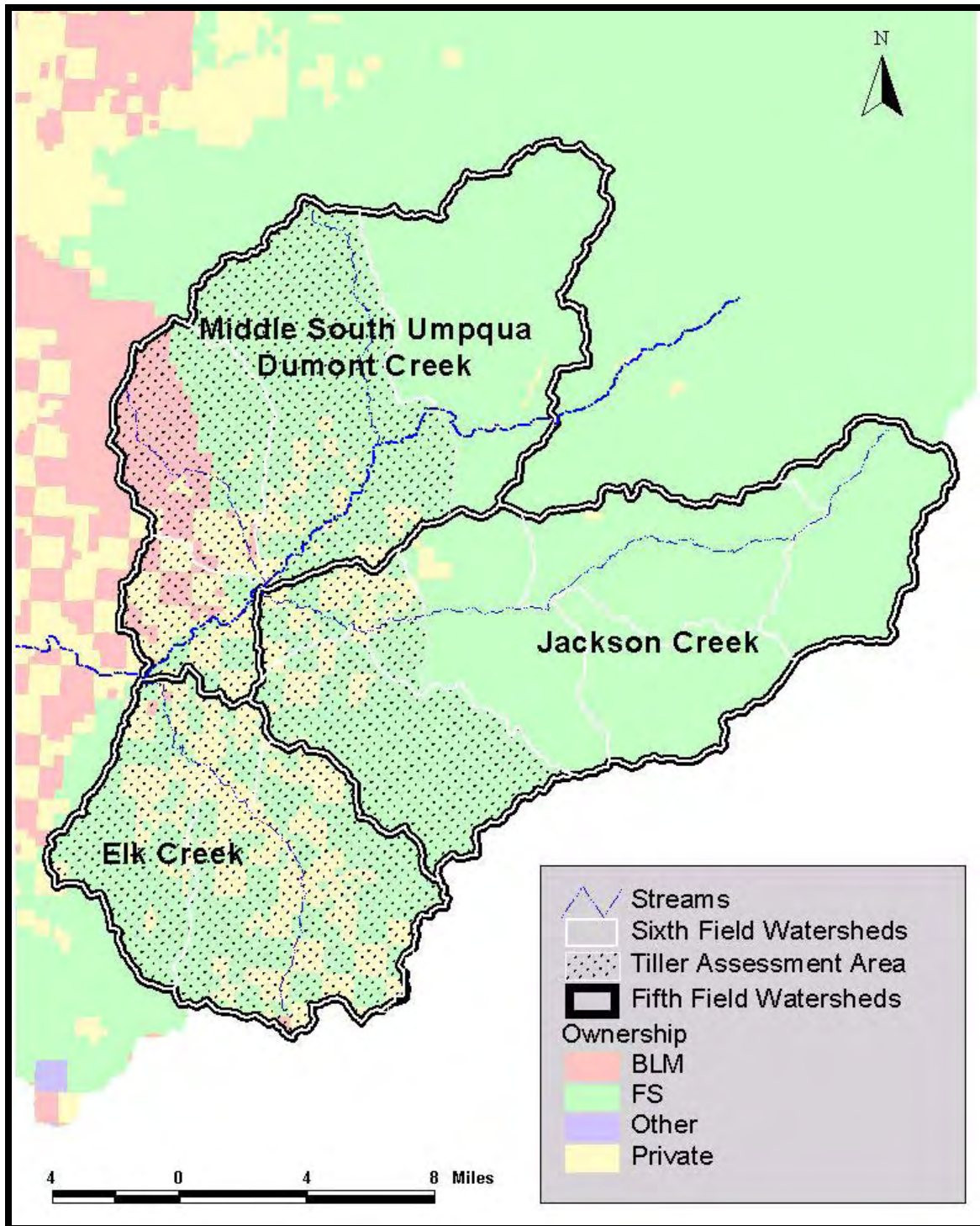
The Tiller Region is not a watershed per US Geological Survey delineation. This region includes six sixth-field drainages within three fifth-field watersheds: Middle South Umpqua/Dumont Creek, Elk Creek, and Jackson Creek (see Map 1-2). The sixth-field watersheds within the Tiller Region are a matrix of public and private ownership (see section 1.3.1). Sixth-field watersheds with only a small percent of private lands have been excluded from this assessment.

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

⁴ See Map 1-8 for stream locations.



Map 1-1: Location of the Tiller Region.



Map 1-2: Sixth-field watersheds comprising the Tiller Region.

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 small geographic areas and is too general for the purposes of this assessment. However, ecoregions are useful because they divide watersheds 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 Tiller Region. In some cases, ecoregion information is used to supplement other data.

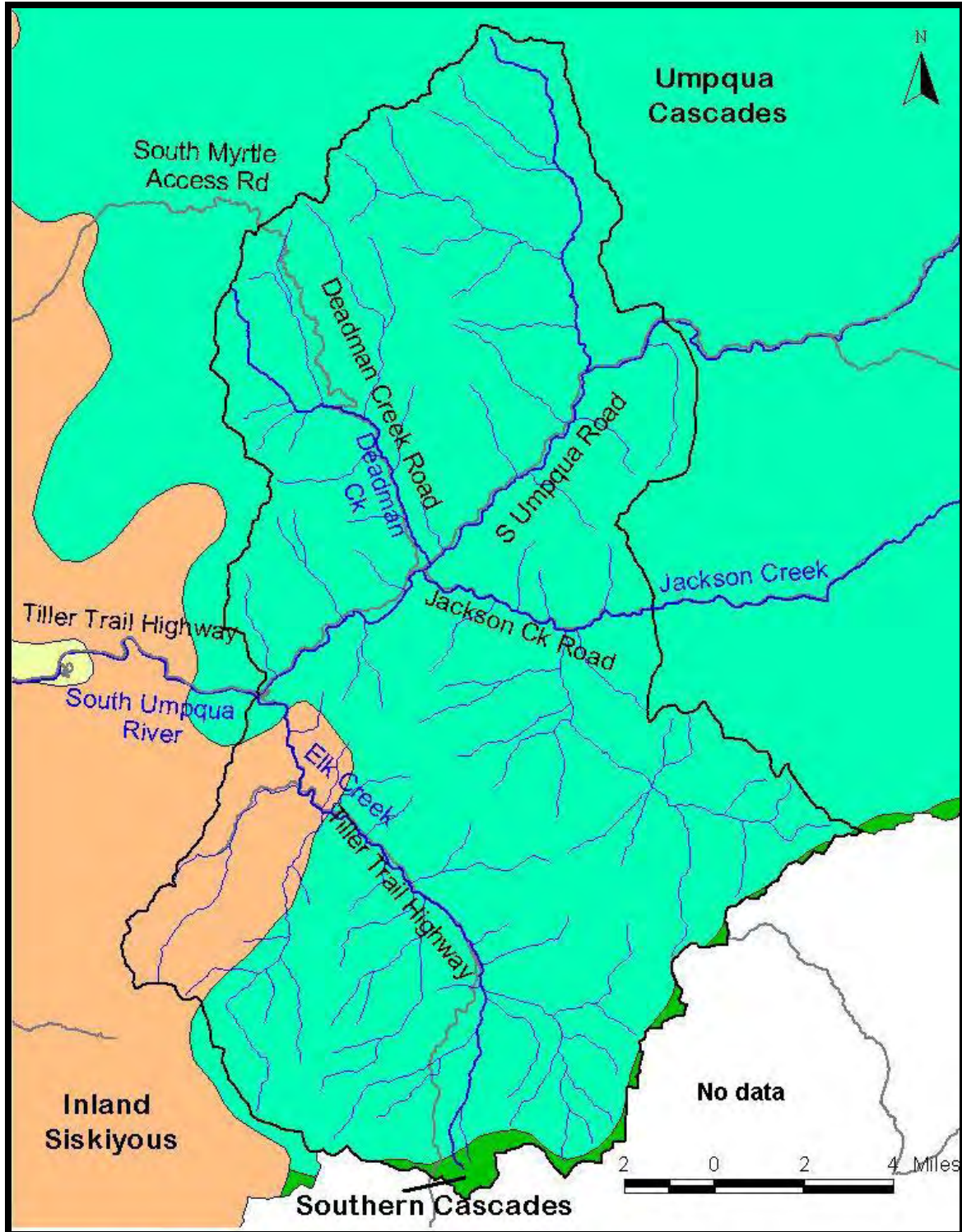
Map 1-3 and Table 1-1 show the Tiller Region's location, acres, and percent within each ecoregion. The majority of the Tiller Region is within the Umpqua Cascades Ecoregion (91.7%). A portion of the southwestern section around Callahan Creek is part of the Inland Siskiyou Ecoregion, while the southeastern boarder is within the Southern Cascades Ecoregion.

Ecoregion	Acres	Percent of total⁶
Umpqua Cascades	138,660.9	91.7%
Inland Siskiyou	10,452.5	6.9%
Southern Cascades	2,023.8	1.3%
Total	151,137.3	100.0%

Table 1-1: Acres and percent of the Tiller Region within each ecoregion.

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

⁶ Percents do not add to 100 due to rounding.

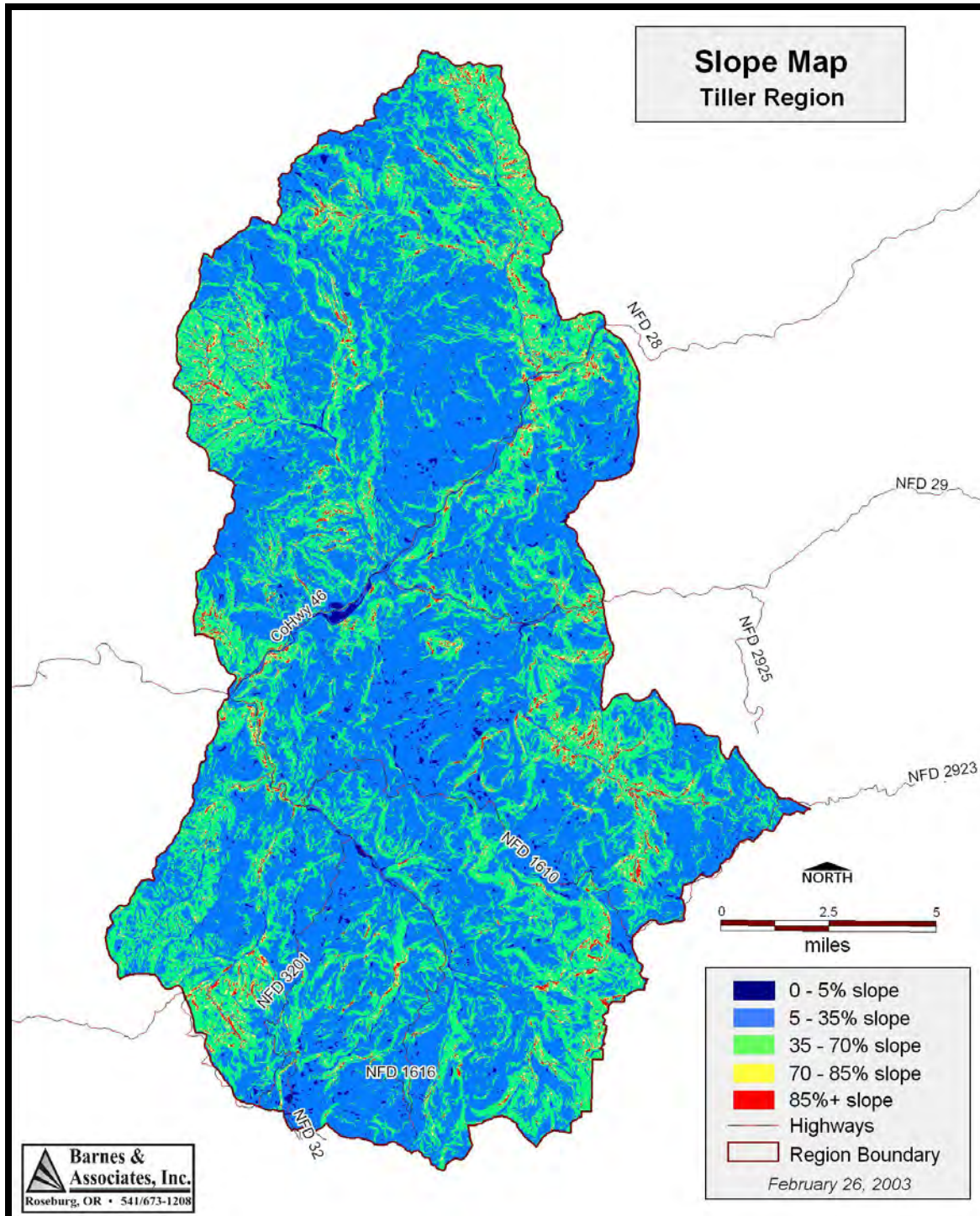


Map 1-3: Ecoregions of the Tiller Region.

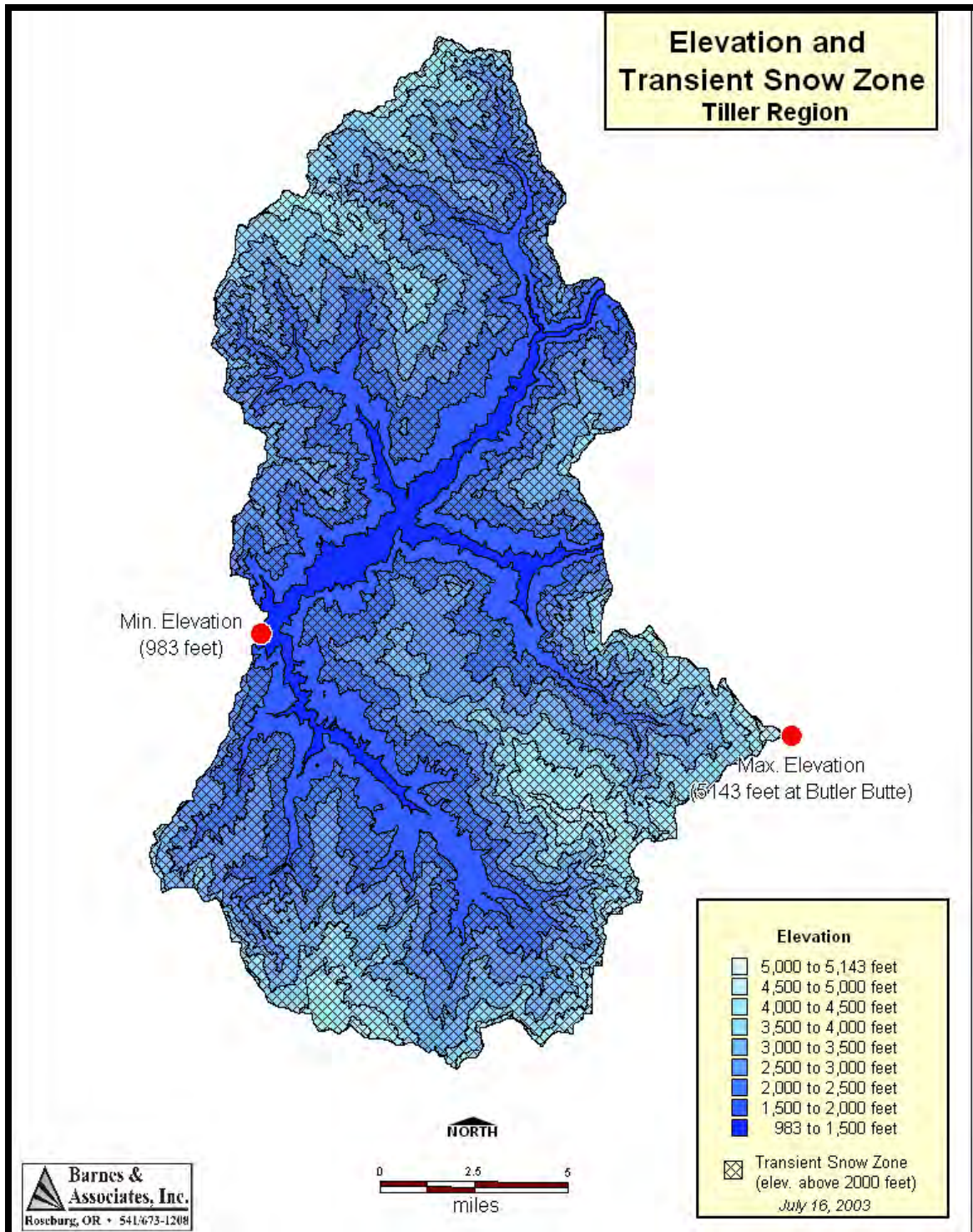
1.2.3. Topography

Mountains with deep, “V”-shaped valleys and steep slopes characterize the Umpqua Cascades Ecoregion and the Inland Siskiyou Ecoregion (see Map 1-4). The lowest point

in the Tiller Region is 983 feet at Elk Creek's confluence with the South Umpqua River. The highest point is 5,143 feet at Butler Butte. In the Tiller Region, 80.2% 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 1-5).



Map 1-4: Percent slope for the Tiller Region.



Map 1-5: Tiller Region elevation with highest and lowest points.

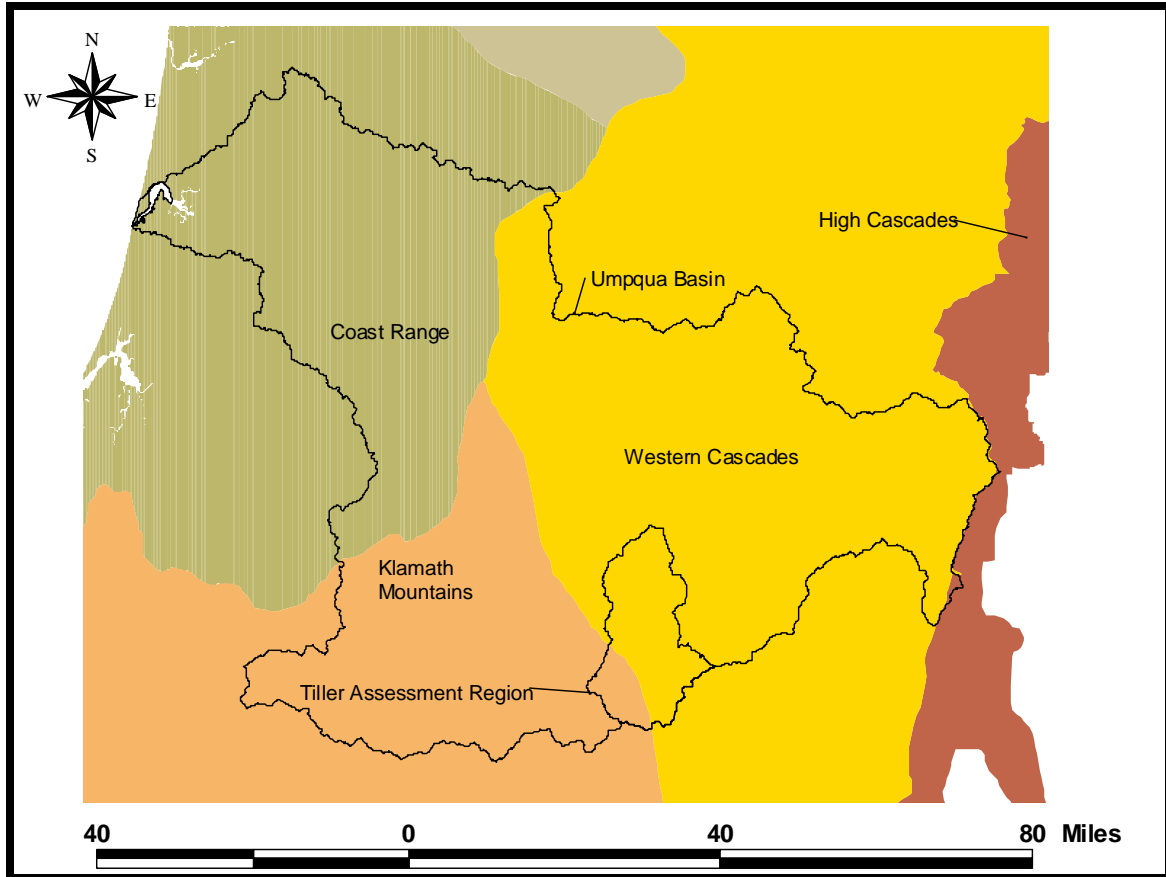
1.2.4. Geology⁷

The geologic history and current setting of any area 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 Tiller Region. 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).

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. The majority of the Tiller Region lies within the Western Cascades, while the southwestern portion lies within the Klamath Mountains. Map 1-6 illustrates the physiographic province distribution within the Umpqua Basin.

⁷ Kristin Anderson and John Runyon of BioSystems, Inc., contributed the text, table, photo, 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.



Map 1-6: Physiographic provinces for the Umpqua Basin and the Tiller Region.

The Klamath Mountains

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.

The Western Cascades

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 part 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.

The Tiller Region

The Tiller Region exhibits fairly steep topography, with streams dissecting the landscape. Except for one small portion of the South Umpqua River between tributaries Deadman Creek and Dompier Creek, where the river opens up into a small floodplain, no prominent low relief features are found within the Tiller Region. Pickett Butte, Savage Bluffs, Rondeau Butte, and Smith Ridge are some prominent high points in the Tiller Region. Although the topography is fairly consistent throughout the Tiller Region, some changes in slope are evident along contacts between geologic units.

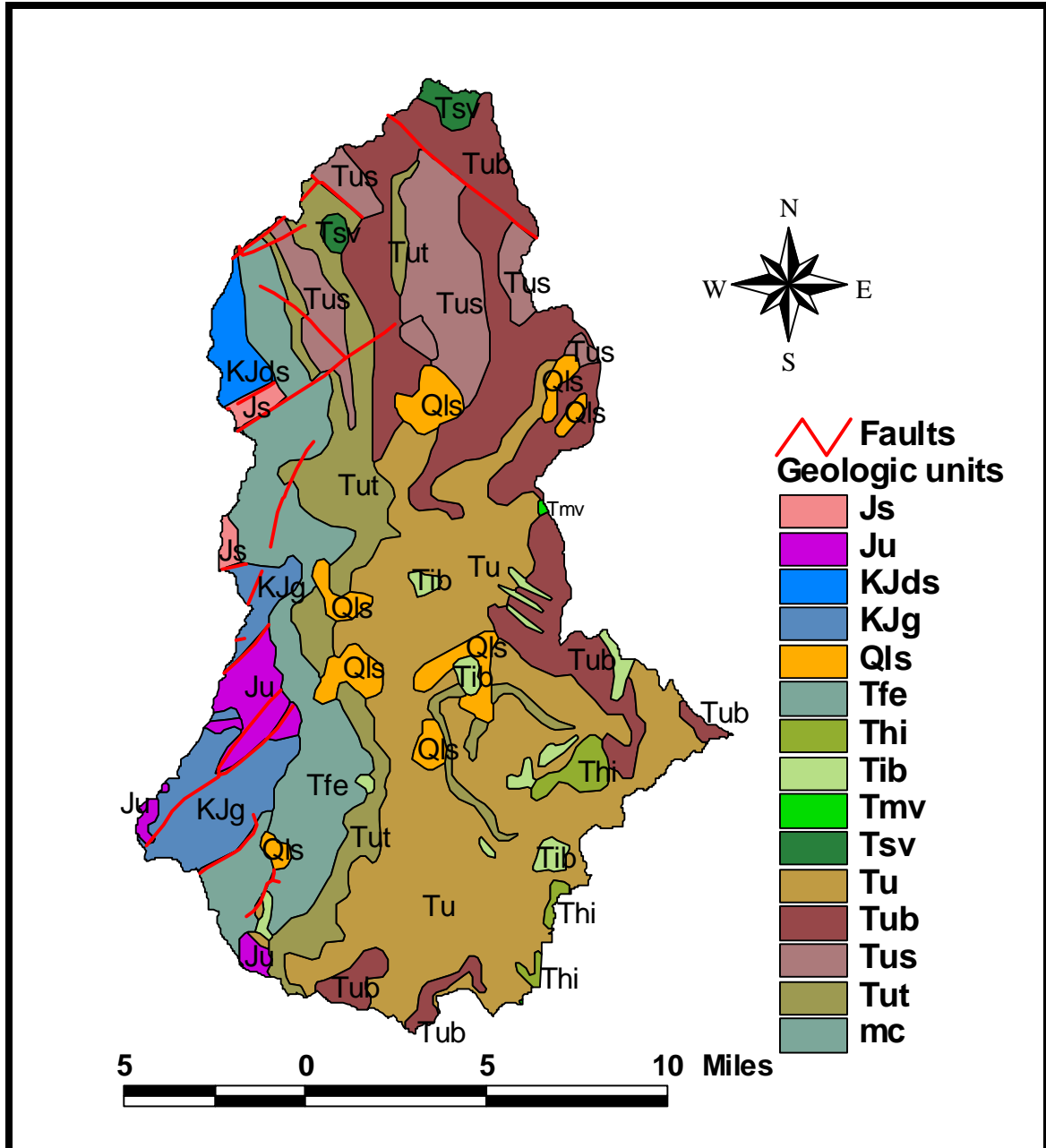
Geologic units of the Tiller Region

According to Walker and MacLeod (1991), there are fifteen geologic units within the Tiller Region, ranging in age from Paleozoic to Quaternary (see Table 1-2 and Map 1-7). Most of the geologic units within the Tiller Region are Tertiary-aged rocks characteristic of the Western Cascades, though the older Cretaceous- and Jurassic- aged rocks in the western portion of the region are characteristic of the Klamath Mountains. A detailed description of units and a glossary of terms can be found in Appendix 1

The May Creek (mc) schist, considered to be of Paleozoic age, is found in the far southwest. Jurassic ophiolite sequences (Ju), or oceanic crust incorporated into the continent, are found in the southeastern part of the Tiller Region. Jurassic sedimentary rocks (Js) are found on the western border of the region. The Dothan Formation sedimentary rocks (KJds), found in the northwest, consist of sandstone, conglomerate, graywacke, and chert. Intrusive granite rocks (KJg) exist in the southwest. A series of Tertiary-aged geologic units associated with volcanic activity are found throughout the rest of the region. The Fisher and Eugene Formations (Tfe), composed of sandstone, siltstone, tuff, breccia, and ash, border the characteristic Klamath Mountain geologic units (see Photo 1-1). Basaltic lava flows (Tub), tuff (Tut), and sedimentary and volcanoclastic rocks (Tus) (the unit *Tu* includes an undifferentiated mix of the preceding three units) are the result of volcanic eruptions in the Miocene and Oligocene epochs. Silicic vent complexes (Tsv) and mafic vent complexes (Tmv) occur in small areas of the region. Intrusive diorite (Thi) and basalt and andesite (Tib) are found scattered throughout the region. The youngest geologic units in the Tiller Region are Quaternary-aged landslide deposits that are found scattered throughout the region.

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 1-7: Geologic units and faults within the Tiller Region.



Photo 1-1: Photograph of a roadside exposure of the Colestin Formation (included the Tfe geologic unit).⁸

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 Tiller Region has several faults within the portion of the region that lies with the Klamath Mountains, and thus associated with exotic terranes that were crushed into the edge of the continent. Most of these faults are in a southwest-northeast orientation (Map 1-7), but some smaller faults fall in an orientation nearly perpendicular to this. There are far fewer faults within the younger Tertiary volcanic rocks, as the collision of terranes had in that period declined. The tectonic subduction zone that extends under the entire western part of the state extending beneath the Cascades poses an earthquake hazard to the entire western part of Oregon.

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

⁸ This photograph was taken from Universal Transverse Mercator coordinate 507588/4748085.

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 Tiller Region, are naturally surface water dominated, with groundwater playing a relatively minor role.

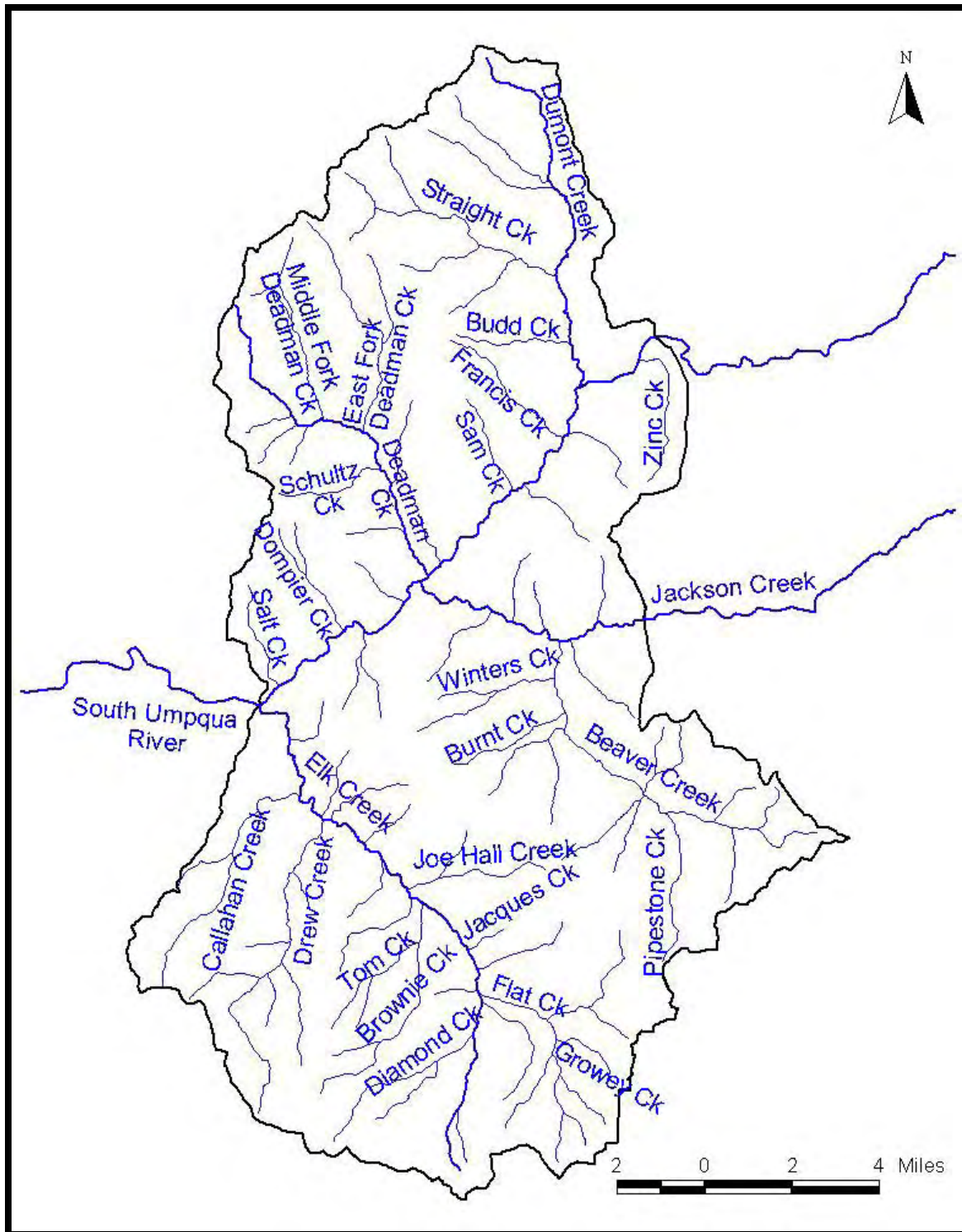
The composition of rocks can impact the quality of fish habitat and water. Generally, granitic rocks are more acidic, while calcareous rocks are more alkaline. Fish prefer neutral to alkaline conditions (Hastings et al., 2002). Erosion of rocks and subsequent delivery of sediments to streams as well as groundwater inputs delivered to streams through rock units influence the water chemistry of those streams. Within the Tiller Region, some areas of granitic area 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 sediment).

1.2.5. The Tiller Region stream network

Map 1-8 shows all of the streams within the Tiller Region 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 260.7 stream miles in the Tiller Region.⁹ The South Umpqua River is the main stem stream, running a total of 14.5 stream miles within the Tiller Region. The longest tributary is Elk Creek (14.6 stream miles). Within the Tiller Region, average stream gradients are 0.9% for the South Umpqua River, 3.2% for Elk Creek, and 1.5% for Jackson Creek. The average stream gradient for tributaries other than Jackson Creek and Elk Creek is 10.7%.

⁹ 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 1-8: Major streams of the Tiller Region.

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. Precipitation in the Umpqua Cascades Ecoregion ranges from 50 to 80 inches and up to 90 inches in higher elevations. In January, maximum, minimum, and average temperatures are generally 42°F, 32°F, and 37°F. In July, maximum, minimum, and average temperatures are generally 82°F, 49°F, and 67°F. Within the Tiller Region, precipitation and temperatures in the Inland Siskiyou Ecoregion and Southern Cascades Ecoregion would be similar to the Umpqua Cascades Ecoregion.

The Umpqua National Forest's Tiller Ranger Station has temperature and precipitation data from 1985 through 2002 for the Buckeye remote automatic weather station (RAWS). This station is located on Buckeye Creek approximately 20 miles east of the Tiller Ranger Station, which is outside the Tiller Region boundary. Figure 1-1 shows the average maximum and minimum temperatures for the Buckeye RAWS. Table 1-3 shows the number of data measurements on which Figure 1-1 is based. According to these data, summer maximum temperatures are in the low to mid 80s. Winter minimum temperatures are generally above freezing. RAWS precipitation data are collected intermittently and the records are incomplete. Therefore, no conclusions can be made about annual or monthly precipitation in the Tiller Region. Appendix 2 provides temperature and precipitation data from the National Oceanographic and Atmospheric Administration (NOAA) climate station in Riddle (station #7169). This is the closest NOAA station to the Tiller Region.

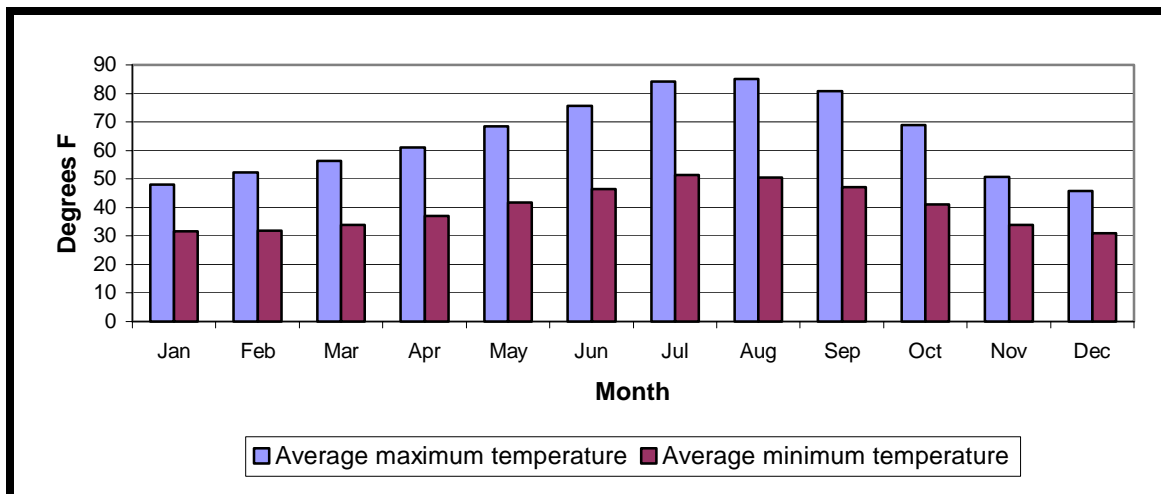


Figure 1-1: Tiller Region temperature data.

Month	Number of data measurements	Month	Number of data measurements
January	355	July	616
February	400	August	637
March	427	September	620
April	484	October	632
May	579	November	574
June	612	December	427

Table 1-3: Tiller Region temperature data collection records

1.2.7. Vegetation

The high elevations of the Umpqua Cascades Ecoregion 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. Within the Tiller Region, the Southern Cascades Ecoregion would have similar vegetation as the Umpqua Cascades Ecoregion.

In the Inland Siskiyou 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.

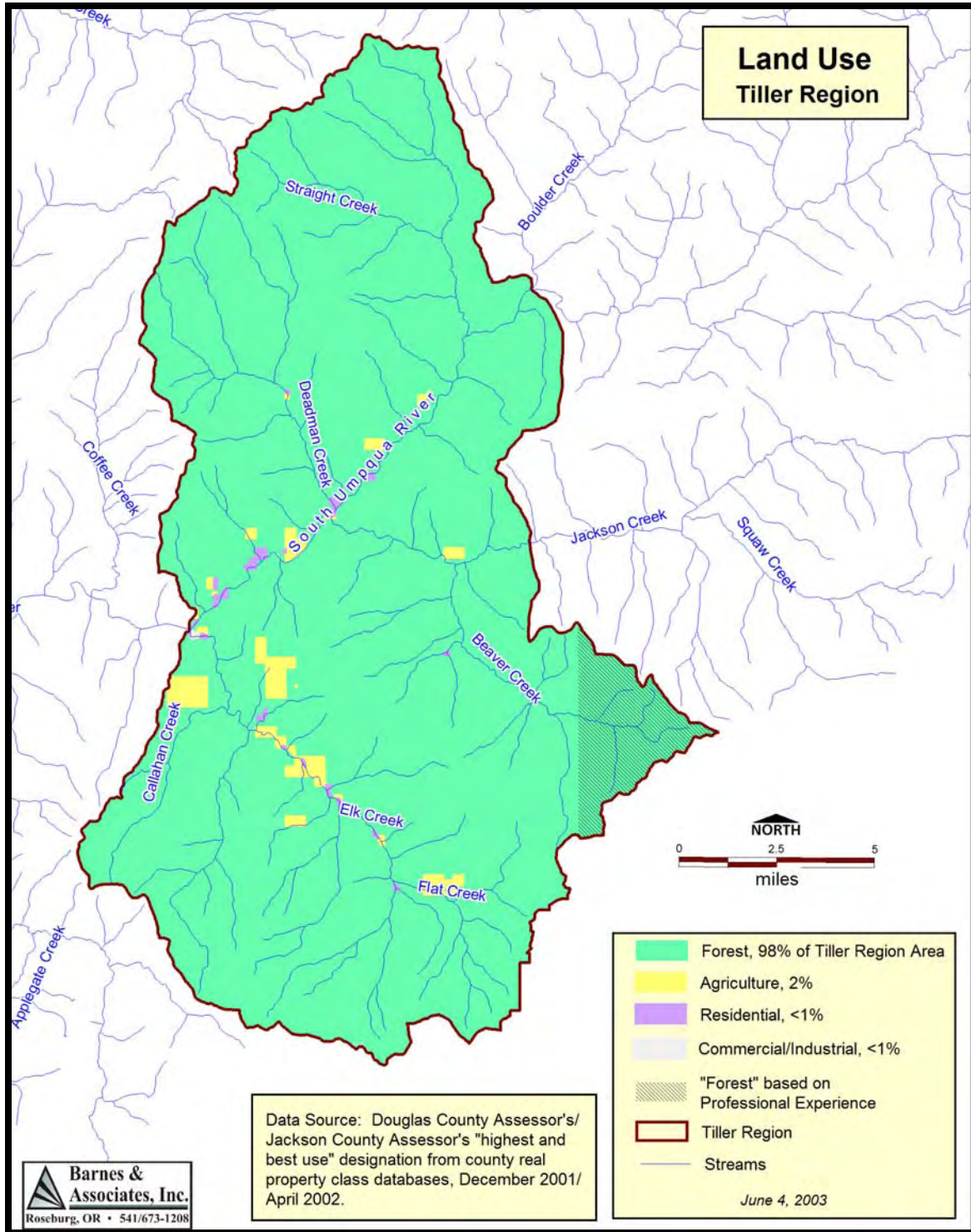
1.3. Land use, ownership, and population

1.3.1. Land use and ownership

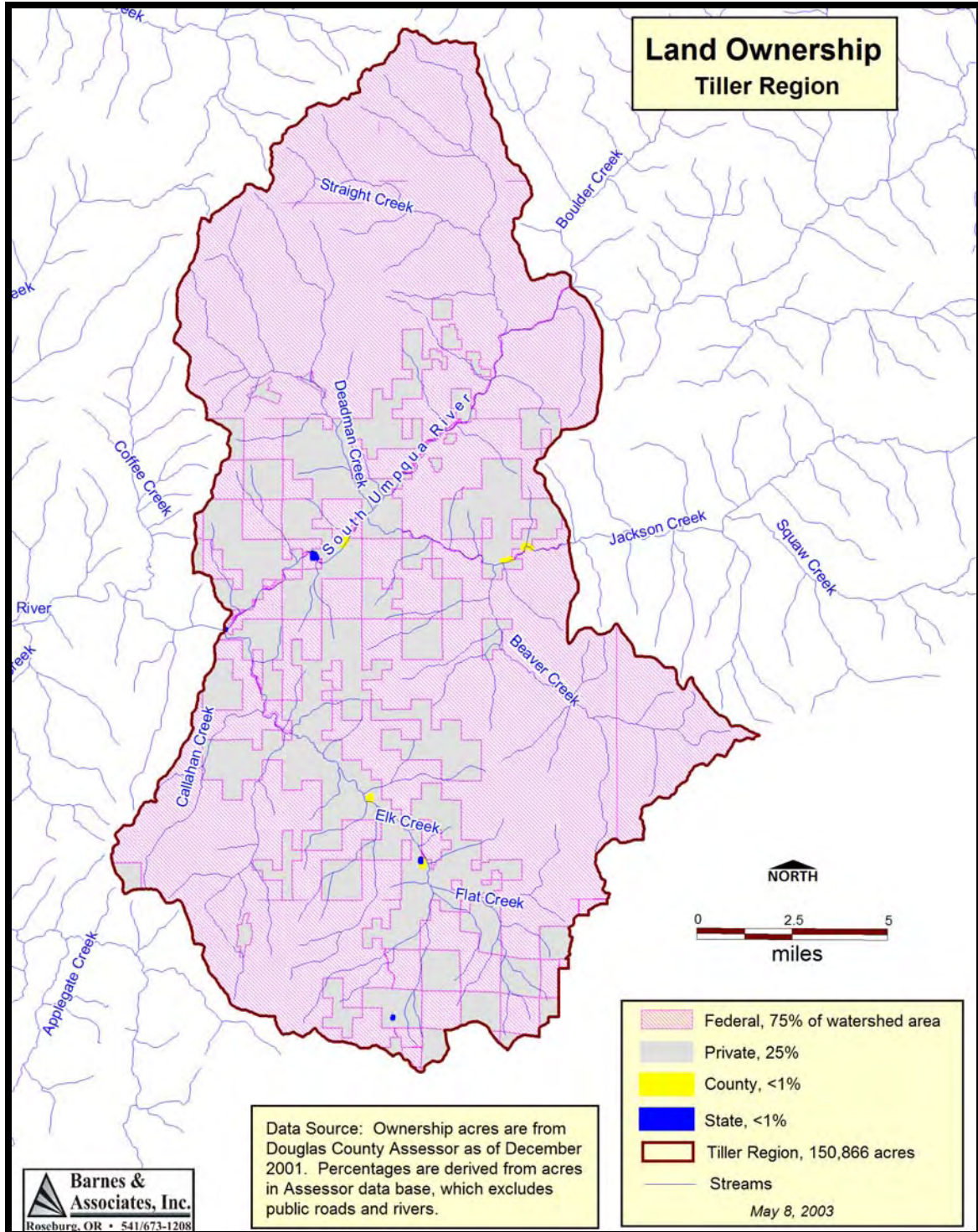
Land use in the Tiller Region is approximately 98% forestry. Agricultural lands, residential developments, and commercial developments constitute approximately 2% of the land base (see Map 1-9). Approximately 75% of the Tiller Region is federal land. The BLM administers the federal lands in the Deadman Creek and Dompier Creek drainages; the US Forest Service administers the rest. Approximately 25% of the Tiller Region is privately owned. Douglas County and the State of Oregon each administer less than 1% of the total land base (see Map 1-10).

Map 1-11 and Table 1-4 show parcel size distribution and percent by class for the Tiller Region as of 2001. Almost 95% of the region consists of tax lot parcels that are over 100 acres. Parcels less than 100 acres correspond with areas of private ownership. Less than

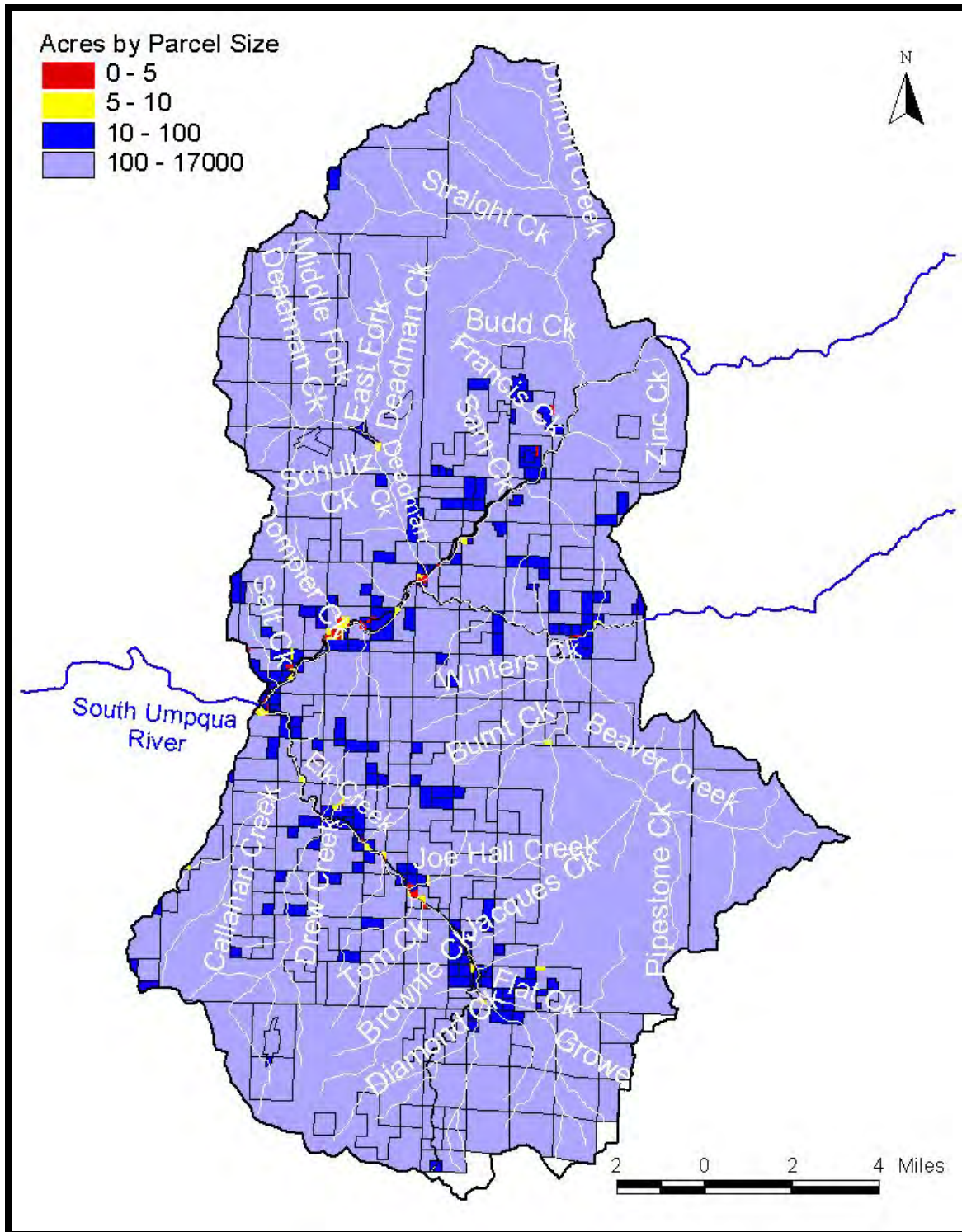
one percent of the Tiller Region is in parcels less than five acres. These parcels are mostly concentrated along the South Umpqua River and Elk Creek.



Map 1-9: Land use in the Tiller Region.



Map 1-10: Land ownership in the Tiller Region.



Map 1-11: Parcel size distribution for the Tiller Region.

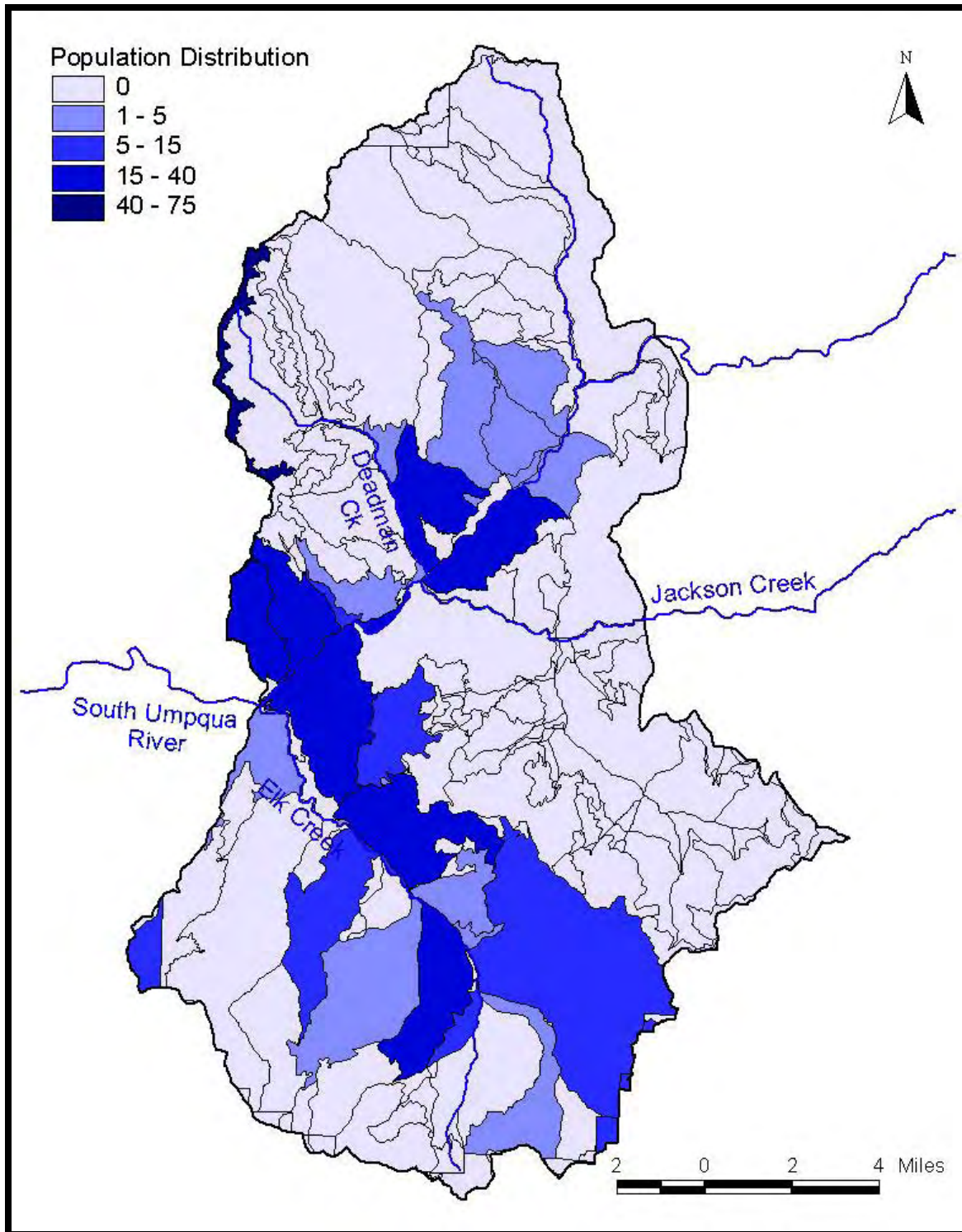
Parcel size	Percent of region
0-5	0.1%
5-10	0.2%
10-100	5.2%
100+	94.6%

Table 1-4: Percent of landholdings by parcel size for the Tiller Region.

1.3.2. Population and demographics

Population

US Census tracts and blocks do not follow the Tiller Region's boundaries, so it is not possible to make a precise estimate of the Tiller Region's population. According to the US Census, no more than 407 people lived the region in 2000, or an average of 1.7 people per square mile. The relative population distribution in the Tiller Region is shown in Map 1-12.

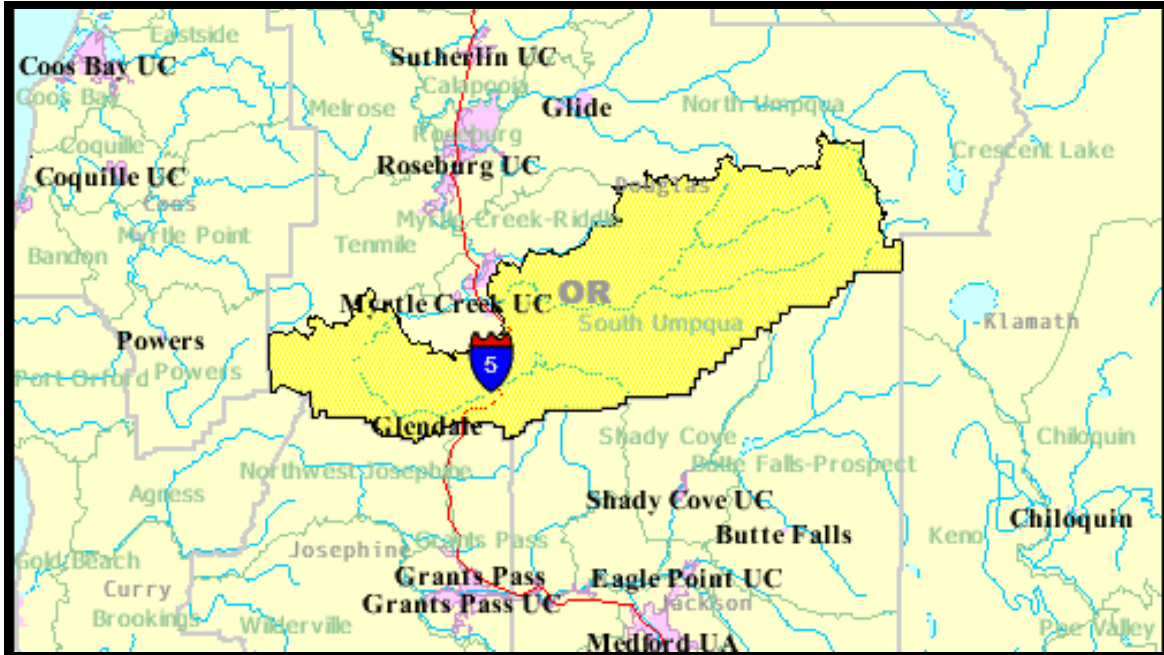


Map 1-12: Relative population density within the Tiller Region.¹⁰

¹⁰ The lines on Map 1-12 indicate US Census divisions.

General demographic characteristics and housing

Parts of the South Umpqua census county division (CCD) are within the Tiller Region (see Map 1-13).¹¹ Data from the South Umpqua CCD are included in this section to provide an overview of the populations living within the Tiller Region.



Map 1-13: Location of the South Umpqua CCD.¹²

Table 1-5 provides Census 2000 information about general demographic characteristics and housing for the South Umpqua CCD. Douglas County information is included for comparison. The median age for the South Umpqua CCD is slightly higher than the county's median age. The largest racial group for both the county and the South Umpqua CCD is white, with the next largest groups being Hispanic or Latino, and persons of two or more races. Average household size, family size, and percent owner-occupied housing are comparable for both areas. The South Umpqua CCD has a higher housing vacancy rate than the county.

¹¹ 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."

¹² This map is from the US Census Bureau website <http://factfinder.census.gov/servlet/BasicFactsServlet>.

Parameter	South Umpqua CCD	Douglas County¹³
Median age (years)	42.6	41.2
<i>Race</i>		
White	89.2%	91.9%
Hispanic or Latino	4.8%	3.3%
Asian	0.4%	0.6%
American Indian or Alaskan Native	2.1%	1.4%
African American	0.1%	0.2%
Native Hawaiian or Pacific islander	0.2%	0.1%
Some other race	0.2%	0.1%
Two or more races	3.1%	2.4%
<i>Households</i>		
Avg. household size (#)	2.51	2.48
Avg. family size (#)	2.91	2.90
Owner-occupied housing	71.5%	71.7%
Vacant housing units	11.7%	8.0%

Table 1-5: 2000 US Census information for general demographic characteristics and housing for the South Umpqua CCD and Douglas County.

Social characteristics

Table 1-6 provides information from the 2000 Census for education, employment, and income for the South Umpqua CCD and for Douglas County. The South Umpqua CCD has a lower percent of high school graduates and a lower percent of people with at least a four-year college degree than does Douglas County. The percent of unemployed persons in the labor force is higher for the South Umpqua CCD than for Douglas County. The top three occupations listed in Table 1-6 account for almost three-fourth of the labor force in the South Umpqua CCD. The top three industries employ over half of workers, with “manufacturing” accounting for 20% of all jobs. Per capita income and median family income for the South Umpqua CCD are lower than for Douglas County. The South Umpqua CCD has a higher poverty rate than does the county.

¹³ The total population of Douglas County in 2000 was 100,399 people.

Parameter	South Umpqua CCD	Douglas County
<i>Education – age 25+</i>		
High school graduate or higher	76.5%	81.0%
Bachelor’s degree or higher	10.0%	13.3%
<i>Employment- age 16+</i>		
In labor force	52.0%	56.9%
Unemployed in labor force	7.3%	7.5%
Top three occupations	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	Manufacturing; Educational, health, and social service, Arts, entertainment, recreation, accommodation, food service	Educational, health, and social services; Manufacturing; Retail
<i>Income</i>		
Per capita income	\$15,036	\$16,581
Median family income	\$34,559	\$39,364
Families below poverty	11.2%	9.6%

Table 1-6: 2000 US Census information for education, employment, and income for the South Umpqua CCD and Douglas County.

2. Past Conditions¹⁴

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 Tiller Region. Sections 2.1 through 2.5 describe the history of Douglas County. Section 2.6 provides information specific to the Tiller Region. Most of sections 2.1 through 2.5 are 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 1841, funded by the federal government and led by Lt. George F. Emmons, met with

¹⁴ 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.

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.

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).

Origin of the name “Umpqua”

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).

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" (Schlessner, 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 (Schlessner, 1973).

<u>Pre-Settlement timeline</u>	
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 (Schlessner, 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 (Schlessner, 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	<i>Swan</i> 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).

Mining techniques

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.

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

1890s to the 1960s timeline

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 6 th 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.¹⁵ 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

Mining at the Bonanza Mine in 1955

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).

¹⁵ 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 (Leady, 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.¹⁶

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

¹⁶ 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.¹⁷

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).

<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

¹⁷ 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 0).

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).

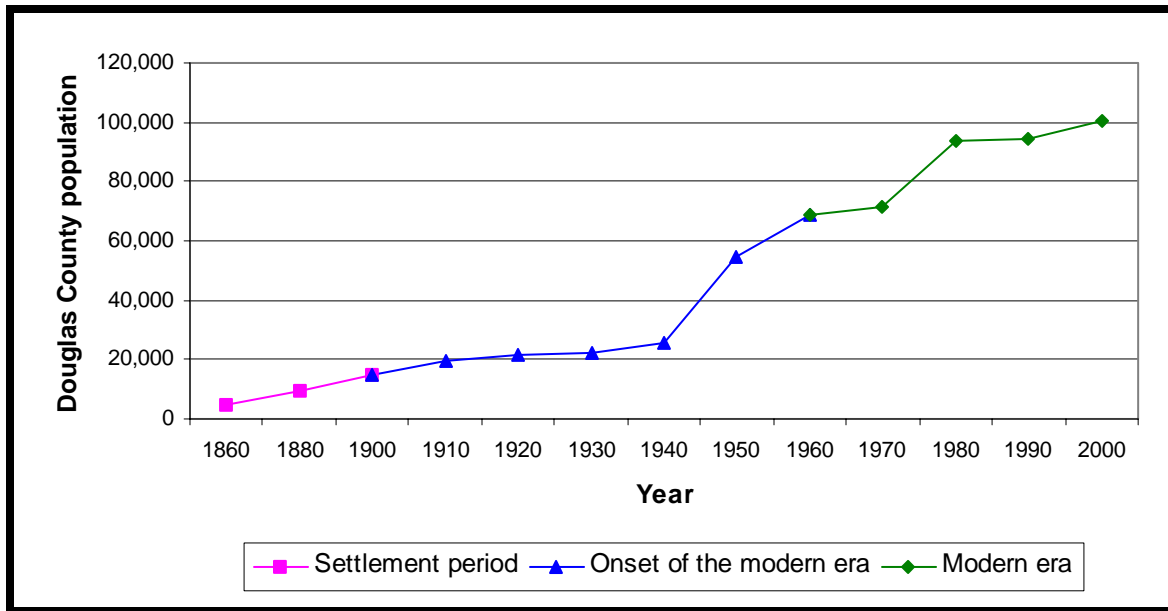


Figure 2-1: Population growth in Douglas County from 1860 through 2000.

2.6. History of the Tiller Region

2.6.1. Historical timeline

This section includes significant historical events that most likely had an impact on the Tiller Region. Background information for this section was compiled from the following groups' documents, websites, and specialists: the USDI Bureau of Land Management (BLM), the Oregon Department of 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); 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 Valley on his way to the 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 the "gold rush" moves into southern 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.
1855	Almost all open lands of the Cow Creek Valley were claimed. Additional settlers moved to outlying areas, including the Tiller Region, further from amenities and required more land clearing.
1855	A thriving gold mining camp existed for 10 years at Coffee Creek, located two miles west of the Tiller Region. The camp attracted over 1,000 miners.
1856	The government removed over 2,000 Indians from southwestern Oregon.
1866	Oregon and California Land Grant Act was established to finance railroad construction.
1877	Elk Creek post office (at the mouth of Elk Creek) was established with S.C. Cramer as first postmaster. The post office was renamed in 1884 and moved to Perdue (Milo).
1882	The Oregon and California (O&C) Railroad reached Riddle and was temporarily terminated before resuming construction to the south. This provided a new means of transportation and commerce to the north for Riddle and other communities such as Canyonville, Perdue, Days Creek, Tiller, and Drew.
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.

1891	James Pickett and James Overstreet built a sawmill in Tiller.
1900s	Fire suppression efforts began in earnest.
1902	Alfred Marquam built the first store that also served as the Tiller post office, with Mr. Marquam as first postmaster. The area was named after early pioneer Aaron Tiller because “Marquam, Oregon” already existed.
1907	President Theodore Roosevelt established the Umpqua National Forest. Tiller became the site of the ranger station.
1914	Clarence Jackson was the first ranger at Tiller Ranger Station.
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. Land was administered by General Land Office and later the Bureau of Land Management. ¹⁸
1920s	The Pacific (Highway 99) paved road bypassed Riddle and was routed through Canyonville to Galesville.
1920s	The Tiller to Drew road was built.
1929	The Beaver Creek fire burned approximately 6,000 acres in the southeastern portion of Tiller Region. Arson was the suspected cause.
1933-1942	In response to the Depression of 1929, President Franklin Roosevelt established the Civilian Conservation Corps (CCC) to put physically fit young men to work on conservation-related projects. The CCC proved to be instrumental in the development and “opening” of the Umpqua River basin. Funding for CCC ceased after the outbreak of WWII.
1940s	A sawmill was built in Tiller to process the one million board feet of sugar pine that had been selected for a timber sale. At the time, Douglas-fir could not be milled at a profit.
1944	The Sustained-Yield Management Act of 1944 provided the momentum in shifting the role of USFS from caretaker to administering the sale of timber.

¹⁸ According to the Oregon State University Forest Sciences Laboratory (1998): “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.”

1950s-1960s	Timber harvesting and construction of access roads were major influences on the Tiller Region landscape.
1960	The Multiple Use-Sustained-Yield Act of 1960 shifted the USFS role as timber managers to include outdoor recreation, range, watersheds, and fish and wildlife biology.
1961	A fire burned around three sides of Tiller, including the ranger station.
1964	A flood damaged roads and washed out bridges, temporarily isolating Tiller.
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. Staffing at the Tiller Ranger Station was reduced by over 50%.
1995-1996	After a December 1995 windstorm, followed by a heavy wet snowfall, many trees were uprooted, felled, or suffered crown damage.
2002	Within the Tiller Region, the Boulder fire burns 7,894 acres, mostly in the Dumont Creek drainage.

2.6.2. Population¹⁹

It was not uncommon for French-Canadian and meti (mixed blood) trappers working for the Hudson's Bay Company to marry Cow Creek women. Many of these families settled in the Tiller Region after the fur trade lost momentum. Areas that were previously occupied and burned and cleared by Indians were probably settled first. By 1907 approximately 40 homesteaders lived up the South Umpqua River above Tiller. The area of Drew was named after early settler Robert Drew and supported the Tison School from 1910 through the 1940s.

Several prospects such as the "quicksilver" (mercury) mines Buena Vista, Maude S (Umpqua Mine) and Gold Cut attracted miners to the Tiller Region. Both the Banfield Mine and Rowley Mine in the Drew Creek drainage reported the presence of trace minerals but never produced significant amounts.

The Civilian Conservation Corps (CCC) program had an impact on populations between 1933 and 1942. In 1933, the CCC Medford District listed 6,000 men and 100 officers that were involved in the construction of trails, roads, bridges, ranger stations, fire fighting, reforestation and other conservation related activities. Camps were established throughout the area, including the Tiller Region. Approximately 320 men were stationed at Drew Camp. Local merchants provided most of the food and supplies for these camps and most likely benefited from the increase in population. After the CCC program

¹⁹ There are no incorporated cities in the watershed so it is difficult to retrieve accurate population counts.

ceased, a number of CCC personnel settled in the Umpqua region and became successful ranchers or loggers.

2.6.3. Historical fish use

The Tiller Region is located within the South Umpqua River sub-basin. In 1937, the Umpqua National Forest surveyed portions of the South Umpqua River sub-basin for fish use. An abundance of salmon, steelhead, and cutthroat trout were found throughout the South Umpqua River and its tributaries. Cow Creek tribal members have identified important historical fishing camps in the Elk Creek drainage. Early settlers such as the Marquam family in the Callahan Meadows near Drew have described the local streams as being abundant with trout and salmon and a fish catch of 100 trout in less than half of a day.

From 1880 through 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 modification to the dam.²⁰ In 1946, the Oregon State Game Commission (predecessor to ODFW) recommended that the Umpqua River and its tributaries be closed for spring chinook salmon fishing for five years and fishing to be curtailed for coho due to declining catch rates.

It is estimated that prior to the 1960s, the fish runs in the South Umpqua River sub-basin were as high as 30,000 winter steelhead, 5,000 spring chinook, and 70,000 coho. 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.

ODFW has conducted annual summer snorkel counts of spring chinook in index pools above and below the South Umpqua Falls and in Jackson Creek. The data suggest a downward trend from 1960 through 1980. ODFW estimates total chinook escapement by doubling these index numbers. The estimates are still well below the historical escapements of 5,000 spring chinook for the South Umpqua run (see section 3.5.2 for more information about Tiller Region fish abundance).

2.6.4. 1900 forest conditions

Figure 2-2 provides an indication of the forest cover at the turn of the last century.²¹ Only 11% of the Tiller Region was identified as timberless. Timberless would include grasslands, grazed land, cultivated, and homestead areas. Eighty-eight percent of the Tiller Region was designated as forested. Twenty-six percent of the forested area was categorized as having 25 to 50 thousand board feet per acre and fell primarily in the upper reaches of Beaver Creek and Elk Creek. A portion of the headwaters of Beaver Creek was designated as a burned area of approximately 1,575 acres within the Tiller Region.

²⁰ The dam was believed to be in the vicinity of the current Douglas County fairgrounds.

²¹ 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.

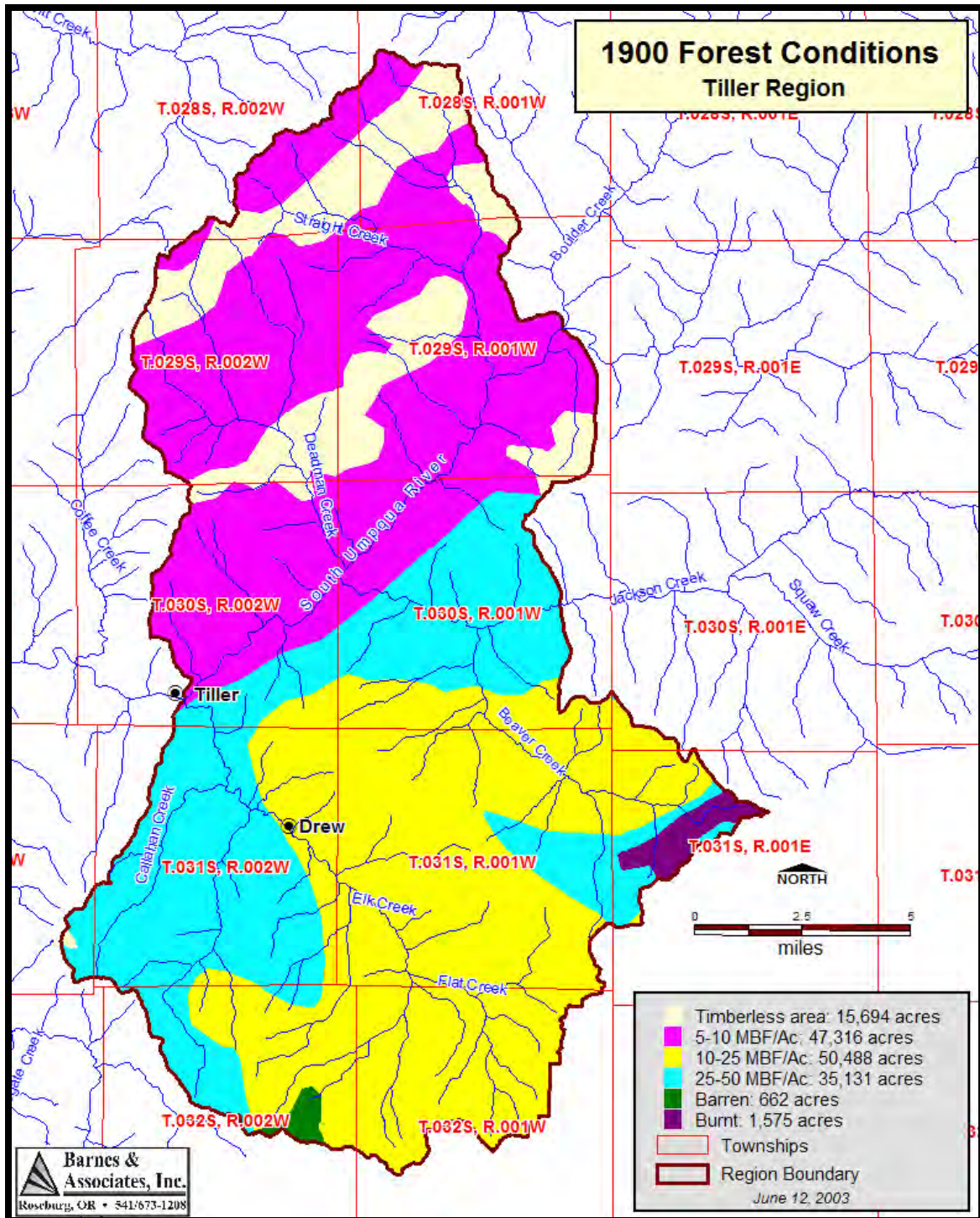


Figure 2-2: 1900 vegetation patterns for the Tiller Region.

Historically, fire has played an important role in the Tiller Region. Large stand replacement fires caused by lightning and humans created a mosaic of age classes, even before any extensive logging began. Effective fire suppression began in the early 1900s and altered the fire regime compared to historical time. 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.

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3. Current Conditions

This chapter explores the current conditions of the Tiller Region 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), the *Fish Passage Short Course Handbook* (Oregon State University Extension Service, 2000), the *Elk Creek Watershed Analysis* (USDA Forest Service, 1996), the *Jackson Creek Watershed Analysis* (USDA Forest Service, 1995), and the *Dumont Creek Watershed Analysis* (1995). Additional information and data are from the following groups' documents, websites, and specialists: the USDI Bureau of Land Management, the USDA Forest Service, 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 Tiller Region 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 region, and what are their impacts on water availability?
- What are the flood trends within the region?
- 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 morphology²²

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 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 Tiller Region. Information in this section has been summarized from the following documents: *Oregon Watershed*

²² Kristin Anderson and John Runyon of BioSystems, Inc., provided the text, photos, and Table 3-1 for this section.

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).

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 Tiller Region along with examples of streams that fall into each. Photo 3-1 and Photo 3-2 show examples of channel habitat types.

Channel Habitat Type	Example within region	Restoration opportunities
Low gradient small floodplain	South Umpqua River between the outlets of Deadman Creek and Dompier 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	Elk River near Drew	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	Callahan Creek downstream of headwater reaches	Though these channels are not often responsive. Riparian planting projects may improve water temperature and erosion issues.
Moderate gradient moderately confined	Anderson 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	Drew Creek	Though these channels are not often responsive, riparian planting projects may improve water temperature and erosion issues.
Moderate gradient headwater	The headwaters of Diamond Creek	These channels are often moderately responsive to restoration. Riparian planting projects may improve water temperature and erosion issues.

Moderately steep narrow valley	Middle Fork Deadman 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	The headwaters of Dumont Creek	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 Tiller Region.



Photo 3-1: Photograph looking east-southeast (upstream) at Elk Creek near Drew, where the stream has a low gradient moderately confined channel.²³

²³ This photograph was taken from Universal Transverse Mercator coordinate 508108/4747552.



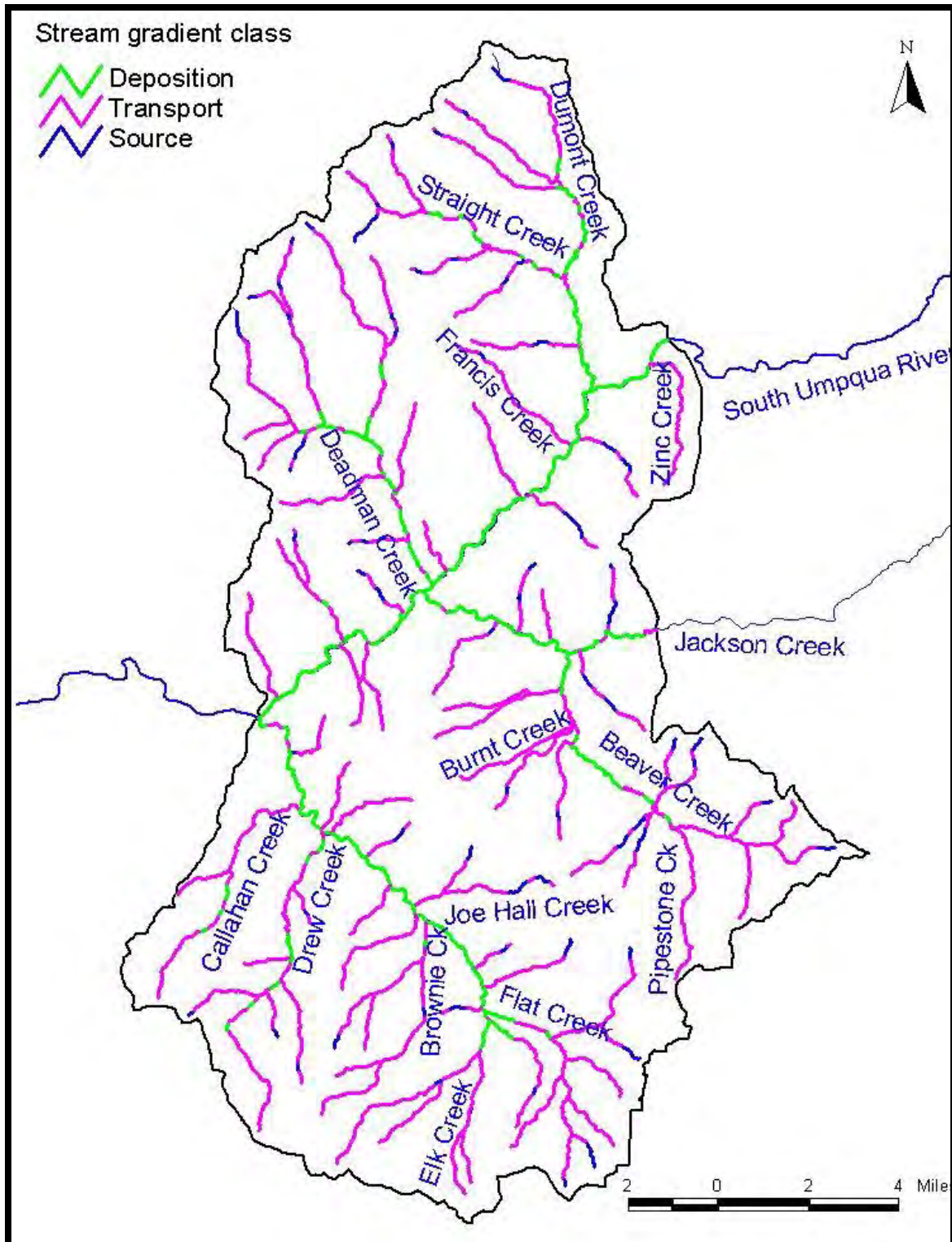
Photo 3-2: Photograph looking south-southwest (upstream) at Callahan Creek, a low gradient and in most places confined stream.²⁴

²⁴ This photograph was taken from Universal Transverse Mercator coordinate 501248/4743816.

Ellis-Sugai and Godwin (2002) also look at streams in terms of their position in a 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. Table 3-2 and Map 3-1 show the total stream miles and percent of streams within each gradient class.

Gradient class	Stream miles in the region	% Total
Source	19.4	7.4%
Transport	188.9	72.5%
Deposition	52.3	20.1%
Total	260.7	100.0%

Table 3-2: Tiller Region stream miles within each gradient class.



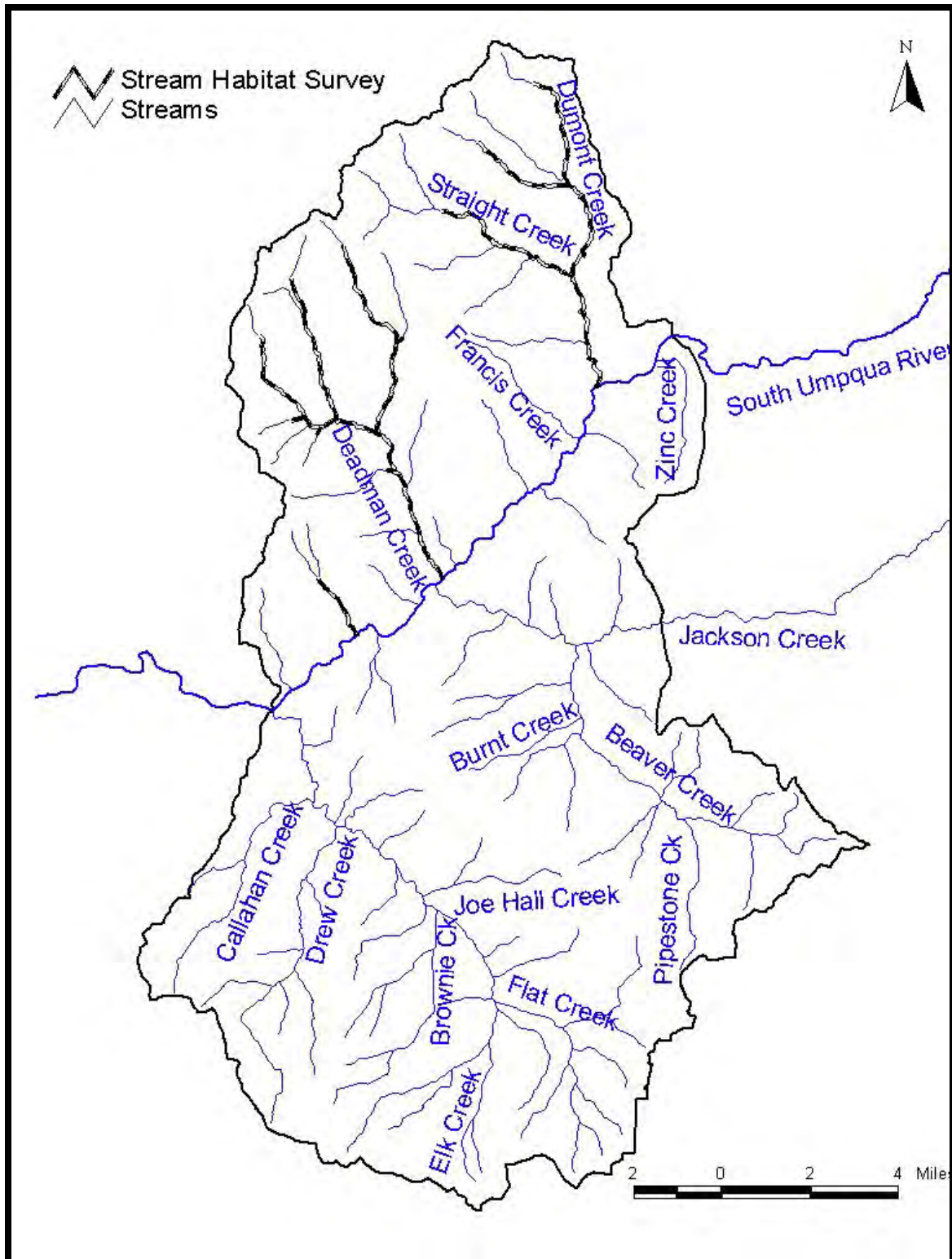
Map 3-1: Stream gradients in the Tiller Region.

The headwaters of many tributaries to the South Umpqua River and Elk Creek within the Tiller Region are fairly steep (8% to 16% slope). These are source streams, providing sediment and wood. Many of these streams and stream reaches are above the anadromous fish zone. Shade and other riparian projects may help improve those stream reaches. Most of these headwater streams quickly become moderately sloped (4% to 8% slope) shortly downstream with confined to moderately confined conditions. Several headwater streams within the Tiller Region also have a moderate gradient. These reaches function as transport streams, both storing and delivering sediment and wood downstream. Adding large wood, stabilizing banks by planting trees, and improving shade in these reaches may be helpful for the stream system. Only along a short section of the South Umpqua River (between the outlets of Deadman and Dompier Creeks) does the channel open up in a small floodplain. These broader, 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.

ODFW 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. In the summers of 1992, 1993, and 1996, ODFW staff conducted stream habitat surveys in the Tiller Region. Approximately 33.9 stream miles were surveyed (see Map 3-2), which is about 13% of the total stream miles visible on the map (260.7).²⁵ Each stream was divided into reaches based on channel and riparian habitat characteristics for a total of 26 reaches averaging 1.3 miles in length. Appendix 3 provides a map detailing the stream reaches.

²⁵ See section 1.2.5 for more information about the stream map.



Map 3-2: ODFW stream habitat survey locations within the Tiller Region.

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

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 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.

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 pieces²⁶ 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

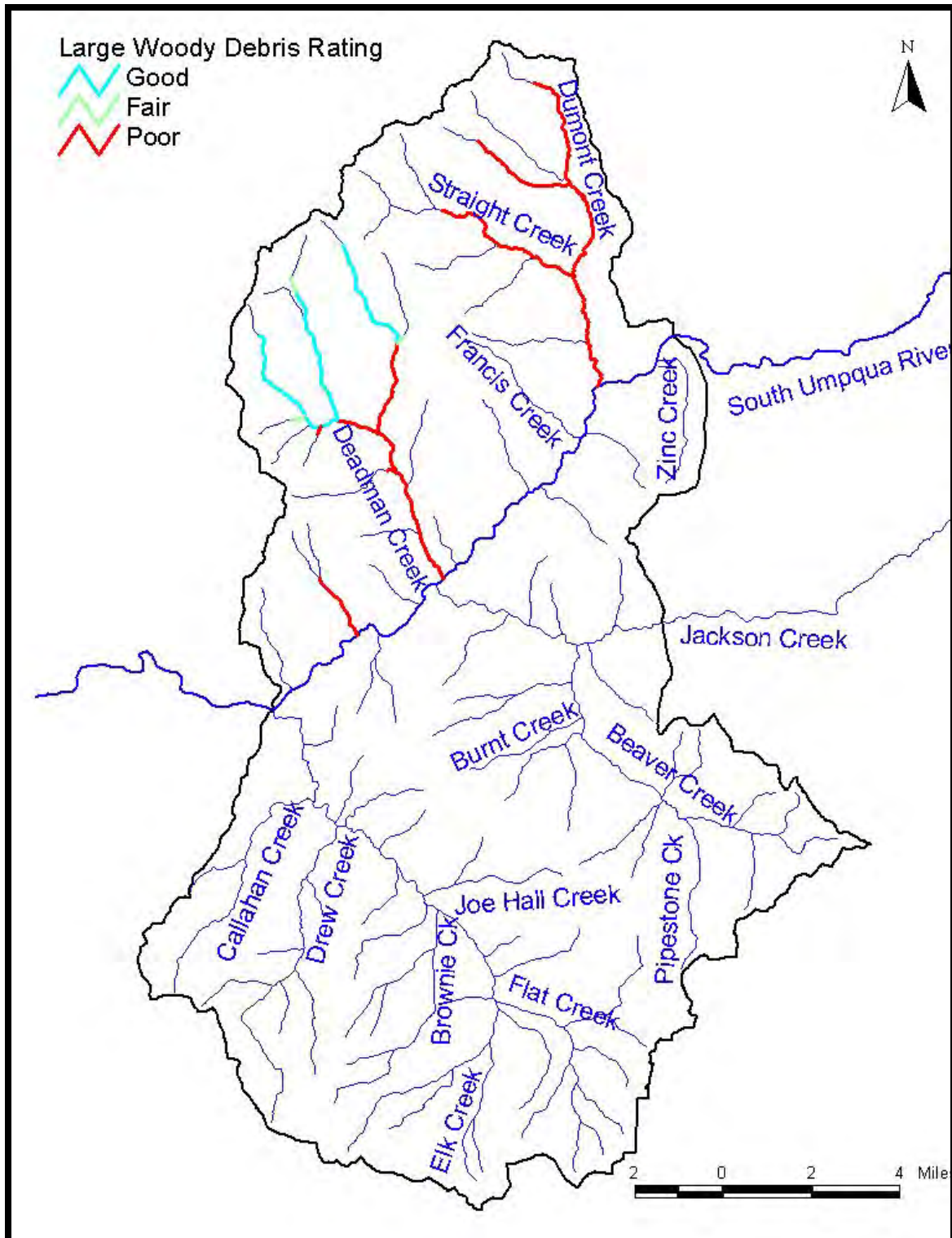
Table 3-3: Stream habitat survey benchmarks.

²⁶ Minimum size is six-inch diameter by 10 ft length or a root wad that has a diameter of six inches or more.

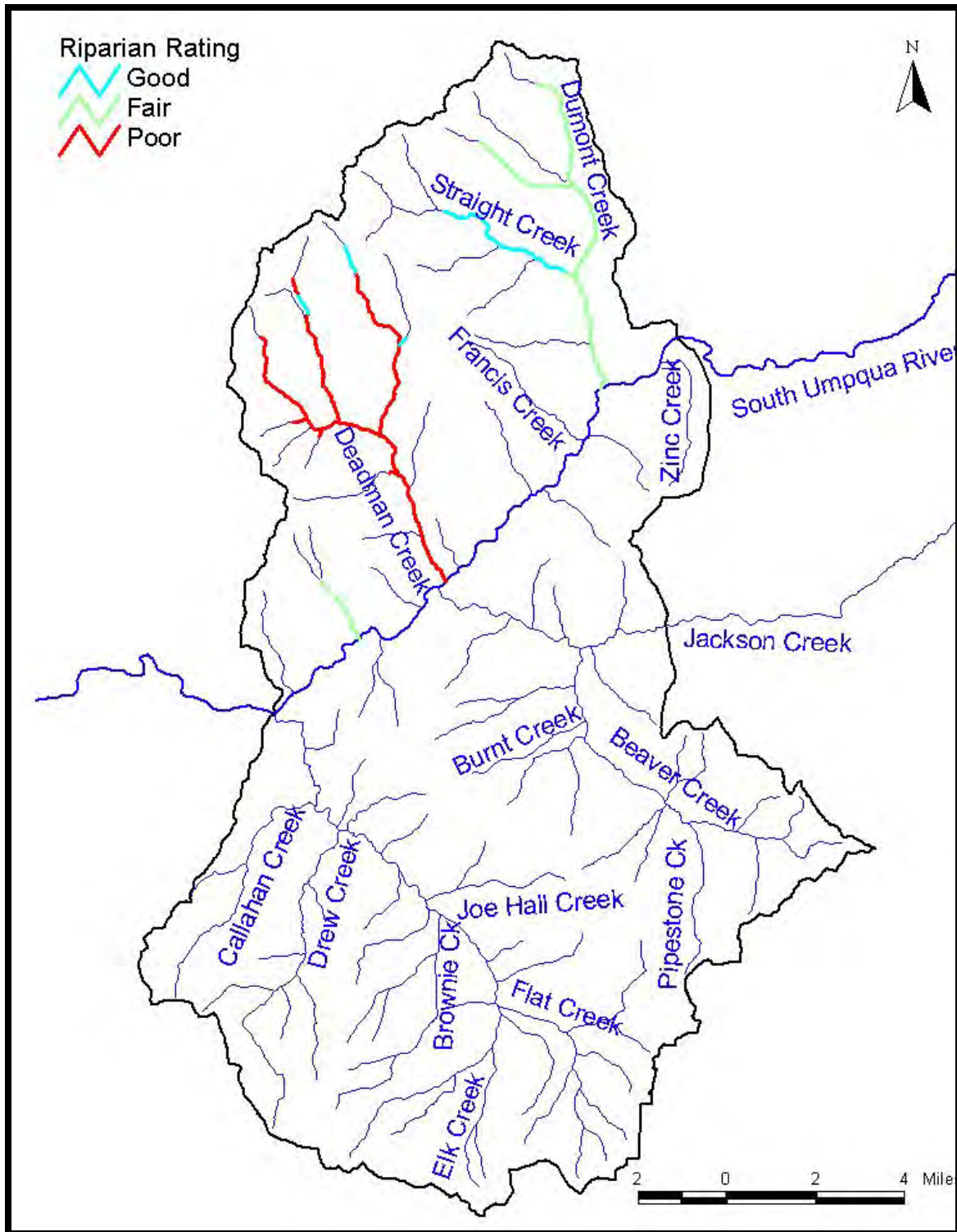
Overview of stream conditions

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 Tiller Region is beyond the scope of this assessment. Instead, it looks for patterns within the whole region and along the streams to provide a broad view and help determine trends that might be of concern.

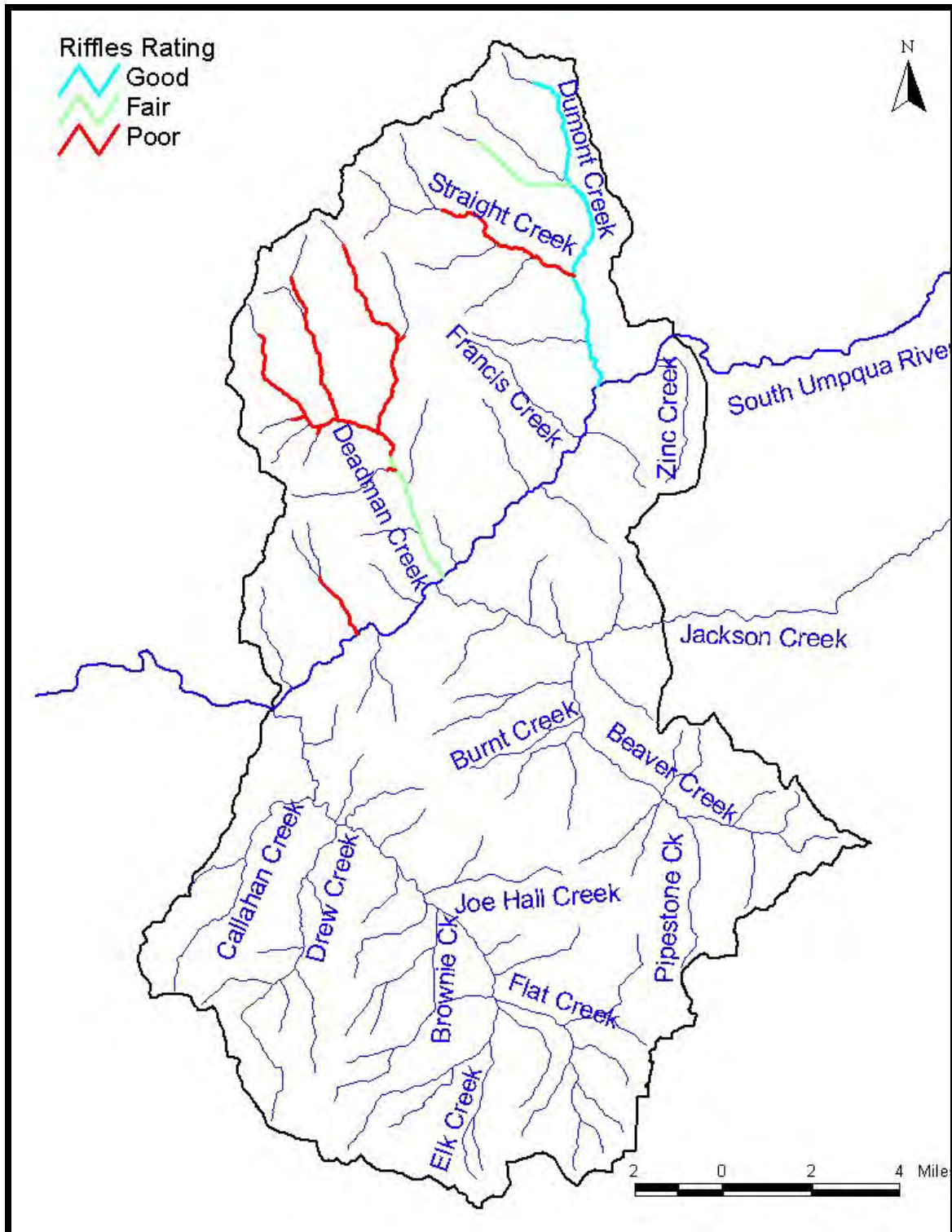
Of the 26 stream reaches surveyed by ODFW, none rate as fair or good in all four categories. Twenty-one stream reaches have at least two categories rate as poor (80.8%). Looking at Map 3-3, it is striking that all of Dumont Creek, Straight Creek, Dompier Creek, and mainstem Deadman Creek have poor large woody material levels. Most of the Deadman Creek drainage has poor riparian areas (see Map 3-4). Three-fourths of surveyed stream reaches have poor riffles (Map 3-5). The lower reaches of Dumont Creek and Deadman Creek have good pools (see Map 3-6). Ratings and land uses by stream reach are provided in Appendix 3 and Appendix 4.



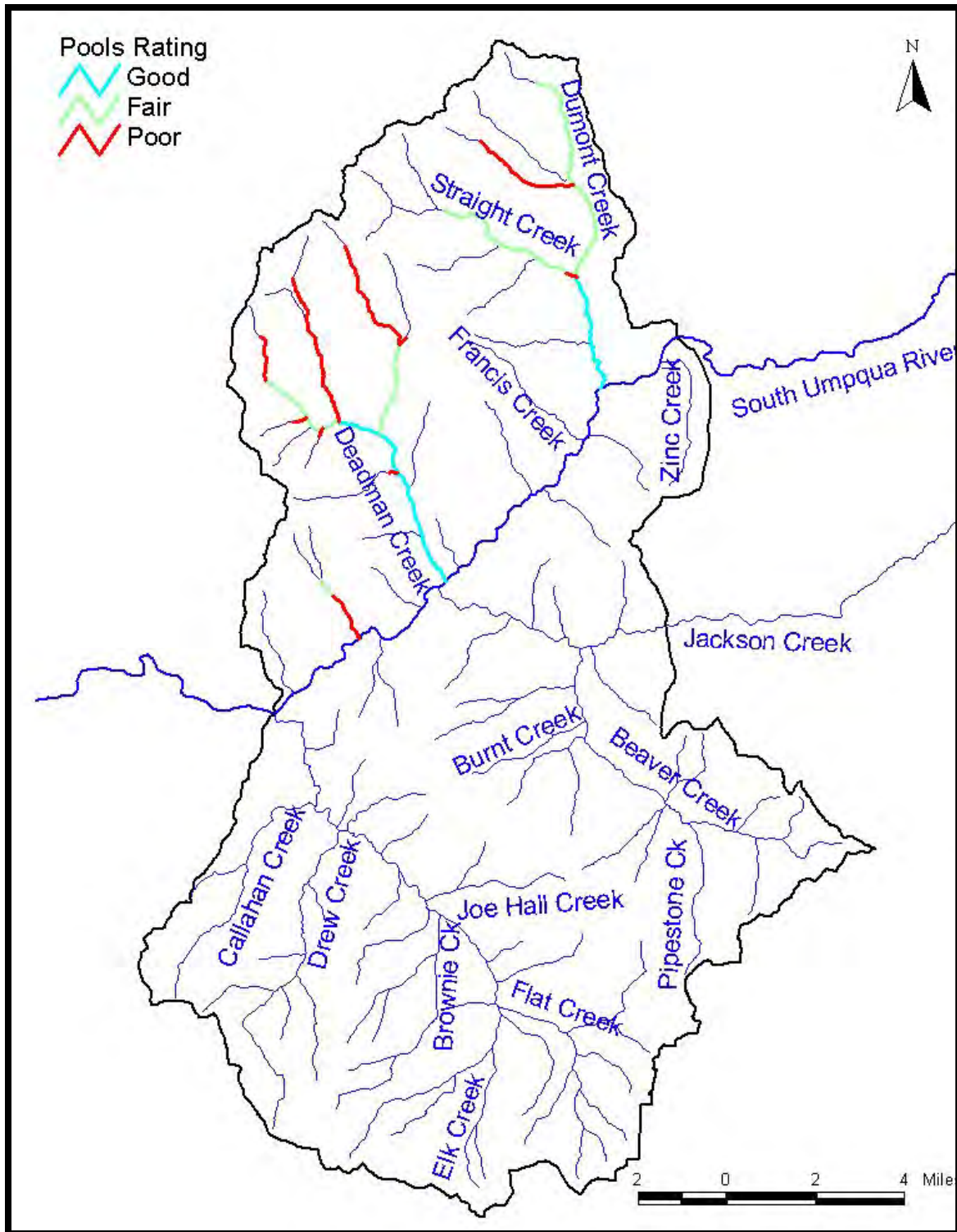
Map 3-3: Stream habitat survey large woody debris ratings for the Tiller Region.



Map 3-4: Stream habitat survey riparian ratings for the Tiller Region.



Map 3-5: Stream habitat survey riffles ratings for the Tiller Region.

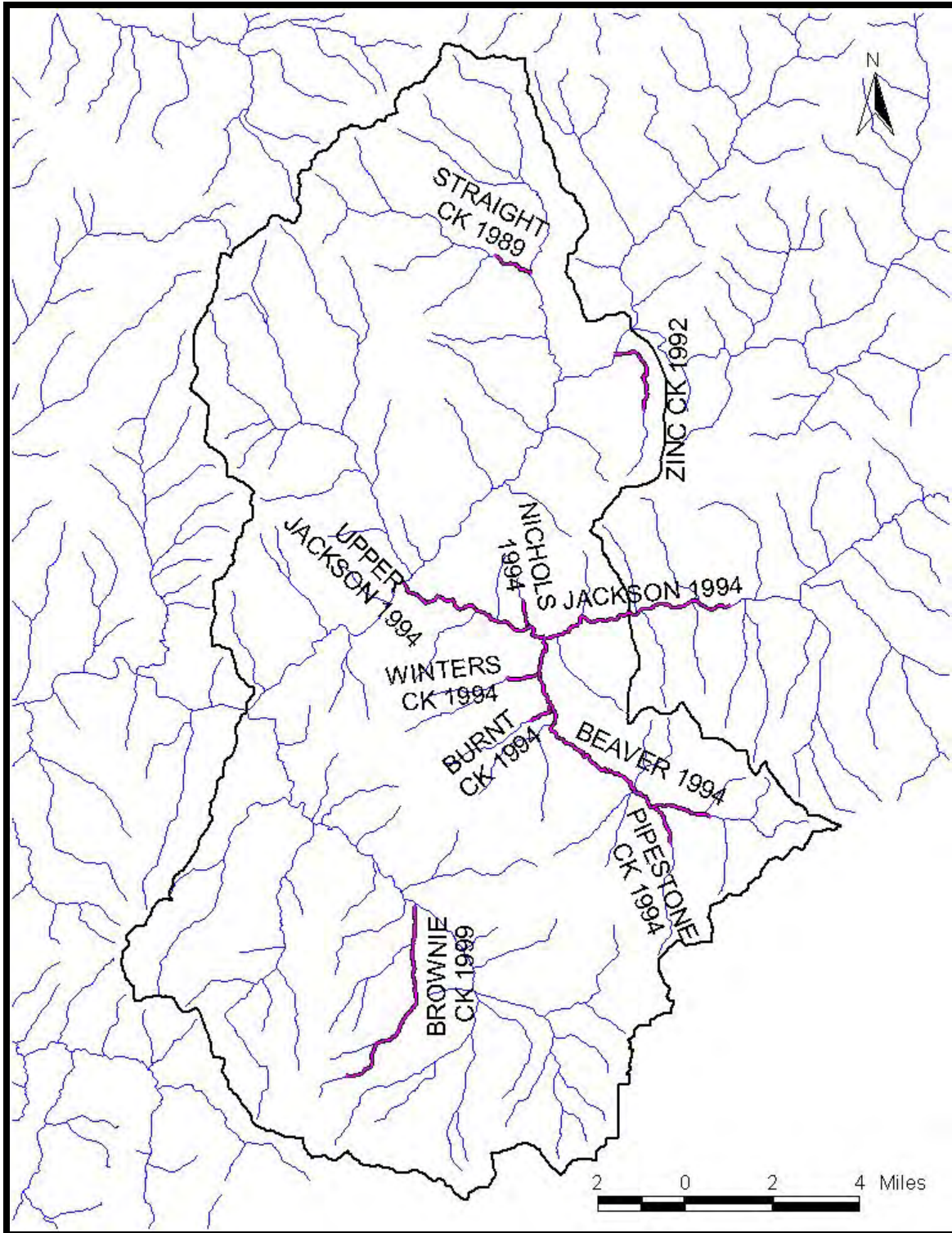


Map 3-6: Stream habitat survey pools ratings for the Tiller Region.

Umpqua National Forest stream habitat surveys

The Umpqua National Forest (UNF) conducted stream habitat surveys on 16 streams in 1989, 1992, 1994, and 1999 (see Map 3-7). These data were collected for the USDA Forest Service's Stream Management, Analysis, Reporting, and Tracking (SMART) database.²⁷ When evaluating stream conditions for fish and aquatic life, the UNF uses the SMART data as well as other information, such as historical data, physiographic province information, peer-reviewed literature, and the professional judgment of UNF fish biologists. Stream evaluations are often done to analyze the potential impacts of stream-associated projects. These analyses are done in conjunction with National Oceanographic and Atmospheric Administration (NOAA) consultations, and are project-specific. Therefore, the UNF does not have benchmark ratings for the SMART data.

²⁷ Data are available from the Umpqua National Forest upon request.



Map 3-7: Umpqua National Forest stream habitat survey locations.

Table 3-4 provides large woody debris (LWD) SMART data for streams within the Tiller Region. LWD size class definitions have changed over time. According to the current definitions, “large LWD” is greater or equal to 36 inches in diameter and is 50 feet long

from the large end of the log. “Medium LWD” is greater or equal to 24 inches in diameter and is 50 feet long from the large end. “Small LWD” is greater or equal to 12 inches in diameter and is 25 feet long from the large end. Additionally, some portion of the wood must be within the active stream channel.

Stream	Reach	Amt. of LWD per mile	Total large LWD	Total medium LWD	Total small LWD
Straight Creek	1	92.0	12.6	79.4	57.1
Burnt Creek	1	0.0	0.0	0.0	0.0
Nichols Creek	1	1.0	1.0		9.3
Winters Creek	1	12.6	5.3	7.3	24.1
Pipestone Creek	1	70.8	31.8	39.0	41.8
Upper Jackson Creek	1	45.0	11.5	33.5	85.7
Jackson Creek	1	2.3	1.5	0.8	4.7
Jackson Creek	2	3.49	1.2	2.3	9.3
Jackson Creek	3	11.1	1.5	9.5	18.3
Beaver Creek	1	19.2	8.5	10.7	29.5
Beaver Creek	2	42.3	24.7	17.6	28.5
Beaver Creek	3	68.8	37.7	31.1	49.0
Zinc Creek	1	59.8	18.4	41.4	55.5
Brownie Creek	1	30.2	2.2	28.0	35.5
Brownie Creek	2	35.7	9.6	26.0	55.0
Brownie Creek	3	47.6	25.5	22.2	33.5

Table 3-4: Large woody debris measurement SMART data for UNF stream habitat surveys.

Table 3-5 provides UNF SMART data for pools and riffles. Residual pool depth is in feet, and is taken during low flows. Therefore, residual pool depth represents the minimum pool depth for the stream reach.

Stream	Reach	% pools	% riffles	Width to depth ratio	Residual pool depth
Straight Creek	1	29.1%	59.4%	8.3	2.6
Burnt Creek	1	95.3%	4.7%	5.5	0.7
Nichols Creek	1	40.6%	56.7%	5.6	0.9
Winters Creek	1	43.6%	55.7%	14.0	1.1
Pipestone Creek	1	43.6%	55.2%	14.3	1.4
Upper Jackson Creek	1	36.2%	60.0%	11.4	1.6
Jackson Creek	1	45.9%	30.5%	72.7	3.0
Jackson Creek	2	38.3%	44.2%	71.7	4.2
Jackson Creek	3	53.3%	33.4%	50.1	3.7
Beaver Creek	1	48.0%	46.2%	20.0	2.1

Stream	Reach	% pools	% riffles	Width to depth ratio	Residual pool depth
Beaver Creek	2	51.6%	40.7%	19.9	2.1
Beaver Creek	3	48.3%	51.3%	16.8	2.1
Zinc Creek	1	9.6%	71.2%	6.1	2.3
Brownie Creek	1	47.9%	46.5%	12.7	1.5
Brownie Creek	2	44.1%	53.2%	10.9	1.6
Brownie Creek	3	36.5%	61.9%	11.7	1.7

Table 3-5: Pools and riffles SMART data for UNF stream habitat surveys.

Table 3-6 shows UNF SMART data for dominant and secondary streambed substrate. In this table, “Sand” constitutes particles that are less than 0.08 inches in diameter, “gravel” is from 0.08 to 2.5 inches in diameter, “cobble” is from 2.5 to 10 inches in diameter, “boulder” is 10 to 160 inches in diameter, and “bedrock” is greater than 160 inches in diameter. Substrate findings are not available for Brownie Creek.

Stream	Reach	Dominant substrate	Secondary substrate
Straight Creek	1	Cobble	Sand
Burnt Creek	1	Bedrock	Gravel
Nichols Creek	1	Cobble	Gravel
Winters Creek	1	Cobble	Gravel
Pipestone Creek	1	Cobble	Gravel
Upper Jackson Creek	1	Cobble	Gravel
Jackson Creek	1	Cobble	Gravel
Jackson Creek	2	Cobble	Gravel
Jackson Creek	3	Cobble	Gravel
Beaver Creek	1	Cobble	Gravel
Beaver Creek	2	Cobble	Gravel
Beaver Creek	3	Bedrock	Gravel
Zinc Creek	1	Gravel	Cobble

Table 3-6: Dominant and secondary streambed substrate SMART data for UNF stream habitat surveys.

Table 3-7 shows SMART data for percent vegetation by class for each surveyed streams’ floodplain. According to the USDA Forest Service’s 2002 *Stream Inventory Handbook: Levels I and II*, the purpose of this information is to “define from an overhead (i.e. bird’s eye) view which successional class occupies the most overstory area within the [riparian zone] width along both banks of the measured channel unit. It is the average of both banks’ condition (p. 45).”

Vegetation is classified by its diameter at breast height (dbh). “Grass/forb” has no diameter class. “Shrub/seedling” includes woody vegetation that is 1.0-4.9 inches dbh.

“Sapling/pole” is 5.0-8.9 inches dbh, “small tree” is 9.0-20.9 inches dbh, “large tree” is 21.0-31.9 inches dbh, and “mature tree” is 32.0+ inches dbh.

Stream	Reach	Grass/ forb	Shrub/ seedling	Sapling/ pole	Small tree	Large tree	Mature tree
Straight Creek	1			100%			
Burnt Creek	1		60%		40%		
Nichols Creek	1			32%	67%	1%	
Winters Creek	1		15%	10%	24%	18%	34%
Pipestone Creek	1			1%	16%	27%	56%
Upper Jackson Creek	1	1%	1%	89%	6%	3%	
Jackson Creek	1		12%	61%	27%		
Jackson Creek	2		2%	27%	72%		
Jackson Creek	3			18%	65%	17%	
Beaver Creek	1	4%	6%	28%	22%	20%	15%
Beaver Creek	2		11%	9%	19%	14%	41%
Beaver Creek	3				40%	30%	29%
Zinc Creek	1			98%	2%		
Brownie Creek	1		18%	14%	45%	22%	
Brownie Creek	2		49%	9%	11%	31%	
Brownie Creek	3		9%		12%	79%	

Table 3-7: Floodplain vegetation SMART data for UNF stream habitat surveys.

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.²⁸

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 locations of human-caused fish passage barriers and obstacles within the Tiller Region.

²⁸ See section 3.3.2 for more information about stream temperature.

Irrigation ditches

Irrigation ditches without fish wheel screens are primarily a problem for juvenile fish.²⁹ 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 Tiller Region 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.³⁰ 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. The UBWC and the Oregon Water Resources Department are not aware of any dams in the Tiller Region 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 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.

²⁹ Fish wheel screens are self-cleaning screens that prevent fish from entering an irrigation ditch while passing floating debris that may prevent water flow.

³⁰ Some landowners may have dams on small tributaries to provide water for wildfire control, provide water for livestock, or for landscape aesthetics.

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.

It is unknown at this time how many culverts are fish passage barriers or obstacles in the Tiller Region. 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.³¹ A document summarizing the results of this project will be available in 2004.

3.1.3. Channel modification³²

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.³³ History has shown that channel 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.

³¹ See section 3.5.2 for information about anadromous and resident salmonid distribution within the Tiller Region.

³² Information in section 3.1.3 is primarily from interviews by the author with Douglas Soil and Water Conservation District staff.

³³ 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 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.

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.³⁴ 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

To protect the Tiller Highway, there is riprap along parts of the South Umpqua River. The Douglas Soil and Water Conservation District, the Oregon Water Resources Department, and the UBWC are not aware of any other permitted channel modification projects within the Tiller Region. However, 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 region, and different enhancement opportunities exist.
- Most streams within the Tiller Region 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 indicate that poor large woody material levels limit salmonid habitat in Dumont Creek, Straight Creek, Dompier Creek, and mainstem Deadman Creek. Poor riparian areas limit habitat in most of the Deadman Creek drainage. Poor riffles limit salmonid habitat in three-fourths of surveyed streams.

Stream connectivity key findings

- Culverts may reduce stream connectivity, affecting anadromous and resident fish productivity in the Tiller Region. More information about fish passage barriers will be available from UBFAT in 2003.

³⁴ In general, a gravel bar that has no grass or other vegetation is very unstable.

Channel modification key findings

- There have been very few permitted channel modification activities in the Tiller Region.
- 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, collect gravel and increase the amount of large woody material in stream channels 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.³⁵
- 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 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 streams. 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.

³⁵ Thirty feet is the maximum stream width for which instream log and boulder placement projects are permitted.

UBWC staff members were unable to locate stream-specific information about riparian conditions in the Tiller Region. The USDA Forest Service watershed analyses for Jackson Creek, Dumont Creek, and Elk Creek provide some insight into overall conditions. Riparian condition findings from these documents are provided below.

Jackson Creek and Dumont Creek

The following text is compiled from the *Dumont Creek Watershed Analysis* (Tiller Ranger Station, 1995, p. 34) and the *Jackson Creek Watershed Analysis* (Tiller Ranger District, 1995, p.77):

Because of similar fire regimes, management practices and fire exclusion effects, [hillslope vegetation types] can be extended ...to the riparian zones of many intermittent streams. They do not apply to the riparian zones of perennial streams.

Subjective impressions during riparian vegetation sampling suggest that riparian buffers between perennial streams and clear cuts are not retaining such riparian zone functions as: a mesic microclimate, stream shade, nutrient uptake and sediment filtering, and streambank stabilization. This is probably because, for such a high contrast edge, a buffer width of one tree height provides negligible interior conditions. However, large woody debris input may be elevated, for the short term, because many of these trees trip over. [This is] probably because the buffer is all edge and was placed to meet a prescribed distance rather than an ecosystem function.

It is striking that Jackson Creek's path is apparent from satellite imagery as a strip of seeding-sapling-pole pixels. This is not a natural, successional phenomenon. It is a direct effect of the road, by its presence, and an indirect effect from logging and increased access for dispersed recreation sites.

Elk Creek

The following text is from the *Elk Creek Watershed Analysis* (Tiller Ranger Station, 1996, p. 124):

Obviously, riparian zones or perennial streams have vegetation that is considerably different than that of the adjacent hillslopes. However, for intermittent streams, those differences are less common. They occur primarily among non-conifers in the understory, are confined to short reaches, and don't extend the full width of the FEMAT riparian reserves.³⁶ Considering this, similar fire regimes, management practices, and fire exclusion effects, the vegetation...can be extended from the hillslopes to the riparian zones of many intermittent streams.

³⁶ "FEMAT" stands for the Forest Ecosystem Management Assessment Team.

Vegetation size structure within the riparian area has greatly changed due to human management...Assuming the unmanaged riparian areas represent the expected natural size and structure distribution, managed riparian stands are much more simplified and the vegetation greatly reduced. The balanced representation of vegetation size classes and structure apparent in the unmanaged stands is now replaced by a greater percentage of smaller and single story tree communities. For managed stands, the dominant categories are the seedling/sapling/pole group and the pole/small conifer group.

Subjective impressions during riparian vegetation sampling suggest that riparian buffers between perennial streams and clear cuts are not retaining such riparian zone functions as: a mesic microclimate, stream shade, nutrient uptake and sediment filtering, and streambank stabilization. This is probably because for such a high contrast edge, a buffer width of one tree height provides negligible interior conditions. However, large woody debris input may be elevated, for the short term, because many of these trees tip over. These conditions probably occur because the buffer was placed to meet a prescribed distance rather than an ecosystem function.

3.2.2. Wetlands³⁷

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 assessment 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 USDA Bureau of Land Management, Oregon Division of State Lands, US Environmental Protection Agency, US Fish and Wildlife Service, USDA Forest 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.

What is a wetland?

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;³⁸

³⁷ Jeanine Lum of Barnes and Associates, Inc., contributed section 3.2.2.

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;
3. At least periodically, the land supports predominantly hydrophytic (water-loving) vegetation.

Function and values

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.
- 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.

Background on the Clean Water Act and National Wetlands Inventory

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.

³⁸ The growing season in Douglas County is from March 1 through October 31.

Types of wetlands

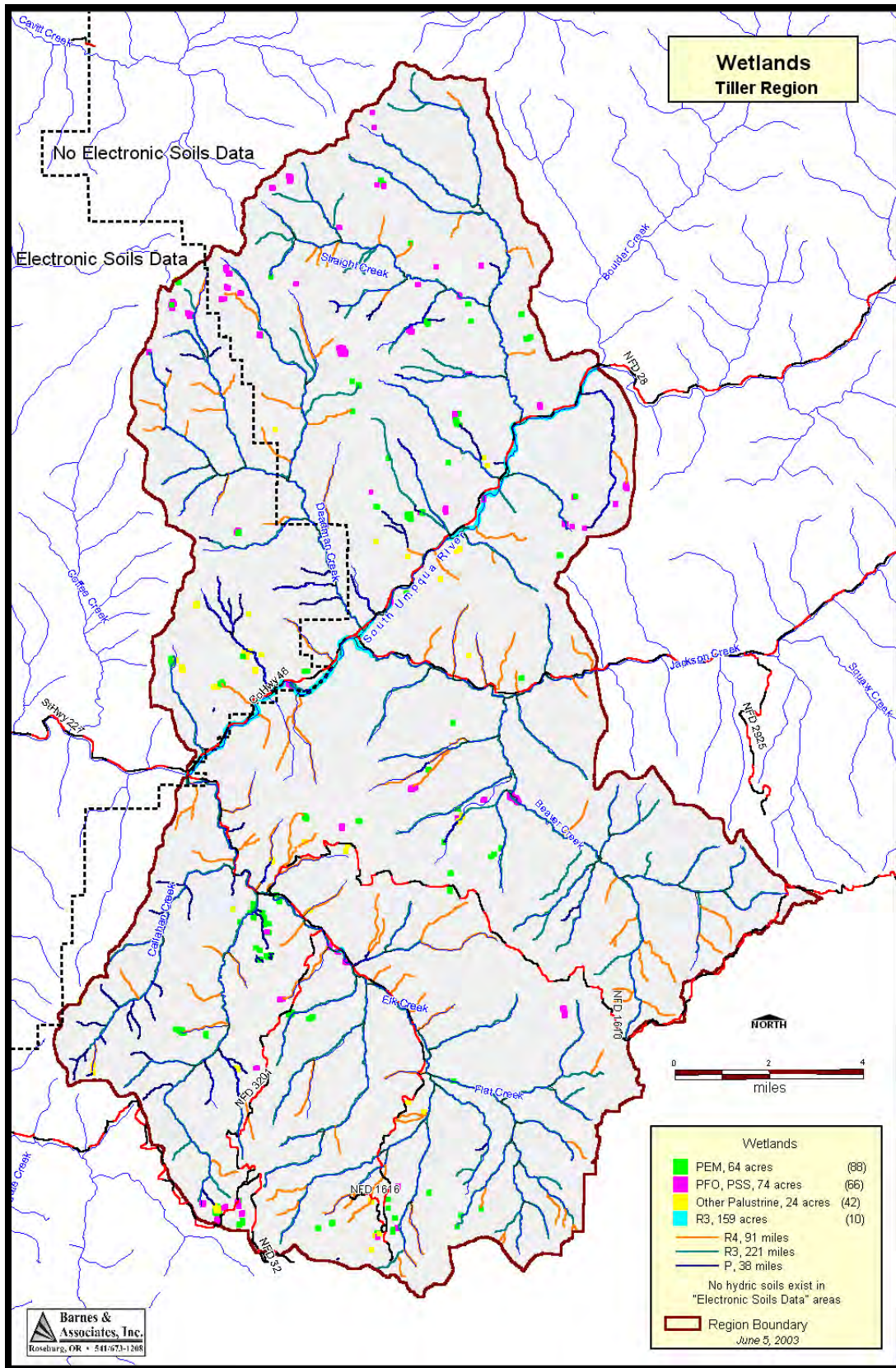
A wetland that holds water all year round is the easiest wetland to recognize and the one most people understand as a wetland. Another type of wetland is the ephemeral wetland, or a wetland that holds water for only a few days, weeks, or months during the year. The timing and duration of water are important 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 3-8 as line data labeled “P.” Table 3-8 is a summary of codes and descriptions used in the NWI. Data are displayed in Map 3-8.

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.
	Other	No vegetation evident at the water surface, or 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 3-8: National Wetlands Inventory wetlands codes and descriptions.



Map 3-8: Tiller Region wetlands.

Description of current wetlands in the Tiller Region

A review of the NWI data shows the main channel of the South Umpqua River and its major tributaries are classified as riverine (stream-associated wetland) systems that periodically or continuously contain flowing water. Portions of land adjacent to the South Umpqua River are seasonally flooded and are designated on Map 3-8 with polygons labeled “R3.” This area represents 159 acres over 10 occurrences along the river. 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.

Palustrine classification is the primary wetland found scattered throughout the Tiller Region and occupies approximately 162 acres. The 154 occurrences represent less than one-tenth of one percent of the Tiller Region. There is a congregation of these wetlands found near a spring off Drew Creek, around Drew Lake, and near the Threehorn Campground area off the Tiller-Trail Highway.

Within the palustrine system, PEM, or palustrine with emergent vegetation, has the greatest number of occurrences (88) covering 64 acres. Indicator plants of wet pastures such as rushes (*Juncus spp.*) and sedges (*Carex spp.*) are typically found in this type of wetland. PFO (palustrine dominated with forest) and PSS (palustrine dominated with shrubs) occur 66 times in the region covering 74 acres. Ash swales containing ash, alder, and vine maple would be typical of PFO. Willows would be typical of a PSS wetland. Ash swales are reported to be common in the Beaver Creek area.

Approximately 65% of the palustrine wetlands occur on public land managed either by the Umpqua National Forest or Bureau of Land Management. The remaining palustrine wetlands are mostly farm ponds on private land, typically deep and constructed to hold water year round. Approximately 35 of these ponds cover 16 acres. These ponds have been diked and dammed and, in some cases, may have impacted the flow of water to and from wetlands.

Red Top Pond situated near the headwaters of Deadman Creek is an altered natural wetland. This area was logged in the 1960s and the size of the wetland increased when water was “backed-up” by a logging road placement. The ponds, as well as a nearby constructed “heli-pond” are important water sources during fire fighting. Effort is made by BLM not to dredge into the functional portion of this wetland when improving the depth for bucket dipping. This area has high recreational use and BLM recently constructed a trail around the pond, including some boardwalks to keep people out of the wetland.

Historical wetlands and changes in the Tiller Region

There is little specific reference in historical records to wetlands in the Tiller Region. 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 is no indication of hydric soil types in the limited soil survey done in the Tiller Region; however, depressions with impermeable clays can be found. Sag ponds created by large dormant landslide deposits that disrupted water flow are found in the Tiller Region. Blue Bluffs in the nearby Jackson Creek drainage is a wetland system that was probably formed this way.

As early as the 1960s and into the 1980s, a technique called “pot-holing” was used to “enhance” wetlands for recreational fishing or for “pump chances” to provide water all year for firefighting. This technique involved detonating dynamite or excavating to create a deeper hole and later stocking with non-native fish. Some of these non-native fish have been known to prey on egg masses and tadpoles of red-legged frogs. Other wetlands such as Blue Bluffs were dredged and diked to enhance the wetland for recreational fishing.

Field scientists have observed remnants of wetlands in high elevation valleys that are not identified in the NWI. The hydrology of these wetlands has been altered with adjacent logging and disappearance of beaver.

Restoration opportunities in the Tiller Region

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 on private land 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.

Of the Umpqua National Forest portion of the Tiller Region, only a small percentage is categorized as wetland. However, cattle have used most wetlands that are located in livestock allotments. Cattle prefer these areas and will “hang out” there, typically from July through September. Some areas have been fenced in recognition of this intensive use and impact by cattle. There are three allotments that are actively grazed, while three other historical allotments are not presently used. Grazed utilization standards that reduce impacts to wetlands have been implemented on the current allotments. Four “permittees” are currently grazing the three allotments, of which three have fewer than 100 cow/calf pairs.

The Umpqua National Forest has identified some wetland areas as restoration projects, primarily because of the previous alterations, presence of non-native species, and posed threats to the western pond turtle and red-legged frog. Podunk Pond near Smith Ridge,

Drew Lake, and Blue Bluffs are three sites that have been targeted for restoration pending funding or partnership development.

BLM has begun to map and inventory ponds and lakes in their district. In addition they are evaluating the biological pertinence of these areas to determine if current management is appropriate. Possible restoration could include removal of exotics from these areas.

Bank stabilization and riparian planting can increase habitat value along targeted creeks. 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.

The wetlands that fall on private land will require landowner “buy-in.” Voluntary participation must be fostered if wetland conservation is to be successful in the region. 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. A restoration demonstration project on public land might be well received by local residents because of the high percentage of public land in the region.

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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Kris Rutledge, USFS
Wes Yamamoto, USFS

3.2.3. Riparian zones and wetlands key findings and action recommendations

Riparian zones key findings

- Human management activities, including timber harvesting and fire suppression, have altered riparian zone conditions from their natural state. Evidence suggests that

riparian zones in managed forests are predominantly young, single-story stands. This may affect riparian zone functions such as stream shading and nutrient uptake.

Wetlands key findings

- Over 75% of the wetlands in the Tiller Region are found on public land and are managed by USFS or BLM.
- There is a congregation of palustrine wetlands found near a spring off Drew Creek, around Drew Lake, and near the Threehorn Campground area off the Tiller-Trail Highway.
- Some of the wetlands that have been historically “enhanced” for recreational fishing have been targeted for restoration to their previous condition. However, the ability to actively manage these wetlands or restore them is contingent on competitive funding. Public agencies are willing to develop partnerships for funding, expertise, or volunteer labor to begin the process of restoration.

Riparian zones and wetlands action recommendations

- Use ground surveys and, when available, digital aerial photographs to identify streams and stream reaches with narrow or simplified riparian zones, poor vegetation composition, or insufficient shade. Take the following action where appropriate:
 - Along poorly shaded streams or streams with narrow riparian zones, encourage wide buffers of native trees (preferably conifers) and/or shrubs, depending upon local conditions. Priority areas are fish-bearing streams which more than 50% canopy cover is possible.
 - Where brush and blackberry are present, convert these areas to native trees (preferably conifers) and/or shrubs, depending on local conditions.
- Identify or establish various peer-related demonstration projects as opportunities to educate stakeholders. A restoration demonstration project on public land might be well received by local residents because of the high percentage of public land in the region.
- 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 3-9 lists all beneficial uses for streams and rivers within the Umpqua Basin.

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 3-9: 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.”³⁹ 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.⁴⁰ 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 3-10 shows the Tiller Region streams included in the 2002 final 303(d) list that require TMDL plans.⁴¹ This table is not a comprehensive evaluation of all water quality concerns in the Tiller Region. 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.

³⁹ ODEQ can also use data collected by other agencies and organizations to evaluate water quality.

⁴⁰ 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.

⁴¹ Streams that are water quality limited for habitat modification and flow modification do not require TMDL plans. In the Tiller region, these streams are: Beaver Creek (habitat), Callahan Creek (habitat), Deadman Creek (habitat), Dumont Creek (habitat), Elk Creek (habitat and flow), Jackson Creek (habitat), and the South Umpqua River (habitat and flow).

Stream	Parameter(s)	Year listed	Stream miles listed	Season
Beaver Creek	Temperature	1998	0 – 2.1	Summer
	Sedimentation	1998	0 – 2.1	No season listed
Brownie Creek	Temperature	1998	0 – 5.8	Summer
Callahan Creek	Temperature	1998	0 – 6.2	Summer
Deadman Creek	Temperature	1998	0 – 4.9	Summer
			4.9 - 9	Summer
Drew Creek	Temperature	1998	0 – 8.3	Summer
Dumont Creek	Temperature	1998	0 – 2.9	Summer
	Biological criteria	1998	0 – 2.9	No season listed
E. Fork Deadman Creek	Temperature	1998	0 – 5.8	Summer
Elk Creek	Temperature	1998	0 – 14.6	Summer
Flat Creek	Temperature	1998	0 – 5	Summer
Francis Creek	Temperature	1998	0 – 3.7	Summer
Jackson Creek	Temperature	1998	0 – 25	Summer
	Biological criteria	1998	0 – 25	No season listed
	pH	1998	0 – 25	Summer
	Sedimentation	1998	0 – 25	No season listed
Joe Hall Creek	Temperature	1998	0 – 3.4	Summer
Middle Fork Deadman Creek	Temperature	1998	0 – 4.6	Summer
		2002	0 – 4.6	Sept. 15 – May 31
South Umpqua River	Temperature	1998	57.7 – 102.2	Summer
	pH	1998	57.7 – 102.2	Summer
	Sedimentation	2002	80 – 102	All year

Table 3-10: ODEQ water quality limited streams in the Tiller Region.⁴²

To evaluate water quality in the Tiller Region, 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.

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

⁴² 303(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.⁴³ 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 Tiller Region, there are 14 streams 303(d) listed for temperature at various times of year (see Table 3-10).

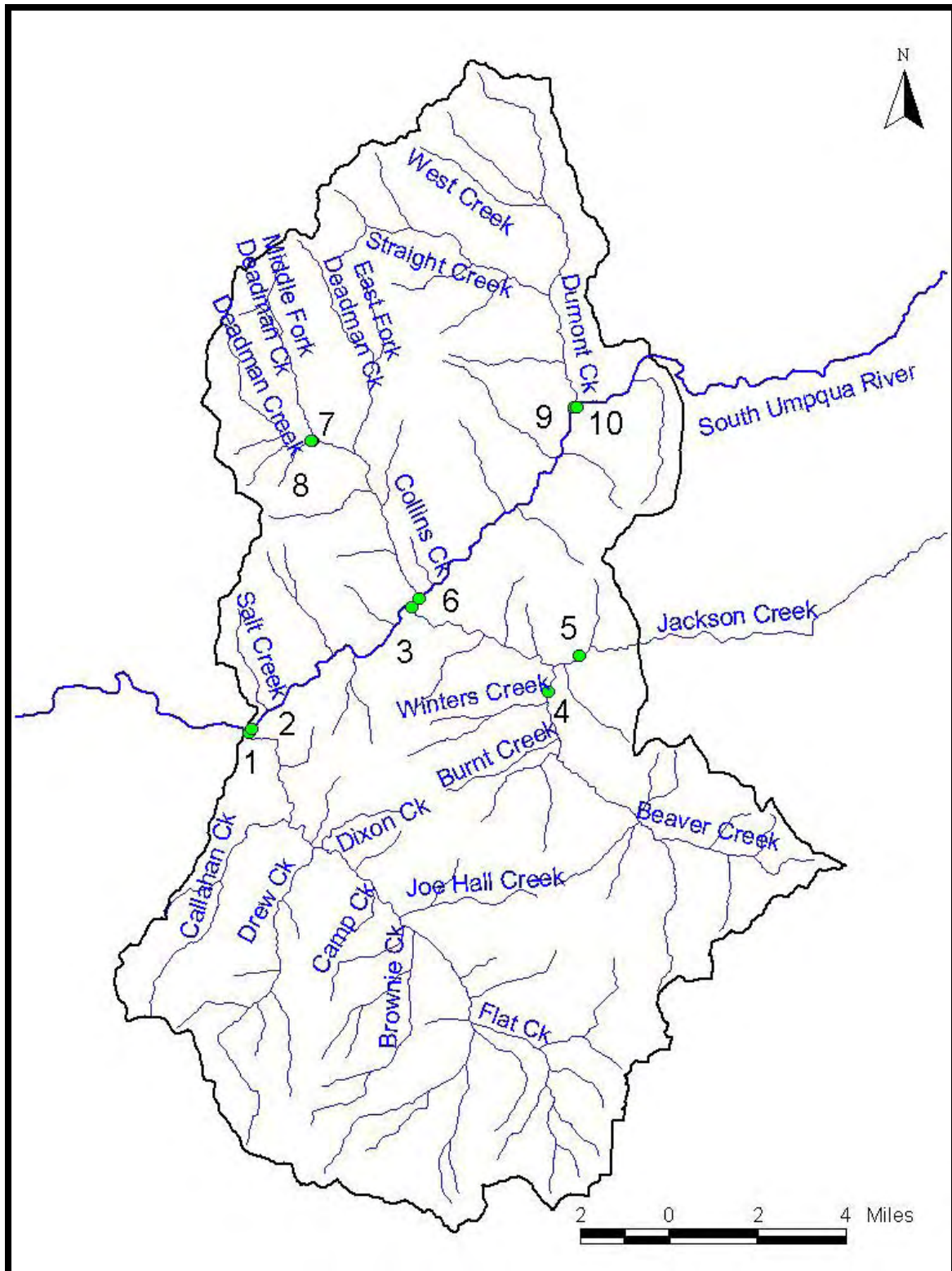
In 1999, the Umpqua Basin Watershed Council (UBWC) undertook a study on stream temperature for the entire South Umpqua River sub-basin to determine temperature trends for the South Umpqua River and its tributaries, including streams in the Tiller Region (the Smith report).⁴⁴ Continuously sampling sensors were placed at 119 locations within the sub-basin, of which 10 were within the Tiller Region. Sensors collected data from June, 1999, through the end of September, 1999. Table 3-11 and Map 3-9 show the locations of the monitoring sites within the region.

Site name	Site #
South Umpqua above Elk Creek	1
Elk Creek at mouth	2
Jackson Creek at mouth	3
Beaver Creek at road 3014	4
Jackson Creek upstream of Beaver Creek	5
Deadman Creek at mouth	6
West Fork Deadman Creek at mouth	7
Middle Fork Deadman Creek at mouth	8
Dumont Creek at mouth	9
South Umpqua above Dumont Creek	10

Table 3-11: Monitoring sites name and identification number in the Tiller Region.

⁴³ Cold water holds more oxygen than warm water; as water becomes warmer, the concentration of oxygen decreases.

⁴⁴ Copies of this study “South Umpqua Watershed Temperature Study, 1999” by Kent Smith are available at the UBWC office.



Map 3-9: Temperature monitoring sites within the Tiller Region.

Table 3-12 has the number of days and percent of days for which seven-day moving average maximum temperatures exceeded 64°F. Figure 3-1 shows the seven-day moving average maximum temperatures for sites on Jackson Creek, Beaver Creek, and Dumont Creek.⁴⁵ Figure 3-2 shows the same information for sites on the South Umpqua River, Dumont Creek at the mouth, and Elk Creek at the mouth.

Name	Site #	#Days >64	#Days monitored	%Days >64
W Fork Deadman Ck	7	0	100	0.0%
Middle Fork Deadman Ck at mouth	8	4	100	4.0%
Dumont Ck at mouth	9	46	105	43.8%
Beaver Ck at road #3014	4	48	105	45.7%
Jackson Ck at mouth	3	53	106	50.0%
S Umpqua above Elk Ck	1	17	30	56.7%
Deadman Ck at mouth	6	61	105	58.1%
Jackson Ck upstream of Beaver Ck	5	48	78	61.5%
Elk Ck at mouth	2	72	104	69.2%
S Umpqua upstream Dumont Ck	10	61	78	78.2%

Table 3-12: Number of days and percent of days for which seven-day moving average maximum temperatures exceeded 64°F in the Tiller Region.

The South Umpqua River and major tributaries, except Dumont Creek, had monitoring sites exceed the 64°F standard for at least half of the study period. Dumont Creek and Beaver Creek exceeded the 64°F standard for 40% of the study period. West Fork Deadman Creek attained the 64°F standard every day of the study; Middle Fork Deadman Creek achieved the standard 96% of the time. Data from the Smith Report 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).

⁴⁵ The seven-day moving average maximum temperature is an average of the maximum temperatures of a given day, the three preceding days, and the three days that follow.

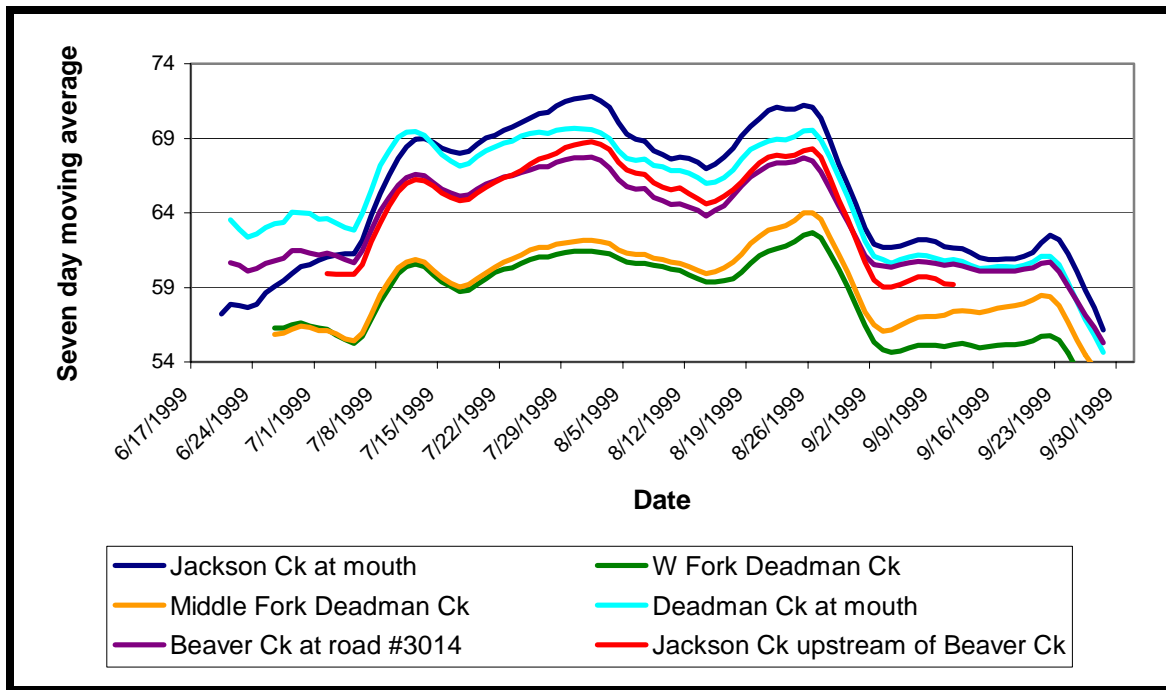


Figure 3-1: Summer temperature trends for Jackson Creek, Beaver Creek, and Deadman Creek sites.

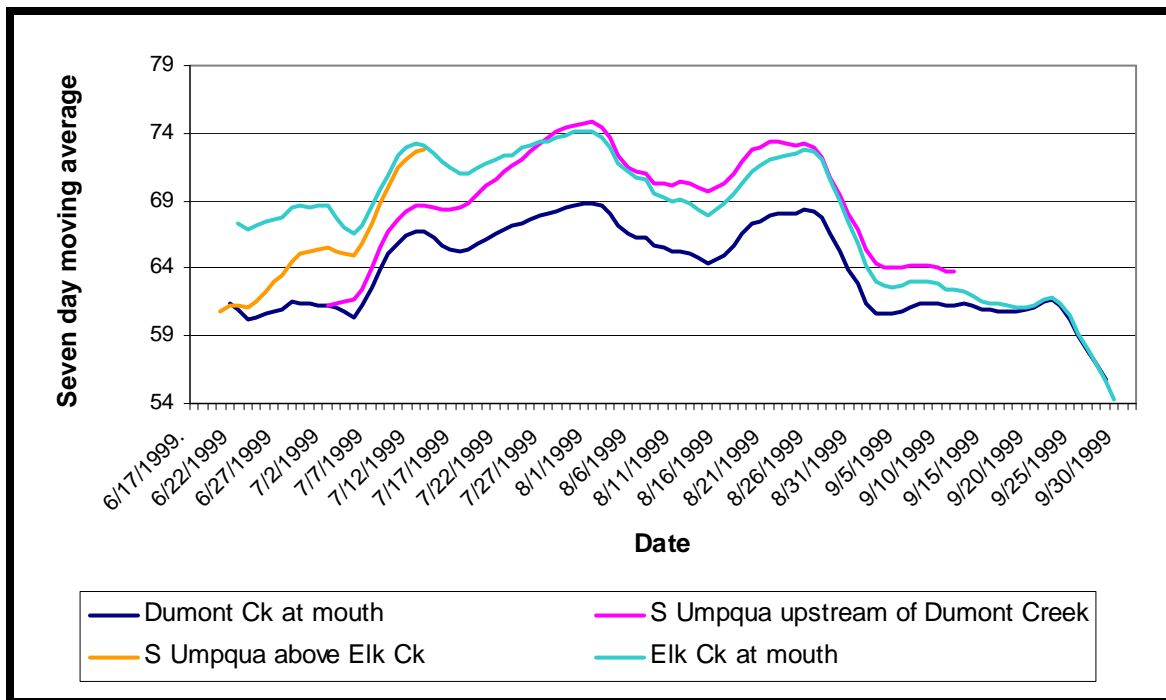


Figure 3-2: Summer temperature trends for the South Umpqua River and tributaries at the mouth.

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.⁴⁶ 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, data from the Smith Report indicate 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 3-3 shows stream temperature difference on August 26, 1999 (a very warm day), and August 14, 1999 (a very cool day). The bars are the stream temperature difference between the warmest and coolest day. Sites with the greatest temperature difference may correspond with areas of little stream shade.

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 and from Smith's "Thermal Transition in Small Streams Under Low Flow Conditions" analysis suggest that in some cases tributaries with gravel-dominated streambeds permit cooler subsurface water to pass into the main stem, even when the stream has little or 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.

⁴⁶ Friction adds a very small amount of heat to streams. Geothermal heat is a minor factor in the Umpqua Basin.

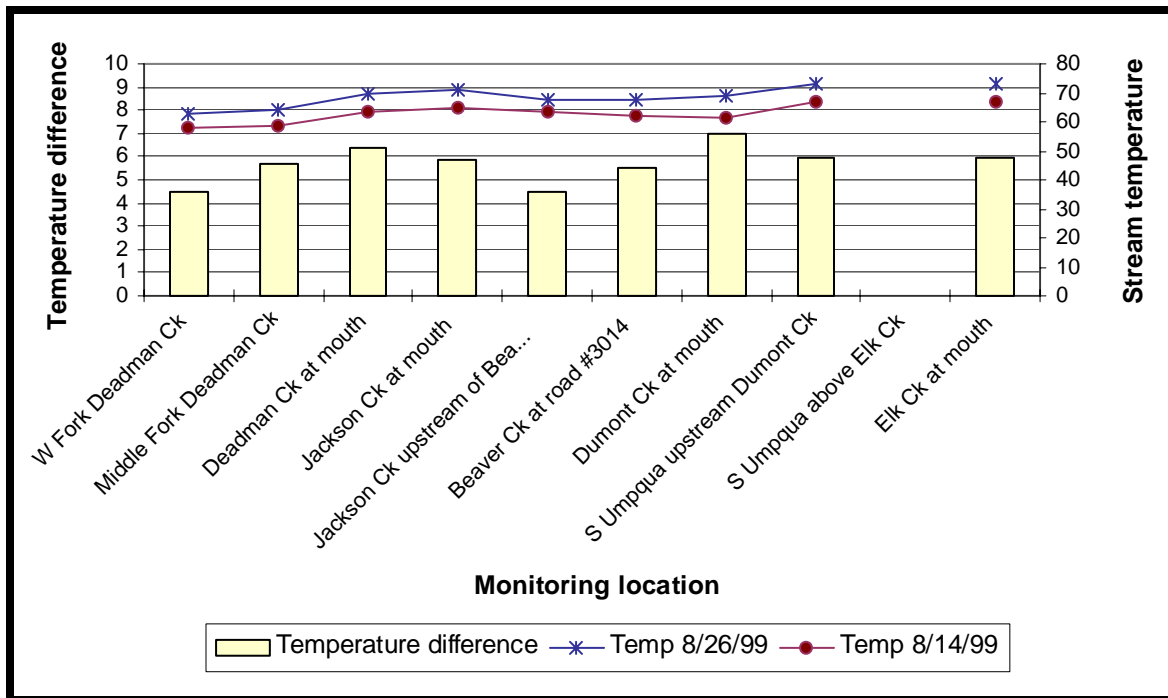


Figure 3-3: Temperature difference for monitoring sites in the Tiller Region.

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.⁴⁷

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.

⁴⁷ From Kent Smith's "Thermal Transition in Small Streams Under Low Flow Conditions" (2002).

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 (CO₂) is produced during respiration and used for photosynthesis. The level of dissolved CO₂ 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 CO₂ levels. However, stream inputs that increase or decrease respiration and photosynthesis by aquatic organisms can indirectly shift pH by changing CO₂ 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 CO₂ is produced and used. When CO₂ 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.

From 1990 through 2002, 13 of 57 pH samples (22.8%) taken from 16 Tiller Region sites did not meet pH water quality standards. Table 3-13 shows sampling locations, sample size, and the number and percent of samples exceeding pH standards in the Tiller Region.⁴⁸ Jackson Creek, Elk Creek, and the South Umpqua River all have pH samples outside of water quality standards. Jackson Creek is 303(d) listed during the summer from the mouth to stream mile 25; the South Umpqua River is 303(d) listed during the summer from stream mile 57.7 to 102.2. Additional monitoring is necessary to determine if pH levels exceed water quality standards at other sites.

⁴⁸ Data are from ODEQ’s Laboratory Analytical Storage and Retrieval (LASAR) database. All ODEQ data are available via the website www.deq.state.or.us. Select “water quality” and “Laboratory Analytical Storage and Retrieval Database – Monitoring Data.”

Sample site	# of samples	# exceeding	% exceeding
Dumont Ck at mouth	3	0	-
Dumont Ck at rm ⁴⁹ 4.95	1	0	-
East Fork Deadman Creek at rm .25	2	0	-
Elk Ck at Hwy 217 (1.5 Mile E Of Tiller)	5	1	20.0%
Jackson Ck at rm 0.6	2	2	100.0%
Jackson Ck at road mile 1.3	5	2	40.0%
Middle Fork Deadman Ck at USFS rd #13	9	0	-
Salt Creek at rm 0.64	2	0	-
S. Umpqua 1.3 miles upstream of Jackson Ck	10	0	-
S. Umpqua above Boulder Ck	1	0	-
S. Umpqua at Jackson Ck bridge	3	0	-
S. Umpqua at Pickett Butte Rd	6	4	66.7%
S. Umpqua at Zinc Creek bridge	1	1	100.0%
S. Umpqua Below Elk Ck	4	3	75.0%
S. Umpqua at Cash Flat	2	0	-
Zinc Ck	1	0	-

Table 3-13: Tiller Region pH levels.**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 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. The 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

⁴⁹ River mile.

uses 11.0 mg/l as the dissolved oxygen standard for the Umpqua Basin. For the rest of the year, the standard is 8.0 mg/l.

In the Tiller Region, one out of 43 samples (2.3%) taken from 14 sites from 1990 through 2002 exceeded dissolved oxygen standards. The sample that did not meet standards was taken from the South Umpqua River below Elk Creek; this site was only sampled twice. These data suggest that dissolved oxygen levels in the Tiller Region adequately support beneficial uses.

3.3.5. Nutrients

The beneficial uses affected by nutrients are aesthetics or “uses identified under related parameters.”⁵⁰ 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 then 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 2002.⁵¹

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 Tiller Region. Therefore, this assessment used the OWEB recommended standards for evaluating nutrient levels in the region. OWEB recommends using 0.05 mg/l for total phosphorus, and 0.3 mg/l for total nitrate (including nitrites and nitrates). In the Tiller Region, 29 phosphorus and 29 total nitrate samples were taken from 11 sites from 1990 through 2002; no samples exceeded water quality standards.⁵² These data suggest that nutrient levels are not limiting water quality in the Tiller Region.

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.

⁵⁰ From ODEQ’s *Oregon’s Approved 1998 303(d) Decision Matrix* (1998).

⁵¹ Diamond Lake is within the Umpqua National Forest in the extreme eastern portion of the Umpqua Basin.

⁵² Data are from ODEQ’s Laboratory Analytical Storage and Retrieval (LASAR) database.

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.

There is very little bacteria data for the Tiller Region. In 2002, bacteria levels were sampled once on Jackson Creek at road mile 1.3; the sample met water quality standards.⁵³ More sampling is necessary to determine if bacteria levels are of concern in the Tiller Region.

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 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.

⁵³ Data are from ODEQ’s Laboratory Analytical Storage and Retrieval (LASAR) database.

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. In the Tiller Region, Beaver Creek from the mouth to stream mile 2.1, Jackson Creek from the mouth to stream mile 25, and the South Umpqua River from stream mile 80 to 102 are 303(d) listed for sediment. ODEQ bases these listings on 1995 US Forest Service findings that the streams have excessive fine sediment and are therefore considered degraded.⁵⁴

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 Tiller Region that are 303(d) listed for turbidity.

OWEB recommends using 50 NTUs as the turbidity evaluation criteria. At this level, turbidity interferes with sight-feeding aquatic organisms and provides an indication of the biological effect of suspended sediment. In the Tiller Region, ODEQ sampled turbidity 12 times at seven sites from 1990 through 2002. No sites exceeded OWEB's evaluation criteria.⁵⁵

Sediment delivery processes⁵⁶

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 through the introduction of nutrients to water, 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, range agriculture, and residential development. All of these human modifications occur in the Tiller Region. With good management, the impact of these practices can be minimized.

Without further field verification and analysis using GIS, a more in-depth and detailed report on sediment processes within the assessment area is beyond the scope of this screening-level assessment. This assessment reviews four potential sources of stream

⁵⁴ Sedimentation listing criteria 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 303(d) list by waterbody name, parameter, and/or list date."

⁵⁵ Data are from ODEQ's Laboratory Analytical Storage and Retrieval (LASAR) database.

⁵⁶ Kristin Anderson and John Runyon of BioSystems, Inc., contributed the introductory text for this section.

sedimentation and turbidity in the region: roads and culverts, slope and debris flow potential, soils, and burns.

Roads and culverts

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 Tiller Region 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.⁵⁷

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 1,102.6 miles of roads in the Tiller Region. These are broken into nine classes (see Table 3-14).

Surface type	Road Miles	% total
Surfaced		
• Federal roads (paved)	0.0	-
• State roads (paved)	0.0	-
• County/other (paved)	42.9	3.9%
• Major gravel	191.0	17.3%
• Minor gravel or spur	397.7	36.1%
Total surfaced	631.6	57.3%
Unsurfaced		
• Major dirt road	448.5	40.7%
• Minor dirt road	10.7	1.0%
Total unsurfaced	459.2	41.6%
Other		
• Unknown	2.8	0.3%
• Closed	9.0	0.8%
Total other	11.8	1.1%

Table 3-14: Miles and percent of Tiller Region roads by class.

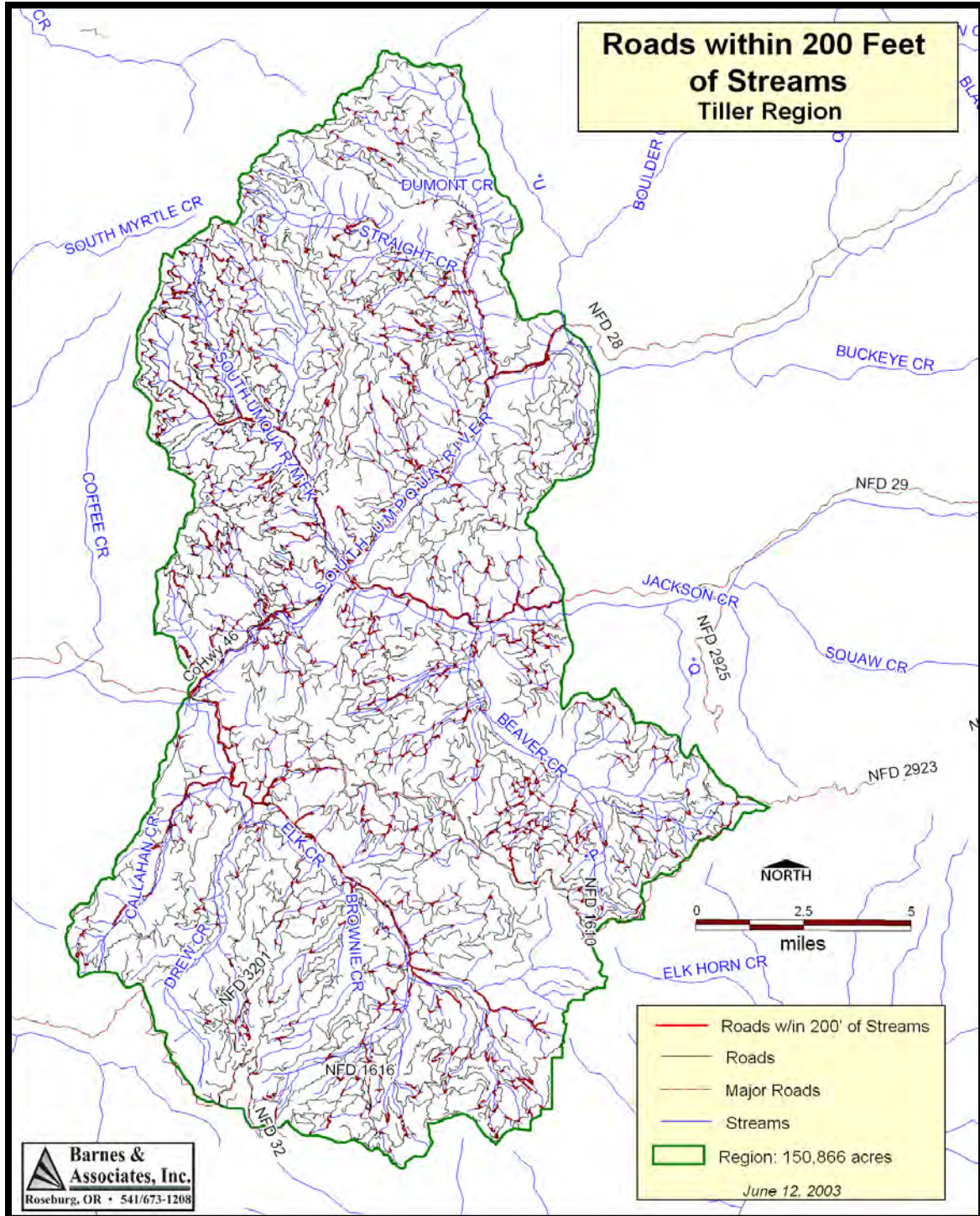
The closer a road is to a stream, the greater the likelihood that road-related runoff contributes to sedimentation. In the Tiller Region, there are 160.1 miles of roads (14.5% of 1,102.6 total miles) within 200 feet of streams (see Map 3-10). Of these, 106.7 miles

⁵⁷ Jenny Allen, Tim Grubert, and John Runyon of BioSystems, Inc., contributed this paragraph.

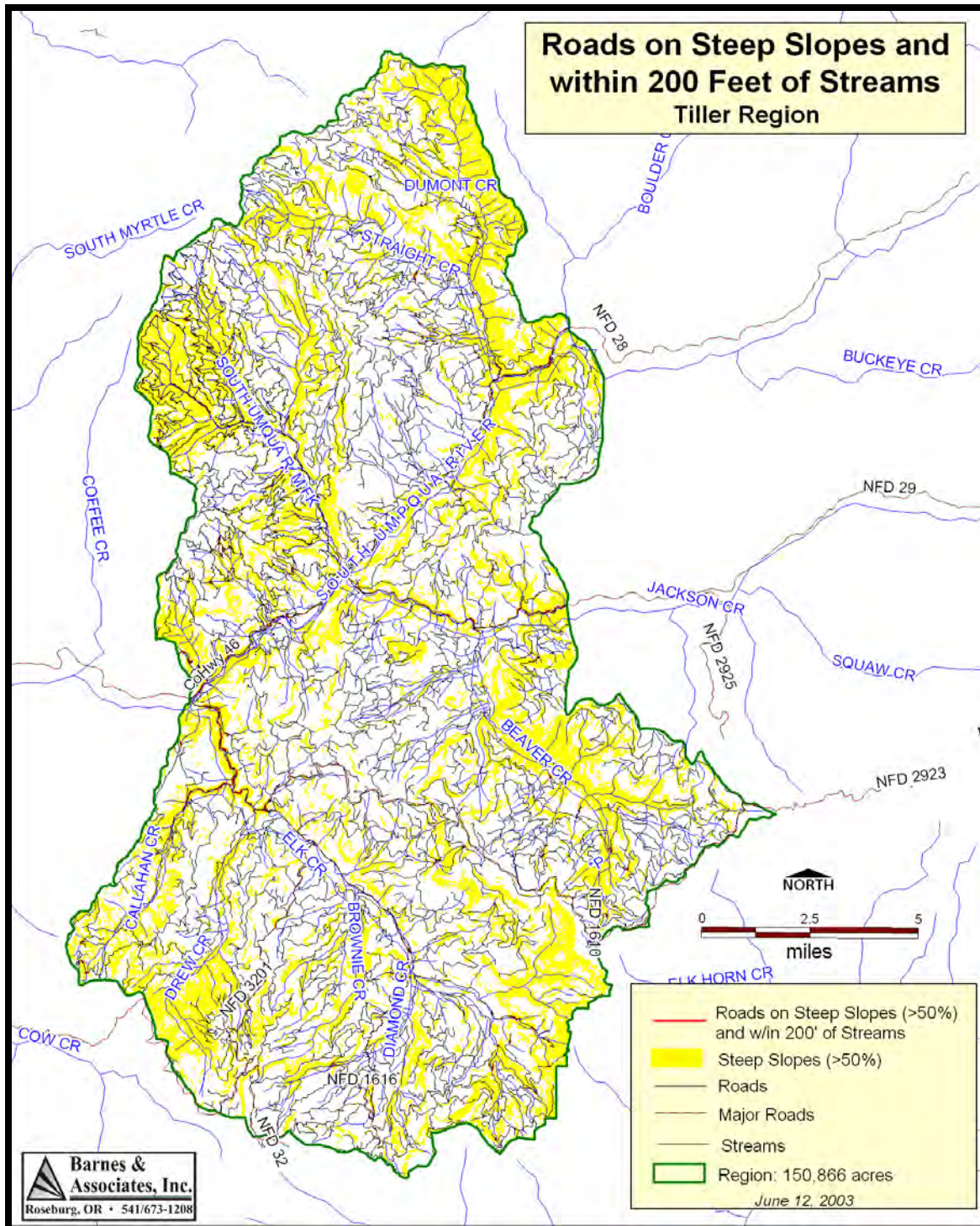
(66.6%) are surfaced roads, 51.8 miles (32.4%) are unsurfaced roads, and 1.6 miles (1.0%) are unknown or closed.

Roads on steep slopes have a greater potential for erosion and/or failure than roads on level ground. There are 10.8 miles of roads (1.0% of 1,102.6 total miles) located on a 50% or greater slope also within 200 feet of a stream (see Map 3-11). Of these roads on steep slopes, 8.2 miles (75.9%) are surfaced, 2.5 miles (22.2%) are unsurfaced, and 0.2 mile (1.9%) is 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 surface of a stream. 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 of these crossing are culverts and how many culverts are failing. Section 3.1.2 provides more information about current culvert identification and restoration efforts in the Umpqua Basin.



Map 3-10: Locations of Tiller Region roads within 200 feet of a stream.



Map 3-11: Locations of Tiller Region roads within 200 feet of a stream and on slopes greater than 50%.

Slope and debris flow potential⁵⁸

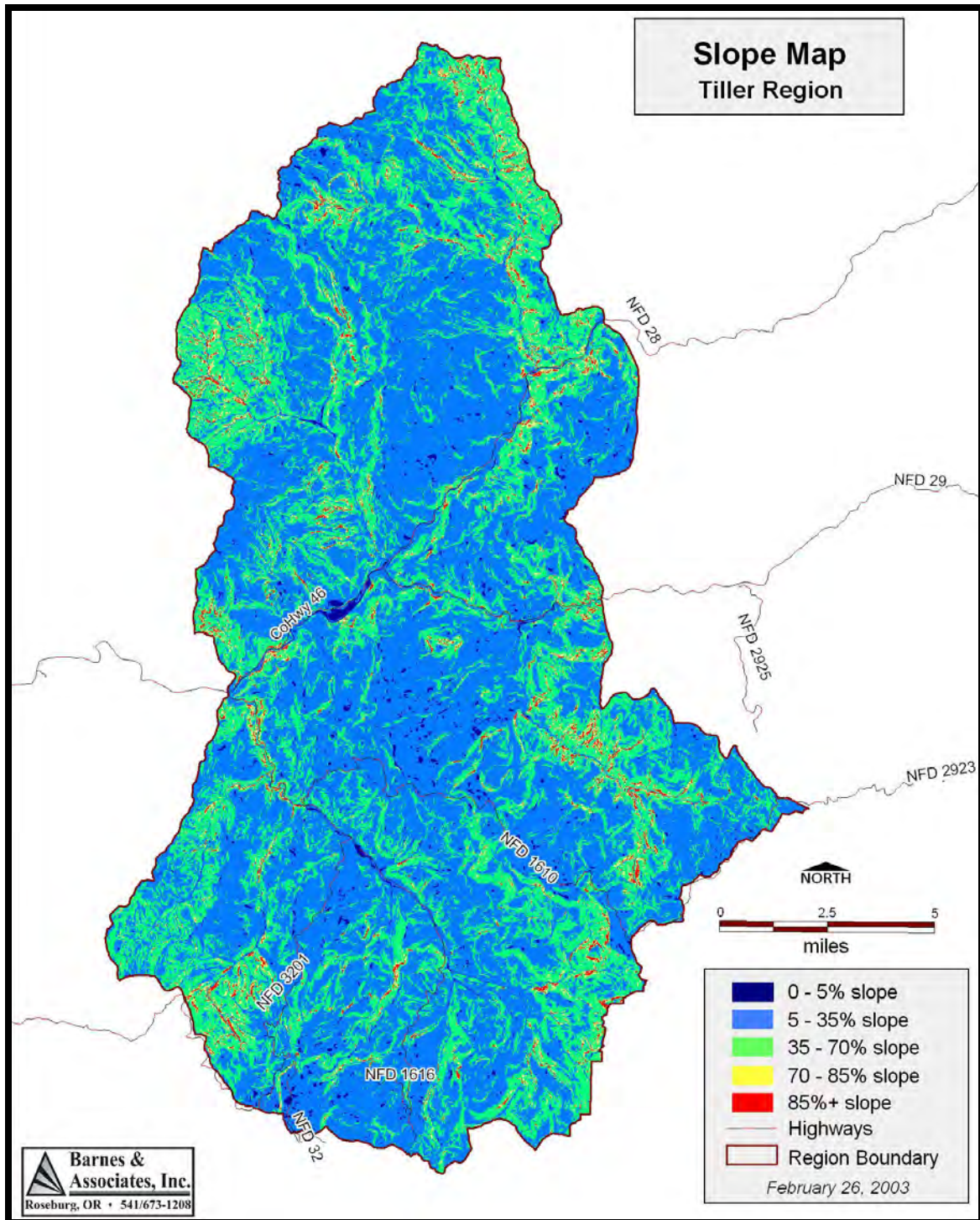
Steep slopes provide greater energy to runoff and therefore have more power to deliver sediment to streams. Slope is an important consideration to sediment delivery, both in long-term erosion processes and in catastrophic events. Map 3-12 shows Tiller Region slope. Relatively steep slopes can be seen throughout the Tiller Region. There are no prominent low gradient areas within the region.

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 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. Natural debris flow hazards as determined by ODF in the Tiller Region are shown in Map 3-13. This ODF study will very soon be superseded 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.

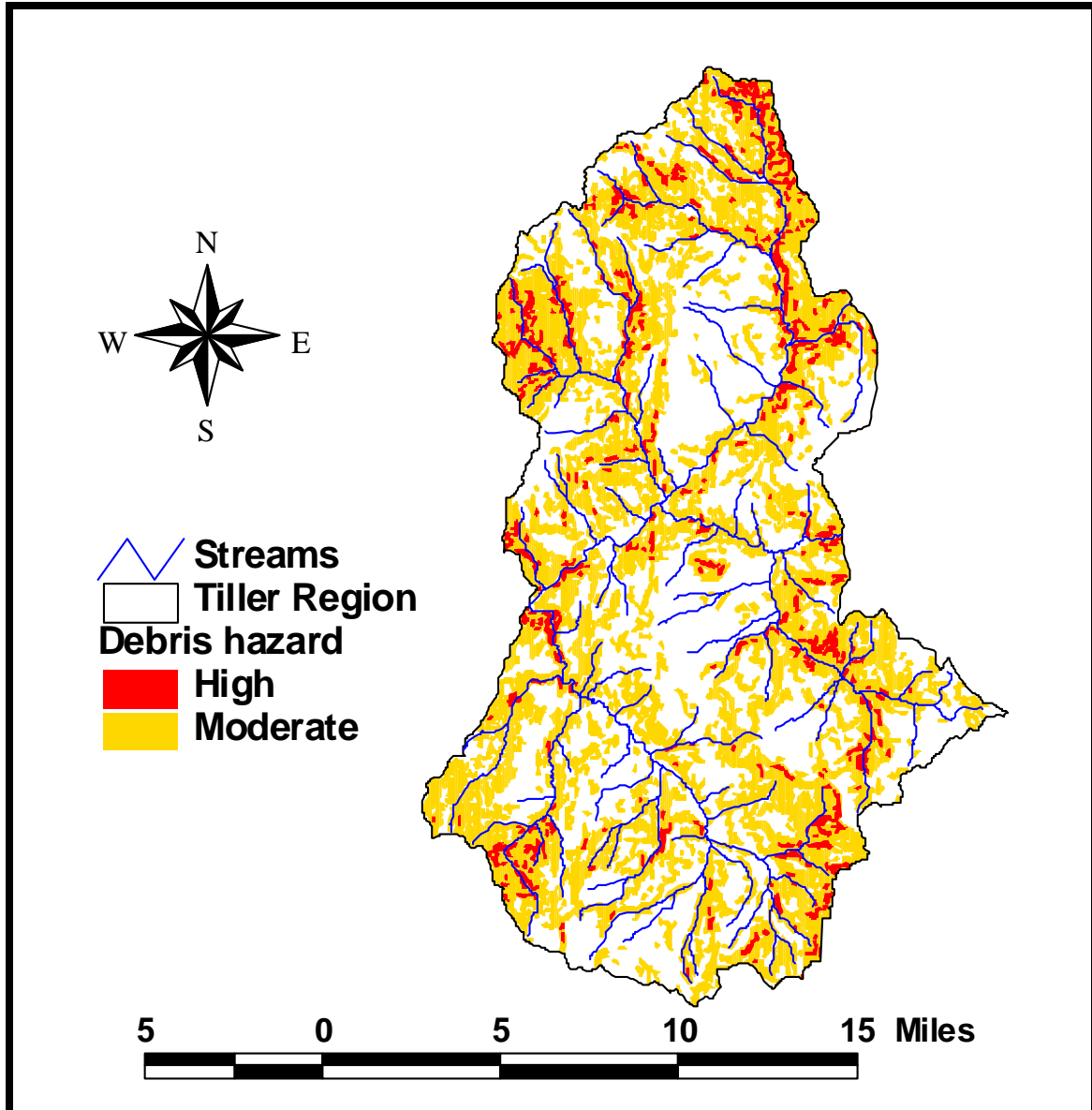
Mass wasting, or the downslope movement of materials, causes significant and sometimes catastrophic sediment delivery to streams. An original, updated mapping study of landslide areas using aerial photos would provide valuable information about past and potential landslides in the Tiller Region.⁵⁹

⁵⁸ Kristin Anderson and John Runyon of BioSystems, Inc., contributed this section's text and Map 3-13.

⁵⁹ Information on upcoming data and landslide mapping provided by R. J. Hofmeister (Oregon Department of Geology and Mineral Industries, verbal communication, 2003).



Map 3-12: Percent slope for the Tiller Region.



Map 3-13: Natural debris flow hazard areas in the Tiller Region as outlined in a coarse scale study by ODF.

Soils⁶⁰

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

⁶⁰ Kristin Anderson and John Runyon of BioSystems, Inc., contributed the text, tables, and maps for this section.

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 soil erosion potential

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, 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.

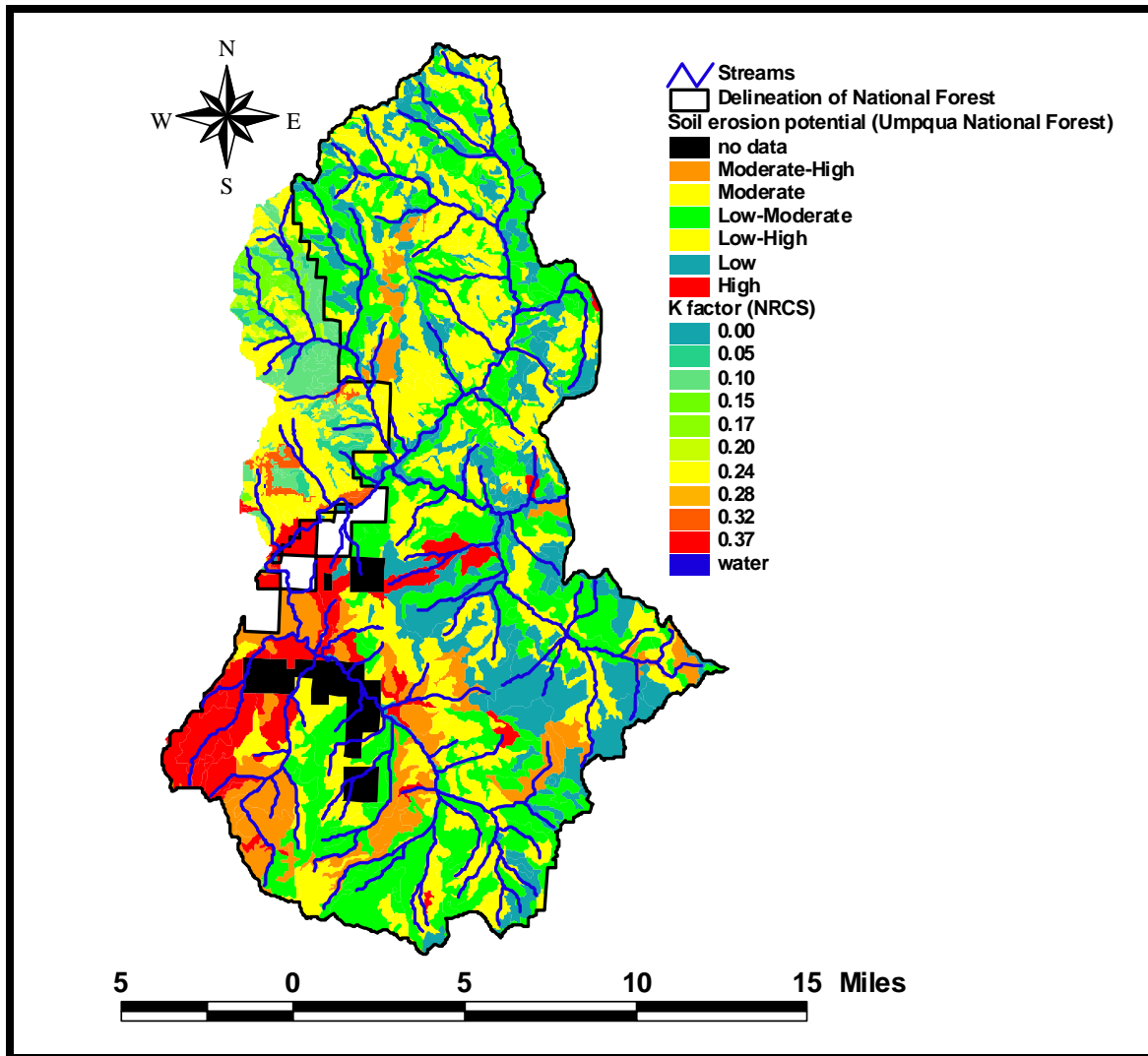
Within the Tiller Region, a portion of the area lies with the Umpqua National Forest, and the UNF does its own soil survey work. Like the K factor variable used by the NRCS, the surface erosion potential is a measure of the potential for erosion based upon characteristics of the soil. The surface erosion 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 3-15.

Surface erosion potential rating	Maximum potential surface erosion (tons/acre/year)
Low	0.0 -10
Moderate	10.1-25
High	25.1-40

Table 3-15: Soil erosion potential ratings as assigned by the Umpqua National Forest.

Map 3-14 depicts the K factor adjusted for the effect of rock fragments of the surface layer of soil and soil erosion potential within the Tiller Region. Soils with high erodibility are concentrated primarily in the southwest portion of the region, coinciding with granitic intrusive rocks (KJg) that crumble easily in the hand. Soils of moderate erodibility are also found in the southwest portion of the region, as well as in small pockets throughout the region. Areas of low to moderate erodibility are found near the South Umpqua River and Elk Creek. As can be seen in Map 3-14, a 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, the gap may be in an area at the edge of the National Forest that is a private land holding. These private holdings were not part of the soil study, and they account for areas within the national forest where there are no data.⁶¹



Map 3-14: K factor (soil erodibility) and soil erosion potential data in the Tiller Region.⁶²

⁶¹ Explanations given by Steve Campbell (NRCS, verbal communication, 2003) and Don Morrison (Umpqua National Forest, verbal communication, 2003).

⁶² Kristin Anderson and John Runyon of BioSystems, Inc., contributed this map. Data are from the Natural Resources Conservation Service and Umpqua National Forest

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 low infiltration rates. 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 3-16 provides descriptions of the hydrologic soil groups.

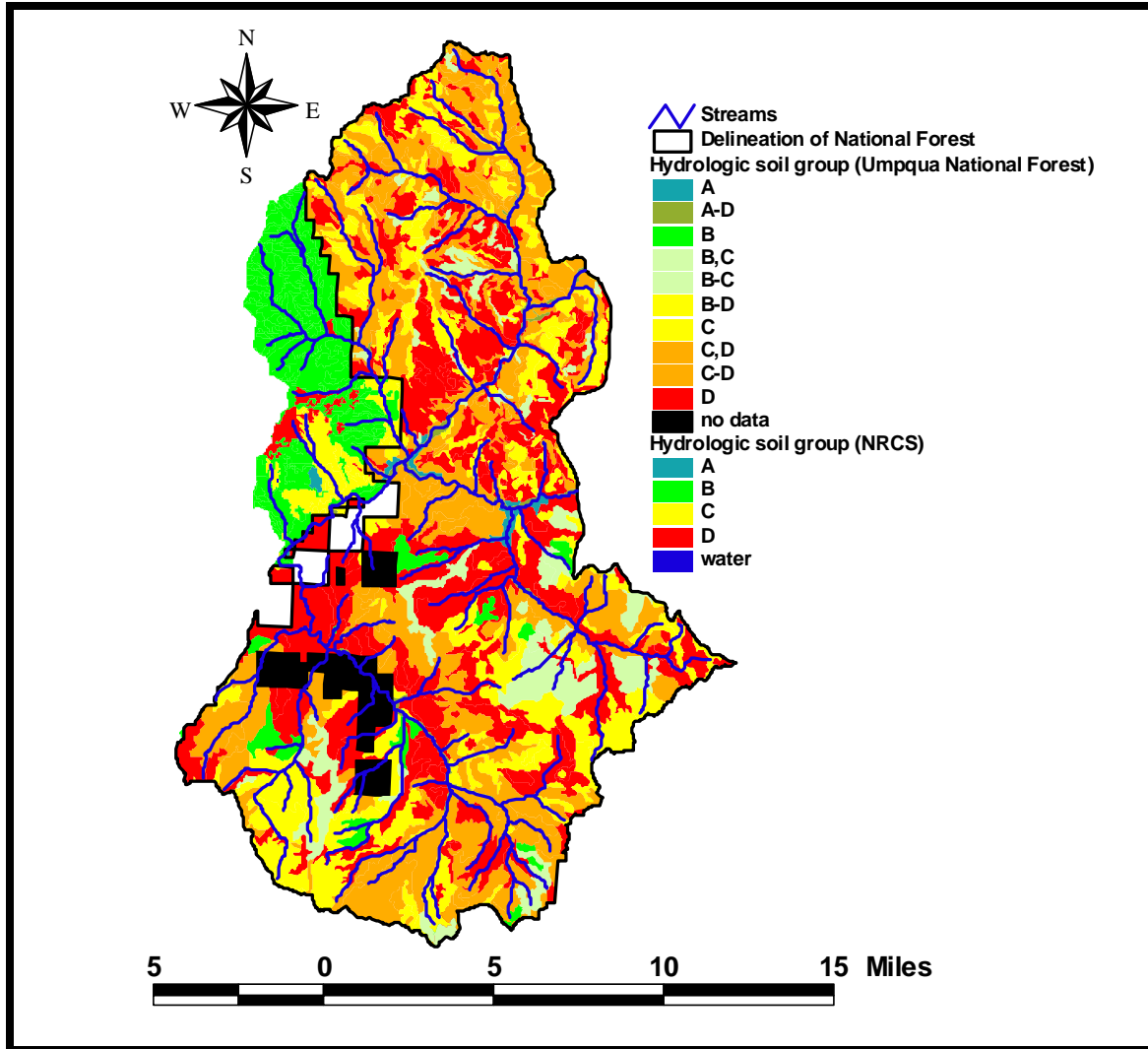
HSG	Soil Description
A	Have low runoff potential and high infiltration rates even when thoroughly wetted; consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (greater than 0.30 in/hr)
B	Have moderate infiltration rates when thoroughly wetted 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 3-16: Hydrologic soil group descriptions.⁶³

Within the Umpqua National Forest, the same hydrologic soil groupings were used as in the NRCS classification. However, a discrepancy between measurements by the NRCS and the Umpqua National Forest seems apparent. As mentioned above, the data from each source are best interpreted relative to other data within each source's area.

Nearly all of the Tiller Region has soils that fall into the C or D hydrologic groups (see Map 3-15). These areas may be more prone to delivering sediment and faster runoff than other areas. Only one small portion of the watershed in the northwest has predominantly B type soils that are less prone to produce runoff. However, this area still has steep slopes. Slopes are also important to erosion and runoff processes.

⁶³ From USDA Technical Release 55 (1986).



Map 3-15: Hydrologic soils map of the Tiller Region.

Burns

Burned areas erode more easily than unburned areas because of the lack of vegetative cover and abundance of fine material, such as ash. Figure 3-4 shows the number of acres burned during non-permitted (accidental) fires from 1991 through 2002, excluding the 2002 Tiller Complex fire. Map 3-16 shows fire distribution in the Tiller Region, including the 2002 Tiller Complex. Over 7,000 acres of the Tiller Region was within the 2002 Tiller Complex fires, of which most occurred in the Dumont Creek drainage. The UBWC was unable to locate quantitative data on burns/stream proximity and it therefore cannot evaluate the potential for stream sedimentation from burns.

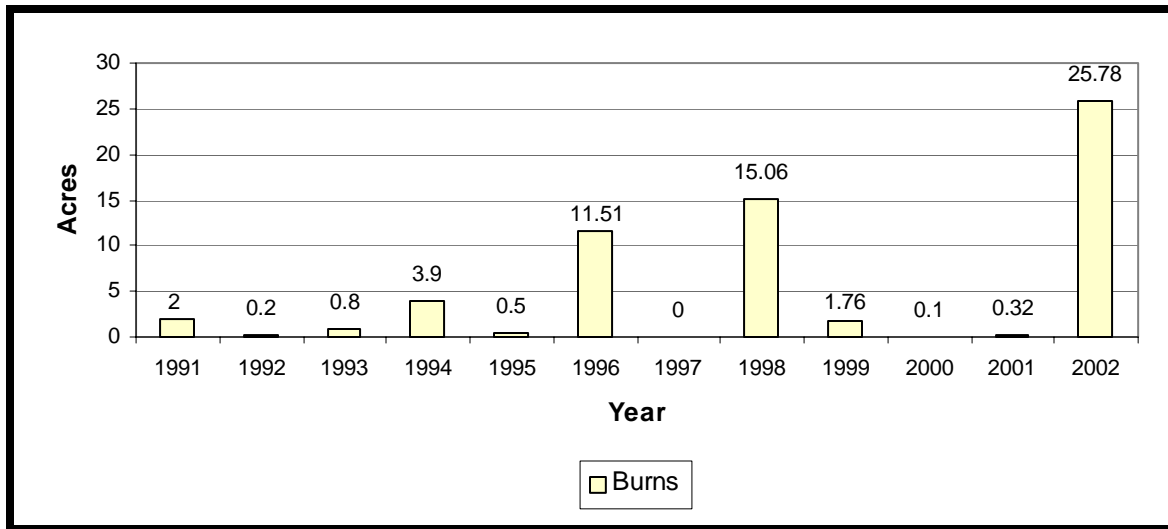


Figure 3-4: Acres burned by year for the Tiller Region.

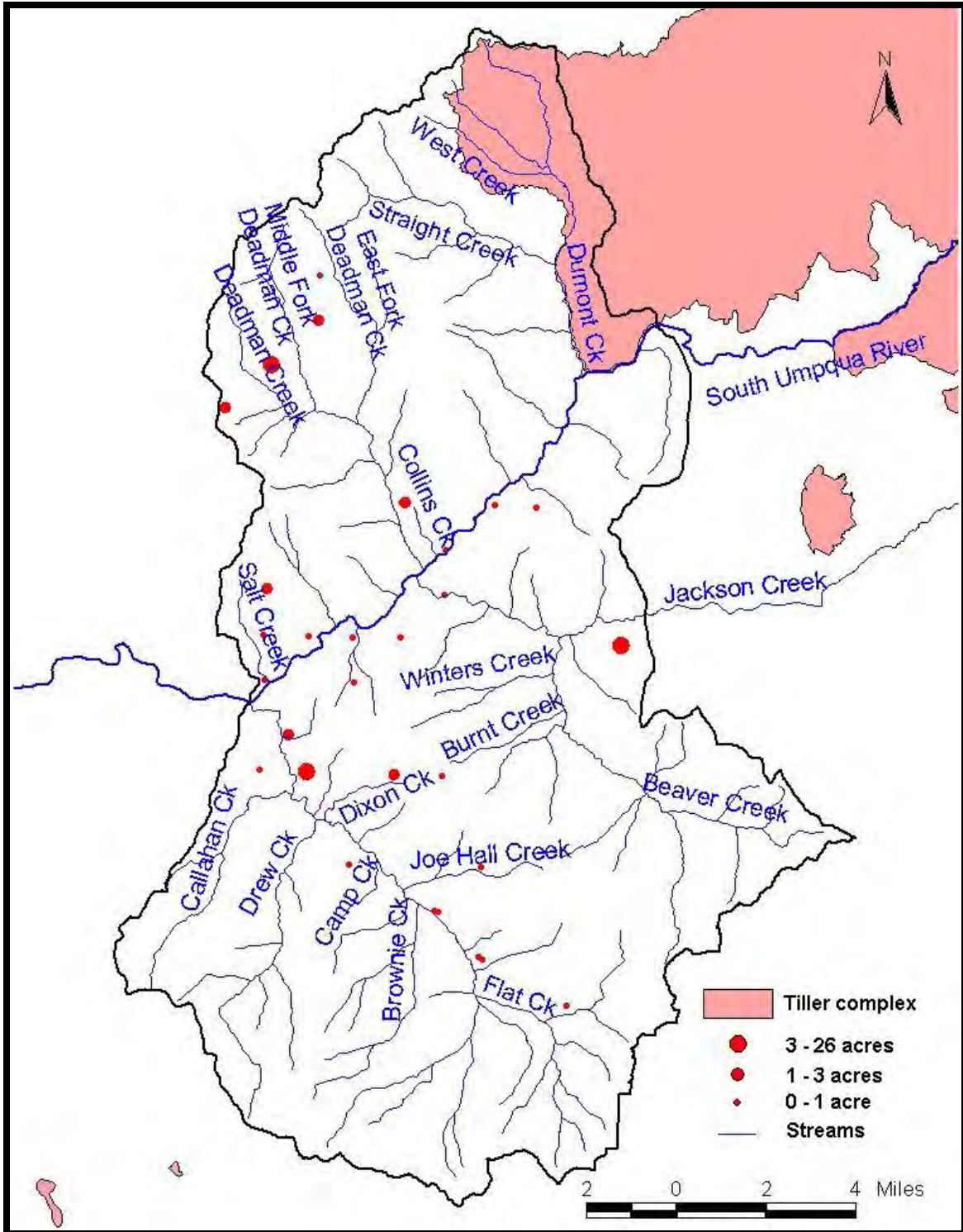
Due to concerns about the effects of the 2002 Tiller Complex burn on fish habitat, the Umpqua National Forest is planning an extensive stream sediment-trapping program to protect salmonid streams.⁶⁴

During the wildfires of 2002, approximately 1,470 acres within Boulder and Dumont Creeks experienced high fire severity. These watersheds are some of the most important streams for salmon, steelhead, and trout on the Tiller Ranger District and on the Umpqua National Forest. Both watersheds were designated under the Northwest Forest Plan as key watersheds and as Late Successional Reserve because of [their] importance as fish and wildlife habitat.⁶⁵

High fire severity areas having little to no canopy or ground cover, steep slopes and high potential for erosion, sediment delivery and down-cutting of stream channels were identified for this project. Fish habitat conditions in Boulder and Dumont Creeks are considered to be fair to poor, and the addition of fine sediment to spawning gravels will negatively affect salmon production. [The Umpqua National Forest is] proposing this project to reduce or delay some of impacts of the 2002 wildfires on salmon and trout habitat caused by past management activities.

⁶⁴ This information provided by Casey Baldwin, fisheries biologist, Umpqua National Forest.

⁶⁵ See section 4.2.4 for more information about Late Successional Reserves.



Map 3-16: Wildfire location and size in the Tiller Region.

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).⁶⁶

As shown in Table 3-10 on page 94, there are no streams 303(d) listed for toxics in the Tiller Region. No monitoring information suggests that toxics are of concern in this area.

3.3.9. Water quality key findings and action recommendations

Temperature key findings

- Eight out of 10 Tiller Region temperature monitoring sites has seven-day moving average maximum temperatures frequently exceeding the 64°F standard during the summer study period. High stream temperatures would limit salmonid rearing in these reaches.
- Warmer sites often lack shade. Increasing shade on small and medium-sized streams may improve overall stream temperature.
- 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 Tiller Region, pH levels do not meet water quality standards in Jackson Creek and the South Umpqua River. Dissolved oxygen levels are within ODEQ's water quality standards. Nutrient levels meet OWEB's recommended levels. It is unknown if these parameters limit water quality in any tributaries.
- Bacteria have only been sampled once in the Tiller Region.
- Toxics do not appear to be of concern in the Tiller Region.

Sedimentation and turbidity key findings

- In the Tiller Region, turbidity data suggest that usual turbidity levels should not affect sight-feeding fish like salmonids.
- Beaver Creek, Jackson Creek, and the South Umpqua River are all 303(d) listed for sediment. These listings are based on a 1995 US Forest Service study.
- Areas of moderate to high soil erodibility lie in the southwestern portion of the Tiller Region. The majority of the region has a high runoff potential.

⁶⁶ From ODEQ's *Oregon's Approved 1998 303(d) Decision Matrix* (1998).

- Steep to moderately steep slopes dominate the topography of the region. 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.
- There were extensive fires in the Dumont Creek draining during the summer of 2002, which may cause increased stream sediment levels. The US Forest Service plans to control sediment in Dumont Creek.

Water quality action recommendations

- Continue monitoring the Tiller Region for all water quality conditions. Increase the number of bacteria monitoring locations.
- 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.
- Maintain the Tiller Region’s low nutrient levels through the following activities:
 - 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.
 - Reduce chemical nutrient sources.
- Where data show that stream sediment exceed established water quality standards, identify sediment sources such as 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.
- In areas with high concentrations of group C or D hydrologic soils, encourage landowners to identify the specific soil types on their property and include soils information in their land management plans.
- Identify landslide-sensitive and disturbed areas using aerial photography and, when available, the refined debris flow hazard data from Nature of the Northwest in Portland.
- Educate landowners about water quality concerns and potential improvement methods, such as controlling road runoff from improper drainage, to control erosion in sensitive areas of the Tiller Region.

3.4. *Water quantity*

3.4.1. *Water availability*⁶⁷

Data from the Oregon Water Resources Department (OWRD) has been used to determine water availability in the Tiller Region. 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 instream water rights from streamflow. In most of the Umpqua Basin, including the Tiller Region, there is no water available for new water rights from “natural” streamflow during the summer.⁶⁸

To analyze water availability, OWRD has divided the Umpqua Basin into water availability units, or WABs. The Tiller Region consists of four WABs. All of the Elk Creek WAB (#307) and the Deadman Creek WAB (#304) are entirely within the Tiller Region. The lower portions of the South Umpqua River WAB (#31630214) and the Jackson Creek WAB (#317) are also within the Tiller Region; however, the majority of these WABs are east of the region’s boundary.

Figure 3-5 and Figure 3-6 show surface water availability for the Elk Creek and Deadman Creek WABs in cubic feet per second (cfs). The solid yellow area is average streamflow. The blue line is the total amount of water held in instream water rights. The red line is consumptive use; the numbers running horizontally along the bottom of the graph are consumptive use values by month. The pink line is expected streamflow, which is determined by subtracting consumptive use from average streamflow. Instream water rights exceed average streamflow from September through November in the Elk Creek WAB and from August through November in the Deadman Creek WAB. For both WABs, consumptive use is less than average streamflow all year. Surface water availability graphs for the South Umpqua River WAB and Jackson Creek WAB are in Appendix 5.

⁶⁷ 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/>).

⁶⁸ 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.

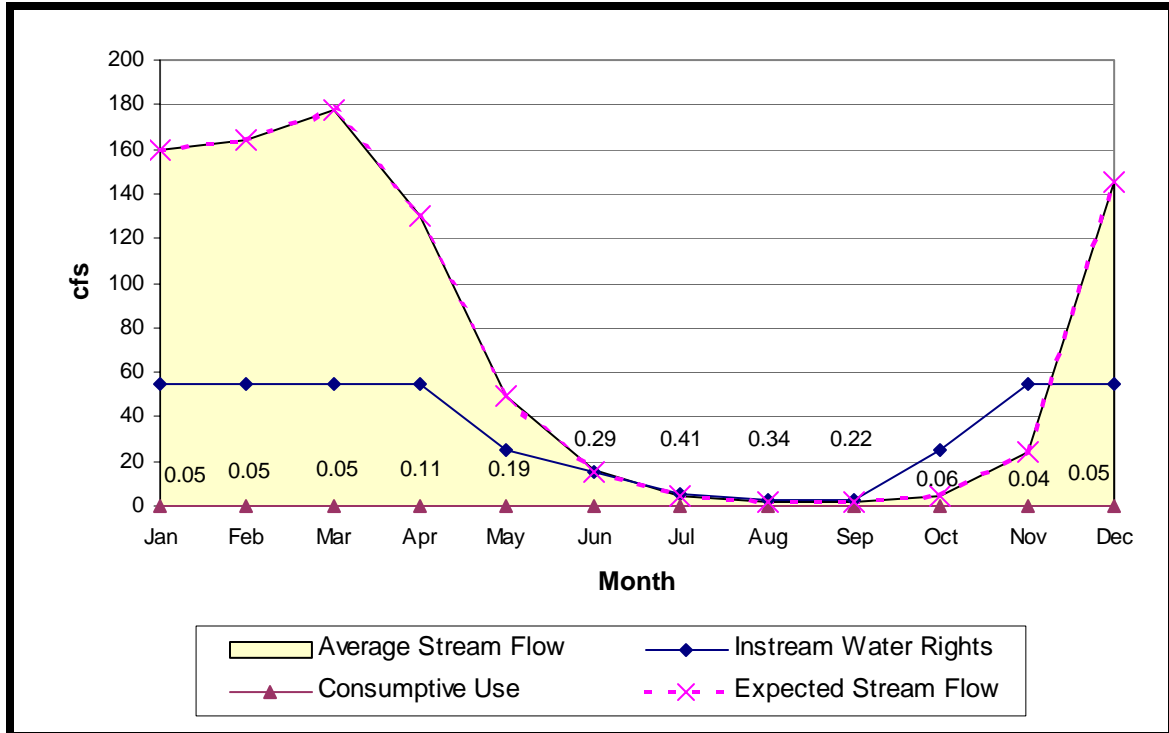


Figure 3-5: Water availability for the Elk Creek WAB (# 307).

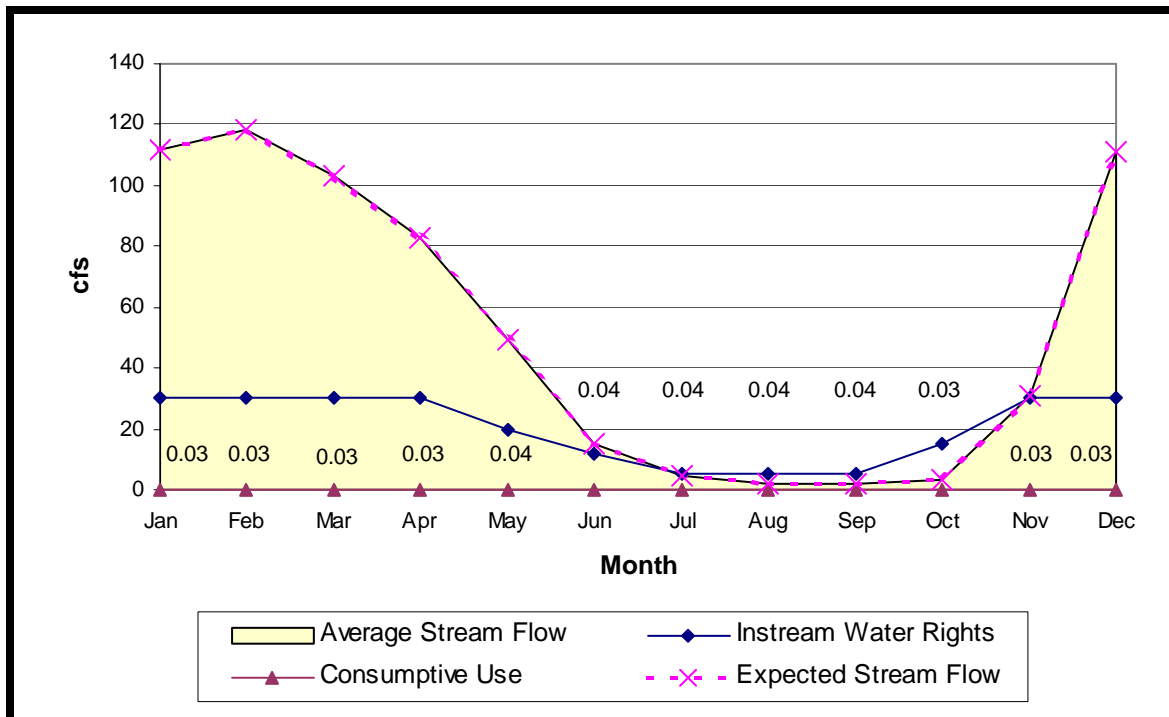


Figure 3-6: Water availability for the Deadman Creek WAB (#304).

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.

3.4.2. Water rights by use⁶⁹

Table 3-17 and Table 3-18 show consumptive use by category for the Tiller Region.⁷⁰ Data are shown for the total region and by stream system: the South Umpqua River and tributaries,⁷¹ Elk Creek and tributaries, Jackson Creek and tributaries, and Deadman Creek and tributaries. Appendix 6 lists the uses included in each category. Table 3-17 and Table 3-18 show uncanceled water rights and do not indicate actual water consumption.⁷²

The “fish” category is the largest use in the Tiller Region (97.1% of total use) and for each stream system. “Irrigation” is the next largest use of water for the area (1.9%) and for the four stream systems. The greatest volume of irrigation water comes from the South Umpqua River system and the Elk Creek system. The third largest use of water for the total region and for each stream system is “domestic.”

	Total region		South Umpqua River and tributaries ⁷³	
Source	Cubic feet/sec	% total	Cubic feet/sec	% of S. Umpqua
Domestic	1.88	0.6%	1.16	0.7%
Irrigation	5.89	1.9%	3.53	1.4%
Industrial	0.76	0.2%	0.10	>0.1%
Fish	307.03	97.1%	240.01	97.6%
Livestock	0.72	0.2%	0.70	0.3%
Misc. ⁷⁴	0.05	>0.1%	0.03	>0.1%
Total	316.32	100.0%	245.98	100.0%

Table 3-17: Water rights by use for the total region and for the South Umpqua River and its tributaries.⁷⁵

⁶⁹ Water rights data are available from OWRD’s Water Rights Information System database available at <http://www.wrd.state.or.us/>.

⁷⁰ Table 3-17 and Table 3-18 only includes categories for which there are water rights in the Tiller Region.

⁷¹ Excluding Elk Creek, Jackson Creek and Deadman Creek.

⁷² 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.

⁷³ Excluding Elk Creek, Jackson Creek, and Deadman Creek.

⁷⁴ The miscellaneous category includes fire protection and road construction.

⁷⁵ Percents do not add to 100 due to rounding.

	Elk Ck and tributaries		Jackson Ck and tributaries		Deadman Ck and tributaries	
Source	Cubic feet/sec	% Elk Creek	Cubic feet/sec	% Jackson Creek	Cubic feet/sec	% Deadman Creek
Domestic	0.13	0.8%	0.02	0.1%	0.12	1.0%
Irrigation	1.63	9.7%	0.68	1.6%	0.05	0.4%
Industrial	0.00	-	0.66	1.6%	0.00	-
Fish	15.02	89.3%	40.00	96.7%	12.00	98.6%
Livestock	0.01	>0.1%	0.01	>0.1%	0.00	-
Misc. ⁷⁶	0.02	0.2%	0.00	-	0.00	-
Total	16.81	100.0%	41.37	100.0%	12.17	100.0%

Table 3-18: Water rights by use for Elk Creek, Jackson Creek, Deadman Creek, and their respective tributaries.⁷⁷

3.4.3. Streamflow and flood potential

There are three US Geological Survey (USGS) stream gauges in the Tiller Region that have been active for more than 10 years. The gauges are located on the South Umpqua River near Tiller (gauge #14308000), Jackson Creek near Tiller (gauge #1430770), and Elk Creek near Drew (gauge #14308500). The South Umpqua River gauge has been consistently active since 1940. The Jackson Creek gauge was active from 1956 through 1986. The Elk Creek gauge has been active since 1955; however, 1982 and 1986 data are incomplete and there are no data from 1983 through 1985.

Figure 3-7 and Figure 3-8 chart maximum, minimum, and average streamflow by month for the South Umpqua River near Tiller. The same data for Jackson Creek near Tiller and Elk Creek near Drew are provided in Appendix 7. As would be expected from climate information in section 1.2.6, the winter months have the greatest average flow due to precipitation. During the summer months, the South Umpqua River's flow can drop to less than 50 cfs, Jackson Creek can drop below 30 cfs, and Elk Creek can drop below one cfs. All three locations show the highest minimum flows during the spring. This is most likely the result of spring snowmelt contributing to streamflow levels.

⁷⁶ The miscellaneous category includes fire protection and road construction.

⁷⁷ Percents do not add to 100 due to rounding.

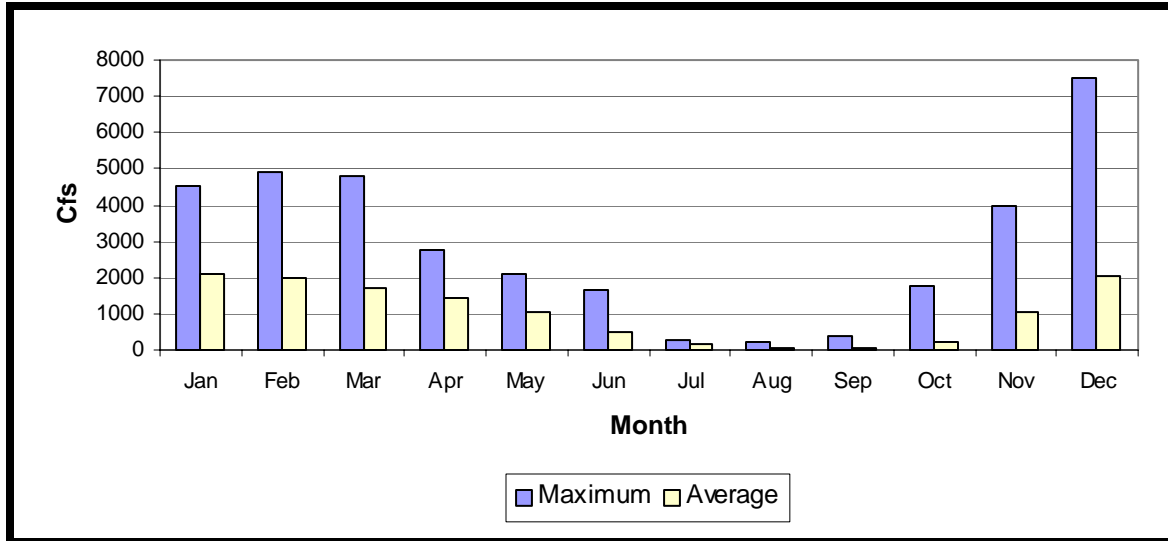


Figure 3-7: Maximum and average streamflow by month for the South Umpqua River near Tiller (gauge # 14308000).

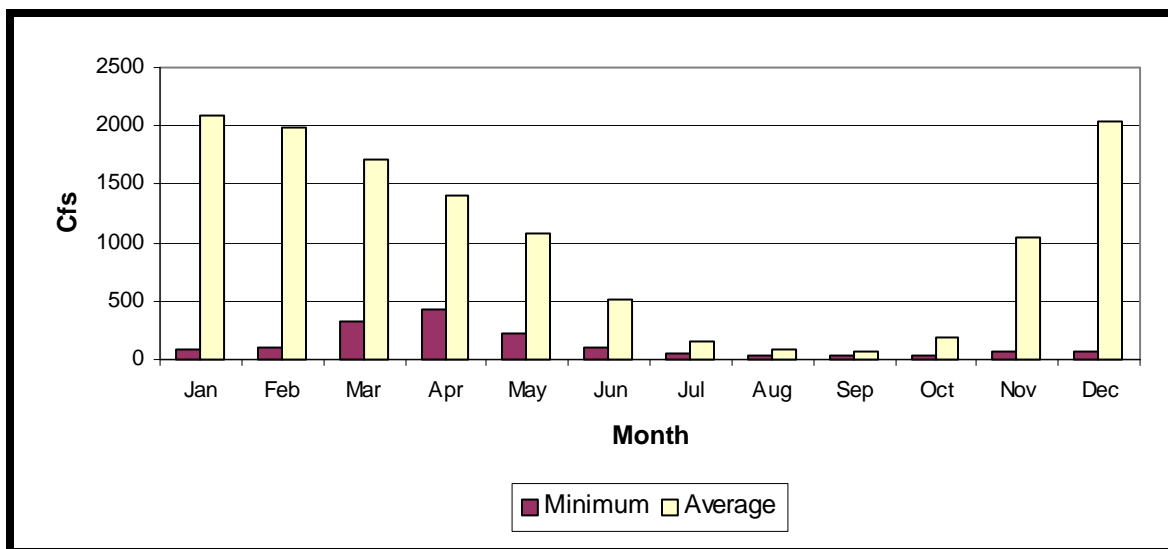


Figure 3-8: Minimum and average streamflow by month for the South Umpqua River near Tiller (gauge #14308000).

Figure 3-9, Figure 3-10, and Figure 3-11 show peak flow and average annual streamflow data for the South Umpqua River near Tiller, Jackson Creek near Tiller, and Elk Creek near Drew. Data for the South Umpqua River have been collected annually since 1940. Jackson Creek data are from 1956 through 1986. Elk Creek data are from 1955 through 2001; there are no peak flow data from 1983 through 1986 and no average annual flow data from 1982 through 1986.⁷⁸

⁷⁸ Data are shown by water year. Water years begin the first of October and end September 30. Therefore, a flood event in December, 2001, will be recorded in the 2002 water year.

Peak flow and annual average streamflow varies, and years with high peak flow events do not necessarily have corresponding high annual flows. For example, each of the three stream systems had extreme flood events on December 22, 1964. However, the average annual streamflow for each of the corresponding water years is below average.

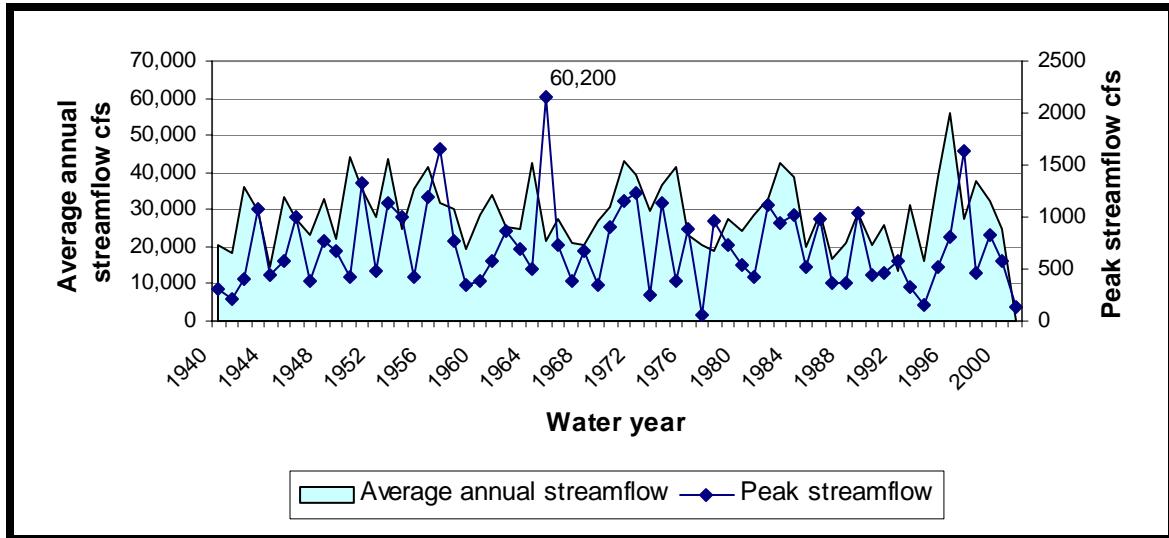


Figure 3-9: Peak streamflow and average annual streamflow for the South Umpqua River near Tiller (gauge # 14308000).

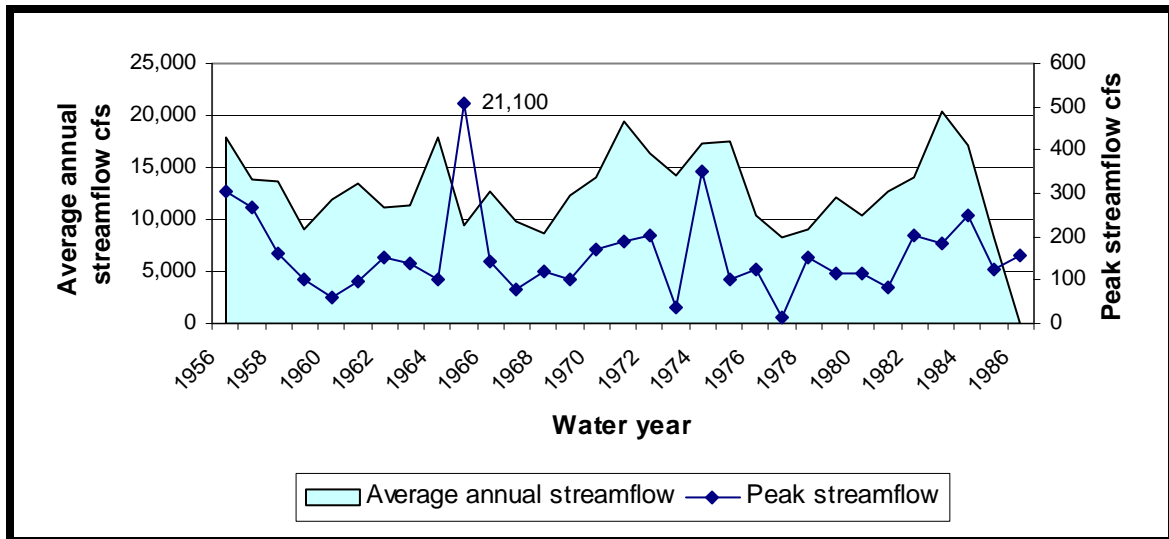


Figure 3-10: Peak streamflow and average annual streamflow for Jackson Creek near Tiller (gauge #1430770).

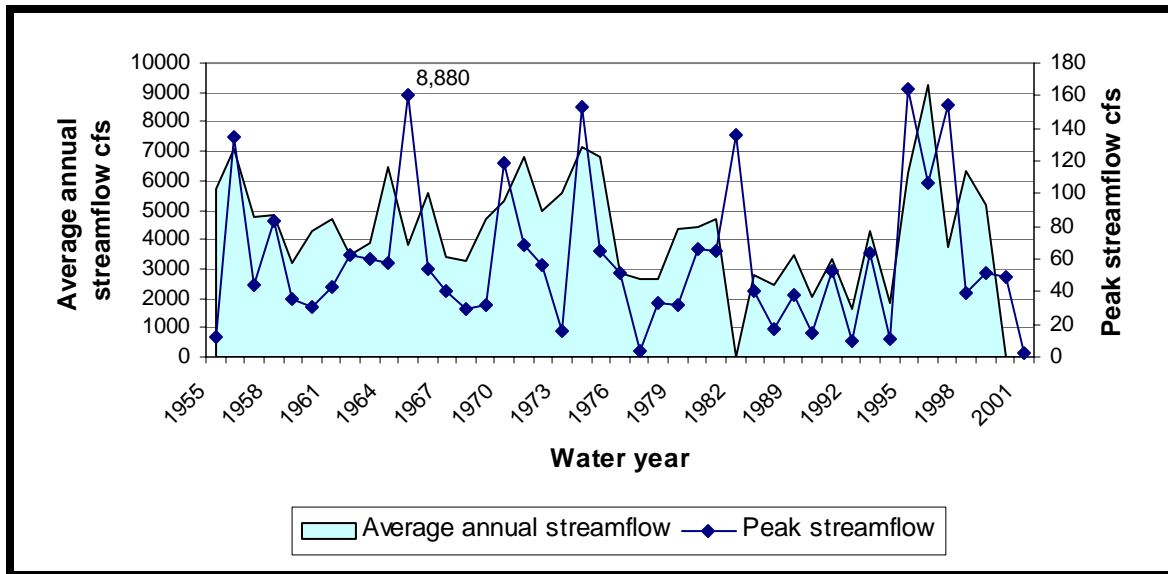


Figure 3-11: Peak streamflow and average annual streamflow for Elk Creek near Drew (gauge #14308500).

Influences on flood potential

Approximately 80% of the Tiller Region is within the transient snow zone (TSZ) (see section 1.2.3). In the TSZ, snow can accumulate in areas with open canopies such as meadows, burned areas, or 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 may be more susceptible to rain-on-snow events than lower elevation streams.

Road density can also influence peak flows. Table 3-19 shows the miles of road per square mile for paved, gravel, and dirt roads. Paved roads are impermeable to water; 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	0.2
Gravel	2.5
Dirt	1.9

Table 3-19: Miles of road per square mile for surfaced and unsurfaced roads in the Tiller Region.

3.4.4. Water quantity key findings and action recommendations

Water availability and water rights by use key findings

- In the Tiller Region, instream water rights exceed natural streamflow during the summer and early fall.
- Throughout the Umpqua Basin, there is no water available for new water rights from “natural” streamflow during the summer
- The “fish” category is the largest use of water in the Tiller Region, distantly followed by “irrigation.”

Streamflow and flood potential key findings

- During the summer months, the South Umpqua River’s flow can drop to less than 50 cfs, Jackson Creek can drop below 30 cfs, and Elk Creek can drop below one cfs.
- No flooding trends can be determined from the records to date.
- The degree to which road density and the TSZ influence flood potential in the Tiller Region is unknown at this time.

Water quantity action recommendations

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

3.5. Fish populations

3.5.1. Fish presence

Table 3-20 lists the fish species in the Tiller Region that have viable, reproducing populations or annual runs.⁷⁹ Smallmouth bass (*Micropterus dolomieu*) are frequently found upstream of the Tiller Ranger Station. These fish are believed to migrate into the area during the summer months, but most likely do not establish reproducing populations. Tiller Region stream temperatures are generally too cold for smallmouth bass. ODFW is not aware of any established populations of non-native fish in the Tiller Region.

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 Tiller Region. 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.

⁷⁹ From Dave Harris, fisheries biologist for the Oregon Department of Fish and Wildlife, Roseburg District Office.

Common Name	Scientific Name
Steelhead	<i>Oncorhynchus mykiss</i>
Coho salmon	<i>O. kisutch</i>
Chinook (spring)	<i>O. tshawytscha</i>
Cutthroat trout	<i>O. clarkii</i>
Western brook lamprey	<i>Lampetra richardsoni</i>
Pacific lamprey	<i>Lampetra tridentata</i>
Umpqua dace	<i>Rhinichthys cataractae</i>
Sculpin	<i>Cottus sp.</i>
Redside shiner	<i>Richardsonius balteatus</i>
Speckled dace	<i>Rhinichthys osculus</i>
Largescale sucker	<i>Catostomus macrocheilus</i>
Umpqua pikeminnow ⁸⁰	<i>Ptychocheilus oregonensis</i>

Table 3-20: Fish species with established populations or runs within the Tiller Region.

3.5.2. Fish distribution and abundance

Information on fish distribution and abundance within the Tiller Region 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 species may be available in the future.

Anadromous salmonid distribution

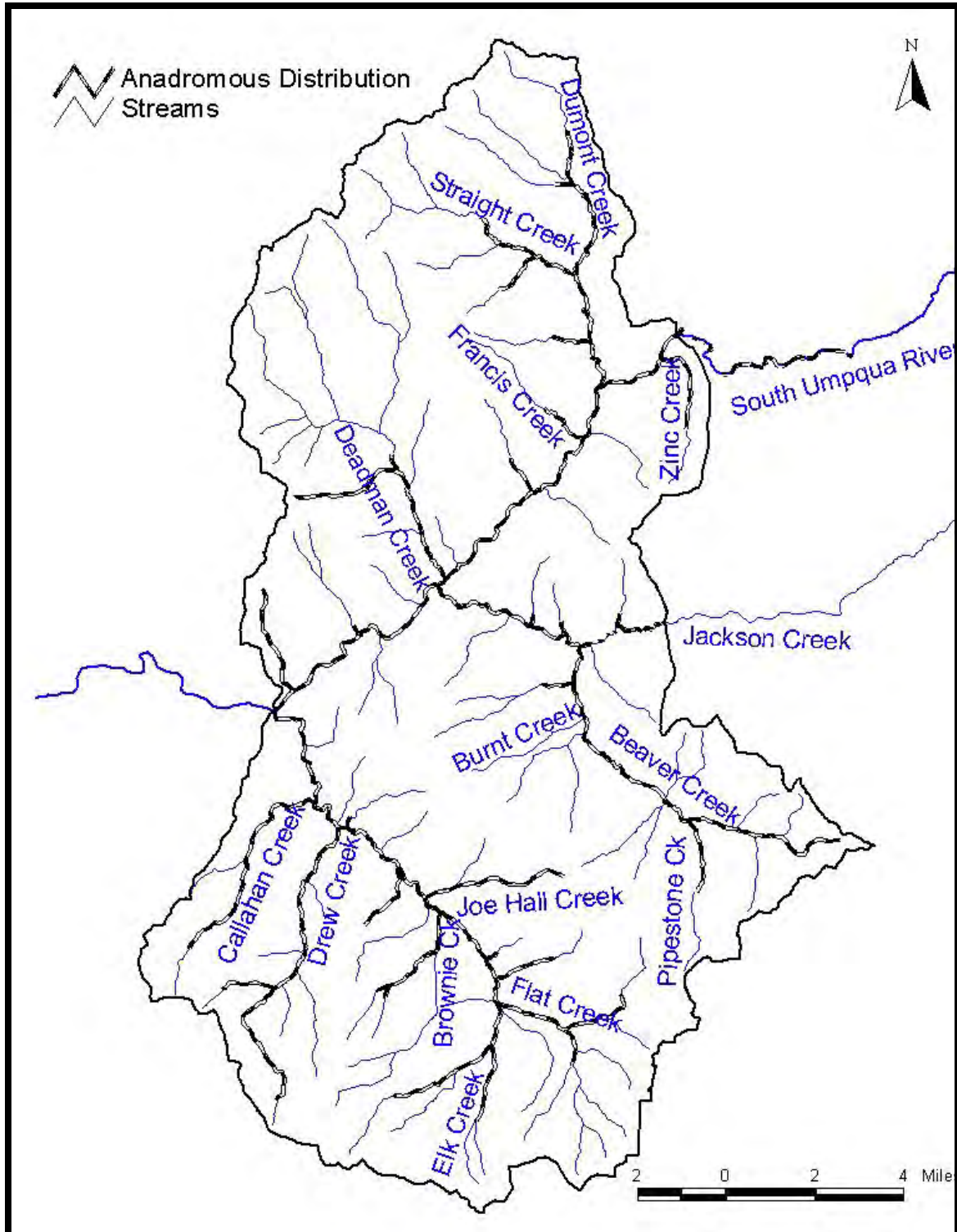
The Oregon Department of Fish and Wildlife (ODFW) has developed anadromous salmonid distribution maps based on fish observations, assumed fish presence, and habitat conditions.⁸¹ Fish observations are the most accurate because ODFW personnel have seen live or dead fish in the stream. With assumed fish presence, streams or reaches are included in the distribution map because of their proximity to fish-bearing streams 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 salmonids use 105.6 stream miles within the Tiller Region. Map 3-17 shows the distribution of these anadromous salmonids within the region and Table 3-21 lists the miles of stream used by each species. Total stream miles with anadromous salmonids does not equal the sum of miles used by each species

⁸⁰ ODFW fish biologists are unsure whether or not Umpqua pikeminnow are permanent residents in the Tiller Region; Tiller area landowners say these fish are common in the area.

⁸¹ Maps are available from the ODFW website <http://www.streamnet.org/online-data/GISData.html>.

because many species overlap (see Appendix 8). Coho and steelhead use many of the same stream reaches but at different times of the year.



Map 3-17: Anadromous salmonid distribution within the Tiller Region.

	Total	Coho	Steelhead	Spring chinook
Miles	105.6	53.1	102.2	23.7

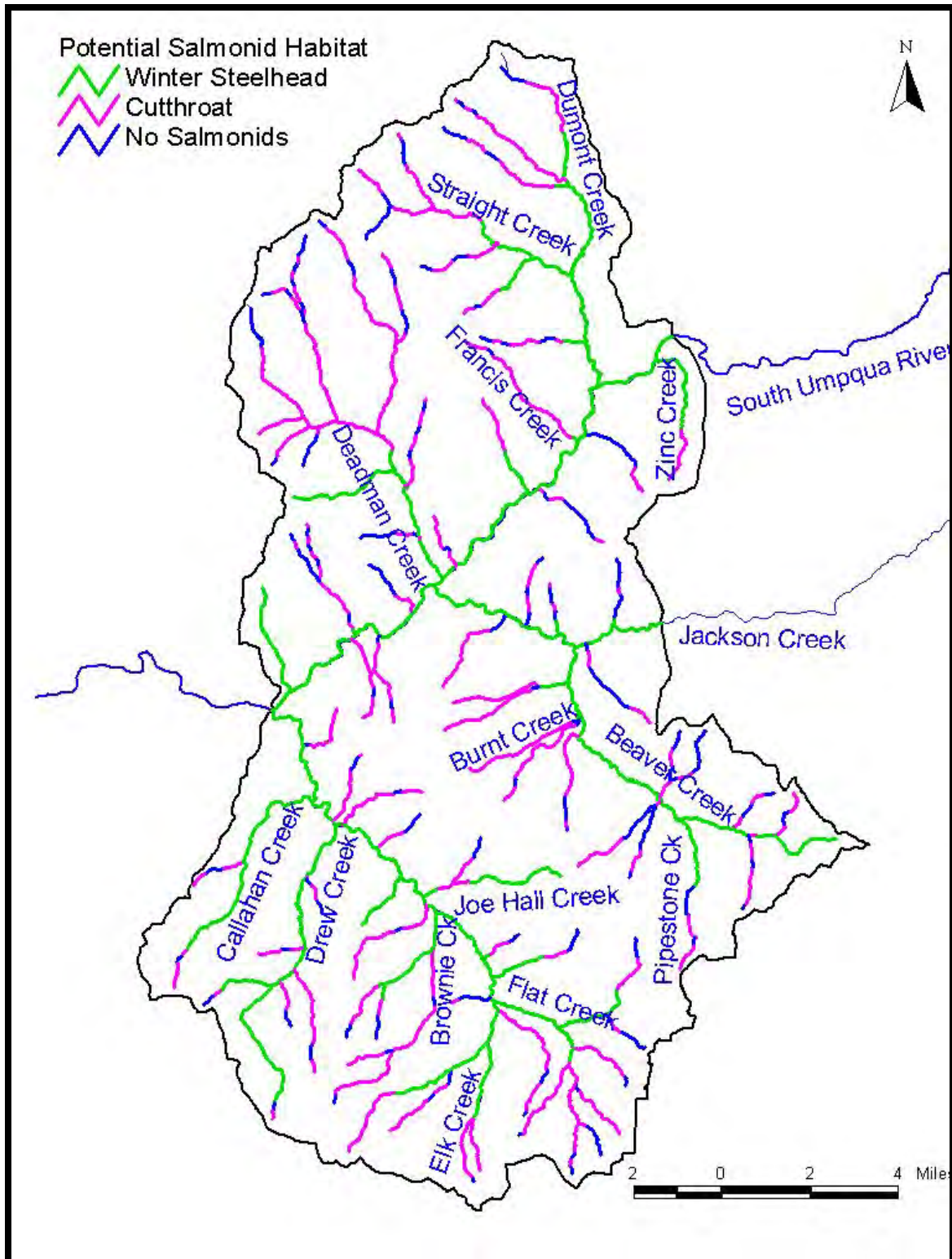
Table 3-21: Miles of stream supporting anadromous salmonids in the Tiller Region.

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.⁸² Map 3-18 shows streams with gradients that are less than 15% and are beyond winter steelhead distribution. Streams such as the upper reaches of Deadman Creek may provide suitable habitat for cutthroat trout. However, there are many factors other than stream gradient that determine fish habitat suitability.

⁸² From Dave Harris, fish biologist, Oregon Department of Fish and Wildlife, Roseburg District Office.



Map 3-18: Potential resident and anadromous salmonid habitat in the Tiller Region.

Coho abundance

ODFW conducts coho spawning surveys throughout the Umpqua Basin.⁸³ Volunteers and ODFW personnel survey pre-determined stream reaches and count the number of live or dead coho. The same person or team usually does surveys every ten days for two or three months. There are coho spawning data for the Tiller Region from 1990 through 1998. Figure 3-12 shows the maximum number of live and dead coho seen per mile on a given day. The estimated total number of coho per mile is included as a red bar next to peak per mile count. Map 3-19 shows the surveyed stream reaches.

Within a given year, streams can have very different coho spawning populations. Whereas in 1993 Dumont Creek observed 11 coho per mile, Deadman Creek had none. Spawning levels within a stream can fluctuate as well. Deadman Creek had eight observed coho per mile in 1993 but from zero to two in subsequent years. More monitoring data are needed to draw conclusions about coho spawning in the Tiller Region.

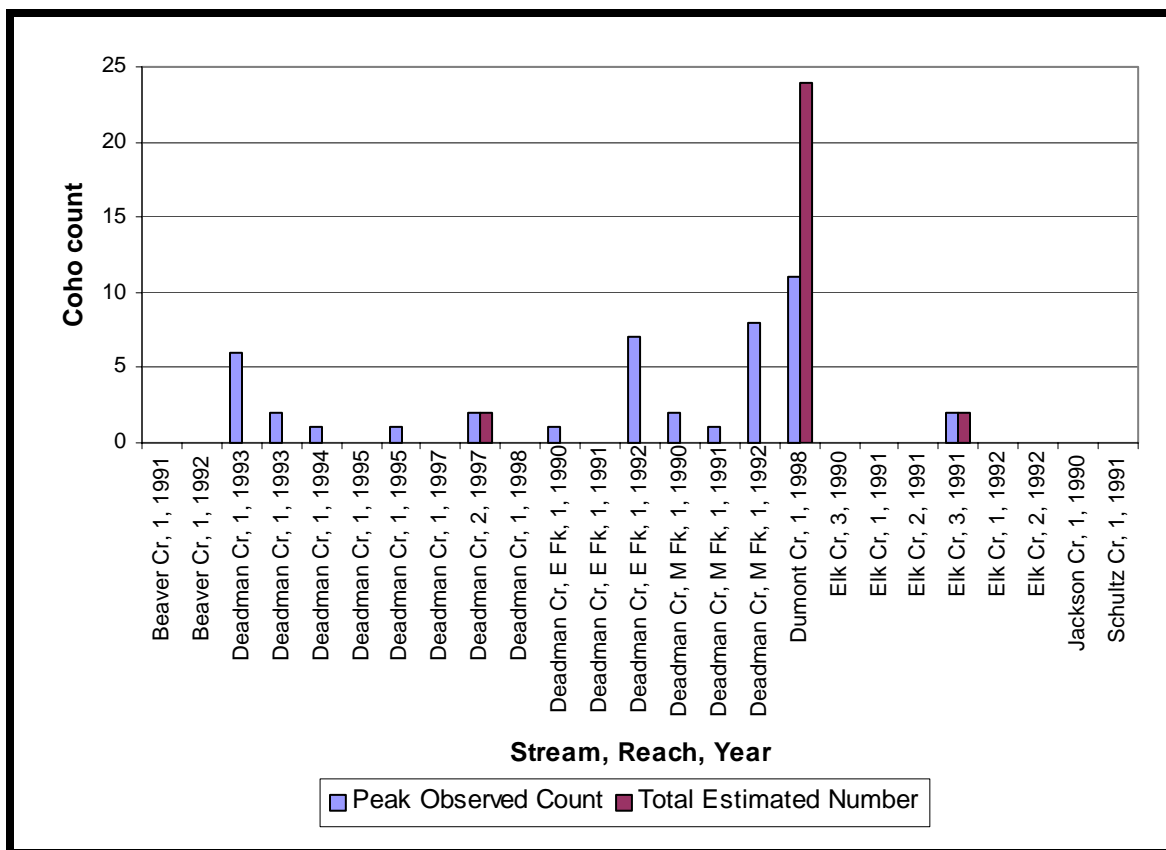
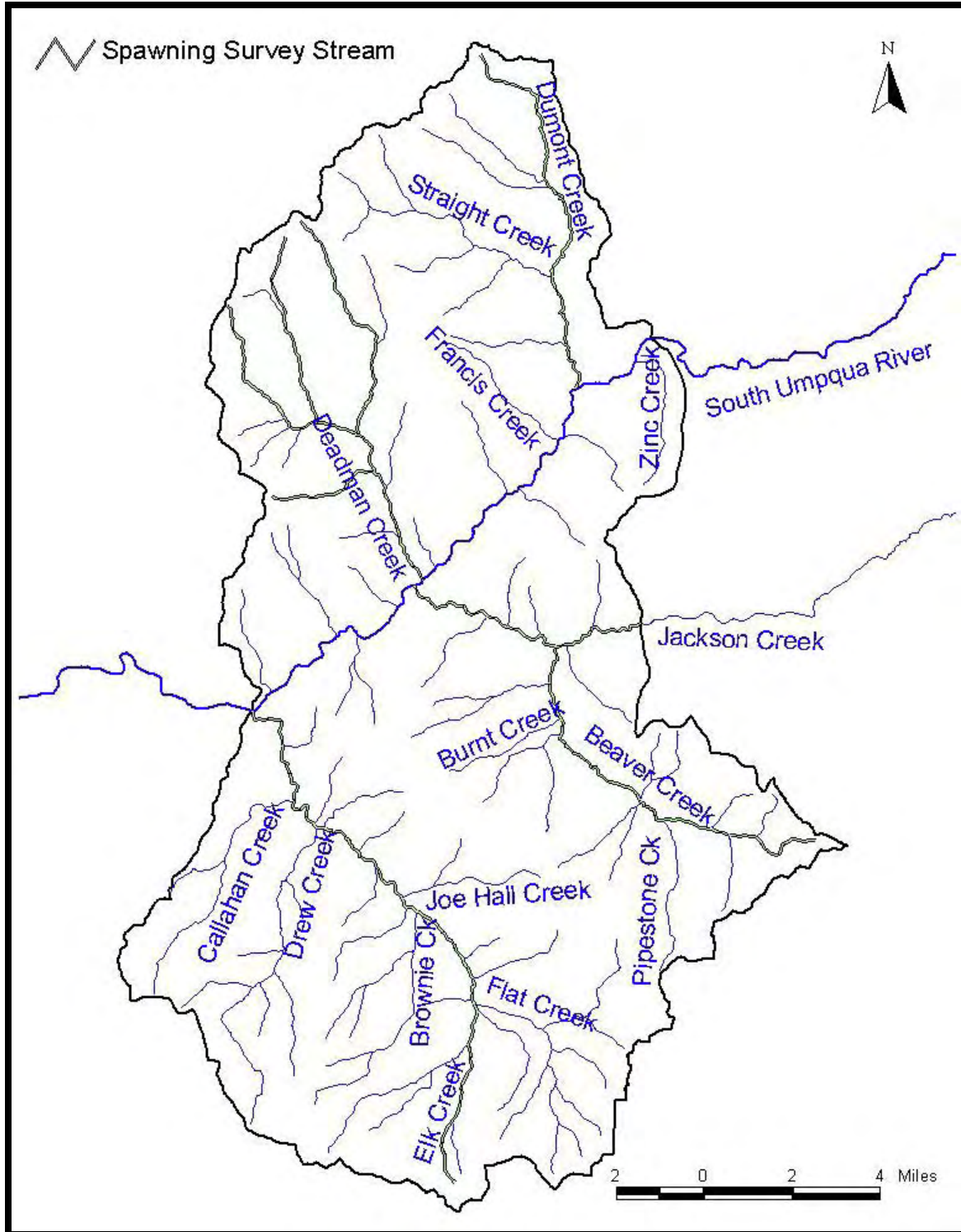


Figure 3-12: Coho spawning surveys from 1990 through 1998 for the Tiller Region.

⁸³ Coho spawning survey data can be requested from the ODFW Corvallis Research Laboratory.



Map 3-19: Tiller Region coho spawning survey locations.

During coho spawning surveys, surveyors record the presence of other salmonid species. In 1990, one steelhead was observed in the first reach of South Fork Deadman Creek. In 1990, 1991, and 1992, a single steelhead was documented in the first reach of Middle

Fork Deadman Creek. In 1994, one chum was recorded in Deadman Creek. No chinook have been documented during coho spawning surveys.

Spring chinook pool counts

Since 1961, ODFW has done snorkel counts of adult spring chinook in the Tiller Region. Between mid-August and mid-September, ODFW personnel snorkel pools that serve as spring chinook adult resting holes.⁸⁴ Data are collected in three areas: the South Umpqua River beginning near Dumont Creek to the South Umpqua River Falls (approximately 9.0 stream miles), from the South Umpqua River Falls to Castle Rock Creek (approximately 5.2 stream miles), and Jackson Creek from the mouth to Deep Cut Creek (approximately 7.0 stream miles).⁸⁵ Data are used to establish long-term population estimates. Much of the data are collected outside the assessment area boundary and therefore do not provide an accurate estimate of spring chinook population trends for the Tiller Region. However, the population fluctuations seen in the data set are most likely indicative of spring chinook population trends in the region.

As shown in Figure 3-13, spring chinook adult counts were low from 1974 through 1983. Spring chinook returns increased beginning in 1984, when ODFW documented the first hatchery fish returns in the South Umpqua River.⁸⁶ From 1984 through 2001, the average spring chinook population has been similar to that found between 1961 and 1973.

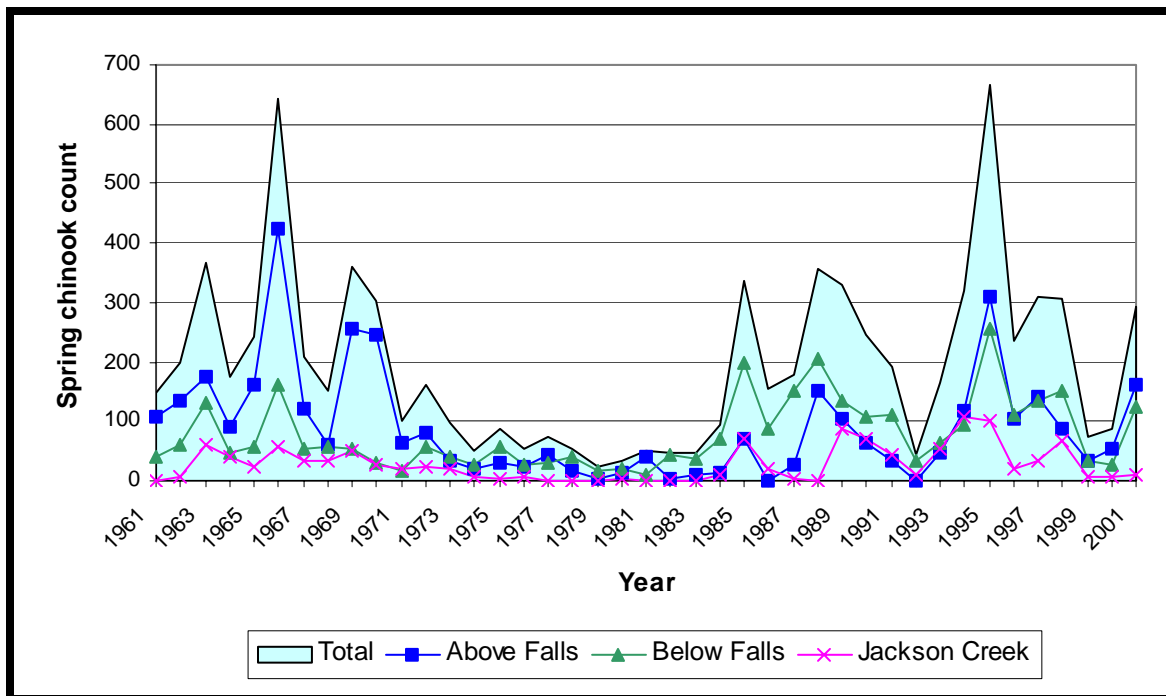


Figure 3-13: Spring chinook counts in the Tiller Region.

⁸⁴ Spring chinook pool count data can be requested from the ODFW Roseburg District Office.

⁸⁵ South Umpqua Falls is located between river mile 95 and 96.

⁸⁶ Hatchery smolts were collected from the North Umpqua River and released into the South Umpqua River over a five-year period. Releases stopped after one brood cycle. Since that time, hatchery spring chinook have not been released in the South Umpqua River system.

Migrating juvenile salmonid populations

The US Forest Service (USFS), the Bureau of Land Management (BLM), and ODFW are collecting long-term information on the movements of juvenile salmonids out of their natal streams.⁸⁷ Juvenile salmonid data are primarily collected with five-foot rotary screw traps, which capture small fish. From data collected during trap operation, fisheries biologists estimate the number of juvenile fish passing by the trap during their outward migration.

The USFS has operated screw traps on the South Umpqua River, Jackson Creek, Dumont Creek, and Deadman Creek. Preliminary data from one or more of these traps are available for 1995 and 1996, and from 1999 through 2001.⁸⁸ Figure 3-14 through Figure 3-18 shows by species the estimated number juvenile fish passing the rotary traps during the spring. On the table “0+” indicates fish less than one year old, “1+” are fish between their first and second year, and so on. Due to the preliminary nature of these data sets, no conclusions can be made about migrating juvenile salmonid populations in the Tiller Region.

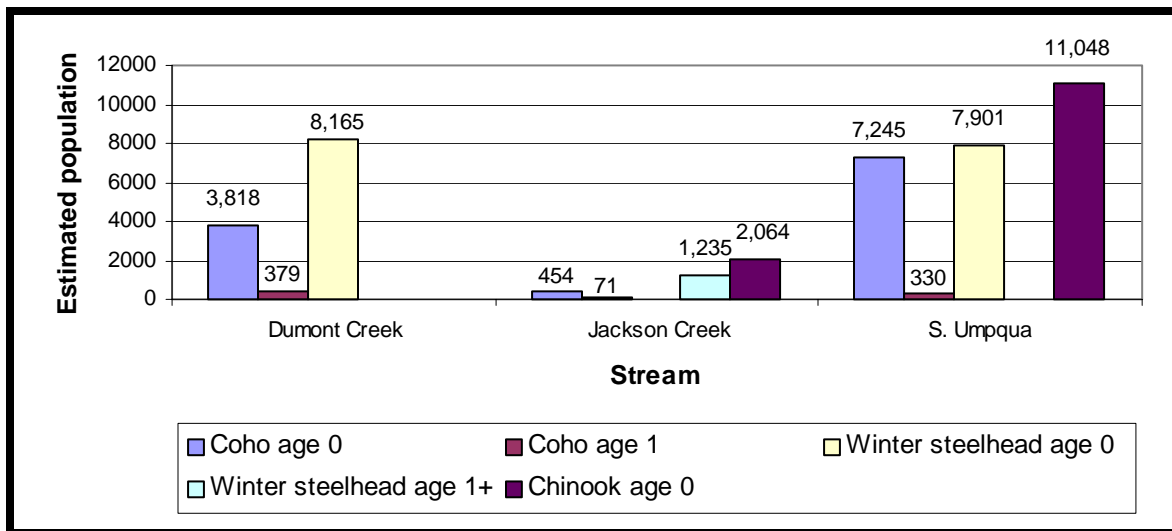


Figure 3-14: 1995 Tiller Region smolt trap data.

⁸⁷ “Natal streams” refer to the streams where juvenile salmonids hatched.

⁸⁸ USFS smolt trap data can be requested from the Umpqua National Forest. As of September, 2003, USFS fisheries biologists have not verified the Tiller Region smolt trap data.

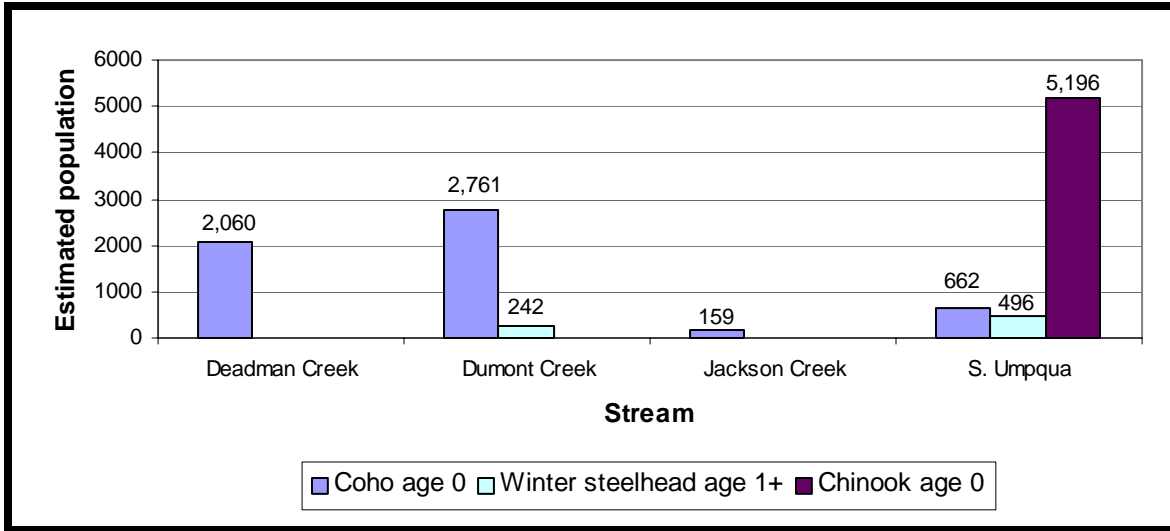


Figure 3-15: 1996 Tiller Region smolt trap data.

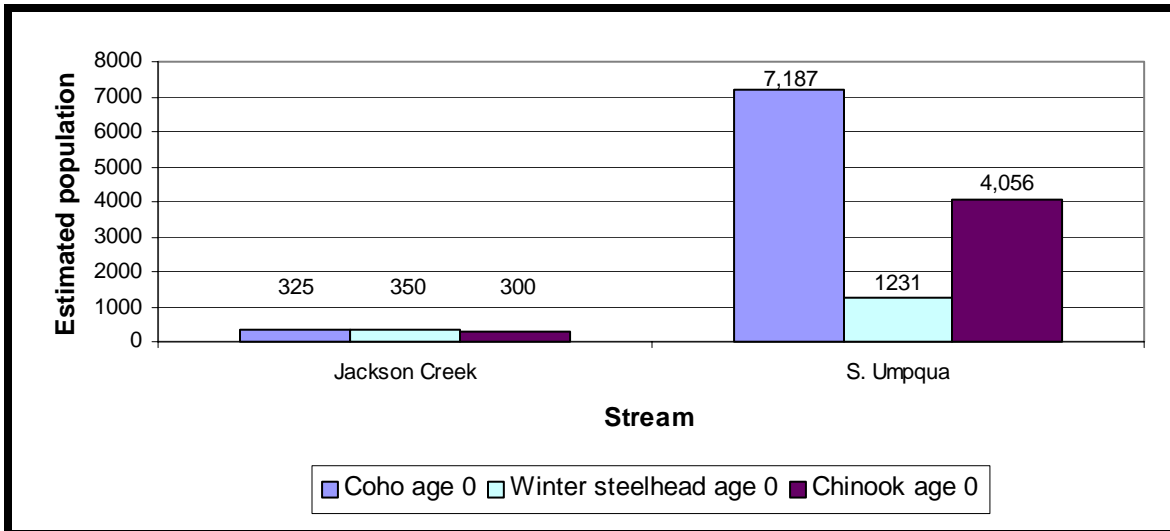


Figure 3-16: 1999 Tiller Region smolt trap data.

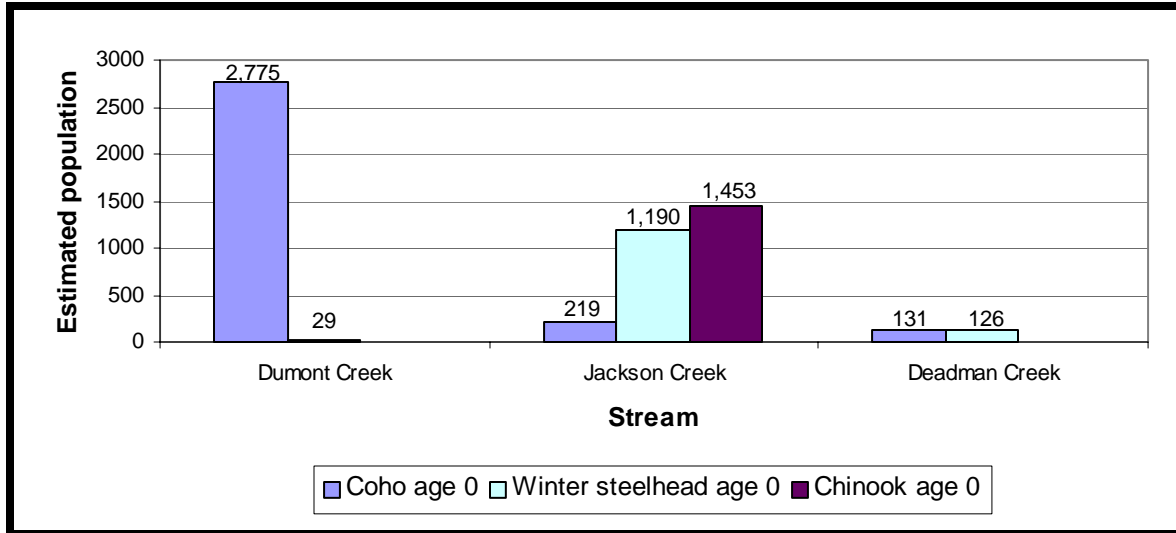


Figure 3-17: 2000 Tiller Region smolt trap data.

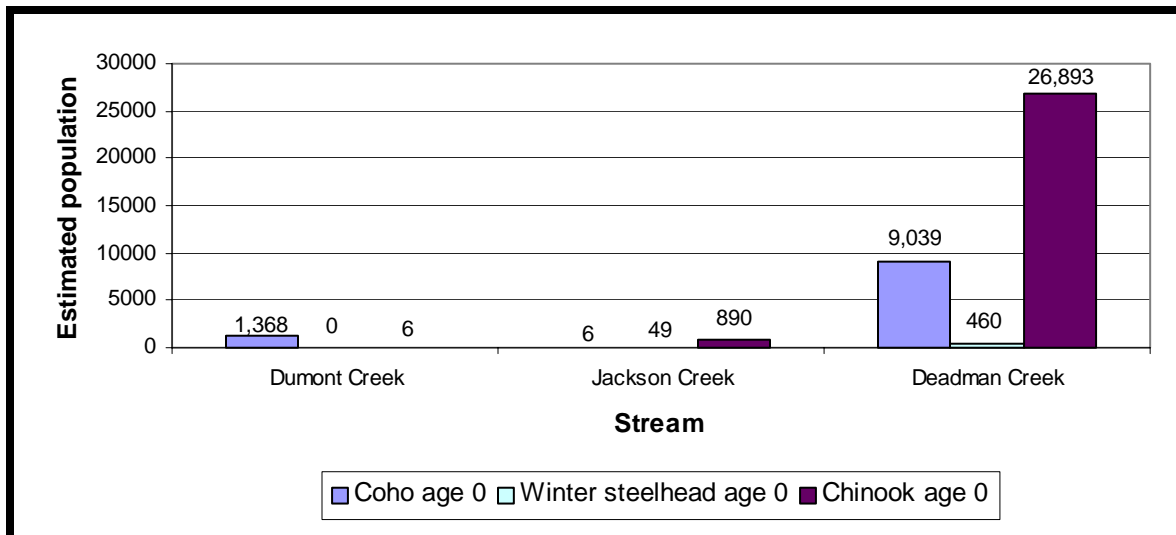


Figure 3-18: 2001 Tiller Region smolt trap data.

3.5.3. 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.

3.5.4. Fish populations key findings and action recommendations

Fish populations key findings

- The anadromous fish species in the Tiller Region are coho, steelhead, spring chinook, and Pacific lamprey. Cutthroat are the only resident salmonid. Although many Tiller Region medium and large tributaries are within the distribution of one or more salmonid species, salmonid ranges have not been verified for each tributary.
- Smallmouth bass have been reported in the South Umpqua River above the Tiller Ranger Station during the summer. Winter stream temperatures prevent these fish from establishing permanent populations in the region.
- Spring chinook populations, which dropped to very low levels during the 1970s and 1980s, have increased.
- More quantitative data are needed to evaluate salmonid abundance and the distribution and abundance of non-salmonid fish in the Tiller Region.
- 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 Tiller Region, especially at the local level.
- Encourage landowner and resident participation in fish monitoring activities.
- 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 Tiller Region.

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 perspectives⁸⁹

4.2.1. Agricultural landowners⁹⁰

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.⁹¹ Only 2% of the Tiller Region is zoned for agriculture (see Map 1-9), and most agricultural lands are privately held and located near the mouth of the river.⁹² 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 water quality activities are limited time, limited money, and in many cases low awareness or understanding of restoration project requirements, benefits, and funding opportunities.

⁸⁹ 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.

⁹⁰ 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.

⁹¹ There are people who raise pigs, dairy cows, horses, llamas, and other animals, but few are commercial operators.

⁹² Many farmers and ranchers are also forestland owners (see section 4.2.2).

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.⁹³ 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 can 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 documented killing and maiming livestock.⁹⁴ Prior to the 1960s, the US Department of

⁹³ Tansy ragwort is less common today than ten years ago due to the introduction of successful biological control methods.

⁹⁴ 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.

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.⁹⁵ 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.⁹⁶ 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.⁹⁷

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

⁹⁵ Cougar populations have been increasing since protection laws were passed in the 1960s. Coyote, fox, bobcat, and other predator populations appear to be stable.

⁹⁶ The topography of the Umpqua Basin makes this area undesirable to large agricultural conglomerates.

⁹⁷ 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.

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.

4.2.2. Family forestland owners⁹⁸

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. In the Tiller Region, approximately 3% of the land base is non-industrial private forestlands. Family forestlands most likely constitute a slightly smaller percent of the private non-industrial forests.

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-

⁹⁸ 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).

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

Changing markets

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.⁹⁹ 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 do most family forestland owners. Other family forestlands have been converted to urban and residential development to accommodate population growth.

⁹⁹ 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.

4.2.3. Industrial timber companies¹⁰⁰

Most industrial timberlands are located in areas that favor Douglas-fir, which tend to be hillsides and higher elevations.¹⁰¹ 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 Tiller Region, industrial timber companies own 21.4% of the region's 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.¹⁰² 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 and are 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.

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

¹⁰⁰ 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.

¹⁰¹ Hillsides and higher elevations are often a checkerboard ownership of Bureau of Land Management administered lands (see section 4.2.4) and industrial timberlands.

¹⁰² 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.

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.

4.2.4. The Bureau of Land Management¹⁰³

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

¹⁰³ 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.

Douglas County.¹⁰⁴ In the Tiller Region, the BLM administers lands in the Deadman Creek and Dompier Creek areas (see Map 4-1).

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 1995.¹⁰⁵ The plan outlines the on-going resource management goals and objectives for lands administered by the BLM. All of the BLM's activities are guided by the resource management plan, and this assessment 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:

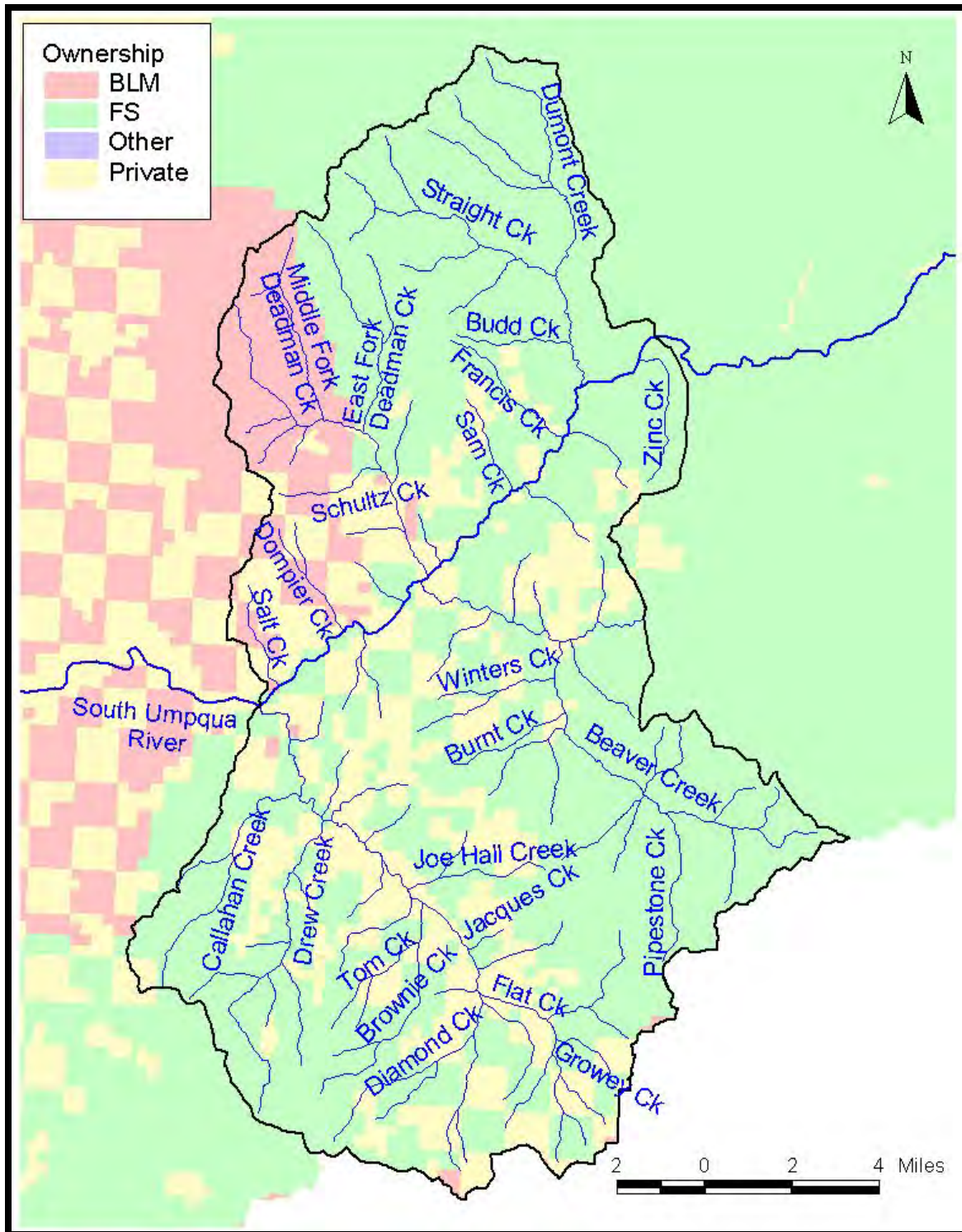
Ecosystem management involves the use of ecological, economic, social, and managerial principals to ensure the sustained condition of the whole. Ecosystem management emphasizes the complete ecosystem instead of individual components and looks at sustainable systems and products that people want and need. 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 Bureau of Land Management through activities such as watershed restoration and protecting riparian areas.

¹⁰⁴ Including 1,717 acres of non-federal land with federal subsurface mineral estate administered by the BLM.

¹⁰⁵ For copies of this document, contact the Bureau of Land Management Roseburg District Office at 777 Northwest Garden Valley Road, Roseburg, Oregon 97470.



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.¹⁰⁶

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.¹⁰⁷ 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.¹⁰⁸ 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.

¹⁰⁶ For specific information about land use allocations and management, see the BLM Roseburg District's Resource Management Plan.

¹⁰⁷ Copies of the Roseburg District BLM's Annual Program Summary and Monitoring Report from fiscal year 2001 are available through the Roseburg District Office.

¹⁰⁸ 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.

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).¹⁰⁹ 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).
- 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.

4.2.5. The Forest Service¹¹⁰

In the Tiller Region, all USDA Forest Service lands are part of the Umpqua National Forest. The Umpqua National Forest (UNF) administers approximately 75% of the Tiller Region land base (see Map 4-1 on page 149). An overview of the UNF's management plans, and specific activities within the Tiller Region, are provided below.

¹⁰⁹ See footnote 18 on page 45 for more information on O&C lands.

¹¹⁰ Information in this section is from Jeff Dose, Forest Fish Biologist for the Umpqua National Forest, and from the Forest's August, 2000 Watershed Business Restoration Plan.

Watershed restoration in the Umpqua National Forest

In August, 2000, the UNF developed its Watershed Restoration Business Plan (Umpqua National Forest, 2000). This plan establishes the UNF's goals and proposes a 10-year, \$40 million budget for restoring the diversity of forest and stream habitats within six watersheds. Two of the watersheds are Middle South Umpqua-Dumont Creek and Jackson Creek, which are partially within the Tiller Region. The purpose of the plan is to "[provide] a vision of what the Umpqua's landscape will look like and a description of what is needed to restore the Forest to that vision." Within the plan, the Umpqua Basin Vision is described as follows:

The Umpqua Basin maintains a balance between human and ecological needs. Basin residents and visitors benefit from clean water, diverse native species, and pleasant outdoor experiences in the headwaters of the Umpqua. Commodity and non-commodity forest users are full partners in realizing their respective benefits from the watersheds. The residents of Douglas County, the Umpqua Basin Watershed Council, and the Umpqua National Forest restoration program provide the vision, leadership, and resources necessary to improve watershed health and foster stewardship (p. iii).

According to the business plan, the UNF has six goals for restoration in the six identified watersheds:

1. To establish a forest resilient to disturbance;
2. To have diverse stream habitats and functioning stream processes that sustain healthy native fish populations;
3. To diversify and sustain economic activities over time;
4. To make watershed restoration a collaborative process and a shared responsibility;
5. To cooperatively design, fund, implement, and monitor restoration using goals, objectives, and performance measures; and
6. To sustain the quality of life for present and future generations.

The Middle South Umpqua-Dumont Creek and Jackson Creek Watersheds are identified as the second and third highest priority watersheds for restoration in the business plan. Within these watersheds, the Dumont Creek, Boulder Creek, and Beaver Creek drainages are restoration focus areas. However, work is not limited to these stream systems; in 2004-2005, a large culvert replacement project is planned on Francis Creek.

The Watershed Restoration Business Plan identifies current challenges to restoring the six watersheds. Timber harvests, road densities, and loss of large wood in streams have altered aquatic, riparian, and terrestrial habitats. Forest diversity is low because of a shortage of optimal old growth habitat and managed forests of similar age classes. Past logging practices have damaged forest soils, and fire exclusion has resulted in increased fuel build-up, dense forest stands, and loss of meadows. As a result, the UNF estimates that it will cost between \$300 and \$400 million to address these concerns forest-wide.

For the Middle South Umpqua-Dumont Creek and Jackson Creek Watersheds, the UNF identifies additional restoration challenges. In both watersheds, there are perceived conflicts between timber harvest activities and the protection/restoration of species and their habitats. Intermingled private lands and BLM lands make restoration challenging in both watersheds. In Jackson Creek, the valley bottom road is one of the highest priority roads for decommissioning or relocation due to its high impact to fish habitat quality, yet it is also a popular access route to the UNF. Finally, there is strong interest in maintaining access to Cow Creek Band of the Umpqua Tribe of Indians traditional use areas in the Jackson Creek Watershed.

Although the Watershed Restoration Business Plan identifies six priority watersheds for restoration, some restoration activities are done routinely throughout the UNF. Old or undersized culverts are replaced during road maintenance.¹¹¹ Unnecessary roads are decommissioned, especially where doing so will improve watershed health. Road decommissioning may become more common; lack of funds makes it very difficult for the UNF to adequately maintain its extensive road system.

Other Umpqua National Forest management issues

Land acquisitions

In Oregon and Washington, between \$10 and \$20 million are allocated to the US Forest Service (USFS) for land exchanges or acquisitions. The UNF actively pursues land exchanges that will improve watershed and fish habitat conditions. In the Tiller Region, the UNF is interested in obtaining privately held land in the lower reaches of Beaver Creek, a tributary to lower Jackson Creek. Beaver Creek has one of the few viable runs of wild coho in the South Umpqua River sub-basin, and the UNF is interested in managing the Beaver Creek drainage for this species. However, any land acquisition will depend upon the willingness of current private landowners to sell or exchange land with the UNF.

Timber management

In the Tiller Region, most UNF land is designated as either Matrix Areas (MA) or Late Successional Reserves (LSR) (see section 4.2.4 for more information about these federal designations). UNF land in Dumont Creek is all LSR, while the Elk Creek, Deadman Creek, and Lower Jackson Creek areas are MA. At this time, the UNF has no plans for timber harvests in these areas.

The UNF's timber management goals focus on increasing species diversity and maintaining the ecological integrity of the forest and stream systems. Therefore, any timber harvests are regenerated with mixed species. In newly planted units, pests, grass, and brush are controlled using manual techniques, such as mulch mats, instead of spraying herbicides or insecticides.

¹¹¹ The UNF recently completed a two-year inventory of potential fish passage barriers on its lands. This study indicates that there are few fish passage barriers remaining on the UNF.

Fire management

The fires of 2002 have made fuel reduction and fire control important topics for the UNF. Currently, the UNF does not receive much funding for fuel control activities. In Oregon, most fuel control funds are allocated to eastside forests, which have more lands that display a frequent, low intensity fire regime, and which have experienced better long-term success with fuel reduction. The UNF does not promote a “let burn” policy for fire management. Every reasonable effort is made to extinguish fires on UNF land.

Education and outreach

The UNF annually funds public education and outreach activities. These activities include participating in public events such as River Appreciation Day, the Douglas County Fair, giving presentations in public schools, and lecturing at colleges and universities. In most cases, what educational message is presented is determined by the needs of the “client.”

In 1992, the UNF initiated a program to educate the public on the widespread problem of poaching over-summering adult spring chinook in the South Umpqua River and summer steelhead in Steamboat and Canton Creeks. At that time, up to 40% of South Umpqua River spring chinook in the UNF were illegally harvested. The UNF partnered with the Oregon State Police, ODFW, and other organizations to simultaneously educate the public about the poaching problem and to apprehend offenders. The program has been very successful; due to increased public involvement in reporting poachers, fish poaching throughout the Umpqua Basin has been greatly reduced.

The future of the UNF

Like the BLM, the 1994 Northwest Forest Plan guides the activities of the UNF. The future of the UNF is therefore dictated by political changes that impact the Northwest Forest Plan. Current events, such as the August, 2003, settlement agreement of the American Forest Resource Council lawsuit, may result in greater timber harvesting on public lands. However, it is highly unlikely that the UNF will ever harvest timber at the same levels it has historically. Post-World War II harvest levels on federal lands were mostly due to insufficient timber supplies on private lands to satisfy the demand for new housing. Currently, private industrial and private non-industrial timber supplies in the Pacific Northwest and Southeast US, as well as foreign timber supplies, are able to fulfill the US lumber demand. Plus, there are very few mills that will accept large-diameter logs, which historically was the bulk of the harvest. It is most likely that in the future, the UNF’s management activities will focus on restoring and maintaining ecological functions, with less emphasis on supplying merchantable timber. Additionally, future merchantable harvests will likely consist primarily of small diameter logs from thinning existing plantations.

4.2.6. Oregon Department of Environmental Quality¹¹²

The Oregon Department of Environmental Quality (ODEQ) plays an important and unique role in fish habitat and water quality restoration. ODEQ’s primary responsibility

¹¹² The following information is primarily from an interview with Paul Heberling, a water quality specialist for the Oregon Department of Environmental Quality in Roseburg.

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 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.¹¹³ Table 4-1 shows by parameter the number of Umpqua Basin streams failing to meet water quality standards.

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
<i>E. coli</i> 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 Cutoff Road, as well as Cow Creek at the mouth, Calapooya Creek at Umpqua, and the North Umpqua at Garden Valley Road, are listed as sites that have shown significant improvement. From these

¹¹³ See section 3.3.1 for 303(d) listed streams in the Tiller Region.

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 Chapter Three 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 Tiller Region. 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.

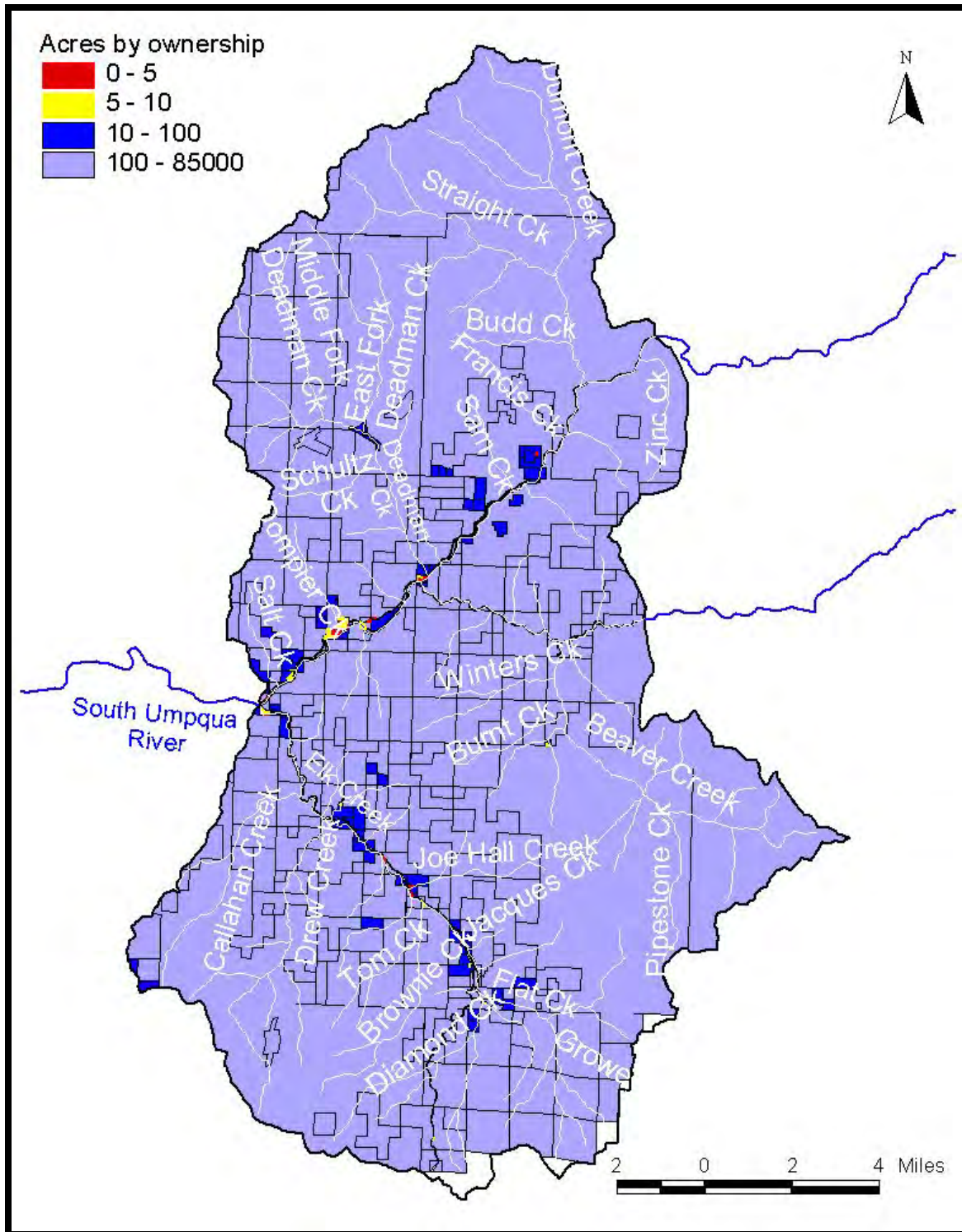
Key Questions

- Where are potential project location sites and activities in the Tiller Region?
- 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 Tiller Region. Unlike Map 1-11 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 Tiller Region are good candidates for large-scale stream habitat restoration projects because they mostly run through large ownerships.



Map 5-1: Ownership size by acre for the Tiller Region.

5.2. Tiller Region 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 region, and different enhancement opportunities exist.
- Most streams within the Tiller Region 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 indicate that poor large woody material levels limit salmonid habitat in Dumont Creek, Straight Creek, Dompier Creek, and mainstem Deadman Creek. Poor riparian areas limit habitat in most of the Deadman Creek drainage. Poor riffles limit salmonid habitat in three-fourths of surveyed streams.

Stream connectivity key findings

- Culverts may reduce stream connectivity, affecting anadromous and resident fish productivity in the Tiller Region. More information about fish passage barriers will be available from UBFAT in 2003.

Channel modification key findings

- There have been very few permitted channel modification activities in the Tiller Region.
- 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, collect gravel and increase the amount of large woody material in stream channels 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.¹¹⁴
- 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.

¹¹⁴ Thirty feet is the maximum stream width for which instream log and boulder placement projects are permitted.

- 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

- Human management activities, including timber harvesting and fire suppression, have altered riparian zone conditions from their natural state. Evidence suggests that riparian zones in managed forests are predominantly young, single-story stands. This may affect riparian zone functions such as stream shading and nutrient uptake.

Wetlands key findings

- Over 75% of the wetlands in the Tiller Region are found on public land and are managed by USFS or BLM.
- There is a congregation of palustrine wetlands found near a spring off Drew Creek, around Drew Lake, and near the Threehorn Campground area off the Tiller-Trail Highway.
- Some of the wetlands that have been historically “enhanced” for recreational fishing have been targeted for restoration to their previous condition. However, the ability to actively manage these wetlands or restore them is contingent on competitive funding. Public agencies are willing to develop partnerships for funding, expertise, or volunteer labor to begin the process of restoration.

Riparian zones and wetlands action recommendations

- Use ground surveys and, when available, digital aerial photographs to identify streams and stream reaches with narrow or simplified riparian zones, poor vegetation composition, or insufficient shade. Take the following action where appropriate:
 - Along poorly shaded streams or streams with narrow riparian zones, encourage wide buffers of native trees (preferably conifers) and/or shrubs, depending upon local conditions. Priority areas are fish-bearing streams which more than 50% canopy cover is possible.
 - Where brush and blackberry are present, convert these areas to native trees (preferably conifers) and/or shrubs, depending on local conditions.
- Identify or establish various peer-related demonstration projects as opportunities to educate stakeholders. A restoration demonstration project on public land might be well received by local residents because of the high percentage of public land in the region.
- Establish an approachable “one-stop shop” or clearinghouse to assist landowners in enrolling in programs that can benefit wetlands and meet landowner goals.

5.2.3. Water quality

Temperature key findings

- Eight out of 10 Tiller Region temperature monitoring sites has seven-day moving average maximum temperatures frequently exceeding the 64°F standard during the summer study period. High stream temperatures would limit salmonid rearing in these reaches.

- Warmer sites often lack shade. Increasing shade on small and medium-sized streams may improve overall stream temperature.
- 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 Tiller Region, pH levels do not meet water quality standards in Jackson Creek and the South Umpqua River. Dissolved oxygen levels are within ODEQ's water quality standards. Nutrient levels meet OWEB's recommended levels. It is unknown if these parameters limit water quality in any tributaries.
- Bacteria have only been sampled once in the Tiller Region.
- Toxics do not appear to be of concern in the Tiller Region.

Sedimentation and turbidity key findings

- In the Tiller Region, turbidity data suggest that usual turbidity levels should not affect sight-feeding fish like salmonids.
- Beaver Creek, Jackson Creek, and the South Umpqua River are all 303(d) listed for sediment. These listings are based on a 1995 US Forest Service study.
- Areas of moderate to high soil erodibility lie in the southwestern portion of the Tiller Region. The majority of the region has a high runoff potential.
- Steep to moderately steep slopes dominate the topography of the region. 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.
- There were extensive fires in the Dumont Creek draining during the summer of 2002, which may cause increased stream sediment levels. The US Forest Service plans to control sediment in Dumont Creek.

Water quality action recommendations

- Continue monitoring the Tiller Region for all water quality conditions. Increase the number of bacteria monitoring locations.
- 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.
- Maintain the Tiller Region's low nutrient levels through the following activities:
 - 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.
- Reduce chemical nutrient sources.
- Where data show that stream sediment exceed established water quality standards, identify sediment sources such as 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.
- In areas with high concentrations of group C or D hydrologic soils, encourage landowners to identify the specific soil types on their property and include soils information in their land management plans.
- Identify landslide-sensitive and disturbed areas using aerial photography and, when available, the refined debris flow hazard data from Nature of the Northwest in Portland.
- Educate landowners about water quality concerns and potential improvement methods, such as controlling road runoff from improper drainage, to control erosion in sensitive areas of the Tiller Region.

5.2.4. Water quantity

Water availability and water rights by use key findings

- In the Tiller Region, instream water rights exceed natural streamflow during the summer and early fall.
- Throughout the Umpqua Basin, there is no water available for new water rights from “natural” streamflow during the summer
- The “fish” category is the largest use of water in the Tiller Region, distantly followed by “irrigation.”

Streamflow and flood potential key findings

- During the summer months, the South Umpqua River’s flow can drop to less than 50 cfs, Jackson Creek can drop below 30 cfs, and Elk Creek can drop below one cfs.
- No flooding trends can be determined from the records to date.
- The degree to which road density and the TSZ influence flood potential in the Tiller Region is unknown at this time.

Water quantity action recommendations

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

5.2.5. Fish populations

Fish populations key findings

- The anadromous fish species in the Tiller Region are coho, steelhead, spring chinook, and Pacific lamprey. Cutthroat are the only resident salmonid. Although many Tiller Region medium and large tributaries are within the distribution of one or more salmonid species, salmonid ranges have not been verified for each tributary.
- Smallmouth bass have been reported in the South Umpqua River above the Tiller Ranger Station during the summer. Winter stream temperatures prevent these fish from establishing permanent populations in the region.
- Spring chinook populations, which dropped to very low levels during the 1970s and 1980s, have increased.
- More quantitative data are needed to evaluate salmonid abundance and the distribution and abundance of non-salmonid fish in the Tiller Region.
- 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 Tiller Region, especially at the local level.
- Encourage landowner and resident participation in fish monitoring activities.
- Encourage landowner participation in activities that improve freshwater salmonid habitat conditions.

5.3. *Specific UBWC enhancement opportunities*

The Tiller Region is predominantly federal land with a very small population of resident landowners. As such, the Tiller Region has been a low priority for UBWC watershed improvement projects. Results of this assessment suggest that lower Deadman Creek, Elk Creek, and the mainstem South Umpqua River have the greatest potential for UBWC restoration activities. Listed below are some watershed enhancement opportunities within the Tiller Region. These recommendations are based on the assessment findings as well as the professional experience of UBWC and ODFW staff members.

1. Work with interested landowners on a case-by-case basis to on the following project types:
 - Improve instream fish habitat in areas with good riparian zones and an active channel that is less than 30 feet; and
 - Enhance and/or protect riparian zones and wetlands to improve wildlife habitat, fish habitat, and water quality conditions.
2. Distribute information to landowners about ways of improving or maintaining riparian and instream conditions, such as the benefits of riparian fencing.

3. 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.
4. 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.
5. Enlist landowner participation to remove fish passage barriers as identified.
6. Educate policy makers about the obstacles preventing greater landowner participation in voluntary fish habitat and water quality improvement methods.

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Appendix 1: Additional geologic information¹¹⁶

Geologic history

Overview of plate tectonics

The geologic history of southwestern Oregon is dominated by plate tectonics. The crust of the earth is a thin veneer of solid rock material that rides on partially molten rocks (the mantle) beneath it that flow as a result of convection heat cycles caused by the radiation of heat from the core of the earth. The crust is composed of continental crust and oceanic crust. Continental crust is relatively lighter than oceanic crust due to its mineralogical characteristics, and thus floats higher on the mantle relative to oceanic crust, resulting in its position above sea level. The crust is broken up into plates, and these plates can move apart, collide, or shear against one another at their borders (Press and Siever, 1994). As one could imagine, the movement of such large plates of earth often results in many local-scale complexities that are difficult to understand without an appreciation for the large-scale processes. Geologic processes that occur at the boundaries of crustal plates result in certain characteristic geologic formation types. At colliding boundaries like that along the northwest coast of the United States, geologic processes result in the rise of coastal mountains, the formation of a volcanic chain approximately 100 miles inland, and accretion of islands to the edge of the continent (Alt and Hyndman, 2001; see glossary for definitions of terms). These processes result in a varied landscape and an often highly deformed and sometimes confounding set of rock formations. The geologic story of the Umpqua Basin follows the plot of a typical collision of the ocean floor with a continent, with its own unique elements.

Setting the stage for continental collision

In the late Triassic and early Jurassic (see Appendix table I for relative geologic time scale), the North American continent started moving westward across the earth, and in doing so, collided with the oceanic crust underlying the Pacific Ocean. 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

¹¹⁶ 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.

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 Tiller Region sedimentary rocks and a chunk of oceanic crust of Jurassic age were incorporated in the landscape. Younger marine sedimentary rocks of Jurassic/Cretaceous age were later accreted onto the edge of the continent and now lie in a part of the Tiller Region. 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).

Coast Range history

The Coast Range began with a core of volcanic rocks that had likely formed as a volcanic island chain, and then collided with the continent. The accretion of these volcanics with North America added about a 50-mile width of land to the continent, and created a forearc basin between the volcanic chain and the continent that received vast amounts of sediment deposited in a marine setting during the Eocene and Oligocene epochs. Ash from the forming Cascades to the east was also deposited in the basin. The subduction of the ocean floor beneath the continent was displaced westward, where a new trench was created after the old one was abandoned; this new trench is the modern trench in which the floor of the ocean is currently subducting beneath the continent. In the Miocene, the sea retreated and the coastal mountains uplifted, as a large thickness of lighter sediments had accumulated (Orr and Orr, 2000). In the Tiller Region, most of the geologic units are marine rocks formed by deposition in the forearc basin.

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 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
Qls	Holocene and Pleistocene	Landslide and debris-flow deposits: Unstratified mixtures of fragments of adjacent bedrock. Locally includes slope wash and colluvium. May include some deposits of late Pliocene age.
Tsv	Pliocene, Miocene, upper Oligocene	Silicic vent complexes: Large rhyolitic to dacitic vent areas in the Cascade Range that commonly include multiple intrusions and much associated silicic eruptive breccia and erosional debris and some flows.
Tmv	Miocene and Oligocene	Mafic vent complexes: Intrusive plugs and dike swarms and related near-vent flows, breccias, cinders, and agglutinate of basaltic andesite, basalt, and andesite; commonly in the form of eroded piles of red, iron-stained thin flows, cinders, and agglutinate cut by mafic intrusions.
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 volcanoclastic 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.
Tus	Miocene and Oligocene	Sedimentary and volcanoclastic rocks: Lapilli tuff, mudflow deposits (lahars), flow breccia, and volcanic conglomerate, mostly of basaltic to dacitic composition; rare iron-stained palagonitic tuff and breccia of basaltic and andesitic composition; and ash-flow, air-fall, and water-laid tuff of dacitic to rhyolitic composition. The palagonite tuff and breccia grade laterally into peperite and into lava flows of basalt and basaltic andesite.
Tut	Miocene and Oligocene	Tuff: Welded to unwelded, mostly vitric crystal and citric ash-flow tuff of several ages. Glass in tuff locally altered to clay, zeolites, and secondary silica minerals.
Tub	Miocene and Oligocene	Basaltic lava flows: Basaltic and basaltic andesite lava flows and breccia; grades laterally into rare bedded palagonitic tuff and breccia.
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.
Tib	Pliocene, Miocene, and Oligocene	Basalt and Andesite intrusions: Sills, plugs and dikes of basaltic andesite, basalt, and andesite. Mostly represents feeders, exposed by erosion, for flows and flow breccias of units Tba and Trb. Includes a few dikes of hornblende and plagioclase porphyritic andesite, commonly altered, and aphyric basaltic andesite that probably were feeders for parts of unit Tub.
Thi	Miocene	Hypabyssal intrusive rocks: Hypabyssal, medium-grained, hornblende diorite and quartz diorite in small stocks and large dikes; includes intrusions of medium- to fine-grained gabbro and plugs and small stocks of medium-grained, holocrystalline, olivine andesite. Also includes medium-grained, commonly porphyritic biotite quartz monzonite and leucocratic granodiorite. Many of these intrusive bodies are moderately to intensely propylitized, as are wallrocks they intrude; locally, along shears, the rocks also are sericitized.
KJds	Lower Cretaceous and Upper Jurassic	Dothan Formation and related rocks: sedimentary rock: Sandstone, conglomerate, greywacke, rhythmically banded chert lenses.
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).
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 serpentinitized and sheared ultramafic rocks, mostly in shear zones. Locally, volcanic and sedimentary rocks shown separately.
mc	Paleozoic	May Creek Schist: Layered amphibolite, schist, gneiss, and quartzite. Protolith considered to be of Paleozoic age.

Jop	Upper Jurassic	Otter Point Formation of Dott (1971) and related rocks: Highly sheared greywacke, mudstone, siltstone, and shale with lenses and pods of sheared greenstone, limestone, chert, blueschist, and serpentine. Identified as mélangé by some investigators.
Jv	Jurassic	Volcanic rocks: Lava flows, flow breccia, and agglomerate 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 serpentinitized and sheared ultramafic rocks, mostly in shear zones. Locally, volcanic and sedimentary rocks shown separately.

Glossary of terms¹¹⁷

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

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.

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

Bedding: The arrangement of sedimentary rocks in layers of varying thickness and character.

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 which 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.

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."

¹¹⁷ These terms are mostly compiled from Allaby and Allaby (1999), Challinor (1978), Jackson (1997), and Orr and Orr (2000).

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.

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.

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 2 and 60 millimeters.

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

Group: Two or more formations in a stratigraphic column which 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.

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.

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.

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

Ophiolite suite: 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.

Pillow lava: A general term for those lavas displaying pillow structures (globes of lava with curved tops and "pinched" bottoms) and considered to have formed under water.

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.

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 1/16 mm and 2 mm in diameter.

Sandstone: A detrital sedimentary rock composed of grains from 1/16 mm to 2 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.

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.

Silt: Mineral particles between 4 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.

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."

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.

Volcaniclastic: Pertaining to volcanic materials formed by any process of fragmentation, dispersed by any kind of transporting agent, deposited in any environment, or mixed in any significant portion with nonvolcanic fragments.

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.

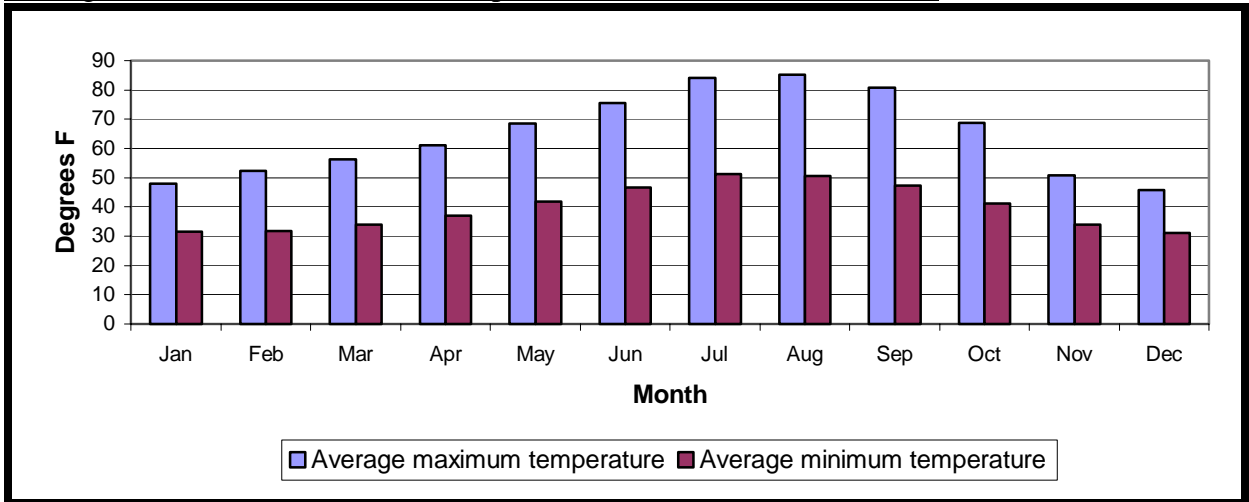
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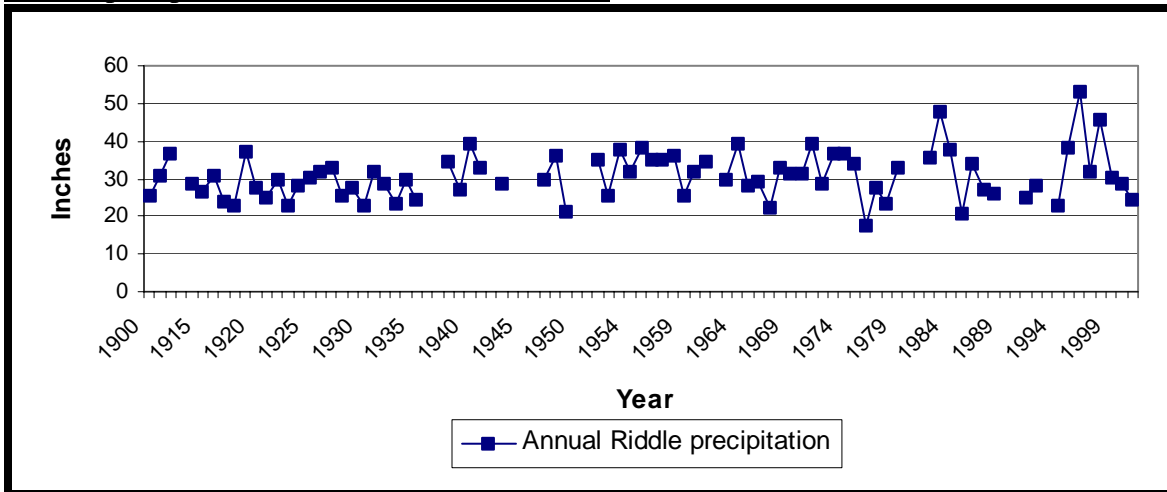
Appendix 2: Riddle climate station data

The Riddle climate station (station #7169) is the closest National Oceanographic and Atmospheric Administration (NOAA) climate station to the Tiller Region. Temperature data from this station are from 1961 through 2002. Precipitation data are from 1900 through 2001.¹¹⁸

Average minimum and maximum temperature for Riddle (station #7169)

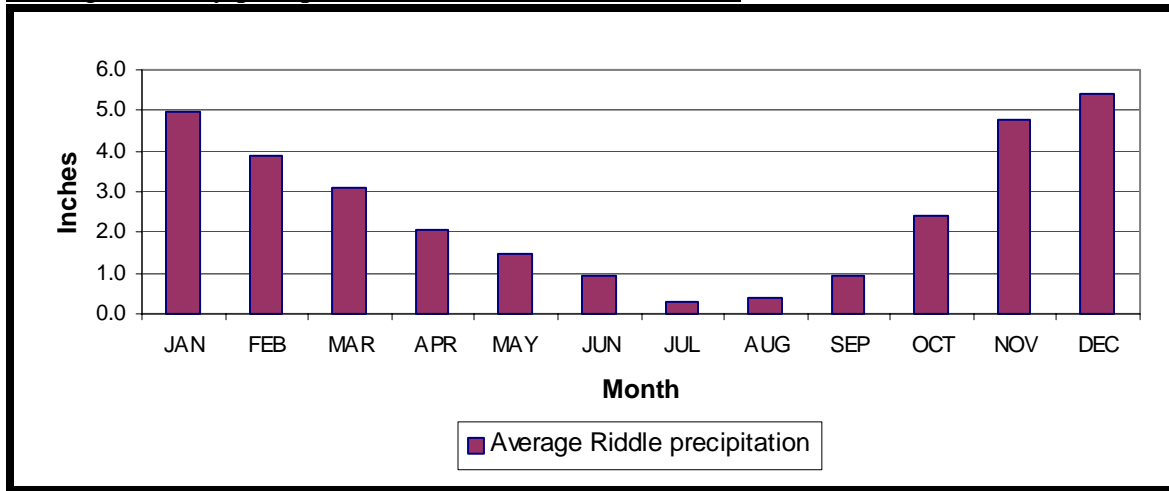


Annual precipitation for Riddle (station #7169)



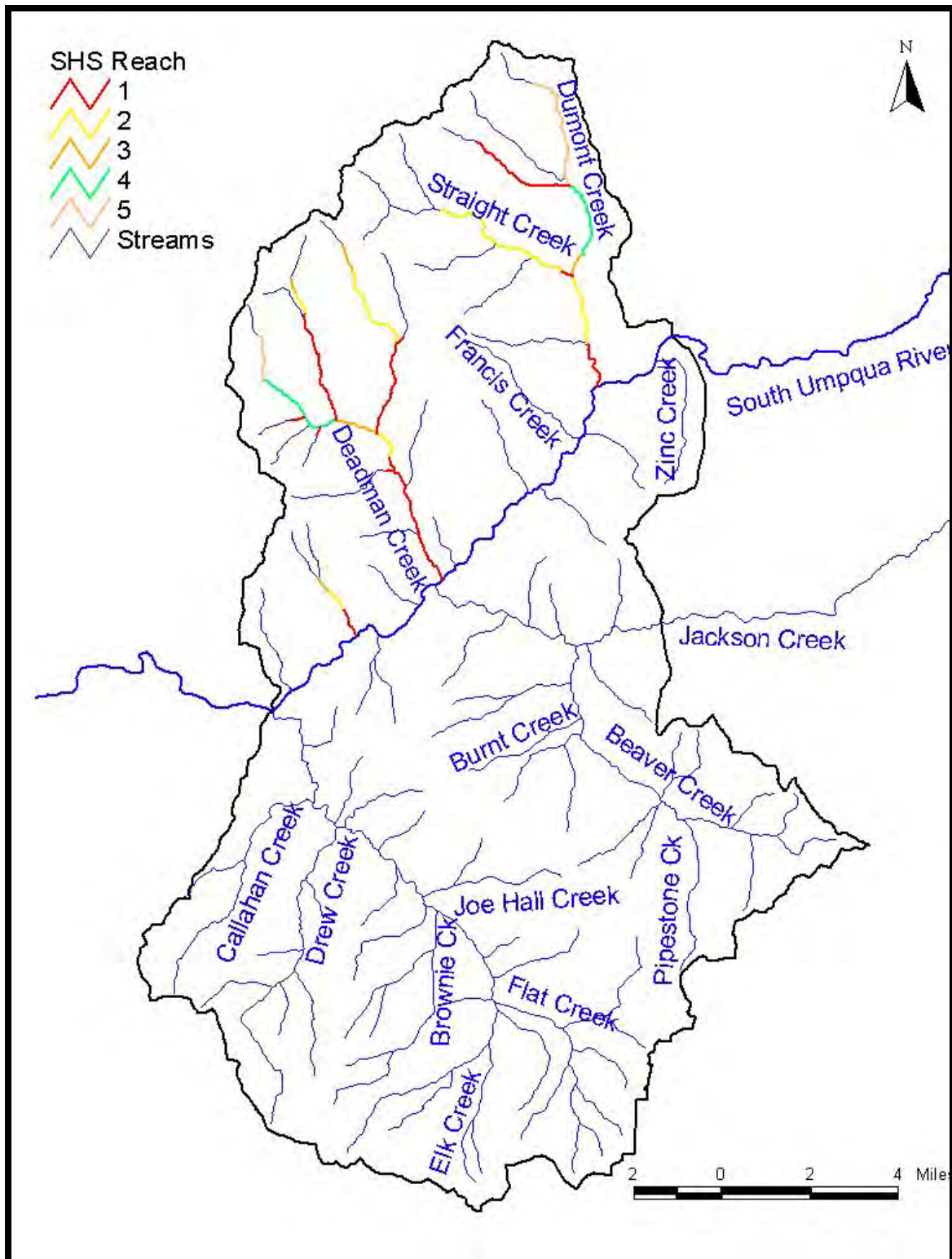
¹¹⁸Data are available from the Oregon Climate Station web site <http://ocs.oce.orst.edu/>.

Average monthly precipitation for Riddle (station #7169)



Appendix 3: Stream habitat surveys

Stream reaches surveyed by the Oregon Department of Fish and Wildlife



UBWC Tiller Region Assessment and Action Plan

Tiller Region

●●● = Good; ●● = Fair; ● = Poor

Stream	Reach	Pools	Riffles	Riparian Area	Large Woody Material
DEADMAN CREEK	1	●●●	●●	●	●
DEADMAN CREEK	2	●●●	●	●	●
DEADMAN CREEK	3	●●●	●	●	●
DEADMAN CREEK	4	●●	●	●	●●●
DEADMAN CREEK	5	●	●	●	●●●
DOMPIER CREEK	1	●	●	●●	●
DOMPIER CREEK	2	●	●	●●	●
DOMPIER CREEK	3	●●	●	●●	●
DUMONT CREEK	1	●●●	●●●	●●	●
DUMONT CREEK	2	●●●	●●●	●●	●
DUMONT CREEK	3	●●	●●●	●●	●
DUMONT CREEK	4	●●	●●●	●●	●
DUMONT CREEK	5	●●	●●●	●●	●
EAST FORK DEADMAN CREEK	1	●●	●	●	●
EAST FORK DEADMAN CREEK	2	●	●	●	●●●
EAST FORK DEADMAN CREEK	3	●	●	●●●	●●●
MIDDLE FORK DEADMAN CREEK	1	●	●	●	●●●
MIDDLE FORK DEADMAN CREEK	2	●	●	●●●	●●●
MIDDLE FORK DEADMAN CREEK	3	●	●	●	●●
SCHULTZ CREEK	1	●	●	●	●
STANLEY CREEK	1	●	●	●	●
STRAIGHT CREEK	1	●	●	●●	●
STRAIGHT CREEK	2	●●	●	●●●	●
WEST CREEK	1	●	●●	●●	●
DEADMAN CREEK TRIB #2	1	●	●	●	●●
EAST FORK DEADMAN CREEK TRIB #1	1	●	●	●●●	●●

Appendix 4: 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 Tiller Region. All categories have been included below, even those not applicable to the Tiller Region.

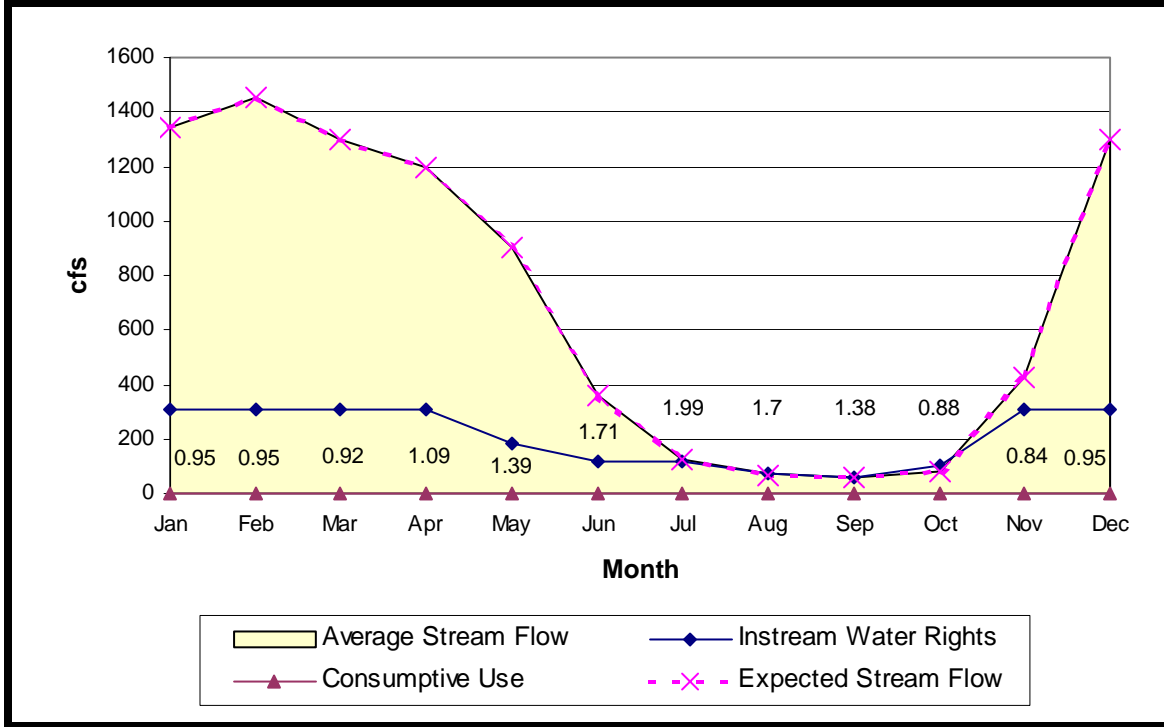
AG	Agricultural crop or dairy land.
TH	Timber harvest: active timber management including tree felling, logging, etc. Not yet replanted.
YT	Young forest trees: can range from recently planted harvest units to stands with trees up to 15 cm dbh.
ST	Second growth timber: trees 15-30 cm dbh within generally 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

UBWC Tiller Region Assessment and Action Plan

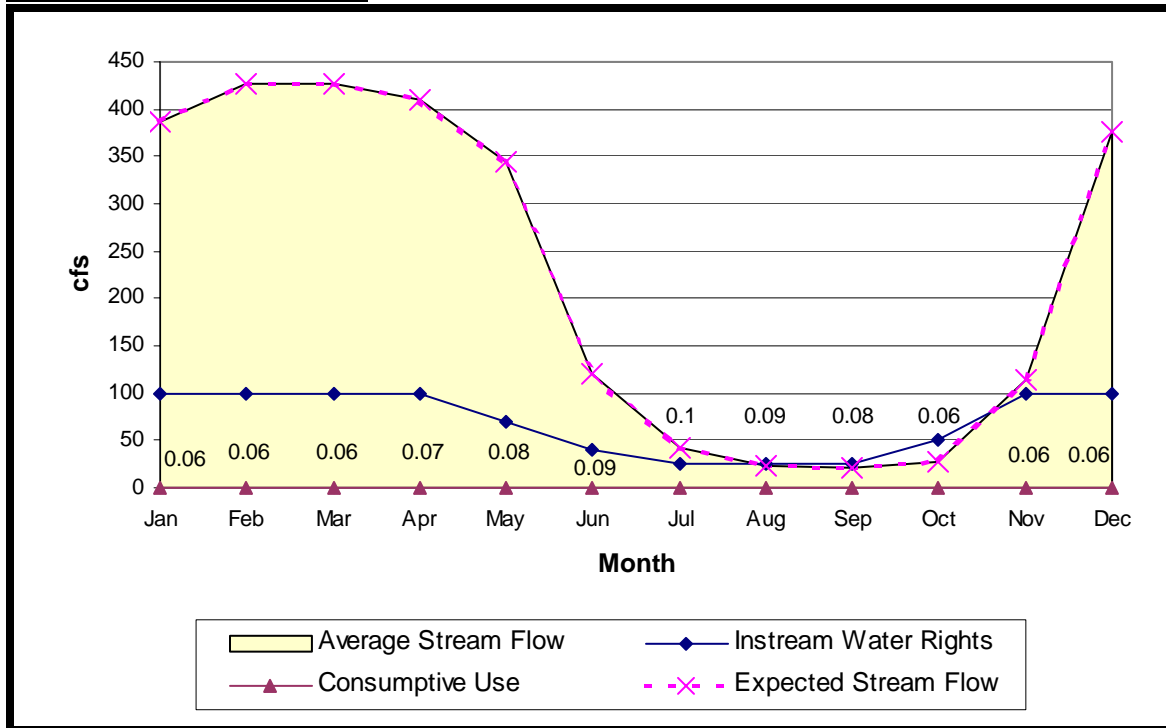
Stream	Reach	Primary Land Use	Secondary Land Use
DEADMAN CREEK	1	ST	
DEADMAN CREEK	2	RR	ST
DEADMAN CREEK	3	RR	ST
DEADMAN CREEK	4	ST	
DEADMAN CREEK	5	ST	
DOMPIER CREEK	1	LT	MT
DOMPIER CREEK	2	MT	LT
DOMPIER CREEK	3	LT	MT
DUMONT CREEK	1	LT	MT
DUMONT CREEK	2	LT	MT
DUMONT CREEK	3	LT	MT
DUMONT CREEK	4	LT	MT
DUMONT CREEK	5	LT	MT
EAST FORK DEADMAN CREEK	1	ST	
EAST FORK DEADMAN CREEK	2	ST	
EAST FORK DEADMAN CREEK	3	ST	
MIDDLE FORK DEADMAN CREEK	1	ST	OG
MIDDLE FORK DEADMAN CREEK	2	ST	TH
MIDDLE FORK DEADMAN CREEK	3	TH	
SCHULTZ CREEK	1	ST	
STANLEY CREEK	1	ST	
STRAIGHT CREEK	1	LT	ST
STRAIGHT CREEK	2	MT	YT
WEST CREEK	1	MT	YT
DEADMAN CREEK TRIB #2	1	ST	
EAST FORK DEADMAN CREEK TRIB #1	1	OG	

Appendix 5: Additional water availability graphs

South Umpqua River WAB (#31630214)



Jackson Creek WAB (#317)



Appendix 6: Water use categories

There are eight general water use categories in the Tiller Region. The table below lists the Oregon Water Resources Department uses that are included in each category. Not all uses occur in the Tiller Region.

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

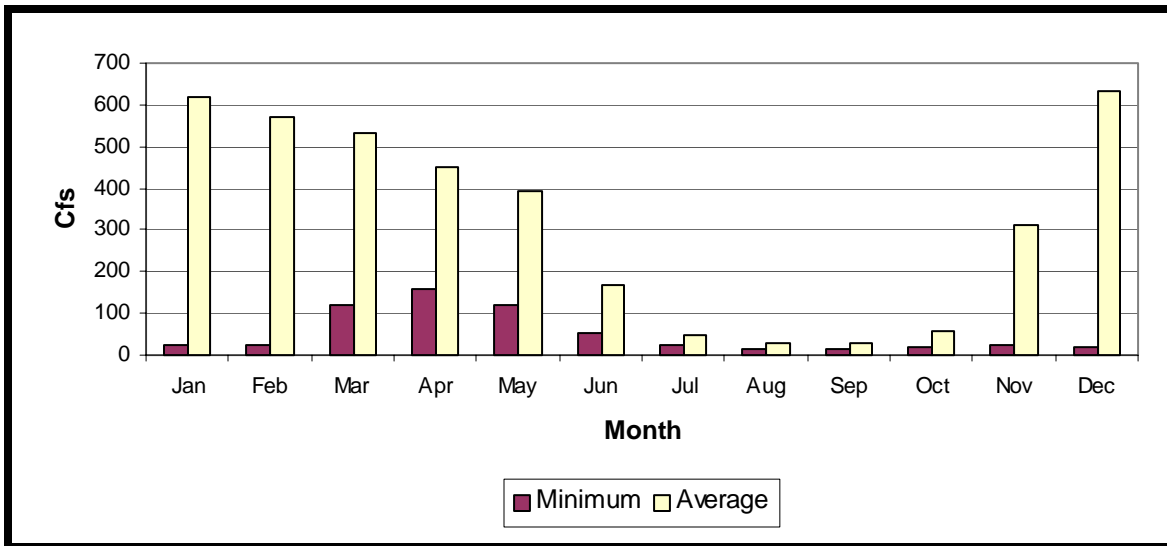
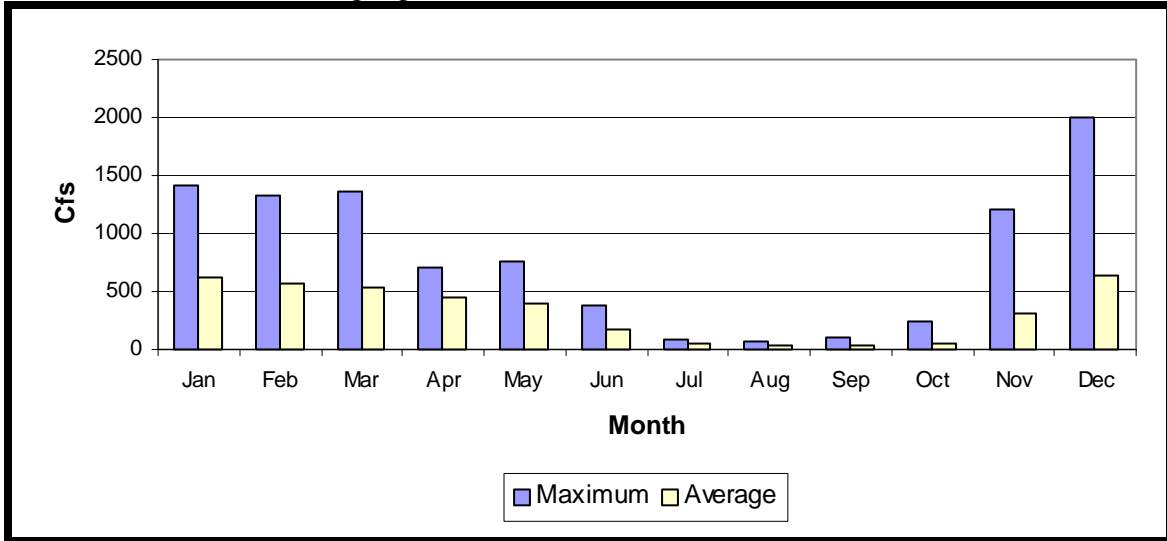
Agriculture
Cranberry harvest
Flood harvesting
All cranberry uses
Temperature control
Dairy barn
Frost protection
Greenhouse
Mint still
Nursery use

Miscellaneous

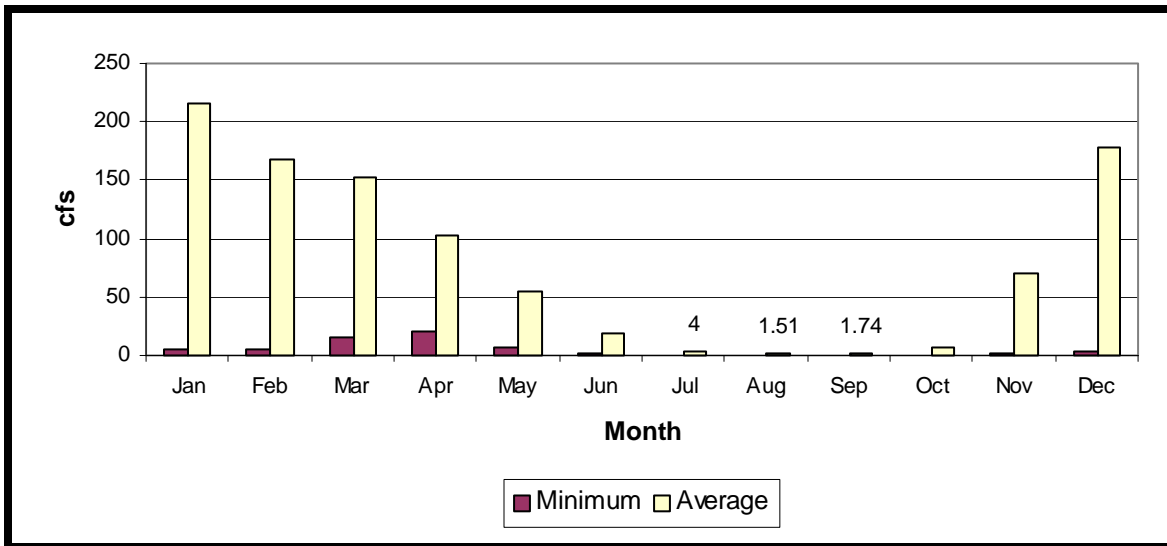
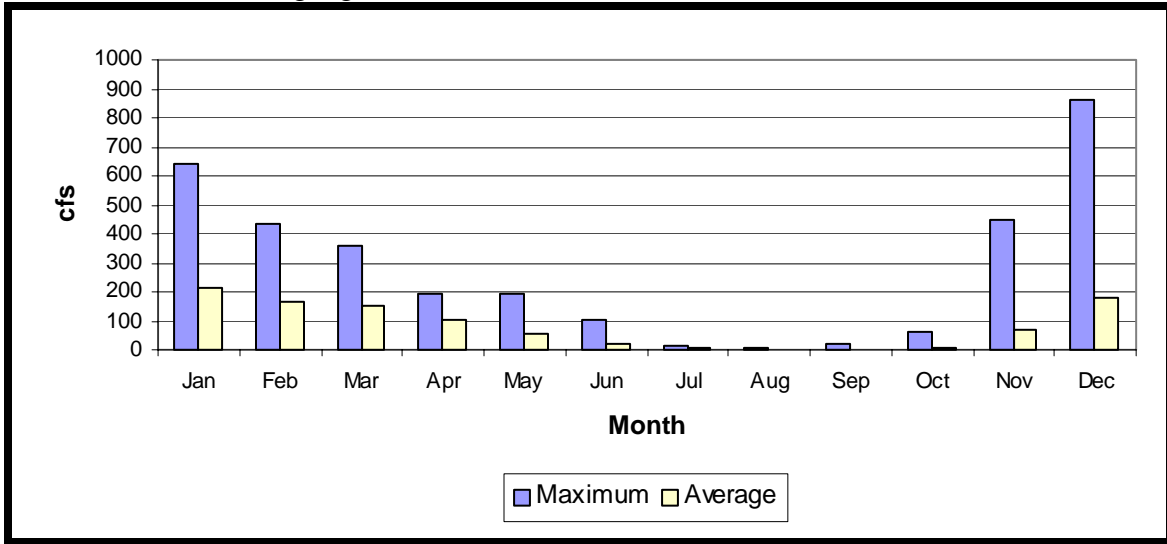
Air conditioning
Aesthetic
Forest management
Fire protection
Groundwater recharge
Pollution abatement
Road construction
Storage

Appendix 7: Elk Creek and Jackson Creek streamflow data

Jackson Creek near Tiller (gauge #1430770)

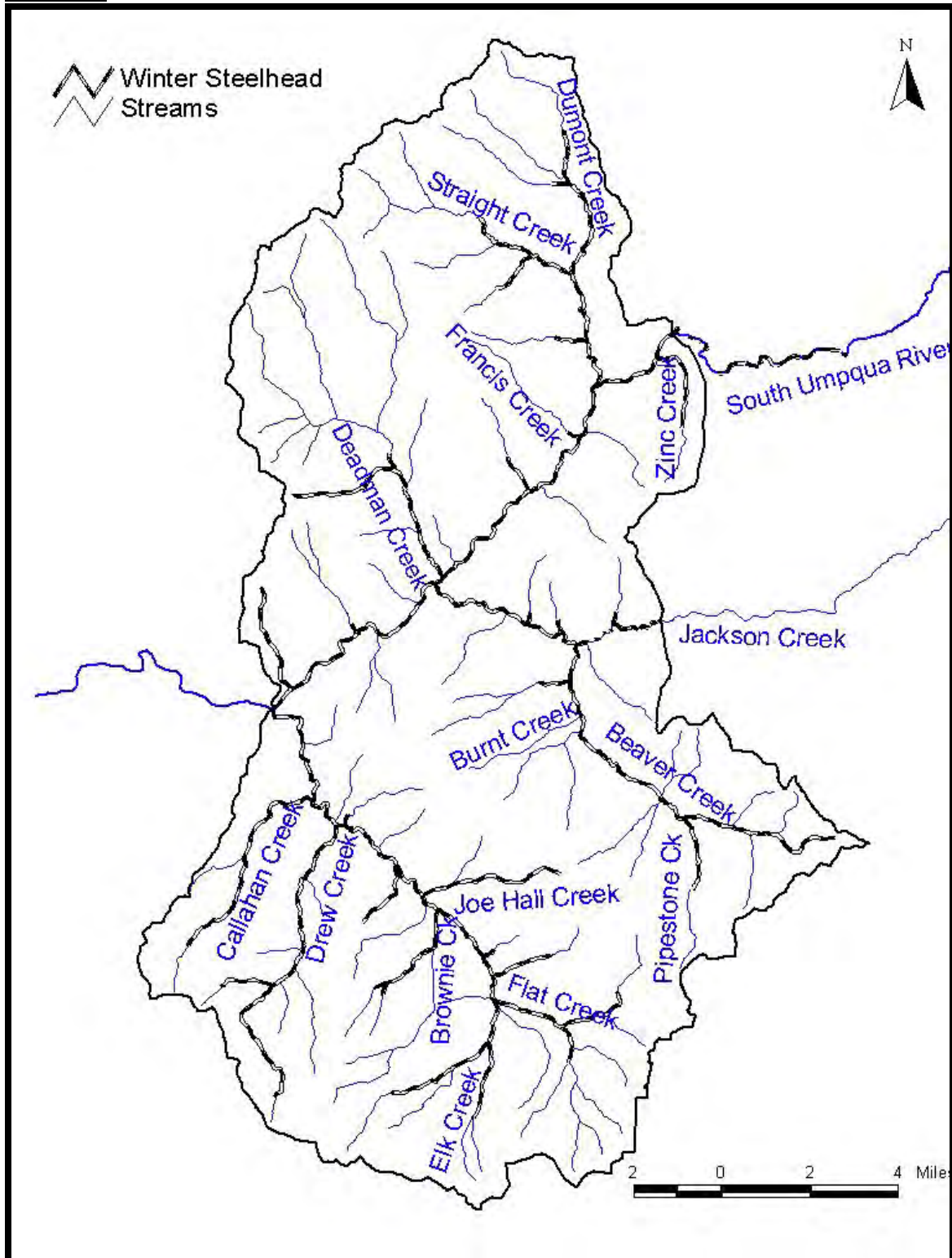


Elk Creek near Drew (gauge #14308500)

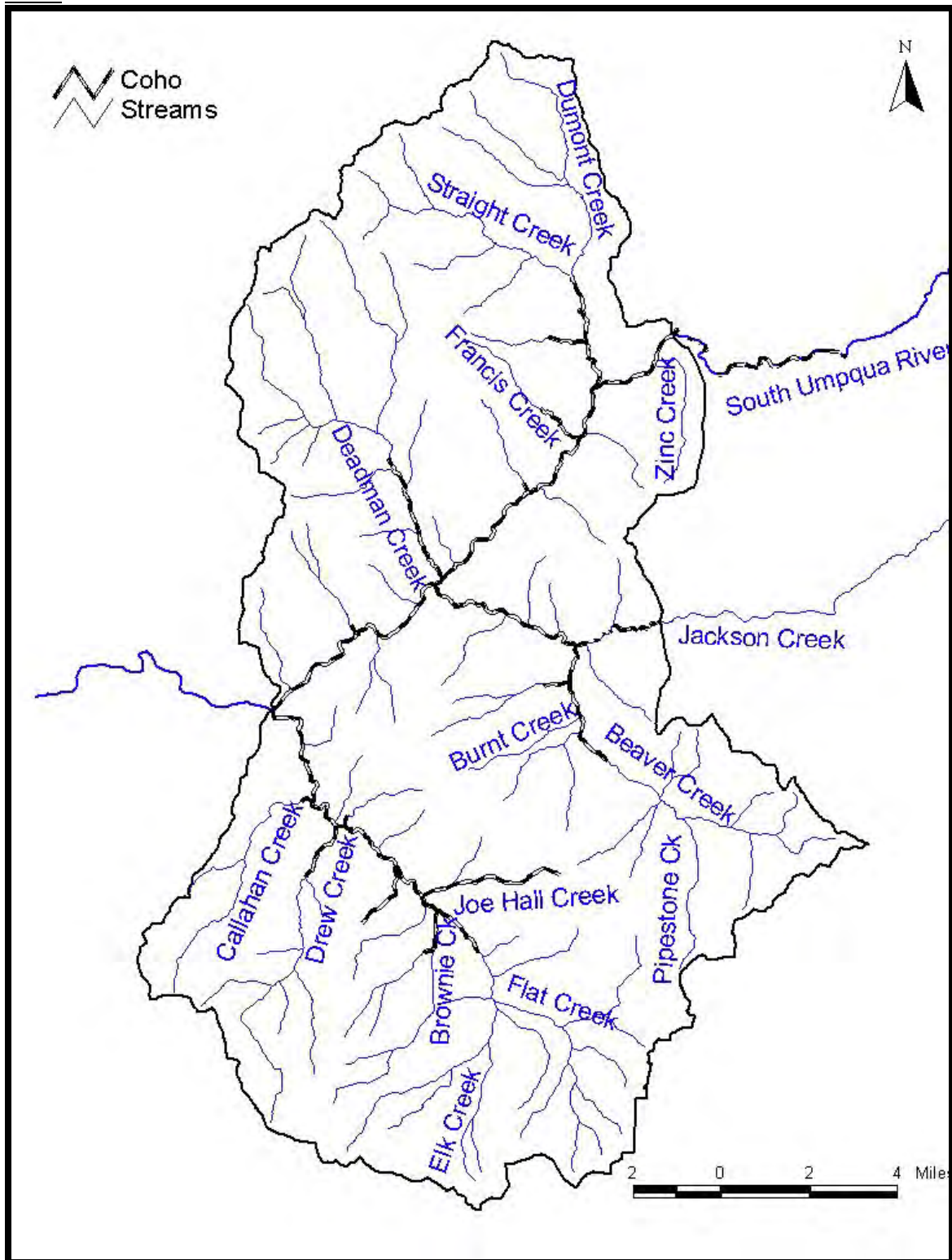


Appendix 8: Anadromous salmonid distribution by species

Steelhead



Coho



Spring chinook

