JACKSON CREEK
WATERSHED ANALYSIS

March, 1995

Tiller Ranger District
Umpqua National Forest

For further information contact:

Administrative Contact:

Roy O. Brogden, District Ranger
Tiller Ranger District

Tiller, Oregon, 97484

Technical Contact:

Bill Day, Team Leader
North Umpqua Ranger District
Glide, Oregon 97443

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Chapter 1 Introduction

The Jackson Creek watershed analysis is an effort by the Umpqua National Forest to develop and document a scientifically based understanding of conditions in the watershed. This analysis will be used as an essential reference, providing information guiding planning and management activities. It provides direction for restoration and monitoring activities and establishes geomorphically and ecologically appropriate riparian reserves. The analysis also provides a common framework for evaluating and managing upland and riparian landscapes.

Watershed Analysis

The impetus for watershed analysis was provided by the Forest Ecosystem Management Team (FEMAT), in their report, and is well documented in the Record of Decision for the President's Forest Plan. Watershed analysis is one of the 4 key components of the Aquatic Conservation Strategy, along with riparian reserves, key watersheds and watershed restoration. In fact, watershed analysis provides the basis for restoration program design, and supports the process of riparian reserves designation. The process of watershed analysis is defined in the ROD (p. E-21).

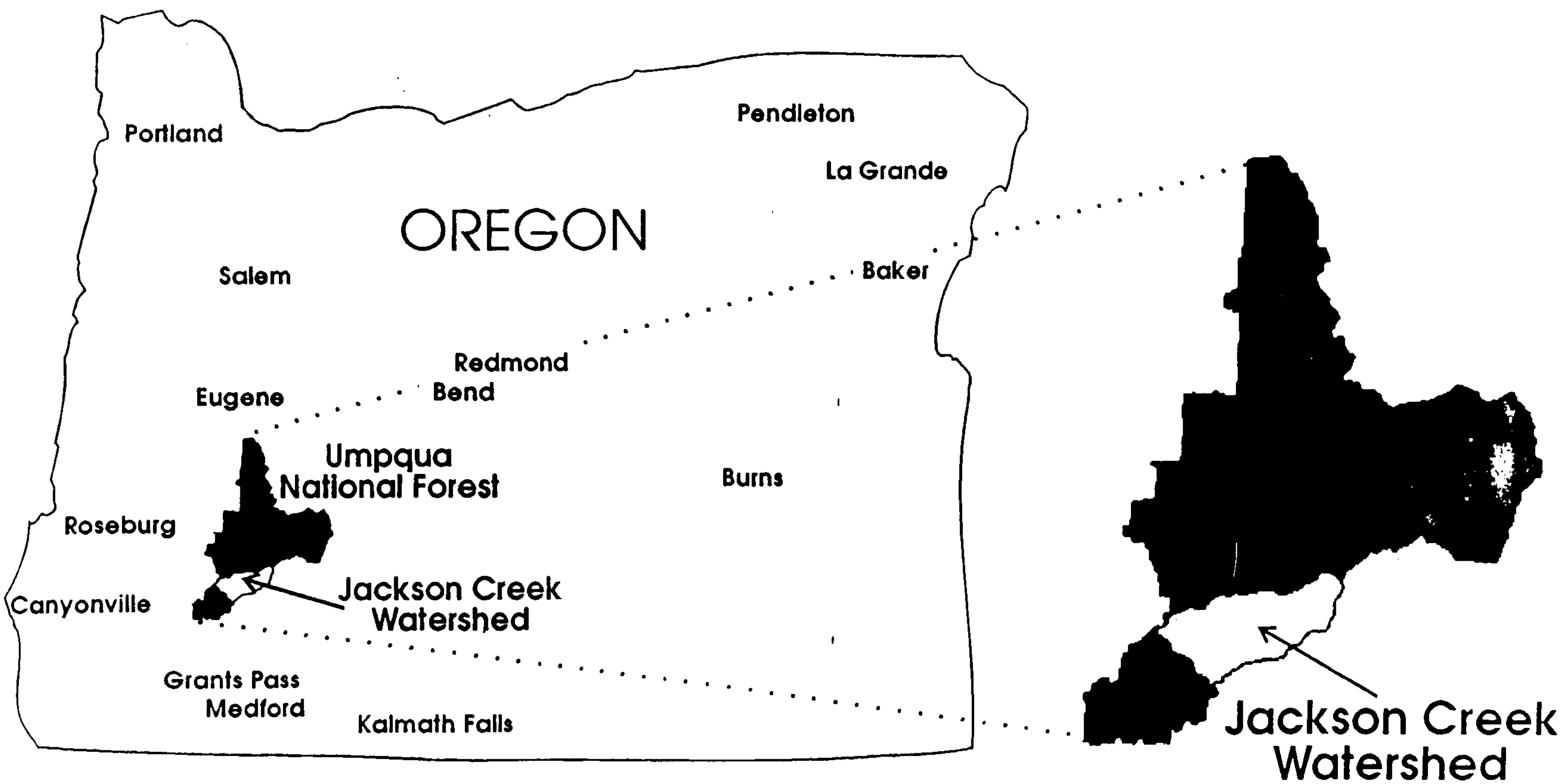
> *A technically rigorous procedure with the purpose of developing and documenting a scientifically-based understanding of the ecological structure, functions, processes and interactions occurring within a watershed.*

Watershed Setting

Location

Jackson Creek watershed is a 102,000 acre ecosystem within the upper South Umpqua River Basin in southern Douglas County, Oregon (Figure 1). It is within the Cascade Mountains and ranges in elevation from 6,295 feet at Hershberger Mountain to less than 1100 feet, at the confluence of Jackson Creek and the South Umpqua River. It is located about 3 miles upstream from the community of Tiller, and about 25 miles southeast of Roseburg. Approximately 94% of the watershed is administered by the Tiller Ranger District of the Umpqua National forest. The watershed includes the Rogue-Umpqua Divide Wilderness, the Squaw Flat Research Natural Area and the Abbot Butte Research Natural Area.

Figure 1
Umpqua National Forest
Jackson Creek Watershed Vicinity Map



Climate

Climatic variation in the basin is extreme. It is predominantly Mediterranean although maritime and temperate conditions occur as well. The drainage receives about 35 to 60 inches of precipitation annually. Of this precipitation, 90% falls between September and May. Winter snow is transitory in much of the watershed. Average annual temperatures are mild; but summers are hot with a June through August average maximum in the low 80s Fahrenheit.

Geology/Geomorphology

The Umpqua Basin is influenced by four distinct geologic terrains; the Klamath Mountains, Coastal Marine, Western Cascades and High Cascades. These terrains have resulted in the development of unique landscape patterns and ecological adaptations.

Plants and Animals

The Jackson Creek watershed is within the Sierran Steppe-Mixed Forest-Coniferous Forest-Alpine Meadow Province of the Mediterranean Division, described by Bailey et al (1994). Below about 4200 feet, it is represented by the Mixed-Conifer Zone described by Franklin and Dyrness (1973). The Abies concolor Zone describes local, high-elevation portions of the watershed. There are local occurrences of the Western Hemlock and Mixed Evergreen Zones.

Fisheries

Jackson Creek is a tier-1 key watershed by virtue of its three anadromous fish stocks considered at risk of extinction by the American Fisheries Society. Those fish stocks are coho salmon, sea-run cutthroat trout, and spring chinook salmon (Nehlsen, et. al, 1991). Winter steelhead are the most abundant anadromous salmonid in Jackson Creek and are currently undergoing a stock status review by the National Marine Fisheries Service as a subset of Pacific Coast steelhead. Resident and fluvial (migratory within river basin) cutthroat trout also inhabit Jackson Creek.

Social

Before the arrival of Euro-Americans, the Cow Creek Band of the Umpqua Tribe of Indians occupied the southern Umpqua Basin including the Jackson Creek Watershed. Explorers and trappers entered the interior of southwestern Oregon in the 1820's and through the 1840's. In 1899 Forest Rangers entered the drainage beginning fire suppression activities. A trail system connecting shelters, 12 lookouts and remote ranger stations was established beginning in 1912. Only one lookout remains in use today.

The Jackson Creek watershed was first entered for commercial timber production in the 1940's. The period of the 1960's through the 1980's was an era of extensive and intensive road construction and timber harvest activity. While the intensity of timber harvesting has declined in recent years, to date approximately 40 percent of the watershed has been harvested. During this period, timber harvest and related activities contributed substantially to local economies.

Currently, areas along the mainstem of Jackson Creek; along the Rogue-Umpqua Divide, near Huckleberry Lake; Skookum Pond; and Whisky Camp are popular dispersed camping and recreation sites. The area extending from the Huckleberry Lake/Neal Spring vicinity to the Huckleberry Gap/Quartz mountain is the setting for the annual huckleberry harvest by Cow Creek Tribal members. The Huckleberry Patch, as it is customarily called, is of religious significance to the Cow Creeks.

Chapter 2 Key Questions

The Jackson creek watershed analysis group developed a set of key questions during a series of issue-based discussions about the ecological processes and responses specific to Jackson Creek. These questions were focused on particular cause and effect relationships and often overlap and interact between ecological components. No attempt was made to develop specific answers for individual questions in this document. These questions were developed for three broad areas or systems, Aquatic, Terrestrial and Social.

Part 1 / Aquatic Systems

Aquatic Biota

What are the natural processes that shape aquatic communities?

Have human activities changed the makeup of those communities? If so, how?

What are the distributions, abundance, and population trends of highly aquatic amphibians and reptiles in the Jackson Creek watershed?

How important are these populations in Jackson Creek relative to the South Umpqua River scale?

How have human activities affected herpetofaunal populations?

What are the fish stocks at risk in the basin? What are their current population conditions?

What are the primary causes for the status of these stocks? How important is Jackson Creek for these stocks?

Aquatic Habitats

What are the existing conditions of aquatic and riparian habitats in the Jackson Creek watershed?

How have human activities, including road construction, timber harvest, and grazing affected aquatic habitats and communities?

Hillslope Processes

How have erosional and other hillslope processes affected streams and aquatic habitat?

Where will landslides and debris torrents occur in the future, and which streams, roads and other features will be affected?

Streamflow

Have floods or low flows changed in their magnitude, frequency or timing, and how has that affected aquatic habitat?

Where have any changes occurred in Jackson Creek and its tributaries, and why?

Water Quality

Has sediment, temperature or other physical or chemical quality changed in Jackson Creek streams?

Where have those changes occurred and why?

How will those changes occur in the future?

Riparian Habitat and Processes

Where has riparian vegetation changed and how has that change affected water quality, wildlife habitat and aquatic habitat?

How will riparian vegetation change in the future and how can people affect that?

Channel Shape and Aquatic Habitat

How have channel widths changed and where has it occurred?

What changes in channel shape and condition will occur in the future and how will those changes affect aquatic life?

Part 2 / Terrestrial Systems

Existing Vegetation

What is the distribution of seral stages across the Jackson Creek landscape?

What is the typical structure and composition of the seral stages occurring in the Jackson Creek watershed?

How have disturbance processes affected these conditions?

How sustainable are current conditions in Jackson Creek?

Wildlife Species

What wildlife species occur in Jackson Creek Watershed?

What is the relative abundance and distribution of wildlife species in the watershed?

What contributions does Jackson Creek make to maintenance of healthy, viable wildlife populations throughout their range?

Wildlife Habitat

What wildlife habitats occur in Jackson Creek Watershed?

What is the present condition, range of natural conditions and trend of wildlife habitats in the watershed?

How does occurrence, abundance, distribution and condition of habitats relate to past present and future trends of wildlife populations?

What are the processes affecting habitat and population conditions?

Part 3 / Social Systems

Public Use

What have been the significant human uses and activities in the watershed historically?

What type and intensity of recreation use occur in the watershed currently?

What is the current Scenic Condition, Character and Scenic Attractiveness of the watershed relative to the historic landscape?

What will future access and travel needs be for activities such as timber harvest, watershed management, recreation, wilderness, firefighting, etc.?

What hunting, fishing and trapping opportunities and trends occur?

What is the current condition of the Wilderness relative to Limits of Acceptable Change (LAC) when viewed in the context of the last 50 years and the next 20 years?

Is current recreation use in riparian reserves meeting Aquatic Conservation Strategy objectives?

Chapter 3 Relationship to Larger Scales

Geologic Features and Geomorphic Processes

Introduction

The geologic setting of the Jackson Creek watershed, relative to the larger scale of the Umpqua River Basin, is defined by the fact that the Western Cascade Geologic Province has dominated landform development in the Jackson Creek Basin. At the provincial scale, the Umpqua basin has several significant geologic terrains; Coastal, Klamath, Western Cascade and High Cascade.

The tectonic framework that produced the landforms recognized in the Umpqua Basin originated as a result of the volcanic rocks of the Cascades depositing on the marine rocks of the Coast range. Rotation of this rock assemblage occurred approximately 30 million years ago. About that time, major movement along the Canyon Mountain fault appears to have separated the northern Klamath Mountains from the southern Oregon Coast Range.

Geologic History of the Umpqua Basin

Rocks of the Klamath Mountains are much older than those in other parts of the Umpqua Basin and may contain some of the oldest formations in the state. Both volcanic and sedimentary rocks are present, as well as localized, metamorphic units. The Rogue formation is the predominant unit associated with the Klamath terrain and lies in fault contact with the Western Cascades. In addition Serpentinite is found in several locations. These Serpentinite bodies are important for a variety of economic, biologic and social factors. Granitic intrusions are also found in several areas within the Klamath province and are characterized by sandy soils and complex weathering processes. Locally important mineralized zones are associated with these intrusions.

The Coastal Province encompasses the Western portion of the Umpqua basin and a small amount is located on the Umpqua National Forest. This province consists of a complex sequence of volcanic deposits and marine sediments deposited in a tectonic embayment. The predominant rock units found in the Coastal Province are sandstone, siltstones and submarine basalt which were deposited in an ocean environment. During the Plio-Pleistocene period uplift occurred, along with changes in sea level. Subsequent to that uplift, erosional events have occurred that resulted in the drainage patterns and landforms that exist today.

The Western Cascades terrain in the Umpqua Basin is located in the eastern half of the watershed. Rocks of the Little Butte Group are in contact with the coastal assemblage along the western boundary of the Umpqua National Forest. While the origin of the Little Butte Group is subject to question, there appears to be some agreement that much of the volcaniclastic material interbedded with lava flows came from localized source areas with little marine influence (Sherrod, 1986). Overlying the Little Butte Group is a sequence of lava's, breccias and tuffs know as the Middle Miocene Volcanics (Sherrod, 1986). The rocks in the Middle Miocene are variable altered with alteration increasing with depth of burial.

Sometime after the depositional period, gradual uplift of the Western Cascades occurred. This uplift allowed erosion of the softer volcaniclastic materials to occur at a faster rate than the more resistant lava flows. As a result, downcutting of the streams occurred causing rock units to be destabilized by eroding the toe of large lava flows which overly pyroclastic layers (often rich in clay). This has resulted in the development of large earthflows, probably during the Pleistocene period. While the topographic features of these large slides are still apparent, most of them are relatively inactive.

High Cascades Geologic Province

The High Cascade rocks occupy the eastern portion of the Umpqua Basin. Three distinct types and time periods of volcanic eruptions are identifiable in the basin and are responsible for the landforms in evidence today. Shield volcanoes erupted basaltic lava's from about 7-3 million years ago and form the platform of the Cascade mountains evident today. Composite volcanoes erupted andesitic lava from about 3 million years ago and the Mazama pumice eruptions occurred approximately 6800 years ago.

The most recent geologic event that left a lasting impression on the landscape was the Pumice eruptions of Mount Mazama, which occurred approximately 6800 years ago. When Mount Mazama erupted, significant volumes of pumice as well as other volcanic material covered virtually thousands of acres of terrain in the upper Umpqua basin. In addition, both the North and South Umpqua rivers were subject to glowing avalanche (debris flows of pumice, ice and debris that flowed over ridges and down the major tributaries). Relic deposits of this water borne pumice are still evident in a variety of locations through out the basin.

Terrestrial System

Wildlife

Special habitat relationships are tied to physiographic and geologic "provinces" rather than hydrologic province boundaries. All references in this section are in relation to physiographic and geologic provinces. Jackson Creek watershed is in the southern end of the Western Cascades Province bordering the Klamath Mountain Province.

A provincial account of special habitats is lacking, limiting comparison of Jackson Creek to larger scales. A recent assessment of ecosystem health completed for Southwest Oregon in June of 1993 (USDA 1993a) did not address special habitats. Franklin and Dyrness (1973) provides a limited description of some special habitats in relation to forest zones.

A wide variety of "forest zones" are found in Jackson Creek including those found in both northwest and southwest Oregon Cascades and interior valleys. Extensions of forest and non-forest plant and animal communities from all provincial directions and the extreme northern or southern, eastern or western extent of their ranges may be found in Jackson Creek. A noteworthy example is the most southerly station known in the Cascades for the Alaska Cedar found at the head of Jackson Creek drainage. This was studied as early as the late 1800's and early 1900's. A more recent finding is the tall bugbane Cimicifuga elata which until 1992 was only known to occur as far south as the Willamette watershed. A Faunal example is the green tailed towhee, an eastern Oregon bird. Finally, an observation as a product of field sampling in this watershed analysis suggests that native bunch grass communities and oak woodlands described by Franklin and Dyrness (1973) as a part of the Umpqua/Rogue interior valley "zone" including birchleaf mountain mahogany, fescue, California oat grass, and needle grass communites occur in the watershed. These communities are important refuge and source areas since they are rare or have changed significantly in the lower valley due to agricultural practices and exotic grass introductions.

The value of special habitats in Jackson Creek on a provincial scale is in its ability to contribute to provincial biological diversity at all levels (genetic, species, communities) and to conserve rare or declining plants and animals throughout their range.

Geological Relationship to Terrestrial Habitat

The Divide:

Inclusions of high cascade province geology (approximately 2% of the watershed) influences special habitat occurrence on the Rogue/Umpqua Divide at the head of Donegan and Squaw creek. High Cascade basalt is associated with the unique Donegan Prairie area at the head of Donegan creek. This area has undergone little erosional changes over its geologic history compared to similar areas in the province. The associated plant species combinations are unusual.

The Rogue/Umpqua Divide's glacial history is also coincident with unique plant and animal communities which are uncommon or rare in the Umpqua River Basin. Glacial activity sculpted the Ridge Capping Basalts into features such as bluffs, cliffs, talus, balds, and rock gardens in association with the Rogue-Umpqua Divide. Glaciation also deposited moraines in several areas in upper Jackson Creek that are associated with wet and moist meadows and high elevation lakes (Triangle Lake, Toad Lake, etc).

The Remainder of Jackson Creek

Complex patterns of basalts, andesites and pyroclastic rocks (tuffs, breccias, and agglomerates) in the Western Cascades Province (Franklin and Dyrness 1973), influence the occurrence, composition, and structure of special habitats in the province. Franklin and Dyrness (1973), place most of the soils in the Western Cascades Province into two major groups, earthflow type which is derived from tuffs and breccias and non-earthflow type, which is derived from basalt and andesite parent materials. Earthflow types which have areas of relatively deep, poorly drained soils produce much of the wetland habitat types and may be key in maintaining certain pond breeding amphibian populations known to be declining throughout their range. An estimated 20% of the Umpqua River Basin has been mapped as landslide deposits, which could be considered a an approximation of to the earthflow terrain mapped in Jackson Creek. An estimated 40 % of Jackson Creek has been mapped as earthflow terrain.

Vegetation

Some of the plant communities identified through field sampling efforts for watershed analysis are similar to those described in the mixed conifer, western hemlock, white fir, and shasta fir "forest zones" and Umpqua/Rogue interior valley zone. Franklin and Dyrness (1973) describes a major group of non-forested communities associated with very shallow soils and warm, dry summer growing conditions. Field sampling during the Jackson Creek watershed analysis identified different species than those listed in Franklin and Dyrness (1973) and a wider variety of community types with more complex structure.

Franklin and Dyrness (1973) identifies Stipa (needle grass) grass meadows, and rock garden types as common in southwest Oregon. These are also described in Hickman (1968) for the Western Cascades Province of northern Oregon. These two meadow types were found in Jackson Creek.

Jackson Creek also has Oregon ash swamps as identified by Franklin and Dyrness. These ash swamps are characterized as having a rich diversity of species including some found only in ash swamp habitat especially some sedges. A high amount of ash swamp habitat is found in the Beaver Creek Drainage. Brushfields occur in Jackson Creek but the species composition is variable and doesn't match descriptions in Franklin and Dyrness. Vine maple talus slopes are described by Franklin and Dyrness for the western hemlock forest zone, and are found in Jackson Creek. The area around Huckleberry lake on the Rogue/Umpqua Divide, which has extensive huckleberry shrublands, fits in with a Franklin and Dyrness community description for the shasta fir zone.

Key Observations

- The occurrence and species composition of the oak woodlands and bunch grasslands in the Jackson Creek watershed which resemble community descriptions listed in the interior valley zone

- Common observation of meadow encroachment of incense cedar and other tree species in the high elevation white fir zone. This encroachment has been observed north of the Rogue Umpqua divide up to 44 degrees latitude along high ridges.

- Significant proportion of the total known provincial populations of tall bugbane, Umpqua swertia.

Aquatic System

Relation of Fish Stocks to Other Scales

Jackson Creek is a tier-1 key watershed by virtue of its three anadromous fish stocks considered at risk of extinction by the American Fisheries Society. Those fish stocks are coho salmon, sea-run cutthroat trout, and spring chinook salmon (Nehlsen, et al., 1991). Winter steelhead are the most abundant anadromous salmonid in Jackson Creek and are currently undergoing a stock status review by the National Marine Fisheries Service as a subset of Pacific Coast steelhead. Resident and fluvial (migratory within river basin) cutthroat trout also inhabit Jackson Creek.

South Umpqua River anadromous salmonid stocks are regionally unique because they live in a coastal basin but must carry out exceptionally long migrations (125- 200 miles) to reach their inland spawning grounds (Nehlsen, 1994). In addition, the extremely low summer flows and high summer water temperatures make for an exceptionally harsh environment for salmonids to endure. Salmonids living in such environments make important contributions to genetic diversity of their species. This is because harsh environmental conditions select for an unusual genetic makeup which allows these fish to be more fit to survive the harshest conditions (Lichatowich as cited by Nehlsen, 1994). Conservation of populations in such marginal habitats is one of the best ways to conserve the genetic diversity of fish species (Scudder [1989] as cited by Nehlsen [1994]).

Spring chinook salmon

Umpqua basin spring chinook salmon occur as two stocks, one in the North Umpqua River and one in the South Umpqua River. The North Umpqua population is considered healthy and stable with a 47 year average wild fish run size of 5,513 fish (Loomis and Anglin, 1992). The South Umpqua stock is considered "depressed" by Oregon Department of Fish and Wildlife with estimated escapements varying widely and ranging from 92-716 fish in the last 10 years (ODFW, unpublished data).

South Umpqua River spring chinook salmon comprise one of 55 spring or summer run chinook salmon stocks identified as "stocks at risk" in the FEIS to the Forest Plan. This stock is considered "at high risk of extinction" due to habitat damage, overharvest, and hybridization with non-native hatchery fish (Nehlsen et al., 1991). Within Oregon, the South Umpqua River is one of 11 coastal basins that support spring chinook salmon stocks (Nickelson et al., 1992). Nickelson et al. (1992) identified the South Umpqua stock as being "depressed". Depressed stocks were so designated in their report if any of the following applied: 1. available spawning habitat has generally not been fully seeded; 2. abundance trends have declined over the last 20 years; or, 3 if abundance trends in recent years have been generally below 20 year averages (Nickelson et al., 1992).

South Umpqua spring chinook are vulnerable to severe population declines and even extinction because they have a very limited range of 34-37 miles of stream habitat. All of that habitat occurs on the Umpqua National Forest (Figure 1). Jackson Creek provides 15-17 of those miles of habitat. Because of the vulnerability to extinction of this stock, the Forest has funded a four year study of the life history for spring chinook salmon in the South Umpqua basin. Much of the study focuses on Jackson Creek.

Coho Salmon

Wild coho salmon populations in the Umpqua basin make up 25-30% of the total number of wild coho on the Oregon coast (Loomis, personal communication). Umpqua coho contribute primarily to Oregon ocean fisheries with a minor contribution to northern California and southern Washington ocean fisheries.

Coho salmon in the Umpqua basin were assessed as being at moderate risk of extinction by Nehlsen et al., 1991 due to habitat degradation and hatchery influences (hatchery influence is in the North Umpqua River only). Habitat degradation is the factor creating extinction risk for coho salmon in the South Umpqua basin. Umpqua basin coho salmon have been petitioned for a threatened or endangered listing under the Endangered Species Act under two different petitions as part of the Oregon coastal stocks as well as part of the northwest coastal stocks. An initial decision on this petition is pending from the National Marine Fisheries Service.

The Oregon Department of Fish and Wildlife (ODFW) estimates that there are 972 miles of coho spawning habitat in the Umpqua basin, with 340 of those miles occurring in the South Umpqua basin. ODFW also reports an average of 10 coho spawners per mile in their surveyed reaches in the South Umpqua basin. Most South Umpqua coho spawn and rear in the Cow Creek subbasin or in lower South Umpqua tributaries which are downstream from the Umpqua National Forest. However, the Tiller Ranger District does provide spawning and rearing habitat for the most inland coho populations in the upper South Umpqua basin. Important coho streams on the district include Dumont Creek, Deadman Creek, Elk Creek, Jackson Creek, and Beaver Creek.

Of these locations, Beaver Creek and Dumont Creek have had the highest numbers of coho spawners observed (15-30 spawners per mile) since the mid 1980s.

Winter Steelhead

The National Marine Fisheries Service is currently conducting a stock status review of winter steelhead coast-wide as an offshoot of a previously filed petition for a specific steelhead stock in another river system. Winter steelhead populations in the Umpqua basin are generally considered to be stable. ODFW considers the North Umpqua River winter steelhead population to be stable but the South Umpqua stock is "suspected to be declining". The South Umpqua winter steelhead escapement is estimated to be about 4,800 individuals (Umpqua National Forest, 1992).

Cutthroat Trout

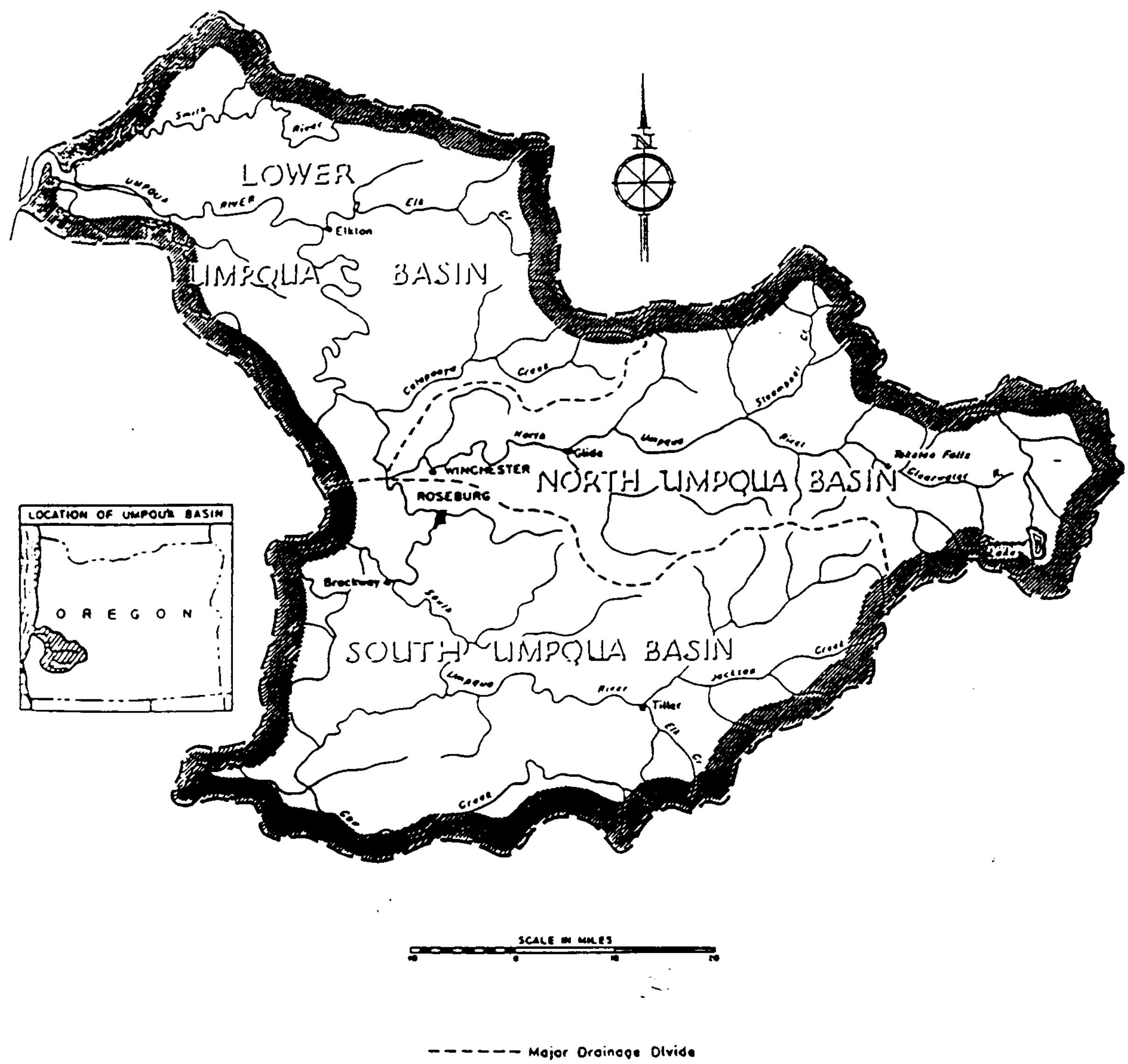
Sea-run cutthroat trout in all Oregon coastal streams are considered "at moderate risk of extinction" due to habitat damage (Nehlsen, et al., 1991). In July 1994, National Marine Fisheries Service proposed Umpqua basin cutthroat trout, including headwater resident populations as well as migratory populations, as "endangered" under the Endangered Species Act. Jackson Creek is known to support all these fish stocks, although very little is known about sea-run and fluvial populations.

Hydrologic System

Jackson Creek is a tributary draining 160 square miles of the South Fork of the Umpqua, a river that stretches from the crest of the Oregon Cascades to the Pacific Ocean (Figures 1 and 2). The North Umpqua and South Umpqua are as different as night and day. They drain roughly a quarter and a third of the 4,560 square mile Umpqua River basin, but the North Umpqua summer flow is twenty times that of the South Fork. Flows of 655 cubic feet per second (cfs) of the North Umpqua and 34 cfs from the South Umpqua join below Roseburg, and 750 cfs flow past Elkton through the Coast Range to the ocean (7-day, 20-year low flows).

Upstream, Cow Creek and the upper South Umpqua River join in the Umpqua valley between the western Cascades and the Coast Range mountains. Annual rainfall averages about 35 inches in the valley, most falling in winter, up to 100 inches at the crest of the Coast Range and 70 inches on the eastern divide between Jackson Creek and the Rogue River. Annual streamflow throughout the basin is roughly 50-60% of rainfall.

Figure 2
Main Drainages in the Umpqua Basin



Streamflow and water quality are very different in the South Umpqua than in its tributaries and the North Umpqua. In 1956, the Oregon State Game Commission said waters in the lower reaches of the South Umpqua get too low, too warm, and too polluted for young fish to thrive (Hayes and Herring, 1960). That hasn't changed. The river is called a Water Quality Limited Stream, not meeting Clean Water Act standards for dissolved oxygen, pH, and nuisance algae. Maximum water temperature in Jackson Creek reached 76° Fahrenheit (F) during the summer of 1992, increasing to 80°F six miles down the South Umpqua at Tiller, and 84°F near Roseburg. The Umpqua River near Elkton, even with lots of cooler North Umpqua water, was 81°F. Only two dams release irrigation flow to the South Umpqua, on Lookinglass Creek, built in 1980 and Cow Creek in 1985. The water quality results from 1992 reflects extra flow released from these dams, especially Cow Creek's larger Galesville Reservoir (U.S.G.S., 1993).

The earliest flow records on the South Umpqua River show that average monthly flows at the Brockway gage near Roseburg were as low as 103 cfs in August 1911, although it is not clear how much irrigation had begun by then. Upstream at Tiller, the August flow was 68 cfs but fell to a record 20 cfs on September 3. Water withdrawal from the river today may make flows lower and water warmer than it used to be, but it may always have been stressful for cold-water aquatic life. Cutting and grazing riparian vegetation, gravel mining, and snagging logs to clear the river have made it wider and shallower, with less complex habitat from its mouth to the headwaters of almost every tributary. In August of 1992, a lower flow year than 1911, the South Umpqua flow was 41 cfs below Jackson Creek and 76 cfs near Roseburg. Even with the added Galesville Dam releases from Cow Creek, low flows may last longer in the summer and run lower in non-drought years, than before the valley was settled.

During September of 1992, fish had to face a low dissolved oxygen level of 45% of saturation (the water quality standard is 90%) in the South Umpqua downstream of the sewage treatment plant at Roseburg, and pH as high as 9.5. Upstream near Tiller and in Jackson Creek, dissolved oxygen was 90% of saturation but pH of 8.6 was still higher than the water quality standard (U.S.G.S. 1994).

Although most rivers warm up and water quality declines as they flow downstream, the extreme conditions in the South Umpqua make the higher flow and water quality of its tributaries even more important. The outstanding fish, wildlife, scenery and cultural characteristics of the South Umpqua above Tiller, Jackson Creek, and Black Rock, Castle Rock and Fish Creeks upstream were found eligible for Wild and Scenic River designation in 1992 (U.S.D.A. Forest Service, 1992). The eligibility study found Jackson Creek annual floods, like the South Umpqua at Tiller, distinctly lower than other Southern Oregon Cascades tributaries. Jackson's low flow was similar to the South Umpqua and most other streams in the Cascades.

Suitability for designation as Wild and Scenic Rivers has not been determined for the South Umpqua and/or Jackson Creek. Until it has, these streams must be protected so their values aren't impaired. A Clean Water Act survey of Oregon streams in 1988 found severe nutrient and stream habitat problems in Jackson Creek and the South Umpqua, like many other western Cascade streams.

Although cooler than the South Umpqua downstream, Jackson Creek is the largest and warmest tributary of the river above Tiller. The Wild and Scenic eligibility study found a 9-year average summer maximum water temperature of 72°F in Jackson Creek, compared to 75°F in the South Umpqua above Tiller and 75°F in Steamboat Creek, a stream of similar size on the North Umpqua. A summer water quality survey of Jackson Creek in 1994 found pH values exceeding 9. That reading was among the highest found in Little River, and the North and South Umpqua Rivers , and may signal stressful habitat in streams that didn't exist prior to channel widening and shade removal.

Social System

Recreation Use

The primary factors determining the pattern of recreation use in Jackson Creek are: the proximity of the watershed to Roseburg, Grants Pass and Medford, its location near the southern entrance to the Umpqua Forest, and the topography of the watershed (few flat places near water).

Other key factors influencing recreation use in Jackson Creek are:

- few developed recreation sites
- transitional snow levels
- access to wilderness trail heads
- low visual sensitivity management direction in Forest Plan
- relatively low elevation for a longer season of use
- climatic relief from summer valley temperatures
- extensive roaded access
- traditional/generational use
- other management such as the anadromous fishing closure in Jackson Creek

Over 150,000 people live within a 2 hour drive of Jackson Creek. The South Umpqua River Subbasin receives periodic intense recreation use and a portion of that use occurs in Jackson Creek.

Chapter 4 Past and Current Condition

Geologic Features and Geomorphic Processes

Geology

The geology of the Jackson Creek basin is predominantly associated with rock units of the Western Cascades, generally consisting of a complex mixture of volcanic and sedimentary units. Individual units range from isolated deposits to large continuos expanses.

Following the deposition of these rock units, the Western Cascades were severely eroded and, on the eastern end of the Jackson Creek drainage, buried under younger High Cascade deposits that include ash and pyroclastic volcanics. Recent glacial, alluvial and landslide deposits are found throughout the basin in localized deposits.

Jackson Creek contains a wide variety of rock units, which have contributed to the diverse landforms and geomorphic terrain's in evidence today. By far the most predominant rock unit mapped in the basin is the Tu unit (61%). Appendix A gives a description of the geologic unit codes. There appears to be a correlation with the Tu deposits on the western side of the Jackson Creek basin associated with the Little Butte Volcanic Group (Sherrod, 1986). This rock complex tends to be associated with the development of large, presently dormant, landslide complexes which developed sometime after deposition. The erosion that occurred during the Pleistocene period was probably responsible for a number of these complexes. An area to the south and east of Squaw Creek is also mapped as Tu, but it appears that this rock unit is associated with rocks known as the Middle Miocene Volcanics (Figure 3). This unit contains a higher percentage of resistant rocks such as basalt's, andesites and tuffs. There is little evidence of large slide complexes developing in the Middle Miocene Volcanics.

Several other rock units in Jackson Creek are identified as part of both the Little Butte and Middle Miocene Volcanics. These additional units include Tus, a conglomeration of volcanics and Tut, an ash-flow tuff deposit that occurs in a series of banded rock units which range from very soft to extremely hard.

Figure 3
Geology of Jackson Creek Watershed

Basaltic rocks in Jackson Creek are identified in two distinct areas in the Tub mapping unit and total 20% of the total rock mass in the basin. The largest concentrations are identified in the lower reaches of Jackson Creek and on the eastern side of Beaver Creek. The basalt's in this area are considered part of the Little Butte Group and are identified as Tub in the geologic mapping. In addition, another unit of basalt (Tub) is associated with the Rogue-Umpqua Divide Wilderness Area, the upper reaches of Jackson Creek, and Lonewoman Creek. This unit has some unique features associated with it. This basalt is considered to be part of the Ridge-Capping Basalt that is significantly younger than those associated with the Western Cascades rock unit (Sherrod, 1986). It has been dated in several areas as 3-8 million years old, while the rest of the Western Cascades is dated between 35 and 17 million years old. These ridge-capping basalt's tend to be very homogeneous and very resistant to erosive forces, which, combined with their relatively young age result in prominent peaks and bluffs. These rocky features provide a number of unique habitats discussed in terrestrial sections of the document.

A third basaltic unit (Qtba) is associated with the High Cascade geologic terrain and is a thick accumulation of basalt, andesite, and occasional flow breccias. This unit forms a series of gentle ridges and benches in the headwaters of Donegan Creek and Squaw Creek. With the exception of glacial processes, little erosion has occurred in this unit relative to the rest of the High Cascade terrain. Although this unit only comprises 2% of the rock units in Jackson Creek, there are indications that this basalt unit is very important to the hydrologic regime in the basin and, therefore, the aquatic biota as well. Donegan Creek contributes 1/3 of Jackson Creeks 12 cfs August flow, 1994. Although 1994 was an extremely low flow year, the drainage area of Donegan Creek, 7 square miles, is 1/9 the basin and it would be expected to contribute a significant percentage of summer flow on yearly basis. This phenomenon is also influencing summer water temperatures in Sqauw Creek , up to 10° cooler than Jackson Creek. This relatively high water yield from small areas is consistent with uniform basalt deposits in the High Cascades.

In addition to the rock units identified above, several other geologic units have played an important role in the development of the basin. Specifically, the secondary igneous features such as sills, dikes and vent complexes that developed sometime after deposition of the primary rock units. A series of basaltic sills, plugs and dikes (Tib) represent a series of shallow igneous events that injected molten rock into the older surrounding rock mass. This molten rock, cooled slower and resulted in more resistant material that tended to be left as erosional remnants, even though the mineralogy is quite similar to the surrounding rock. In addition, the injection of molten material and other liquids under extreme heat and pressure allowed alteration of the host rock to varying degrees. The Tib unit is found throughout the Western Cascade rocks. A number of unique habitats associated with these rock units, commonly know as rock meadows, are in a number locations and these areas have been delineated as unsuitable.

Several areas of Jackson Creek have localized intrusions of diorite and quartz diorite, found as small stocks and large dikes. In some instances they also result in localized shear zones adjacent to the intrusions. These units are mapped as Thi and are found in Crooked Creek, Paradise Creek and upper Squaw Creek.

The headwaters area of Saboo Creek in the upper end of the basin is predominantly mapped as Tsv, a silicic vent complex that includes a number of localized intrusions. This complex contains medium to coarse grained "granitic" type of material. This area has erosion characteristics similar to granitic terrain.

Table 1 represents the Geology of Jackson Creek from Walker and Macleod (1991) as taken from the Umpqua National Forest GIS files. Although some effort was made to verify the main geologic contacts, little effort was made to refine the mapping units.

			GEOLOGIC UNITS (ACRES)									
W.A.A.	ACRES	QLS	Tu	Tus	Tub	Tib	Tmv	Tut	Thi	Tsv	QTba	Qls
05A	4385	2792	3415	0	919	1	50	0	0	0	0	0
05B	3937	3827	723	2106	1108	0	0	0	0	0	0	0
05C	6154	6074	2799	1052	9	640	0	794	0	28	0	832
05D	4109	1555	2303	0	0	36	0	0	0	877	0	893
05E	3741	3031	2053	0	1188	0	0	0	0	500	0	0
05F	5089	78	3414	0	1675	0	0	0	0	0	0	0
05G	5169	0	4052	0	1037	80	0	0	0	0	0	0
05H	3052	0	2889	0	0	163	0	0	0	0	0	0
05I	4905	4	4254	0	0	182	0	0	349	0	0	120
05J	5043	806	4432	0	0	24	0	0	497	0	0	90
05K	6820	0	5634	0	0	347	0	0	345	0	494	0
05L	3275	475	2889	0	139	42	0	0	205	0	0	0
05M	6085	6033	3807	0	1867	398	0	0	13	0	0	0
05N	2943	2735	1384	0	906	653	0	0	0	0	0	0
05O	5141	298	291	0	3960	890	0	0	0	0	0	0
05P	3478	1836	954	0	2275	249	0	0	0	0	0	0
05Q	4826	183	3129	0	1482	215	0	0	0	0	0	0
05R	3237	21	2078	0	82	17	0	3	1057	0	0	0
05S	3970	1803	3036	0	0	451	0	364	100	0	0	19
05T	4029	2771	1924	0	29	359	0	344	0	0	0	1373
05U	2916	2787	2878	0	8	30	0	0	0	0	0	0
05V	2438	580	2121	0	0	233	0	84	0	0	0	0
05W	3133	3027	0	53	3021	0	59	0	0	0	0	0
05X	4357	4	2369	0	603	0	0	0	8	0	1377	0
TOTALS		40720	62828	3211	20308	5010	109	1589	2574	1405	1871	3327

Table 1. Geology of Jackson Creek. Major drainages of each Watershed Analysis Areas (WAA) are located in Appendix B.

Geomorphic Processes

A succession of processes and events have shaped the character of landforms and associated ecologic communities in the Jackson Creek drainage. The basic properties of the rock have contributed to the development of the drainage system that exist in Jackson Creek. Subsequent events associated with Plate Tectonics and changes in global climatology have shaped the topographic features in evidence today.

Jackson Creek has a number of geologic controls that have determined the development of the channel that exists today. Differential weathering processes have allowed Jackson Creek to develop a channel gradient that's connected with the erosional rates of the surrounding rocks. The western section of the creek (up to about river mile 11) has gradients below 2%. This rather gentle gradient appears to be associated with the older Little Butte Volcanic rocks, along with a number of large slide complexes that have encroached on Jackson Creek (Table 2).

Earthflow Terrain In Jackson Creek by Slope Class						
WAA	ACRES	Q1	Q2	Q3	TOTAL	%
		0-30%	30-60%	>60%	Ols	AREA
A	4464	1441.67	1214.04	134.3	2790.01	62.5%
B	3940	2368.36	1371.52	81.51	3821.39	97.0%
C	6160	3371.81	2497.59	190.48	6059.88	98.4%
D	4110	669.58	701.44	182.18	1553.2	37.8%
E	3740	1070.5	1624.8	332.99	3028.29	81.0%
F	5090	49.69	28.64	1.92	80.25	1.6%
G	5170	0	0	0	0	0.0%
H	3050	0	0	0	0	0.0%
I	4910	23.85	47.16	1.19	72.2	1.5%
J	5040	464.6	331.38	12.92	808.9	16.0%
K	6820	0	0	0	0	0.0%
L	3275	265.4	195.76	14.97	476.13	14.5%
M	6085	2354.32	3096.38	579.05	6029.75	99.1%
N	2440	1294.58	1246.75	195.44	2736.77	112.2%
O	5140	26.46	225.51	50.28	302.25	5.9%
P	3480	338.74	1243.24	254.21	1836.19	52.8%
Q	4830	73.35	75.01	34.34	182.7	3.8%
R	3240	6.46	14.67	0	21.13	0.7%
S	3970	1311.77	672.39	8.78	1992.94	50.2%
T	4030	2534.3	983.85	200.56	3718.71	92.3%
U	2920	2257.31	495.24	28.88	2781.43	95.3%
V	2440	219.67	302.41	55.77	577.85	23.7%
W	3130	1339.04	1295.53	387.08	3021.65	96.5%
X	4360	3.16	1.89	0	5.05	0.1%
Total	101834	21484.62	17665.2	2746.85	41896.67	41.1%

Table 2. Earthflow Terrain.

These slide complexes have allowed the development of alluvial deposits and, in some cases, elevated terrace deposits along several reaches. These slide complexes were identified and mapped from high elevation air photos and field verified, when possible (Appendix C). Within this low gradient reach, several aggraded sections of Jackson Creek occur in association with earthflow features. In particular above the mouth of Beaver Creek, a depositional reach has developed in association with an earthflow encroaching upon Jackson Creek. Information obtained from aquatic studies suggest that, under current conditions, this reach appears to be in a degraded condition. However, there appears to be some physical characteristics remaining that could encourage restoration efforts.

Jackson Creek bisects a large basalt unit from about the mouth of Beaver Creek to the junction of Squaw Creek. The channel in this reach is predominantly defined by bedrock and boulder morphology and the joint patterns in the basalt have contributed to the development of large pools. This reach is recognized for its important contribution to adult chinook holding and subsequent spawning habitat, and coho spawning and rearing habitat.

The Luck Creek Flats section of Jackson Creek is characterized by an abrupt change in direction from approximately due East to N45 East and then reverts back to the original direction several miles downstream. This structure resembles a fault zone and correlates well with a fault identified on the Walker and Mcleod (1991) map just north of Jackson Creek. It is also supported in Barnes (1978) that a predominance of the fault extensions in the Western Cascades trend NE to NNE, parallel to the structures in the adjacent Klamath mountains.

There appears to be an influential relationship between several active earthflow complexes and the identified fault zone. Several of these earthflow landslide complexes have been identified from aerial photos and field investigations (Appendix C). These slides occupy both sides of Jackson Creek and, in some areas, indicate recent activity along the toes. Sections of the Jackson Creek Road have had stability measures applied to maintain the integrity of the road. This instability could either be from the creek encroaching on the road or the road impinging on the active toe zone.

There is also a noticeable lack of older earthflow complexes associated with the Mid-Miocene Volcanics units to the south of Squaw Creek and to the east of Squaw Creek from the mouth upstream to the junction of Twomile creek.

The upper reaches of the main stem of Jackson Creek shows significant increases in stream gradient which is predictable as one progresses towards the headwaters. Several reaches along this section stand out as being atypically gentle. The reach known as Luck Creek Flats is associated with several large landslide complexes that have contributed to the development of this large aggraded reach. Specifically, these slide complexes, probably provided a considerable amount of material to this alluvial deposit, as well as acting as a damming mechanism during active slide periods.

In addition to the contribution of sediment and associated organic material, these landslide complexes appear to be playing a role in the geohydrology of this particular reach. The influence of these landslides, and possibly, the associated fault zone on both water quality and water quantity could be substantial. Preliminary measurements of stream flow in this area suggest that as much as 1/12 of the summer low flow in the basin could be emerging as subsurface flow through this reach. Observations of salmonid populations in this reach suggest that several factors including subsurface flow, increased nutrients associated with buried organic debris, and temperature could all be important in providing rearing habitat for salmonids. More information is required to determine the precise nature of the importance of the role of groundwater in the Luck Creek Flats reach.

Glaciation

In general, most of the topographic features evident in Jackson Creek have developed since the Ice Ages of the Pliestocene Period, about 2 million years ago. The erosive nature of the glacial episodes, particularly the channel forming processes left many oversteepened headwalls and side slopes marginally stable. These conditions allowed the development of the earthflow features still in evidence today. Several of these features dominate the landscape of Jackson Creek, particularly the dormant earthflow landslide complexes discussed previously.

In addition to the development of earthflow terrain, glacial erosion produced cirques and glacial moraines, particularly noticeable in the Lonewoman Creek, Falcon Creek, and Upper Jackson Creek watersheds. Several areas in the upper reaches of Lonewoman Creek, specifically Triangle Creek and Toad Creek, are associated with moraine deposits that have impoundment's behind them and provide excellent aquatic habitat for non-native species (brook trout). Surveys of the stream channels in this terrain indicate that the fine textured material along the stream banks is very vulnerable to changes in the flow regime and are very young in the development of their channel morphology.

Measurements of Triangle Creek stream flow in fall of 1994 resulted in 0.6 cfs from 0.6sq/miles, which equates to 1cfs/square mile. This extremely high summer flow suggest that there is a deep aquifer or a contribution of ground water beyond the surface expression of the drainage. I believe that these flows are associated with high storage capacity of glacial deposits.

Glaciers occupied the headwaters of most of the major tributaries in Jackson Creek, and glacial canyons are in evidence above 3000 feet in elevation. These glaciers scoured high-elevation outcrops in the headwaters of the basin and resulted in promontories, cliffs, and bluffs that provide habitat for a variety of species. This is most evident in the landscapes along the Rogue-Umpqua Divide Wilderness.

The Little Ice Age, which lasted from about 1350 to 1870 A.D., experienced winters that were colder, summers that were cooler, and precipitation that was heavier. Ecological communities that exist now were probably heavily affected during the latest period of transition. These global climatic variations also suggest that during warm dry periods, fire played an important role in the evolution of the ecosystem, while during the cool moist periods, fire was probably less influential. In Jackson Creek, this climatic regime is still evident. The north side of Jackson Creek has a dramatically different fire regime than the south side (Dahlgreen, 1995).

Siesmic Activity

The eruption of the Mount Mazama, about 6800 years ago, resulted in the removal of the upper 5000 feet of the mountain and created the Crater Lake caldera. The pumice eruption flowed down the main channel of the Rogue River, and some of the volume could not move through the system and subsequently pushed its way over the Umpqua divide and found its way down Squaw Creek (Sherrod, 1986).

While most of this deposit was transported through the system, several secondary alluvial deposits are identifiable along Jackson Creek, Beaver Creek, and the South Umpqua River. These deposits are important in identifying the amount of erosion that has occurred since these deposits were laid down. In several locations they are found well above the current 100 year flood plain, including the residential compound of the Tiller Ranger Station.

In addition to the pumice deposits, there is evidence that seismic activity accompanied the eruptions, and earthquakes occurred throughout the area. This could explain the deposits of water-borne pumice which are found as far as a mile upstream on Beaver Creek. A possible explanation for this deposition is that a seismic induced landslide downstream of Beaver Creek impounded a large volume of the pumice flow and caused the material to eddy into Beaver Creek, depositing material on older alluvial surfaces.

While there is little knowledge of historic seismic activity in the Jackson Creek basin, the High Cascade volcanoes are still considered active. Recent siesmic activity in Southern Oregon and off shore indicates that seismic activity will continue to play an active role in the development of the landscape. Erosional processes have played an important role in the development of the landforms that are found in Jackson Creek, particularly those processes that post-date the last period of glaciation. The predominant processes identified in the basin are surficial erosion and mass wasting, both of which occur in a variety of situations.

Landslides

Attempts to define the causal relationship between landslide events and human activities are limited by known dates of management events. There is some indication that 27% of the mapped slides in Jackson Creek occurred prior to the 1939 photos, at a time when the basin had few, if any ,roads and no recorded timber harvest activity (Table 3).

GIS SUMMARY OF LANDLIDES BY ROAD AND HARVEST DATA, JACKSON CREEK													
		LANDSLIDES	NATURAL		ROAD SLIDES				HARVEST SLIDES				
				%	BEFORE	%	AFTER	%	BEFORE	%	AFTER	%
WAA	Acres	TOTAL	ASSUME		ROADS	PRIOR	ROADS	AFTER	HARVEST	PRIOR	HARVEST	AFTER
A	4464	41	36	88%	1	2%	4	10%	0	0%	0	0%
B	3940	19	7	37%	3	16%	1	5%	8	42%	0	0%
C	6160	21	4	19%	5	24%	2	10%	7	33%	3	14%
D	4110	15	3	20%	4	27%	0	0%	6	40%	2	13%
E	3740	25	0	0%	6	24%	4	16%	8	32%	7	28%
F	5090	29	26	90%	2	7%	0	0%	1	3%	0	0%
G	5170	35	32	91%	1	3%	0	0%	2	6%	0	0%
H	3050	8	1	13%	3	38%	0	0%	3	38%	1	13%
I	4910	48	43	90%	2	4%	0	0%	3	6%	0	0%
J	5040	34	11	32%	3	9%	9	26%	6	18%	5	15%
K	6820	28	23	82%	2	7%	0	0%	2	7%	1	4%
L	3275	16	6	38%	6	38%	1	6%	1	6%	2	13%
M	6085	51	32	63%	8	16%	0	0%	8	16%	3	6%
N	2440	24	17	71%	1	4%	6	25%	0	0%	0	0%
O	5140	72	33	46%	2	3%	12	17%	14	19%	11	15%
P	3480	20	15	75%	5	25%	0	0%	0	0%	0	0%
Q	4830	15	2	13%	5	33%	0	0%	7	47%	1	7%
R	3240	20	3	15%	7	35%	3	15%	1	5%	6	30%
S	3970	17	9	53%	3	18%	4	24%	0	0%	1	6%
T	4030	16	7	44%	5	31%	0	0%	4	25%	0	0%
U	2920	6	4	67%	1	17%	1	17%	0	0%	0	0%
V	2440	11	5	45%	1	9%	2	18%	1	9%	2	18%
W	3130	34	29	85%	0	0%	1	3%	4	12%	0	0%
X	4360	23	12	52%	0	0%	5	22%	3	13%	3	13%
Total		628	360	57%	76	12%	56	9%	89	14%	48	8%

Table 3. Landslides.

The 1939 photos do indicate that several significant fires had occurred in the basin, notably, in Beaver Creek, Falcon Creek, and Tallow Creek. There does appear to be a relationship between landslide occurrence and the burn areas, however little direct information is available on the storm and flood patterns during that period.

A review of the 1957 photos, indicates that 53% of the mapped slides in Jackson Creek occurred during the period from 1939 to 1957 (Appendix C). During this time, the earliest timber harvest activities were commencing in the lower reaches of the basin, and approximately 70 miles of road were constructed in order to access that timber. It appears there is a causal relationship between the occurrence of 2 floods (with a ten-year recurrence interval), in December 1955 and again in December of 1956, that resulted in a large increase in the number of slides. The number of slides that were directly associated with timber management activities is uncertain. However, analysis of the available timber harvest information suggests that several WAA's had high landslide rates relative to the mean during this time period.

While earlier information indicated that 80% of the total landslides in the basin were assumed to have occurred prior to 1957, a review of the landslide information by sub-drainage identified a number of specific areas that have above average landslide frequency associated with management activities. Within WAA's C, E, J, N, O, R, V and W, at least 25% of the total landslide features postdate management actions and were assumed to be directly related to management. There appears to be a correlation between the management related landslides and stream conditions in these WAA's . Appendix V identifies trends in channel conditions as related to geology, geomorphology, and land use. Indications are that the channels in areas where landslide frequency is above average generally are in an impaired condition.

In addition, there are a number of landslides that predate management actions but are in close proximity to either roads or timber harvest. While this does not suggest that management actions caused these slides, it does suggest that activities have been implemented in areas where landslides have previously occurred. In a number of areas, these activities have taken place since 1974, and have not been tested by a major storm.

An important observation regarding the early slide history was that there was little evidence of debris flows occurring in direct association with landslide features. Undoubtedly, since historic debris flow deposits are observed throughout the basin, these slides did occur but are not visible in available aerial photography.

While the December 1964 flood is widely recognized as the storm of record (a 100 year event) in Jackson Creek, the small number of landslides identified is surprising. Seventy landslides (11% of the total inventoried) were identified during the photo interpretation and reviewed for relationships to causal mechanism. It appears that there were more slides associated with management activities, primarily timber harvest and road construction. This sequence of photos also identified a number of slides that were directly or indirectly associated with debris flows in several of the subbasins.

Debris Flows

Soil ravel is a process that occurs on localized areas throughout the basin and is associated with slope and vegetative cover. This process can be described as a steady downhill movement of soil and colluvial material collecting in localized concentrations in hollows, draws and streams. Under certain situations, as these deposits accumulate, and collect water via gravity, debris slides can result when a critical saturated thickness is reached.

The majority of stream channels (intermittent and perennial) in mountainous terrain are intermittently subjected to debris flows when channel gradients exceed about 6° (Montgomery and Buffington, 1993). Debris flows generally originate along low-order channels or in hollows steeper than 26° (Campbell, 1975). These flows typically scour high-gradient channels and aggrade the first downstream reach with a gradient low enough to allow deposition.

While the immediate effects of the debris flow are often evident, later effects of the flow may have additional influence on channel morphology and water temperature. Debris flow scour and deposition often disturb riparian vegetation and expand the canopy openings over the channel. This has the potential to alter the riparian community, reducing the potential for the recruitment of large wood. This process can also influence channel temperature by reducing channel shading.

Dam break floods are also known to scour steep alluvial channels when organic debris dams break loose during high discharge events. Failure of these debris dams releases impounded water and sediment as a large flood wave that may proliferate through the system. In Jackson Creek, a number of tributaries were subjected to debris flows, either from road related landslides or channel damming effects. In several instances the lack of large wood in the flow material appears to have greatly influenced the severity of the effect downstream. Since the woody debris is the main component in these dams under a natural setting, any increase in debris flow frequency increases the probability and impact of subsequent dam break floods (Montgomery and Buffington, 1993). This could contribute to an increase in the channel spanning debris accumulations as well the increase the volume of impounded sediment and water as documented by Lamarr, 1989 in the upper reaches of Jackson Creek.

As this debris flow material is transported, and temporarily accumulates in low gradient areas or nick points, younger colluvial deposits are incorporated from the upslope reaches. Water will continue to flow through and under this loose material and is considered subsurface perennial flow, in which a stream flows year around, but only occasionally flows in an exposed channel. With continued deposition, these reaches can become saturated during storm events and remobilize to a point downstream. In many cases, this is the initiating event of debris flows and may be significant in areas where large mass wasting events are relatively scarce.

Eight Subbasins (WAA) were affected by debris flows during the 1964 flood (Table 4) encompassing 8 miles of stream. Subsequently, the 1976 photo interpretation identified 19 additional slides in the basin and almost 12 additional miles of stream affected by debris flows. The occurrence of a 25 year event (in 1974) and a substantial extension of the road network, prior to this photo series, suggest that the debris flows associated with the 1974 storm were related to the type and amount of road construction and resulted in significant impacts in channels downstream.

	DEBRIS FLOWS	Photo Period		
WAA	Streams	66	76	88
A	Nichols, Mule, Bullock			
B	Deep Cut		2.2	
C	Ralph, Tallow, Luck, Twomile, Bean	1.7	1.4	0.7
D	Skookum Pond, Saboo			
E	Upper Jackson	0.7	0.6	0.4
F	Lonewoman			
G	Falcon			
H	Abbott	1.1	0.4	1.4
I	Cougar, Trib E, Paradise	1.5	2.3	
J	Eden, Trib D, Crooked	0.2	0.9	0.2
K	Squaw (Upper)		0.9	
L	Squaw (Lower)	0.3		0.5
M	Black Canyon	0.7	2.4	1.4
N	Soup, Whisky			
O	Mouth of Beaver, Trib C, Coffin			
P	Mouth Beaver to Switchback			
Q	Upper Beaver			
R	Pipestone	1.8		0.9
S	Three Cabin			
T	Burnt, Stampede			
U	Mouth of Beaver, Winters			
V	Mouth Jackson to Beaver			
W	Freezeout, Surveyor			
X	Donegan		0.6	
TOTALS		8	11.69	5.5

Table 4. Debris Flows in Jackson Creek.

A review of these debris flows suggest that they were resultant from debris slides, plugged stream crossings, and probably from dam-break floods that resulted in scoured channels. Based on the occurrence of debris flows associated with vegetation management, it would be safe to assume that there could be a lack of large wood in the debris slides and flows that originate from road fills and harvest units. This could result in different response in a dam break flood event.

An analysis of debris flow data developed from aerial photo information confirms that while no debris flows were recognized in the 1939 or 1957 flights, a number of channels have been measurably affected by debris flows since 1957. The 1966 flight identified 8 miles of stream in 8 different subbasins throughout Jackson Creek that were subjected to debris flows. The 1976 information identified almost 12 miles of additional stream had been subjected to debris flows in 9 WAA's. This was after the 1964 100 year storm but included the 1974 storm, a 25 year event in Jackson Creek (U.S.G.S records). The 1988 photos showed 5.5 miles of disturbed channel in 7 of the WAA's. Although this information is based on interpretation of aerial photos, there appears to be several systems that have been subject to multiple debris flows, either spatially or through time.

While statistical information was not used, there appears to be a relationship between debris flow length and earth flow terrain. This relationship suggest that the debris flows tend to travel further in non-earthflow terrain. This could be a result of lower channel gradients combined with less channel roughness in earthflow terrain. Several WAA's have been subject to debris flows in all 3 periods reviewed and include, WAA's C, E, H, J, and M. Although this study did not attempt to quantify the relationship between disturbance factors and effects, there were some specific instances that indicate that specific management activities were associated with debris flows, namely fill failures and stream crossing on roads. The aquatic section discuss the impacts of these debris flows on aquatic habitat.

Unstable Terrain

The presence of unstable and potentially unstable terrain in Jackson Creek is includes those areas currently on the Forest suitability layer, as well as those areas portrayed as QLS2EF. These are large earthflow features that show abundant evidence of localized instability in the life of the existing vegetation (FEMAT, 1994). There are two areas in Jackson Creek that are extremely active, one is Soup Creek and the other is Winters Creek. Both of these areas have had timber harvest and road construction activities occur within the unstable terrain and it appears that localized movement has increased. This is particularly evident near the stream channels and along the toe of the slide. These areas should be considered as part of the Riparian Reserves system.

Although the relationship of unstable terrain is commonly considered in a negative light, there are some benefits of unstable terrain in ecological terms. Debris filled hollows and draws can provide moisture sinks that serve as microsites for certain biota such as mountain beavers and amphibians. Talus slopes and debris slide scarps are capable of providing habitat that offers a variety of temperature and moisture condition.

Earthflows and rotational slumps often produce sag ponds or collection basins that develop riparian habitat, not necessarily connected to surface flow patterns. This terrain type also produces abundant amounts of large woody debris that is incorporated into both aquatic as well as terrestrial habitat units. Debris slides act as supply mechanisms for a wide array of particle sizes as well as organic material. These types of unstable terrain splay an important role in the development and maintenance of the Unique Habitats found in Jackson Creek.

Soils

Soils in the Jackson Creek basin like the landscape itself, are highly diverse. A simpler stratification approach was adopted to delineate soil related concerns. The predominant features in Jackson Creek have been divided into two broad geomorphic units, that include landscapes originating from ancient earthflows and landscapes that are in association with younger, volcanic materials more resistant to weathering

Earthflow Terrain

The earthflow landscapes are generally made up of fine textured soils, characterized by deep weathered profiles with heavy clay contents. The relationship of earthflows and soft pyroclastic rocks suggest that while the topography tends towards gentle to moderate slopes, the fine textured soils can have unstable tendencies. This instability is shown by the ease of weathering, due to the disrupted nature of the particles and weak matrix, differential weathering as a result of large variance in particle size, and the weathering of pyroclastic material into clays that have a high shrink/swell ratio on steep slopes or in disturbed areas such as road cuts.

This weathering to clay process results in the presence of bentonite and smectite (Purchall, 1994). Studies of these clays show that these clays can expand up to 8 times their volume when saturated when dry and subsequently shrinking when dry. This tends to dislodge rock and soil fragments and may affect structures that are placed on them, such as roads.

Another concern of these fine textured soils is in the erodability, particularly in association with stream channels. A number of stream channels in the earthflow terrain, exhibit active erosion, in the stream bed as well as the stream bank. Streams such as Soup Creek, Burnt Creek and Winters Creek are actively downcutting and contributing large amounts of fine sediment to the system, with noticeable impacts to aquatic habitat, in the tributaries as well as Jackson Creek (Appendix V). Even in low flow periods, these streams are continuing to erode in the absence of large woody material.

In addition to the erosion identified within the stream channels, areas of surface erosion,(WIN sites) have been identified in a number of localities throughout the basin. A predominant number of these sites are in association with earthflow terrain and are identified in the WIN inventory (Appendix D). While little inventory occurred outside of the earthflow landscapes, its expected that additional surface erosion problems will be identified.

The fine textured soils predominant in the earthflow terrain, are also susceptible to detrimental disturbance (Umpqua N.F., 1990) particularly where high clay content is evident. Clay particle size by definition allows for a large amount of surface area in a given volume. This surface area and accompanying number of unattached chemical bonds allows easy access to elements needed by plants and under undisturbed conditions can provide excellent growing sites.

Soil Compaction and Disturbance

Under certain kinds of disturbances, particularly compaction, the small particle size and charged nature results in the loss of macro-pore space and the creation of a semi-solid mass. Although recent studies suggest that certain techniques are effective in reducing compacted surfaces (Hogenvorst, 1995 unpublished) its uncertain as to the long term side effects of these techniques.

The 1990 Umpqua National Forest Land and Resource Management Plan developed Standard and Guidelines for Soil Productivity associated with detrimental disturbances such as compaction and puddling. Detrimental disturbance should not exceed 20% within an activity area. In particular, all roads and landings are considered to be in detrimental condition unless rehabilitated to natural conditions. It's estimated that about 1100 acres of compacted surface are associated with roads and landings, and of this about 300 acres are native surface.

The UPAD harvest data available for Jackson Creek suggest that overall, 22% of the entire drainage has been subjected to tractor logging practices (Table 5). The majority of this has occurred on earthflow terrain, where fine textured soils are prevalent. There are at least 5 WAA's, specifically N, U, T, Q and R where more than 50% of the total area was harvested with ground based logging systems and in several, the area affected approaches 70% include areas where detrimental disturbance and compacted soils may have some significant effects on site productivity. Orton, 1991, presented information that soils within Jackson Creek have been severely disturbed in association tractor yarding practices in several areas over 60%. In addition common practices after tractor yarding activities included machine piling and lack of designated skid trails in the early harvest periods. These activities also contributed to the disrupted conditions found throughout the basin.

Harvest and Logging Practices Throughout Jackson Creek

WAA	ACRES	Tractor	% acres	Cable	% Acres	TOTAL
05A??	4385	1500	34%	1500	34%	3000
05B	3937	891	23%	224	6%	1115
05C??	6154	1900	31%	581	9%	2481
05D	4109	473	12%	488	12%	961
05E	3741	1000	27%	1160	31%	2160
05F	5089	61	1%	55	1%	116
05G	5169	399	8%	129	2%	528
05H	3052	512	17%	346	11%	858
05I	4905	305	6%	571	12%	876
05J	5043	372	7%	909	18%	1281
05K	6820	379	6%	816	12%	1195
05L	3275	665	20%	417	13%	1082
05M	6085	1354	22%	881	14%	2235
05N	2943	1750	59%	402	14%	2152
05O	5141	432	8%	1124	22%	1556
05P??	3478	300	9%	516	15%	816
05Q	4826	2363	49%	980	20%	3343
05R	3237	1592	49%	895	28%	2487
05S	3970	968	24%	367	9%	1335
05T??	4029	3000	74%	572	14%	3572
05U	2916	2015	69%	202	7%	2217
05V??	2438	1413	58%	362	15%	1775
05W??	3130	751	24%	269	9%	1020
05X	4357	255	6%	280	6%	535
TOTALS	102229	24650		14046		38696
?? Includes estimate of private tractor harvest based on air photo interpretatio						

Table 5. Yarding Practices.

Based on this evidence, its our conclusion that the detrimental disturbance and compaction of fine textured soils is widespread and should be considered a significant cumulative effect on both the terrestrial and aquatic communities.

The importance of the soil resource relative to site productivity was also considered with regards to the ability of the soil to provide adequate growing conditions for vegetation, specifically coniferous species (Table 6). A number of specific Standards and Guidelines in the Umpqua National Forest L.R.M. P. define criteria to classify soil suitability as per NFMA. While the argument can be made that these standards have the potential to conflict with an ecological management approach, its important too understand what portions of the Jackson Creek watershed have been delineated as unsuitable for a variety of concerns. This table suggest that several of the WAA's have significant amounts of unsuitable terrain identified, in either verified or unverified status.

			JACKSON CREEK WATERSHED					
		Verified	Unverified	Verified	Verified	Unverified		
WAA	ACRES	TRG	TR3	TLA	TLS	TL1	TOTAL	UNSUITABLE %
05A	4385	0	583	0	0	0	583	13%
05B	3937	17	73	0	0	0	90	2%
05C	6154	91	495	0	0	0	586	10%
05D	4109	277	163	16	0	0	456	11%
05E	3741	38	0	0	41	0	79	2%
05F	5089	3	303	157	0	0	463	9%
05G	5169	84.4	140.3	43.4	0	0	268	5%
05H	3052	116	19	17	0	0	152	5%
05I	4905	492	0	31	0	0	523	11%
05J	5043	513	62	121	0	0	696	14%
05K	6820	640	1	12	0	0	653	10%
05L	3275	286	42	0	0	0	328	10%
05M	6085	453	0	0	0	0	453	7%
05N	2943	53	24	44	0	0	121	4%
05O	5141	60	139	0	0	0	199	4%
05P	3478	0	1170	0	0	0	1170	34%
05Q	4826	28	437	0	0	0	465	10%
05R	3237	127	2	0	0	0	129	4%
05S	3970	48	29	0	0	0	77	2%
05T	4029	116	12	0	0	154	282	7%
05U	2916	41	186	0	0	61	288	10%
05V	2438	0	0	0	0	3	3	0%
05X	4357	278	0	0	0	0	278	6%
TOTALS		3761.4	3880.3	441.4	41	218	8342.1	

Table 6. Soil Productivity.

Disturbance

Various disturbance processes have affected Jackson Creek at a stand and landscape level: glaciation, flooding, fires, wind, insects, diseases, road building, timber harvest and subsequent management activities. Detailed reviews of many of these processes are provided by Agee (1993) and Oliver and Larson (1990). Exclusion of these processes can be considered another kind of disturbance. Processes which occurred before European influence, with the exception of glaciation, have since been altered by management activities. These processes are all interconnected and altering one or more process will have effects on one or more of the others. Because these processes are strongly related to climate, their intensity and frequency have varied over time and space, just as climate has varied (Figure 4). Thus, a previous era's disturbance regime should be considered in terms of its climate and future disturbance regimes should be considered in terms of the inevitability of future climate change.

Flood

Flooding has profound effects on riparian vegetation, creating a mosaic of riparian plant communities that have twice the species richness of upslope communities (Gregory et al. 1991). No site-specific information was gathered that allows discussion of the effects of flooding on riparian zone vegetation within the Jackson Creek Watershed.

Insects and Disease

Historic insect and disease processes were not evaluated for this project. However, it is certain the extent and intensity of insect and disease activity varied with the climate, soil and vegetation.

A 1994 Insect and Disease Assessment of Jackson Creek is included in Appendix E. Key points of this assessment (Marshall 1994) are:

1) There is widespread loss of sugar pine in the mixed conifer forests as a result of mountain pine beetle. Excessive stand density and drought have been the primary causes allowing infestation. On some sites, white pine blister rust predisposes the trees to attack but it is not the primary cause of death. The same processes are affecting western white pines at higher elevations, with similar widespread losses. For ponderosa pine, the situation is not as advanced, but it is becoming more serious. Unless preventive measures are taken, sugar pine could be virtually eliminated from these forests.

2) In the higher elevation, true fir forests, Armillaria root disease is most noticeable in selectively harvested stands.

3) Management practices will alter the extent and intensity of insect and disease activity in the future.

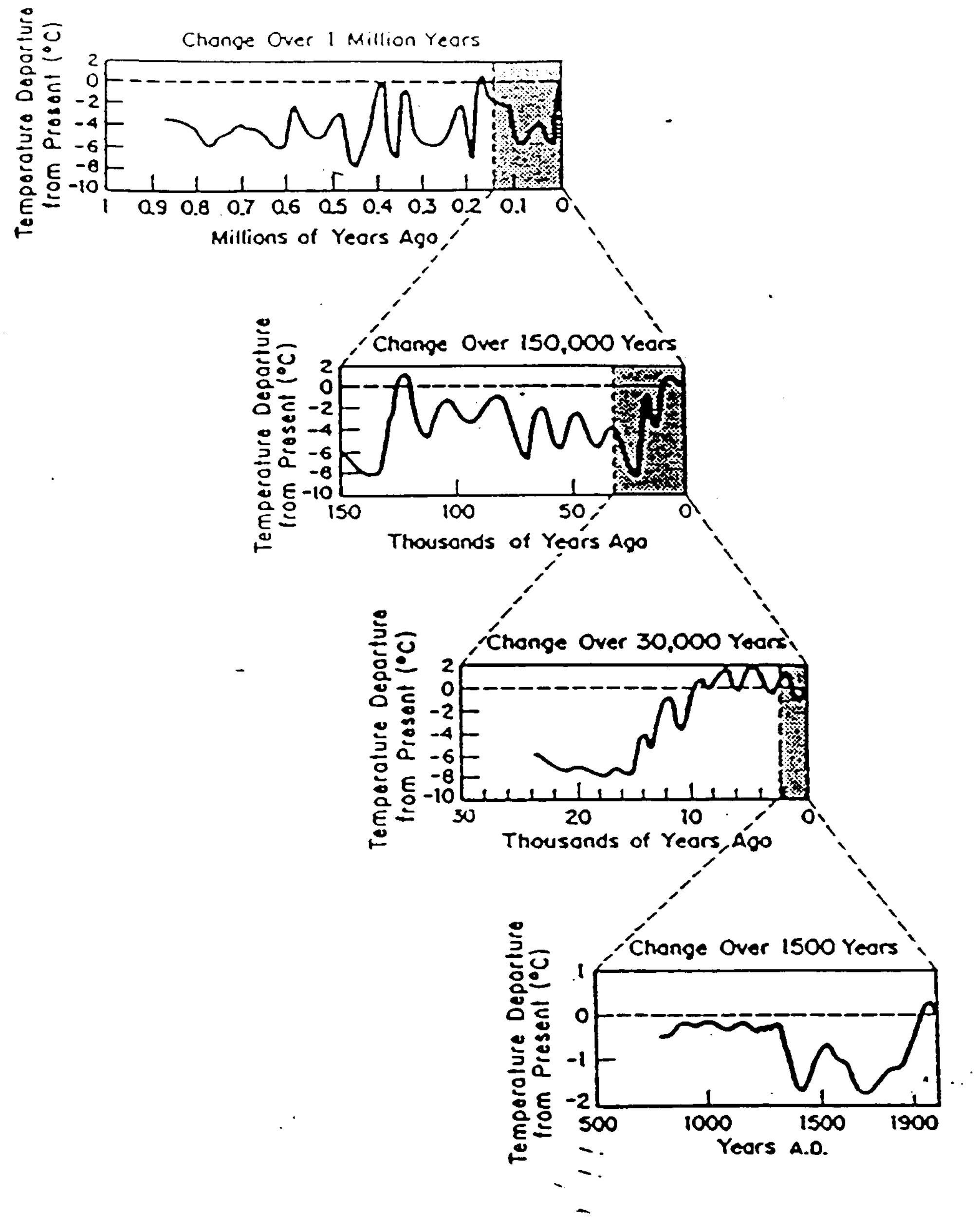


Figure 4. Change in temperature over different periods of time during the last million years. (From Committee for the Global Atmospheric Research Program and Marsh and Dozier, Landscape, c 1981, John Wiley & Sons, in Botkin 1990.)

Wind

Wind storms are a recurring disturbance process in the western Cascades. However, there is little evidence that wind represents more than a fine-scale disturbance in Jackson Creek. Wind created disturbance causes gap-phase regeneration in older stands and height differentiation and increasing species diversity in younger stands. No records or anecdotes suggest that wind in the Jackson Creek watershed approaches the stand-replacing intensities that occur near the Columbia Gorge or on the Olympic Peninsula. However, at a small scale, the effects of a single event can be dramatic.

Certain management practices, applied to large areas of the landscape may, however, result in more significant impacts from similar storms. Trees in over-stocked stands grow too tall, relative to their width, to support the weight of their own crowns during periods of increased wind or snow loads. Fertilization, which results in a thicker tree crown, can exacerbate this condition. Planting off-site trees may also cause them to be structurally challenged. Under these conditions, normal winter storms can result in the collapse of major portions of these stands. The increased quantities of down and dead material would result in increased risk of Douglas-fir beetle and wildfire, with stand and landscape level impacts, respectively.

Although dense, single species stands occurred prior to management, they experienced more frequent disturbance and were not as widespread as such managed stands now are.

Fire

Fire, from human and natural causes, has burned northwest landscapes for centuries (Agee 1993). It is difficult to identify the relative effects or pattern of human versus natural caused fires during pre-historic times. Burke (1980) found no pattern in lightning fire occurrence between 1910 and 1977 in the central Cascades of Oregon. Ripple (1994) used satellite data to evaluate the distribution of forests in western Oregon. He presents tree-size evidence suggesting that Indian burning may have been concentrated along major rivers. Beginning in about 1870, the pattern of human ignition changed with increasing European settlement and decreasing Indian populations (Appendix Z). The Forest Service began fire detection and suppression activities in the 1910's but human caused fire was significant until about the 1930s (Appendix Z). The 1929 arson-caused Beaver Creek fire is the most dramatic of these early fires. The period of effective fire suppression is assumed to have begun about 1930 with the advent of the Civilian Conservation Corps.

The landscape and stand-level effects of historic fires can be inferred from fire frequency, intensity, and size. In Jackson Creek all three of these fire characteristics have varied a great deal, largely as a result of climate. Since about 1700, the interval between these low intensity fires has ranged from 6 to 100 years. The number of trees surviving these low intensity fires varied from 27 to 112. Although high intensity, stand replacing fires have occurred in Jackson Creek since 1700, their frequency wasn't quantified. Because fires were not limited by fire suppression efforts, many persisted for several burning periods and got very large. However, no generalization can be made other than that variation in fire size was extreme. Before about 1700 there appears to a have been an intense fire, or series of fires, that burned much of the watershed. The effects of this fire were greater at lower elevations on both sides of Jackson Creek where fewer trees appear to have survived.

Fire history results suggest that between the late 18th and early 20th centuries, three fire regimes affected Jackson Creek (Figure 5). Fire history methods are discussed in Appendix F.

Homogeneous, high frequency-low intensity fire regime

North of Jackson Creek, low intensity, surface fires with a mean fire-return interval of 23 years, (a range of 11 to 41 years), burned on a landscape whose fire behavior was dominated by its southerly aspects. Because weather, fuels, and topography were homogeneous, burning patterns were too. In this environment, understory re-initiation was continuous, resulting in multiple age classes of trees across the landscape, and in most stands.

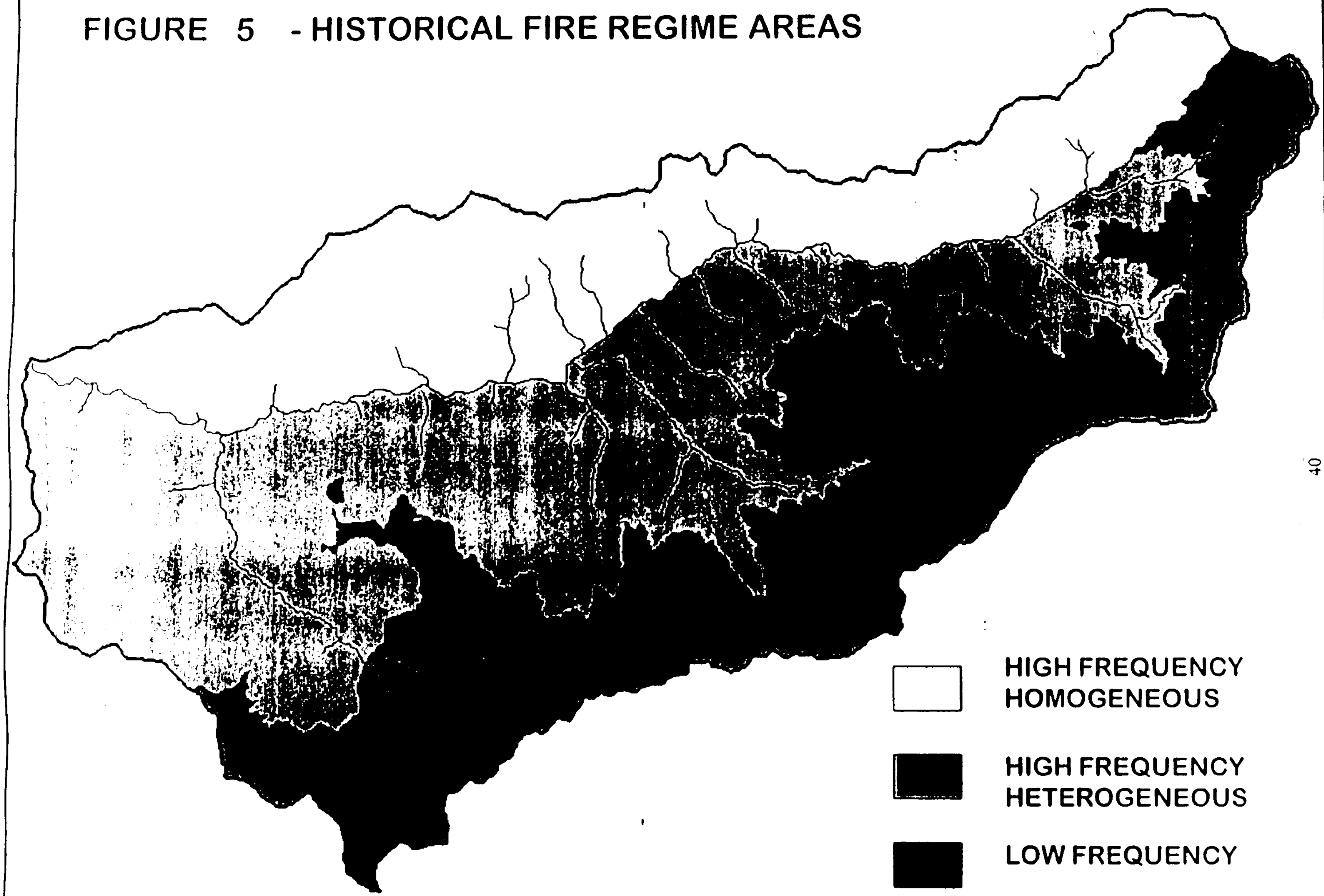
Heterogeneous, high frequency-low intensity fire regime

South of Jackson Creek, at low elevations, weather, fuel, and topography were more heterogeneous which caused burning patterns to be more variable. Most of the area experienced low intensity surface fires with a mean fire-return interval of 23 years, (a range of 6 to 37 years). Understory re-initiation was continuous, resulting in multiple age classes of trees across the landscape, and in most stands. However, on steeper, north apects within the influence of riparian zones, fires were less frequent with higher intensities. These stands had a single cohort of early seral species in the overstory and multiple agesof late seral species. Low intensity, smoldering ground fires occured here as well.

Low frequency-high intensity fire regime

South of Jackson Creek, at higher elevations, the fire regime shifted to one of less frequent, more intense fires partly as a function of aspect. Low intensity fires still occurred but were less frequent and smaller in size. Burning conditions here were more homogeneous than at lower elevations south of Jackson Creek, because of the cool, moist climatic conditions. Tree establishment was more wave-like at both the landscape and stand level. A reliable fire-return interval couldn't be calculated from the data gathered for this type.

FIGURE 5 - HISTORICAL FIRE REGIME AREAS



It is hard to overstate, or measure, the variation fire imposes at the stand and landscape level. These three fire regimes are based on a relatively extensive sample. For a single, less than 100 acre, stand in the Dumont Creek watershed, an intensive investigation revealed six separate fire events, only two of which showed evidence of occurring throughout the stand. Such variable and complex burning patterns make identification of fire caused tree cohorts and boundaries difficult. Even stand boundaries become difficult to identify. The extreme variation imposed by this fire regime makes it difficult to identify discrete units of vegetation (Daubenmire 1968) with consistently predictable responses.

Riparian fire frequency

Fuel, weather, and topography interactions are as applicable to riparian zone fire as they are to hillslope fire. Agee (1988) describes a model of riparian disturbance patterns suggesting the probability of fire within a riparian zone is related to stream size. For large streams, fire probability is quite low but increases steeply at the margin of the riparian zone. Medium streams have the next lowest probabilities which increase less steeply moving out from the margin of the riparian zones. Fire probability is highest for small streams and is only somewhat reduced in the riparian zone. In fact, if the channel constricts the air flow, it is more likely to burn. Generally, the presence of lush vegetation dampens fire behavior in the riparian zones and smouldering ground fires kill only occasional trees and the above-ground parts of herbs and shrubs. However, biomass accumulates rapidly in riparian zones and, sooner or later, weather conditions and ignition are coincident and high intensity fires result. Recent fires in the Entiat River Basin in Washington burned hottest in the riparian zones and killed virtually all the vegetation (Agee 1994). Notably, this area has a very short fire-return interval and fire exclusion may have resulted in abnormally high fuel accumulation in riparian zones. That fire intensity can be extreme in riparian zones is apparent in the Beaver Creek burn episode. Fire of this intensity creates establishment conditions with successional processes similar to hillslopes (Meehan et al. 1977).

The moisture, vegetation, and topography of many intermittent streams within Jackson Creek are less able to moderate fire behavior. A high frequency, low intensity fire regime is proposed for these areas. However, it is not appropriate to simply take the hillslope frequency and apply it here. Because of higher soil moisture, herbs cure later and live fuel moistures are higher throughout the summer, thus fire conditions are favorable for a shorter period. A representative mean fire-return interval is not known for this riparian fire regime.

Management Related Disturbance

Roads

The Jackson Creek drainage was accessible by trail only until shortly after World War two. A Bureau of Public Roads Contract was awarded in 1947 to build the first 4 miles of road up Jackson Creek. This road started at the confluence of Jackson Creek and the South Umpqua River and extended to Beaver Creek. This, and subsequent sections of road were located in the valley bottom adjacent to the stream itself and often in the actual flood plain. Development continued in 1951 and 1953 by BPR contract, when an additional 6.3 miles was constructed. The first timber sale to build road in conjunction with the sale was the Jackson Creek Timber Sale and 6.5 miles was constructed. The road constructed adjacent to Jackson Creek eventually extended as far as Lone Woman Creek by the early 1960's.

By 1955 about 70 miles of road had been constructed in the Jackson Creek basin, including the roads from Beaver Creek confluence to Whisky Camp and over the Rogue/Umpqua divide west of Butler Butte (Road 30). The Crooked Creek road (Road 31) was constructed over the Rogue/Umpqua Divide at Huckleberry Gap southwest of Quartz mountain. These roads provided opportunities to access areas for a variety of uses, including timber sales and primitive recreation.

Road construction continued at the same rate until about 1964 with the development of road systems that accessed upper Jackson Creek as well as Squaw Creek and Deep Cut Creek drainages. In addition to the these new road systems, additional access was developed to support the expanding timber program.

From 1965 to 1974, the road program rapidly expanded, more than doubling the amount of road in the basin, from 140 miles to 333 miles with a heavy emphasis on accessing additional areas for timber management. This development was concentrated along the upper north side of Jackson Creek, Abbot and Falcon Creeks, in the Crooked Creek drainage and in the upper tributaries of the Beaver Creek basin.

In the period from 1974 to 1988, an additional 137 miles of road was constructed, however these roads tended to be ancillary development of the road system, spurs and tie through roads to further access the areas for timber development and administrative use.

Since 1988, only about 14 miles of new road has been constructed. The majority of this has been short spurs and extensions of existing road systems to facilitate timber harvest activites.

A summary of the road construction by time period by WAA is summarized in Table 7 and is based on information available for System Roads in the forest travel management system database. In addition, there is approximately, 78 miles of additional road in Jackson Creek, including non-system and private roads that is not described in the database.

GIS	WAA Road Densities by Construction Year									
WAA	Acres	0-1955	1956-64	1965-74	1975-80	1981-88	1989-94	Additional	Total	**Rd/Sq_Mi**
A	4464	6.28		0.47	3.33	0.67	0.49	14.38	25.62	**3.67**
B	3940	3.02	6.09	8.52	5.82	3.63	0.24	1.12	28.44	**4.62**
C	6160	13.6	3.96	17.85	7.01	4.44	3.99	2.77	53.62	**5.57**
D	4110	2.05	2.68	12.75	6.09	6.36		1.12	31.05	**4.84**
E	3740		1.88	19.53	2.87	1.18		2.87	28.33	**4.85**
F	5090			1.93		0.02		2.15	4.10	**0.52**
G	5170			8.62	1.03			0.82	10.47	**1.30**
H	3050		1.37	6.34	1.03	0.11	0.52	0.23	9.60	**2.01**
I	4910	0.66	1.36	5.06	0.63	2.43	3.91	0.15	14.20	**1.85**
J	5040	6.33		14.14	3.63	2.38		2.22	28.70	**3.64**
K	6820	10.22	1.82	2.02	0.03	4.13		1.61	19.83	**1.86**
L	3275	0.13	5.33	6.03	0.84	1.38		1.89	15.60	**3.05**
M	6085	2.66	14.09	6.72	6.53	4.86		4.17	39.03	**4.11**
N	2440	1.11	6.07	5.05	2.18	2.92	1.75	1.74	20.82	**5.46**
O	5140	5.05	4.01	9.14	2.03	4.88		7.19	32.30	**4.02**
P	3480	0.64	2.04	3.13	4.45	1.56		0.98	12.80	**2.35**
Q	4830	5.17	4.18	11.52	6.95	4.11	1.07	2.54	35.54	**4.71**
R	3240	3.08	0.51	12.14	1.31	4.36		3.72	25.12	**4.96**
S	3970	2.17	1.38	10.88	3.94	11.11	0.62	3.53	33.63	**5.42**
T	4030		5.52	11.4	2.37	2.14		4.47	25.90	**4.11**
U	2920	0.37	3.59	9.41	3.91	0.82		8.7	26.80	**5.87**
V	2440		2.48	1.81	3.80	3.01		4.06	15.16	**3.98**
W	3130	2.99	0.2	1.86	1.32	0.49	1	4.54	12.40	**2.54**
X	4360	4.41	2	7.48				0.6	14.49	**2.13**
Jackson	101834							0	563.55	**3.54**
Beaver	22470	11.43	17.22	58.48	22.93	24.1	1.69		135.85	

Table 7. Road densities by watershed analysis area (WAA) by decade.

Table 7 also displays road density by W.A.A and its interesting that the range is from 0.52mi/mi2 in WAA F, almost all roadless and wilderness areas to 5.87mi/mi2 in WAA U, a highly managed tributary of Beaver Creek. On the average, Jackson Creek's road density is 3.54 miles/square mile, although 17 of the WAA's exceed this.

Currently there is 563.6 miles of road in Jackson Creek drainage with 539 miles under Forest Service jurisdiction. This includes Road 29, Jackson Creek Road, the only paved road in the watershed. This road parallels Jackson Creek from the mouth to about river mile 21 and is the only paved road in Jackson Creek. This road bissects private land in several areas in the lower reaches of Jackson Creek and is subject to cost-share agreements. These agreements require mutual consent to implement actions in these areas. Aggerate surface roads comprise 74% of the total and native surface roads equate to 23%. Aproximately 139 miles is currently in a Level 1 Maintenance status.

Although an Access and Travel Management (ATM) Plan been completed, for the Umpqua, its focus was on the existing transportation system and its uses as defined in the 1990 Forest Plan. Roads in Jackson Creek are categorized by maintenance level and provide access for a variety of uses including commodity production, administrative access, and recreation. Roads also serve 5 developed recreation sites as well as as a number of dispersed sites. Jackson Creek Road (29) is inventoried as Sensitivity Level 3 and recognized as a Recreational Access Route to the Rogue-

Umpqua Divide Wilderness. The views from this route is managed as a priority for visual enhancement and rehabilitation and receives an extra degree of sensitive treatment within the foreground not ordinarily applied to other Level 3 routes.

In response to a need for more site specific ATM planning, an attempt was made to delieneate road related uses and conflicts for the road system in Jackson Creek (Appendix Y). While this list is not inclusive, it does contain valuable information on each road and spur in Jackson Creek and should be incorporated into future ATM planning.

The transportation system in Jackson Creek has developed over time with a wide variety of construction methods and practices. For the purposes of this document, several assumptions were developed. Prior to the mid-70's it was an accepted practice to build roads on full bench with sidecast fills or waste. Since that time, construction on this type of terrain required end-haul of the waste material to an approved location. The other assumption pertaining to the age of the roads is around 1980 the forest was directed to reduce the cost of the construction which led to a greatly reduced standard of design and cosntruction. This included steeper grades, less surfacing, alternative drainage designs, and narrower roads that matched the terrain.

The age of the road as well as the standard of construction can be associated with a number of processes that are currently affecting watershed conditions. Specifically, disruption of hydrologic conditions associated with road drainage and erosion relative to the road prism are the two processes that have had significant effects in watershed. This is based on information provided as a result of landslide inventories and WIN inventories and road drainage sampling.

Hydrologic disruption has occurred in a variety of ways, however, the construction of road drainage improvements such as ditches and culverts appear to have had significant affects on capturing and diverting water. Interception of subsurface flow associated with road cuts is a prime factor in disrupting flow paths, and consequently capturing the flow and diverting it has artificially increased surface flow patterns, often into unassociated drainages. Road runoff into ditches has also contributed additional flow into surface flow paths either as gullys and channel initiation, or into existing stream channels. In addition to surface flow, runoff from roads has also had the potential to affect the subsurface flow paths downslope. This was observed in a number of areas as part of WIN inventories, road drainage studies, and unique habitat sampling. In areas such as unique habitats, this could result in drastic consequences such as dewatering meadows or the creation of wetlands in some areas where severe compation was observed.

Recent work by Jones and Grant, 1994, and Wemple, 1994 suggested that roads could be contributing to the extension of the channel network and, thereby, elevating peak flows. Based on this premise, the road network in Jackson Creek was sampled to determine the extent of road interception, transport and delivery of water. Appendix J discusses channel extension and concludes that there are a large difference between the contribution of surfaced roads and native surfaced roads (Table 8). This appears to be associated with relative length distribution of roads 80% surfaced and 20% native, as well as the nature of the roads. A basic assumption is that the native surfaced roads tend to be shorter with steeper grades and typically are shorter in length and cross fewer streams.

Road Stream Relationships

WAA	NAME	ROADS SURF TOTAL	DITCH SURFC INCREAS	ROADS NATIVE TOTAL	DITCH NATIVE INCREAS	TOTAL EXTEN	STRM MILES	STRM EXTEN
O5A	LOWER JACKSON	3.85	1.19	1.11	0.111	1.30	20.87	6.25%
O5B	DEEP CUT	21.3	6.60	5.03	0.503	7.11	16.88	42.10%
O5C	RALPH/TWO MILE CREEK	37.52	11.63	9.84	0.984	12.62	30.96	40.75%
O5D	MIDDLE JACKSON	21.18	6.57	9.34	0.934	7.50	25.09	29.89%
O5E	UPPER JACKSON	21.28	6.60	5.38	0.538	7.13	19.24	37.08%
O5F	LONEWOMAN	2.4	0.74	0.05	0.005	0.75	31.43	2.38%
O5G	FALCON	8.35	2.59	1.81	0.181	2.77	33.53	8.26%
O5H	ABBOTT	6.76	2.10	2.61	0.261	2.36	20.76	11.35%
O5I	COUGAR	10.67	3.31	3.37	0.337	3.64	34.13	10.68%
O5J	CROOKED	23.15	7.18	4.48	0.448	7.62	28.91	26.37%
O5K	UPPER SQUAW	12.47	3.87	6.29	0.629	4.49	42.41	10.60%
O5L	LOWER SQUAW	12.23	3.79	2.93	0.293	4.08	18.5	22.08%
O5M	BLACK CANYON	24.82	7.69	13.06	1.306	9.00	25.65	35.09%
O5N	WHISKEY/SOUP	16.13	5.00	4.17	0.417	5.42	11.4	47.52%
O5O	COFFIN	24.27	7.52	6.29	0.629	8.15	29.98	27.19%
O5P	SWITCHBACK	10.52	3.26	1.6	0.16	3.42	18.87	18.13%
O5Q	FAWN/MAVERICK	25.53	7.91	9.27	0.927	8.84	30.8	28.71%
O5R	PIPESTONE	22.07	6.84	1.62	0.162	7.00	20.14	34.78%
O5S	THREE CABIN	19.38	6.01	7.74	0.774	6.78	20.54	33.02%
O5T	STAMPEDE/BURNT	17.46	5.41	4.8	0.48	5.89	21.65	27.22%
O5U	WINTERS	13.27	4.11	6.55	0.655	4.77	15.43	30.91%
O5V	PICKETT	8.86	2.75	2.88	0.288	3.03	14.52	20.90%
O5W	SURVEYOR/FREEZEOUT	6.53	2.02	1.19	0.119	2.14	13.57	15.79%
O5X	DONEGAN	7.43	2.30	6.46	0.646	2.95	24.76	11.91%
	TOTALS	377.43	117.00	117.87	11.79	128.79	570.02	22.59%

Table 8. Stream Extension.

Erosion processes associated with roads are broadly grouped into surface erosion and mass wasting. Surface erosion associated with roads is associated with cut slopes and ditch lines, as well as in some instances road surfaces, either native or improved. Although this type of erosion is of some concern in specific areas, it does not seem to be a pervasive problem basin wide, relative to aquatic concerns. Mass wasting, primarily debris slides, have occurred in a number of areas in association with roads. In particular, WAA's J, N, O, S, U, V and X all had road related landslides occur in relatively high percentages (Table 9). Based on some field verification of air photo interpretation, these landslides have had a disproportional affect on riparian resources, particulary as a result of debris flows. Road related mass wasting concerns are focused on failed stream crossings as well as fill failures, particulary where water has been directed on side cast material.

Summary Of Landslides In Jackson Creek

GIS SUMMARY OF LANDLIDES BY ROAD AND HARVEST DATA JACKSON CREEK													
		LANDSLIDES	NATURAL			ROAD	SLIDES			HARVEST	SLIDES		
				%	BEFORE	%	AFTER	%	BEFORE	%	AFTER	%	
WAA	Acres	TOTAL	ASSUME		ROADS	PRIOR	ROADS	AFTER	HARVEST	PRIOR	HARVEST	AFTER	
A	4464	41	36	88%	1	2%	4	10%	0	0%	0	0%	
B	3940	19	7	37%	3	16%	1	5%	8	42%	0	0%	
C	6160	21	4	19%	5	24%	2	10%	7	33%	3	14%	
D	4110	15	3	20%	4	27%	0	0%	6	40%	2	13%	
E	3740	25	0	0%	6	24%	4	16%	8	32%	7	28%	
F	5090	29	26	90%	2	7%	0	0%	1	3%	0	0%	
G	5170	35	32	91%	1	3%	0	0%	2	6%	0	0%	
H	3050	8	1	13%	3	38%	0	0%	3	38%	1	13%	
I	4910	48	43	90%	2	4%	0	0%	3	6%	0	0%	
J	5040	34	11	32%	3	9%	9	26%	6	18%	5	15%	
K	6820	28	23	82%	2	7%	0	0%	2	7%	1	4%	
L	3275	16	6	38%	6	38%	1	6%	1	6%	2	13%	
M	6085	51	32	63%	8	16%	0	0%	8	16%	3	6%	
N	2440	24	17	71%	1	4%	6	25%	0	0%	0	0%	
O	5140	72	33	46%	2	3%	12	17%	14	19%	11	15%	
P	3480	20	15	75%	5	25%	0	0%	0	0%	0	0%	
Q	4830	15	2	13%	5	33%	0	0%	7	47%	1	7%	
R	3240	20	3	15%	7	35%	3	15%	1	5%	6	30%	
S	3970	17	9	53%	3	18%	4	24%	0	0%	1	6%	
T	4030	16	7	44%	5	31%	0	0%	4	25%	0	0%	
U	2920	6	4	67%	1	17%	1	17%	0	0%	0	0%	
V	2440	11	5	45%	1	9%	2	18%	1	9%	2	18%	
W	3130	34	29	85%	0	0%	1	3%	4	12%	0	0%	
X	4360	23	12	52%	_0	0%	5	22%	3	13%	3	13%	
Total		628	360	57%	76	12%	55	9%	89	14%	48	8%	

Table 9. Summary of landslides in Jackson Creek.

These are the streams where the cumulative effects of cutting trees (removing root strength) and building roads on unstable areas are most likely to add to landslides that will occur already, and affect aquatic habitat in streams. Cumulative effects evaluations will have to be made for individual activities in Jackson Creek (Umpqua National Forest Land and Resource Management Plan, 1990). Where watersheds of streams have the most harvest and roads on high risk lands, and stream channels are wide or eroding, cutting more mature trees with deeper roots or building more road will be more likely to cause landslides and harm aquatic life. See Appendix K for estimates of canopy and harvest history on high risk land throughout Jackson Creek.

Timber Harvest

Timber harvest resources were developed in the area after World War II. Acessible lands in the Willamette Valley and along the costs of Oregon and Washington were logged out. Loggers began to push further back into the mountainous reaches of the Umpqua. Logging steadily increased on the lands administerd by the Umpqua National forest following 1945. This growth in the timber industry altered the resonsiblities of Forest Service sevice personnel. The days where the primary concern for trails, fires, and recreation were gone. The Forest Service moved into management and developement of its lands including the Jackson Creek drainage (Appendix Z).

Reforestation

The objective for reforestation has been rapid establishment of uniformly close spaced stands of, primarily, Douglas-fir and/or ponderosa pine. The tight spacing prescribed for commercial thinning has also promoted the dominance of these same two species. Species composition and stand structure have been actively altered by cutting and passively altered by differences in the relative tolerance to competition of various tree and shrub species and by inducing competition mortality at close spacings.

In general there has been little variation in the treatments prescribed to the vastly different sites across the landscape.