Closed Canopy (>70%) On Streams

Watershed	WAA	Perennial Stream Miles	% Miles Closed Canopy
Lower Jackson	A	8.6	37%
Deep Cut	B	11.1	13%
Ralph to Two Mile	C	16.9	17%
Middle Jackson	D	9.9	59%
Upper Jackson	E	9.7	70%
Lonewoman	F	14.2	90%
Falcon	G	7.7	54%
Abbott	H	7.0	87%
Cougar	I	15.1	96%
Crooked	J	13.7	73%
Upper Squaw	K	15.5	87%
Lower Squaw	L	6.2	82%
Black Canyon	M	12.2	67%
Whiskey Soup	N	7.9	70%
Coffin	O	11.4	56%
Switchback	P	11.0	58%
Fawn Maverick	Q	11.1	16%
Pipestone	R	4.7	60%
Three Cabin	S	10.8	60%
Stampede Burnt	T	8.0	41%
Winters	U	4.9	36%
Pickett	V	5.1	62%
Surveyor Freezeout	W	7.8	66%
Donegan	X	8.1	91%
Total		238.8	61%

Table 44. Miles of Closed Canopy on Perennial Streams.

Holaday (1992) found that stream temperatures of tributaries of the North Umpqua River's Steamboat Creek had cooled as much as 10 degrees since 1969, but Steamboat at the mouth was unchanged. Also, summer low flow apparently hadn't changed. Jackson Creek has almost the same watershed area and the stream is approximately the same length, but summer low flow is less than Steamboat's. Their water temperatures both reach almost 80 degrees fahrenheit. The shorter, narrower Steamboat tributaries apparently heated up when conifer trees were cut, then cooled twenty years later when riparian hardwoods grew back. Steamboat Creek is wider, flows south, and may have always been warm.

In the same way, Beaver Creek and Falcon Creek have long reaches with hardwood regrowth and have probably cooled somewhat. However, Jackson Creek's temperature depends mostly on the shade of the main creek and is unlikely to cool until the stream narrows and tall conifers grow back. That's more likely on Jackson than Steamboat, since Jackson flows west and is more easily shaded from the south, or sun, side of the creek. The road follows the north side. Still, long reaches have been completely or partially cut on the south side of Jackson for eleven miles up to Squaw Creek, above and below Falcon Creek, and above Lonewoman. The stream won't narrow until it builds floodplain sites for tall trees to grow, and existing old growth trees fall in the channel.

Stream Chemistry

In August 1967, the U.S. Geological Survey reported conductivity of the South Umpqua River was 134 microhos. The conductivity was similar (126-156) in August 1992-93 when the Survey studied the length of the South Umpqua to Jackson Creek in an attempt to discover causes for high pH, algae, and low dissolved oxygen in the lower river (U.S. Geological Survey, 1969 and 1994). Extreme values for these measures of water quality and aquatic habitat weren't measured in 1967, and it is hard to tell if the South Umpqua and Jackson Creek have poorer water quality today. We measured pH, conductivity, alkalinity, and observed algae (Powell, 1994) in Jackson Creek and the South Umpqua in August and September of 1994 (See Appendix O).

The high afternoon pH of Jackson Creek (over pH 9) as far up as Cover Camp in August and September was surprising, especially since pH of the South Umpqua River seemed lower than Jackson Creek. The water quality standard for pH is 6.5 to 8.5 because of the stressful effects of extreme high or low pH on aquatic life. The South Umpqua River to its mouth is designated a Water Quality Limited stream, and Oregon is required to take measures to restore water quality under provisions of the federal Clean Water Act.

Many of Jackson Creek's tributaries had pH 8.3 or higher, including Jackson above Lonewoman, Falcon, most of middle Jackson, Tallow, Deep Cut, Black Canyon, Beaver, and a stretch of Squaw Creek. Aquatic algae, which can raise the pH of water during photosynthesis, was often observed in streams where pH was high. Measurements of nitrogen in runoff from the Coyote Creek Experimental Watersheds nearby show more nutrients available for algae growth after clearcutting than from partially logged or uncut watersheds (Adams and Stack, 1989 and Green, et al 1976). Bedrock reaches and lots of sunlight in clearcut parts of these streams can also increase algae growth.

These are only some of the causes of high pH in streams, and it is not clear what the effects have been on aquatic life in the basin or how long it has been this way. We do know that certain conditions which provide ways for streams to add carbon dioxide back into the water and lower pH:

- Cooler, shaded stream reaches,
- Lots of down trees in the creek,
- Forest stands using up nutrients.

While these principles have been studied elsewhere (Powell, 1994), the interactions of forest activites and stream water chemistry in the Pacific Northwest aren't well known. Watershed analysis has given us a chance to identify a surprising water quality problem and reduce possible causes of algae and high pH.

Finally, the conductivity we measured in the South Umpqua River, Jackson Creek and its tributaries in 1994 was similar to the U.S. Geological Survey measurements. Conductivities of Jackson and the South Umpqua on August 23 were about 130 umohs, and alkalinity of Jackson Creek was 68 ppm. Most tributaries were similar during late August and September (90-150 umohs, and 50-80 ppm), except Deep Cut, Whiskey and Tallow Creeks. These ranged from conductivity of 132-309 umohs and alkalinities from 96 to 132 ppm (Appendix O). Whisky and Deep Cut Creeks flow into Jackson from the south and north across from each other, downstream from Squaw and Black Canyon. High alkalinity and conductivity indicates higher dissolved ions (perhaps from weathered rock) which buffer chemical changes. The high pH in Deep Cut and Tallow Creeks can have more of an effect on Jackson Creek because they are stronger solutions with more alkaline ions. High alkalinity streams are often more productive for aquatic life, providing the calcium and magnesium for bone and chiton, and wildlife often seek out mineral springs that can be the source of these dissolved ions. Work by Bilby (1994) suggests that high alkalinity streams might provide needed calcium for juvenile salmon in years when adult returns are low and decaying carcasses (a significant calcium source) are few.

Erosional Processes and Sediment

Some watersheds of Jackson Creek (Soup Creek, Ralph/Tallow/Two Mile, Upper Jackson, Crooked, Pipestone and Deadhorse Creek for example) have more landslides in harvest units and on roads than others in the basin (see aquatic and geology sections of this chapter). Landslides and other erosion will occur on unstable (high risk) land in the watersheds of other creeks in the next big flood, especially where there are more roads and harvest units. That's also where road restoration can do the most good, and new cutting is likely to cause the most damage.

Table 45 (Jackson Creek Landslides per Square Mile by Watershed) shows that *Coffin, Freezeout, Whiskey/Soup, Cougar and Lower Jackson (WAA's O, W, N, I and A) have the most landslides per square mile. Table 3 in the Geology section of this chapter shows that some watersheds (Upper Jackson WAA E, Pipestone WAA R, and Crooked Creek WAA J, for example) have the highest percentage of slides caused by roads or timber harvest.

Jackson Creek Landslides per Square Mile by Watershed Analysis Area

Landslides are Natural, Harvest, and Road Related

Name	WAA	Total WAA Acres	Landslides Total	Landslides per Mi2
Lower Jackson	A	4444	41	5.9
Deep Cut	B	3928	19	3.1
Ralph to Two Mile	C	6134	21	2.2
Middle Jackson	D	4100	15	2.3
Upper Jackson	E	3725	25	4.3
Lonewoman	F	5076	29	3.7
Falcon	G	5153	35	4.3
Abbott	H	3048	8	1.7
Cougar	I	4907	48	6.3
Crooked	J	5042	34	4.3
Upper Squaw	K	6810	28	2.6
Lower Squaw	L	3275	16	3.1
Black Canyon	M	6082	51	5.4
Whiskey Soup	N	2945	24	5.2
Coffin	O	5143	72	9.0
Switchback	P	3478	20	3.7
Fawn Maverick	Q	4811	15	2.0
Pipestone	R	3226	20	4.0
Three Cabin	S	3887	17	2.8
Stampede Burnt	T	4021	16	2.5
Winters	U	2915	6	1.3
Pickett	V	2438	11	2.9
Surveyor Freezeout	W	3126	34	7.0
Donegan	X	4345	23	3.4
Total		102059	628	5.9

Table 45. Landslides per Square Mile in Jackson Creek Watersheds

Landslides and surface erosion put sediment into streams, filling the pools and riffles that fish, amphibians, insects and algae live in. We found higher landslide rates and debris flows down channels on earthflow land steeper than 30% slope, and non-earthflow land steeper than 60% (see Geology section of this chapter). Thirty percent of Jackson Creek watershed is formed on these higher erosional risk lands, which we've called Hazard 4, 5 and 6 of six landform risk groups, and some of Jackson Creek's twenty-four smaller watershed analysis areas (WAA's) have much more (Table 46).

Upper Jackson Creek (above Lonewoman) WAA E, Black Canyon WAA M, and Switchback Creek (a tributary of Beaver Creek) WAA P are 55 to 60% higher risk lands. Whiskey/Soup WAA N and Ralph/Tallow/Two Mile WAA C have almost half their area in these riskier lands.

More landslides occur on high risk lands where trees are cut and roads have been built, usually when large storms cause rare flood peaks. The floods in the 1950's, 1964 and 1974 caused many natural slides and some from roads and cut areas. About 40% of Jackson Creek has been clearcut or partially harvested. Even though they are often harder to get to, 24% of Jackson's high risk ground has been cut, and 14% of that has happened since the last 25-year flood in 1974. These last places are the most likely to have landslides and debris flows during a big flood today, since plantations are less than 20 years old (with smaller root systems) and road culverts haven't been tested with flows of that size.

In some watersheds of Jackson Creek, much more harvesting has been done on high risk ground. Half of WAA E Upper Jackson's high risk land has been cut, and 30% was cut since the 1974 flood. Sixty percent of Ralph/Tallow/Two Mile WAA C has been cut, the last 30% since 1974. In Winters Creek WAA U, 30% has been cut since 1974 (Table 46).

		High Risk Ac	Total WAA	Haz4+5+6	Hvst to'95	Harvest to '95	Hvst'74-'95	Harvest '74-'95
Name	WAA	Haz 4+5+6	Acres	%WAA	Haz4+5+6	% Haz4+5+6	Haz4+5+6	% Haz4+5+6
Lower Jackson	A	1551	4444	35%	64	4%	59	4%
Deep Cut	B	1453	3928	37%	624	43%	313	22%
Ralph to Two Mile	C	2689	6134	44%	1565	58%	858	32%
Middle Jackson	D	1331	4100	32%	302	23%	203	15%
Upper Jackson	E	2099	3725	56%	1091	52%	642	31%
Lonewoman	F	725	5076	14%	295	41%	14	2%
Falcon	G	1412	5153	27%	216	15%	39	3%
Abbott	H	399	3048	13%	199	50%	45	11%
Cougar	I	1378	4907	28%	56	4%	30	2%
Crooked	J	1143	5042	23%	371	32%	219	19%
Upper Squaw	K	973	6810	14%	83	9%	45	5%
Lower Squaw	L	518	3275	16%	67	13%	38	7%
Black Canyon	M	3675	6082	60%	769	21%	384	10%
Whiskey Soup	N	1443	2945	49%	572	40%	330	23%
Coffin	O	1426	5143	28%	496	35%	223	16%
Switchback	P	2042	3478	59%	305	15%	41	2%
Fawn Maverick	Q	286	4811	6%	221	77%	5	2%
Pipestone	R	460	3226	14%	106	23%	49	11%
Three Cabin	S	907	3887	23%	593	65%	210	23%
Stampede Burnt	T	1198	4021	30%	308	26%	137	11%
Winters	U	549	2915	19%	267	49%	178	32%
Pickett	V	505	2438	21%	183	36%	59	12%
Surveyor Freezeout	W	1683	3126	54%	246	15%	8	0%
Donegan	X	461	4345	11%	43	9%	37	8%
	Total	30304	102059	30%	8690	29%	4164	14%

Table 46. Harvest history on high risk lands.

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 waterseds of streams have the most harvest and roads on high risk lads, 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.

Aquatic Species

Fish Species

Jackson Creek watershed supports a multitude of fish species with various life histories. Indigenous species include spring chinook salmon, coho salmon, cutthroat trout, steelhead and resident rainbow trout, speckled dace, Umpqua longnose dace, redside shiner, largescale sucker, Umpqua squawfish, sculpins, Pacific lamprey, and possibly Umpqua chub. Umpqua Squawfish, largescale sucker and redside shiner have only been confirmed to be present in approximately the lower 5 miles of Jackson Creek. There is a series of small falls (3 to 5 feet high) at this point that may be barriers to upstream colonization by these species. If Umpqua chub are present, it is presumed that their distribution is limited by these falls. The dace species and sculpins are widely distributed but their exact distributions have not been mapped. The distribution of Pacific lamprey is unknown. This information gap is problematic, since this species is on the Oregon state sensitive species list.

Exotic fishes which have been introduced into lakes and ponds within the watershed include brook trout, bullheads, and hatchery rainbow trout. The distribution of brook trout is limited to Triangle and Poole Lakes in the Rogue Umpqua Divide Wilderness, and a 0.25 mile reach of stream below the outlet of Triangle Lake. This stream is not connected (biologically) to downstream waters because all signs of channel scour simply end 0.25 mile below the lake but then resume another 0.25 mile below that point. No brook trout were seen below this discontinuity in the channel during summer 1994 snorkel surveys. Hatchery rainbow trout have been stocked in two additional ponds (Blue Bluffs Pond and Skookum Pond) to support put-and-take recreational fisheries. Stocking is regularly scheduled about every other year in Skookum Pond but is sporadic in the smaller Blue Bluffs Pond (1 acre). Hatchery rainbow trout rarely have access to downstream waters where they could compete with wild fish. The outlets to these ponds are very small intermittent streams in which it would take a high winter storm event to provide enough flow for fish to emigrate the 2 to 4 miles downstream to the nearest fish-bearing stream. Presumably, these fish have had a profound impact on herpetofauna in these ponds which include western pond turtles and red-legged frogs. Fish introduced into ponds that previously had no fish have been shown to prey upon egg masses and tadpoles of frogs (Bronmark and Edenhamn, 1994) as well as introduce pathogens transferrable to amphibians (Blaustein et al., 1994).

Salmonid distributions have been elucidated with more certainty than other fish species in the watershed (Table 47). Cutthroat trout are the most widely distributed fish in the basin but where they co-exist with steelhead and salmon they currently make up a very small proportion of the fish community (less than 5%). Cutthroat trout are dominant in headwater tributaries above steelhead distributions and in some cases reside with sculpins as the only fish species present in these areas (Table 47, Figure 22). Detailed descriptions of historic and existing conditions of salmonid species follow.

	Jackson Creek	Tributaries	Total
Spring Chinook Salmon	16.6	0	16.6
Coho Salmon	8	1.7	9.9
Steelhead Trout	22.3	24.1	46.4
Cutthroat Trout	22.9	47.8	70.7
Cutthroat Dominated	0.6	23.6	24.2
Total Fish Bearing Miles	22.9	39.7	70.7

Table 47. Miles of salmonid bearing stream within the Jackson Creek watershed. Cutthroat dominated miles occur in headwater tributaries above steelhead distributions.

The activities of Euro-American settlers have had an historic influence on all anadromous fish stocks in the South Umpqua drainage. In 1880, a dam was constructed on the South Umpqua River near Roseburg to operate a grist mill. The dam was considered a major anadromous fish barrier at lower water conditions and, in spite of multiple modifications, remained at least a partial migration barrier until at least 1946 (Fish Commission of Oregon and Oregon State Game Commission, 1946).

Spring Chinook Salmon

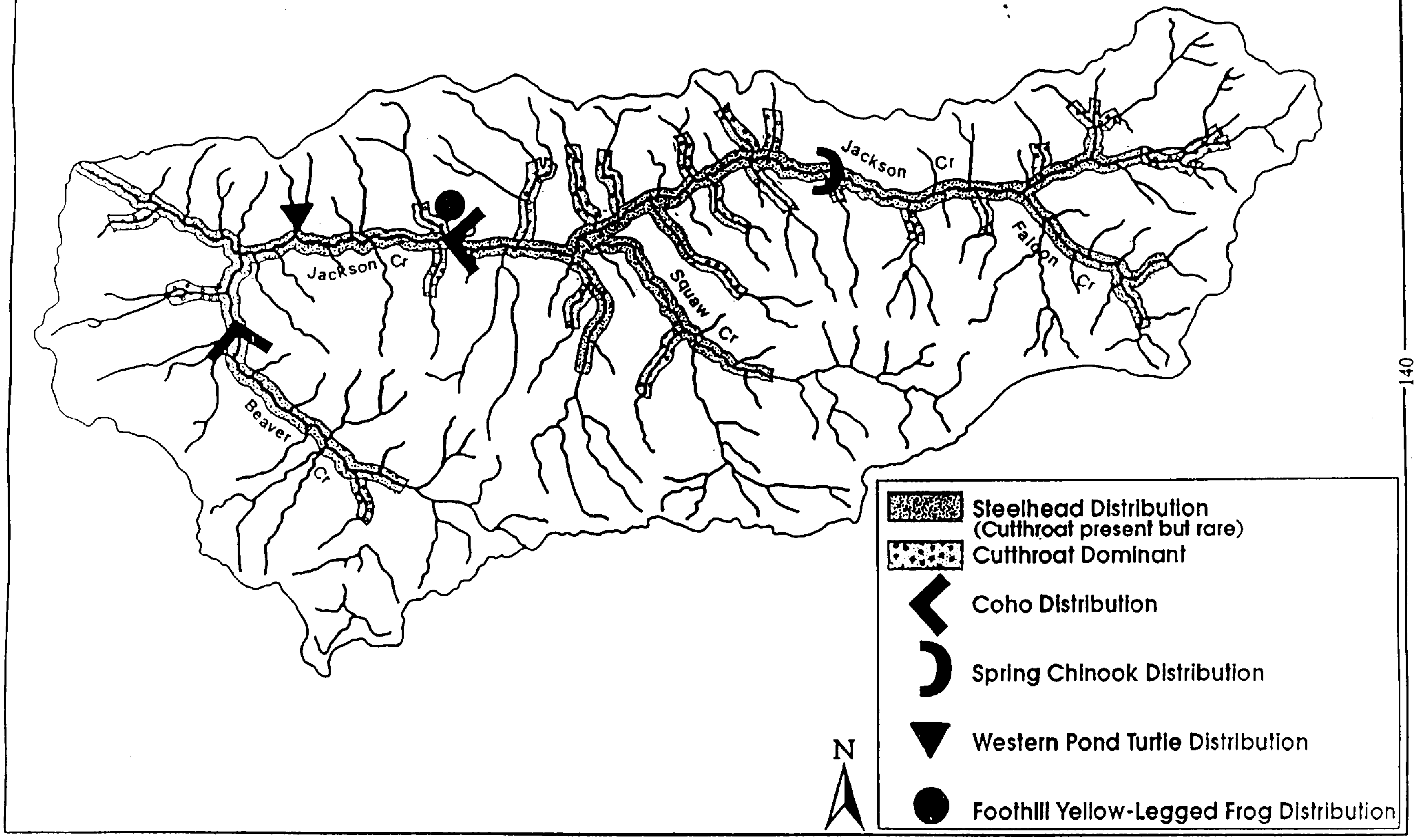
It has been recognized for a long time that spring chinook populations have been declining in the Umpqua basin. Historically, spring chinook were harvested commercially in the main stem of the Umpqua River. Estimated numbers of chinook harvested in-river from 1923 to 1946 plummeted from as high as 11,500 fish down to as low as 100 fish annually (Fish Commission of Oregon and Oregon State Game Commission, 1946). Declining catch rates led the state Fish and Game Commissions to recommend that "additional study be conducted for at least one complete life cycle (five years) of the spring chinook salmon, to attempt to further identify and correct all the factors contributing to the declines of the fishery." The commissions further recommended:

> *"It is recommended that the Umpqua River and its tributaries be closed to fishing for spring chinook salmon, insofar as practicable, by the commercial and sport fisheries for a period of at least five years."*
>
> \- Fish Commission and Game Commission of Oregon, 1946.

Figure 22

Jackson Creek Watershed - Fish Distribution

Current summer distributions of salmonids, western pond turtle, and foothill yellow-legged frog in Jackson Creek basin. Distributions are mapped as upstream limits.



Umpqua basin spring chinook have continued to be harvested commercially and recreationally in ocean fisheries off the Oregon coast, as well as in-river. The estimated, average annual in-river recreational catch of spring chinook salmon from 1977-1985 was 1,948 fish in the Umpqua basin (Nicholas and Hankin, 1988).

Since 1961, the Oregon Department of Fish and Wildlife has conducted snorkel counts of index pools that hold adult spring chinook through the summer in the South Umpqua River and Jackson Creek (Figure 23). While the methods and consistency of these counts is questionable over this long period, the data suggest a long term decline from the 1960s to the early 1980s where numbers increased again for several years but remain inconsistent and highly variable. Low population numbers with high variability as suggested by the trends in the index snorkel counts generally increase risk of extinction (Ruggiero et al., 1994).

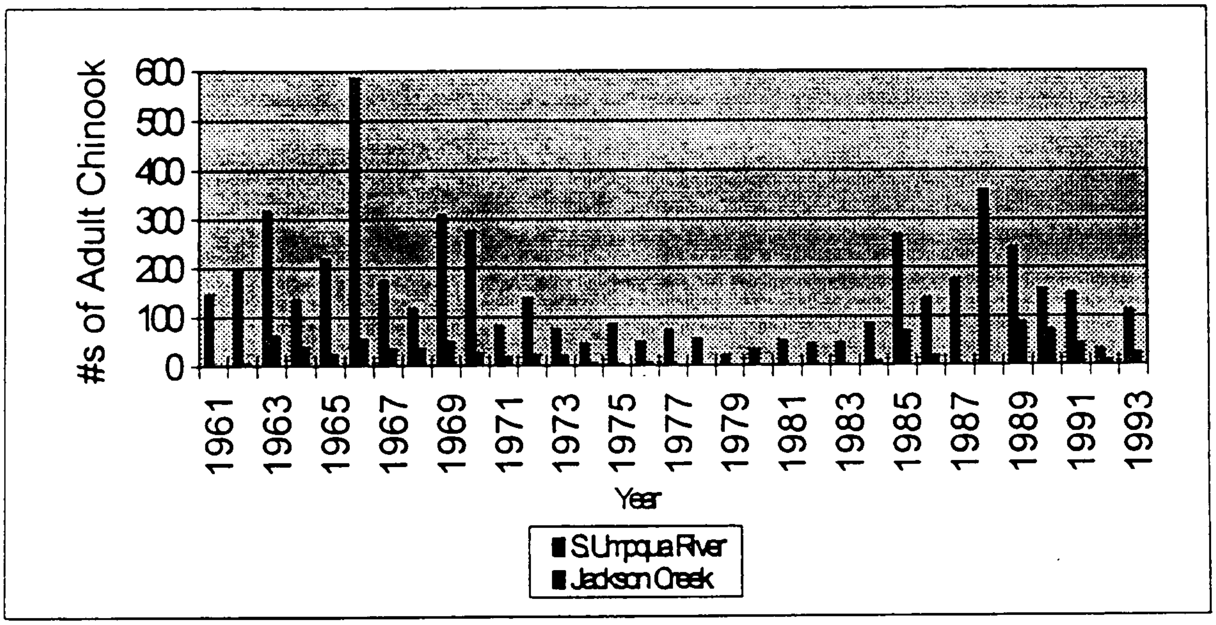


Figure 23. Index snorkel counts of adult spring chinook in the South Umpqua River and Jackson Creek from 1961 - 1993.

The ODFW doubles these index counts to estimate total chinook escapement. In so doing, the estimated range of escapement for the entire South Umpqua River from 1961 to 1993 is 50 to approximately 700 fish with the exception of 1966, when escapement was esimated at 1300 fish. The range for Jackson Creek in this period is from 0 to 180 fish. These estimates pale in comparison to historic escapements of approximately 5000 fish for the South Umpqua spring chinook run (USDA Forest Service, 1966).

For nearly forty years, juvenile chinook originating from North Umpqua River brood stock have been outplanted into the South Umpqua River, with the intent to increase South Umpqua adult returns. As early as 1956 and 1957, 47,000 to 252,000 juveniles (fry, presmolts, and smolts) were transplanted into the South Umpqua system. No additional stocking was done until the 1980s, when annual juvenile releases ranged from 11,000 to 595,000 fish from 1981 through 1994. Some of these fish were released into Jackson Creek. All fish since 1990 have been coded-wire-tagged so that their contribution to adult returns could be tracked on the spawning grounds. The first expected returns from this tagging effort would have been jacks (1 year in ocean) in 1992. In two years of spawning ground surveys (1993, 1994), 152 carcasses were found on the spawning grounds. Only one of these fish was coded-wire-tagged and this individual was a stray from the Rogue River. This suggests that hatchery supplementation of South Umpqua spring chinook with North Umpqua fish did not contribute to the adult population in the South Umpqua from 1992-1994. In fact, this hatchery supplementation effort was suggested as one of the threats creating a high risk of extinction for the wild South Umpqua spring chinook stock by Nehlsen et al. (1991) due to concerns over genetic integrity, as well as competition between hatchery and wild juveniles. The information above suggests that genetic integrity is not being affected. Competition between wild and hatchery juveniles is certainly occurring in streams and in the estuary.

Humans directly impact spring chinook in the South Umpqua by poaching oversummering adults. Adults migrate up river and reach their summer resting positions, in deep pools, during late May and to June. From that time until they spawn in September and October, they are highly vulnerable to poaching. The spring chinook distribution is extremely limited in the upper portion of the South Umpqua basin where Jackson Creek and the upper South Umpqua shrink down to relatively small streams at summer low flow (see section on "Streamflows"). This makes these fish highly susceptible to poaching because in many cases they are virtually "trapped" in their holding pools by low flows and cannot escape poaching efforts. Poaching has long been noted as a threat for South Umpqua spring chinook, especially during times of very low escapement and/or very low summer flows. The presence of valley bottom roads throughout the chinook distribution in the South Umpqua River and Jackson Creek has facilitated easy access for poachers to chinook holding areas. Undoubtedly, without such ease of access, the extent and potential for poaching would be far less than what currently exists.

Until recently, little has been known about spring chinook life histories in the South Umpqua River. As a result, the Umpqua National Forest funded a four year study of the life history of spring chinook in the South Umpqua basin. Much of this study was focused on Jackson Creek. Juvenile salmonid outmigrations were quantified for four years in Jackson Creek and the South Umpqua River above Jackson Creek. Data indicate that approximately 95% of the outmigrants from both sytems were underyearlings (Roper et al., 1994). Annual wild spring chinook outmigrations from Jackson Creek have varied from about 13,000 smolts in 1991 to 0 in 1993, rebounding back to about 8,000 in 1994 (figure 24). Trends in outmigrations in the South Umpqua River have paralleled those in Jackson Creek with approximately twice as many outmigrants leaving the South Umpqua River as from Jackson Creek. The observation of no outmigrants from Jackson Creek in 1993 and only about 5,000 from the South Umpqua, along with the observation of extremely high annual variability in numbers of outmigrants, again suggests a relatively high susceptibility of these fish to extinction due to further environmental change or simply due to chance events (Rieman et al., 1993, Ruggiero et al., 1994). Jackson Creek contributed from 0 to 35% of the total annual number of juvenile chinook outmigrants in the study period.

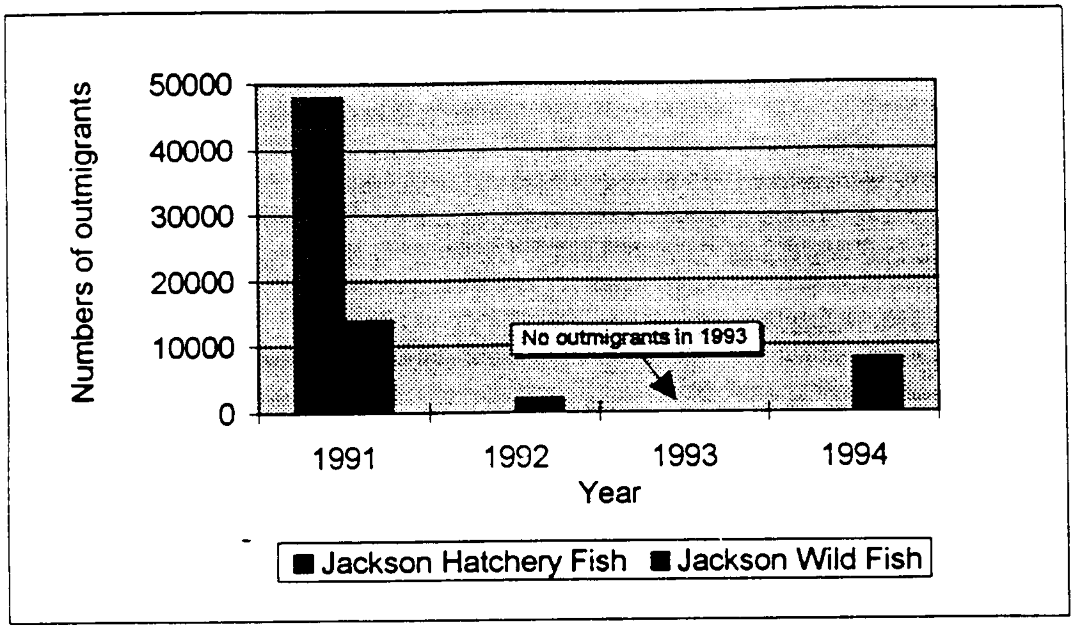


Figure 24. Numbers of juvenile chinook outmigrants estimated to leave Jackson Creek over a four year period.

One of the more disturbing findings from the South Umpqua spring chinook study is that egg to smolt survival rates for chinook in Jackson Creek were below the range observed in the scientific literature (Table 48). Egg to smolt survival in Jackson Creek ranged from 0 to 8.9% with a mean of 4% over four years (Roper, unpublished data). About 95% of Jackson Creek chinook rear for only 2 to 3 months in freshwater prior to becoming smolts and migrating to the ocean (ocean-type life history). Chinook in other river systems live in freshwater for 14 to 15 months prior to becoming smolts (stream-type life history). Egg to smolt survival for stream-type chinook should be much lower than that for ocean-type chinook because stream-type chinook have to overwinter in freshwater prior to becoming smolts. This overwintering period is one of high mortality (40-50%) which ocean type chinook do not experience (Bugert and Seidel, 1989). Therefore, egg to smolt survival for ocean-type chinook, such as those in Jackson Creek, should be much higher than that for stream-type chinook. Jackson Creek chinook egg to smolt survival rates are at the low end of the range, and even below the range in some cases, of egg to smolt survival observed in stream-type populations. **This suggests that, mortality for chinook salmon in Jackson Creek is inordinately high. This mortality occurs during the time between egg deposition and when fry and smolts migrate to the ocean.**

Data Source	Egg to Smolt Survival Rate (Means)	Life History
Jackson Creek	0% - 8.9% (4%)	Ocean Type
Healey (1980), as cited by Healey, (1991)	12% - 20%	Ocean Type
Bjornn (1978), as cited by Reiser and Bjornn (1991)	4% - 14% (8%)	Stream Type
Major and Mighell (1969) as cited by Healey (1991)	5.4% - 16.4%	Stream Type
Bugert and Seidel (1989)	13% - 22%	Stream Type

Table 48. Comparison of Jackson Creek chinook egg to smolt survival rates with those documented in the scientific literature.

The fact that egg to smolt survival is low in Jackson Creek, combined with the long recognized trend of highly variable and low escapement, suggests that density independent factors may be regulating chinook survival. Two potential environmental factors that may be profoundly affecting egg to smolt survival are spawning habitat quality and early rearing habitat quality. Detailed discussion of habitat deficiencies in these areas are located in the "Aquatic Habitat" section.

Coho Salmon

Coho salmon populations in the Umpqua basin have been declining since at least the 1920s. Commercial landings of coho salmon in the Umpqua River indicate a trend of decline in the fishery that mimicked the decline seen with spring chinook. From 1923 to 1946 the coho catch dropped from over 240,000 fish to less than 10,000 fish (Fish Commission of Oregon and Oregon State Game Commission, 1946). This trend prompted the Fish and Game Commissions to recommend that "fishing intensity on the silver [coho salmon] runs should be curtailed."

Coho salmon in the Umpqua basin were considered at "moderate risk of extinction" by Nehlsen et al. (1991) due to habitat degradation and hatchery influences. The ODFW operates a hatchbox program for coho salmon in the South Umpqua basin which results in inconsistent numbers of fry released into the system. One concern with this program is that adults for brood stock are collected in the lower South Umpqua River where the ultimate destinations of these fish are unknown. These fish might be headed for streams with relatively good habitat where smolt production from their reproductive efforts would be relatively high. Eggs are hatched in hatchboxes and fry are released into streams with documented low coho escapements. Reasons for the low escapements in the release streams are not usually known but may often be related to juvenile rearing habitat deficiencies. Thus, the value of releasing fry possibly destined for streams with relatively good habitat, into streams with potentiallv poor rearing habitat is questionable.

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.

In spite of their depressed status, wild coho 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.

The ODFW currently considers coho in the Umpqua basin as a "documented depressed population" (Nickelson et al., 1992). South Umpqua River coho runs were estimated to be as high as 70,00 fish at one time prior to 1966 (USDA Forest Service, 1966). The 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 (Loomis, personal communication) also reports an average of 3 to 4 coho spawners per mile in their surveyed reaches in the South Umpqua basin in 1994. If the spawner counts are representative (they are usually overestimates), the current coho escapement estimate for the South Umpqua basin is 1020 to 1360 fish, a 98% decrease from estimated historic levels.

Most South Umpqua coho spawn and rear in the Cow Creek subbasin or in lower South Umpqua tributaries downstream of 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 within the Jackson drainage. Of these locations, Beaver Creek and Dumont Creek have had the highest numbers of coho spawners observed (as high as 15 to 30 spawners per mile) since the mid 1980s (survey effort has not been equal through all these streams).

Within the Jackson Creek watershed, lower Beaver Creek (the lower 1.5 miles) is the primary stronghold for coho production. Coho have also been seen as high as 12 to13 miles up the main stem of Jackson Creek in high escapement years. The fact that they have not been seen this far up in the basin since 1986 suggests that their historic range may be declining. In most recent years they have been seen only in the lower 6 to 8 miles. In the summer of 1989, juvenile coho abundance in main stem Jackson Creek was relatively low compared to that in Beaver Creek. There was an estimated total of 1723 coho juveniles in the Jackson Creek basin. Of that total, 869 were found in the lower 1.5 miles of Beaver Creek, while the other 854 were dispersed throughout the lower 8 miles of Jackson Creek. These numbers are very low probably in large part due to low coho spawning escapements in recent years. In the 1990s, a range of 0 to 4 coho spawners per mile have been observed in Beaver Creek and none have been observed in Jackson Creek proper, where there has been less survey effort (Roper, personal communication).

In spite of the low numbers of juveniles observed in summer 1989 and in spite of the low numbers of spawners observed, coho smolt production in Jackson Creek appears to be higher than that in the upper South Umpqua River above Jackson Creek. In three out of four years of salmonid outmigrant trapping in these two systems, approximately 75% of the coho smolts trapped in the entire basin originated from Jackson Creek (Roper, personal communication). Trapping periods were timed primarily to capture the chinook outmigration and were not optimally timed for capturing coho smolts. Data collection efforts timed more appropriately to capture the coho outmigration are needed to further quantify coho production.

Low spawning escapement, lack of juvenile habitat complexity, and high summer water temperatures are believed to currently be the primary limiting factors for coho salmon. Deficiencies in spawning habitat quality were identified as part of watershed analysis but these defiencies are not currently believed to be a primary limiting factor. This does not preclude the possibility that spawning habitat quality may become the limiting factor in the future if other factors currently limiting coho production improve. These statements are based on a combination of information on habitat conditions and thermal regimes, as well as professional judgement. See "Aquatic Habitat" and "Temperature" sections for more details.

Winter Steelhead

The condition of winter steelhead in the Umpqua basin is not as well documented as those of chinook and coho salmon. Winter steelhead run size for the South Umpqua basin alone was estimated to be as high as 30,000 at one time prior to the 1960s (USDA Forest Service, 1966). While there has never been a commercial fishery targeting steelhead in the Umpqua River, they were taken as incidental catch during the coho commercial season in numbers approximating 1200 per year prior to 1946 (Fish Commission of Oregon and Oregon State Game Commission, 1946). Currently, the Oregon Department of Fish and Wildlife is establishing winter steelhead escapement goals as part of its Umpqua River Fish Management Planning process. The range of alternatives being considered in this plan call for run sizes of from 3200 to 5300 winter steelhead for the entire South Umpqua drainage (ODFW, unpublished info). These objectives reflect a 82 to 89% decline in steelhead escapement relative to historic numbers.

Steelhead are probably the most abundant salmonid in the Jackson Creek watershed occupying approximately 47 miles of habitat in the basin (Figure 22). The primary summer habitat for juvenile steelhead consists of the 22 miles of main stem Jackson Creek but, several tributaries, most notably Squaw, Falcon, Black Canyon, and Beaver Creeks also provide spawning and rearing habitat. For this watershed analysis, juvenile rainbow trout observed in the headwaters of these tributaries were assumed to be juvenile steelhead. Some of these fish may actually be resident rainbow trout but they were assumed to be juvenile steelhead because: (a) there is no practical way to discern differences between resident rainbow and juvenile steelhead trout using conventional field sampling methods and, (b) there were no obvious barriers to adult steelhead migration into these headwater streams.

Jackson Creek juvenile steelhead abundance and habitat utilization patterns were studied in summer 1989. Approximately 31,000 age 1 and older juvenile steelhead were estimated to be present in the basin. This number is relatively high compared to the two year average of 21,315 steelhead in the Steamboat Creek basin (North Umpqua drainage) in summers 1987 and 1988 where there are both summer and winter runs of steelhead (Dambacher, 1991). Furthermore, there was more than twice the amount of steelhead habitat by surface area in the Steamboat Creek basin (800,000 sq. meters) than in Jackson Creek basin (365,000 sq. meters). Basin-wide average steelhead densities in Jackson Creek (0.068 fish sq. meter) were 2.5 times the average densities in Steamboat Creek (0.026 fish/sq. meter).

Differences in steelhead life history strategies between these two streams may explain the dramatic difference between summer rearing densities. Juvenile steelhead employ what is known as a partial rearing life history in Steamboat Creek and other tributaries of the North Umpqua River. Many juveniles outmigrate from their natal streams at the end of their first year to reside in the main stem North Umpqua River for a second year prior to migrating to the ocean. Approximately 80% of the age 1 and older steelhead outmigrants from Steamboat Creek were age 1 fish while only 20% were age 2 or older fish (Dambacher, 1991). Approximately 70% of the migrants from Calf Creek, another North Umpqua River tributary, were age 1 fish while 30% were age 2 or older fish (Harkleroad and La Marr, 1993). In contrast, although based on incomplete trapping data, it appears that approximately 50% of the age 1 and older steelhead outmigrants from Jackson Creek are age 1 fish while the other 50% are age 2 or older fish (Roper and Scarnecchia, 1991). From these data it appears that a greater proportion of juvenile steelhead in Jackson Creek reside a second year than in North Umpqua River tributaries.

The difference in steelhead life history strategy between North Umpqua and South Umpqua tributaries may be attributable to differences in rearing conditions in the main stems of these two rivers. Summer rearing conditions in main stem North Umpqua River are conducive to high survival for salmonids due to high water quality and quantity, as well as relatively low water temperatures (Dambacher 1991, Harkleroad and La Marr, 1993). These conditions might promote emigration of age >1 steelhead from tributaries into the main river to reside another year before migrating to the ocean. In the South Umpqua River summer water temperatures are at or near lethal levels for salmonids through most of the summer (Roper and Scarnecchia, in progress) so it is not a viable option for salmonids to migrate to and reside in main stem South Umpqua River during summer periods. As a result, a greater proportion of juvenile steelhead in Jackson Creek may reside at least two full years in their natal stream prior to emigrating to the ocean. This would explain the higher summer rearing densities of age >1 steelhead in Jackson Creek compared to Steamboat Creek since many of the one year old fish leave Steamboat Creek at or just before the onset of summer. Discussion of summer habitat utilization for steelhead is located in the "Aquatic Habitat" portion of the document.

Cutthroat Trout

Little historical information exists concerning cutthroat trout in the Umpqua Basin. The Oregon state fish and game commissions recognized cutthroat as the "problem children" of the state game commission because of the lack of information on them (Fish Commission of Oregon and Oregon State Game Commission, 1946). In the past, there were specific sport fisheries targeting large cutthroat trout, either sea-run or fluvial fish (migratory within the river) typically 12" to 16" in length (Oregon Sportsman, 1913, Chenoweth, 1972). Currently there is virutally no fishery for cutthroat trout in the North Umpqua or South Umpqua Rivers.

Umpqua basin cutthroat, most notably sea-run fish, have declined to the point where they are now listed on the Oregon state sensitive species list. This listing includes all cutthroat trout located below migration barriers, both sea-run as well as fluvial migrants. Sea-run cutthroat populations have declined throughout the basin and remnant runs are considered to exist in Smith River and possibly in main stem Umpqua River tributaries (Nickelson et al., 1992). North and South Umpqua River sea-run cutthroat trout were petitioned for threatened or endangered status under the endangered Species Act in April 1993. The National Marine Fisheries Service (NMFS) proposed to list Umpqua basin cutthroat as an "endangered" species. In its status review for the cutthroat, NMFS identified all cutthroat including headwater resident populations as part of the evolutionarily significant unit under consideration for "endangered" status (Johnson et al., 1994).

NMFS included resident cutthroat populations in the proposed listing based on the likelihood that there is at least partial genetic interchange between sea-run, fluvial, and resident forms (Johnson et al., 1994). Information collected in spring 1993 on a North Umpqua River tributary suggests that this contribution may occur in the Umpqua basin (Harkleroad, 1994). An outmigrant trap operated on Cedar Creek, a third order tributary to Steamboat Creek in the North Umpqua drainage, yielded 133 age >1 juvenile cutthroat emigrants. The ultimate destination of these fish is unknown but some of them may have been destined for the ocean to take on a sea-run life history. Small resident cutthroat, (5" to 8") as well as larger, migratory cutthroat (12" to 16") have been observed spawning in the upper reaches of Cedar Creek over the years. The larger spawners may have had either fluvial or sea-run life histories. Sea-run cutthroat escapements into the entire North Umpqua River were only 34 and 10 fish (Loomis and Anglin, 1992) respectively for the two brood years contributing to the emigration documented in Cedar Creek. As cutthroat trout have been documented emigrating from at least three other North Umpqua River tributaries (Loynes, personal communication), it is unlikely that the outmigrants trapped in Cedar Creek originated from sea-run parents. More likely, these outmigrants were of either resident or fluvial cutthroat parentage.

Some studies suggest that cutthroat populations in each stream may be unique unto themselves (Campton and Utter, 1987, as cited by Johnson et al. 1994, and Currens et al., 1992). Sea-run cutthroat populations in different areas of Puget Sound are genetically distinct from each other (Campton and Utter, 1987, as cited by Johnson et al., 1994). Gene flow between neighboring cutthroat populations in headwater tributaries was found to be extremely limited in a coastal Oregon basin and the authors suggested that each tributary has a population with its own distinct genetic makeup (Currens et al., 1992).

Cutthroat in the Jackson Creek watershed are not as widely distributed or abundant today as in the past. Historic accounts document cutthroat being caught regularly in Jackson Creek in the 1920s on into the 1960s. During a 1937 stream survey (Roth, 1937), cutthroat were considered "abundant" in the lower 4 miles of Squaw Creek and "abundant" in the lower 3 miles of Falcon [Abbott] Creek. During fish surveys in summers of 1989 and 1994, extremely few cutthroat trout were observed in these streams based on snorkeling methods (4.7 fish per mile in Squaw Creek, 14 fish per mile in Falcon Creek). Cutthroat were considered "common" in Beaver Creek in 1937 but are quite rare (7 fish per mile, based on snorkeling methods). Cutthroat were documented as "rare" in the lower 5 miles of Jackson Creek in 1937 but were not seen at all in this reach during snorkel surveys in summer 1989.

Current cutthroat distributions were determined as part of field work for this watershed analysis during spring and summer 1994 (Figure 22). Trends in cutthroat distribution and relative abundance in Jackson Creek are generally consistent with those observed in other Pacific Northwest watersheds (Johnson et al., 1994). Cutthroat are the dominant fish species in 24.2 miles of higher gradient (6 to 15%), small, headwater streams. Cutthroat coexist in very low relative numbers with steelhead in another 46 miles of higher order streams including main stem Jackson Creek, Beaver Creek, Falcon Creek, Squaw Creek, and lower Lonewoman Creek. Age >1 cutthroat are outnumbered at least 20 to 1 by age >1 steelhead in these streams.

Population dynamics and genetic relationships of cutthroat in Jackson Creek have not been studied. Therefore, based on the above discussion and the work of Johnson et al (1994), the following assumptions were made for this watershed analysis:

1. Cutthroat populations in headwater tributaries are linked to migratory populations and potentially contribute genetic material to both sea-run and fluvial populations.

2. Headwater cutthroat populations are genetically distinct from each other, potentially resulting in a unique genetic contribution to migratory populations, which makes each tributary stream important.

3. Cutthroat residing in main stem Jackson Creek, as well as in larger tributaries where they are subdominant to steelhead are likely members of migratory populations but may have originated in headwater, resident populations.

These assumptions are intended to be conservative for the sake of not precluding options for the preservation and restoration of all forms of cutthroat trout life history.

Aquatic Macroinvertebrates

Aquatic macroinvertebrate sampling using the ABA Bioassessment method (Wisseman, 1993) has been conducted since 1989 in Jackson Creek as a part of Forest Plan monitoring activities. This protocol entails sampling three different habitats at each site: riffles, channel margins, and coarse particulate organic matter (CPOM). CPOM consists of leaves, needles and other organic matter which collects behind logs, boulders, and in dead water areas. Many different indices are used to characterize macroinvertebrate communities but the "Total Score" index gives a general characterization of aquatic habitat condition as described by Wisseman (1993) (Appendix P).

Two sites on the mainstem of Jackson Creek have been surveyed annually beginning in 1989. One site is located in lower Jackson at about river mile 0.4 while the upper site is located at about river mile 13 in the Luck Creek Flats vicinity. Two years of inventory data are available for Squaw Creek. A summary of results, by site, follows.

Lower Jackson Creek

Total scores for riffle samples ranged from 32 to 52 from 1989 to 1992. This indicates "moderately to severely impaired" habitat (Wisseman, 1993). Accumulations of CPOM could not even be found for sampling at the lower Jackson Creek site from 1989 to 1992 indicating that the channel is so simplified that there are very few calm water areas in lower Jackson Creek where CPOM is deposited. Total numbers of taxa dropped substantially over the four year sampling period.

From 1989 through 1992 the macroinvertebrate community described from riffle and channel margin sampling was dominated by riverine taxa and taxa tolerant of high summer temperatures and fine sediment. Taxa intolerant of high temperatures, fine sedimentation, and high scour were very rare or absent. The fauna present indicated that high summer water temperatures profoundly influenced macroinvertebrate community structure and caused substantial mortality to stone-cased caddisflies that remain dormant throughout the summer (Wisseman 1993). Taxa dependent on large crevices and interstitial spaces in the stream bed were rare. Overall, the macroinvertebrate community in lower Jackson Creek reflected a highly simplified stream channel with severe scouring flows, poor retention of organic matter, excessive sedimentation, and high summer water temperatures..

Upper Jackson Creek

From 1989 through 1992 the total scores ranged from 56 to 64, indicating "slightly to moderately impaired" aquatic habitat. The macroinvertebrate community at this site was severely limited by the lack of habitat complexity (Wisseman, 1993). As with the lower site, little crevice and interstitial space was available and, therefore, very few species associated with these habitats were present. This community also indicated that periodic scour of the site is extreme and where gravel and cobble deposits have accumulated, deposits are re-sorted every few years by floods. During periods of floods, few low velocity refuges exist (Wisseman 1993).

As was the case with the lower Jackson Creek site, a substantial drop in the total taxa richness was observed between 1989 and 1992. Taxa tolerant of fine sediment and high temperatures increased in numbers from 1989 to 1992 or appeared for the first time in 1992 (Wisseman, 1993).

Squaw Creek

During the one year that data was available for Squaw Creek, the total score was 63, indicating a "slightly impaired" condition. The macroinvertebrate community in Squaw Creek reflected relatively low water temperatures and low sedimentation. However, the community also reflected a lack of channel complexity and severe scouring and re-sorting of bed substrates during winter flows. Lack of channel complexity in Squaw Creek is further addressed in the "Aquatic Habitat" section.

Threatened, Endangered, and Sensitive Macroinvertebrates

In 1990, three species of caddis flies (Order: Trichoptera) currently on the Region 6 Regional Forester's Sensitive Species List were found within the Jackson Creek watershed. These species are Apatania tavalus, Farula reaperi, and Erobrachcentrus gelidae. All of these species are generally found in springs or spring fed streams with cold water at high elevation (> 4000 feet). Within the Jackson Creek basin, they were all found in the same vicinity; the headwaters of Squaw and Donegan Creeks. This area is somewhat unique within the basin in view of the fact that there are many cold water springs with relatively large amounts of cold flowing water even under summer low flow conditions. This characteristic may be associated with the High Cascades geology of the area (see "Geology" discussion). No other areas within the Jackson Creek basin have been sampled for these species so there are potentially more populations of these species present than those currently known. Devils Knob Creek and Triangle Creek are two potential streams that could support these fauna due to their spring-like nature.

Semi-Aquatic Amphibians and Reptiles

Amphibians and Reptiles

Seventeen species of aquatic or semi-aquatic amphibians and reptiles are known or suspected to occur in Jackson Creek watershed. Native species include five salamanders, four frogs, one toad, one turtle, and six snakes. One exotic species, the bullfrog also occurs.

Many species of reptiles and some amphibians have terrestrial habitat associations and are not addressed in this section (See Wildlife section). Species with aquatic or dual aquatic and terrestrial associations are discussed here with emphasis on their use of aquatic and riparian habitats.

Dual aquatic/terrestrial forest species such as the tailed frog and the red-legged frog have largely unknown upslope terrestrial life histories along with specific aquatic requirements for breeding. Discussions regarding these species also occurs in the wildlife section and special habitat section of this report. Understanding dual habitat conditions of aquatic breeding and upland terrestrial non-breeding habitats is an important information gap (Bury et. al. 1991). Old growth and mature forest habitats with vernal ponds in the Oregon Cascades proved to be important habitats for red-legged and Cascades frogs (Bury et. al. 1991; Gilbert and Allwine 1991). Lack of knowledge about upslope habitat needs of these species, combined with a lack of knowledge of how land management activities impact these needs may increase their risk of extirpation.

Species and Community Distributions

Jackson Creek watershed has not had extensive inventory and monitoring of amphibians and reptiles. District information is sketchy and mainly related to past timber planning areas where surveys for species on the R6 sensitive species list were completed. A limited field sampling effort in aquatic habitats associated with this watershed analysis focused on determining the distribution of the western pond turtle (Clemmys marmorata marmorata) and foothill yellow-legged frog, (Rana boylii). These are both R6 sensitive and FWS category 2 candidates for T&E listing. Table 49 displays occurrences of species known to be present in Jackson Creek watershed. Table 50 lists species suspected to occur in the watershed.

Detailed descriptions of historic and existing conditions of amphibians and reptiles in Jackson Creek is not possible given existing information. The following is available information on species and habitat.

Western Pond Turtle

The western pond turtle (WPT) is currently classified as a "category 2" candidate for listing by the United States Fish and Wildlife Service (USFWS), "sensitive" by the US Forest Service, and "sensitive (critical)" by the Oregon Department of Fish and Wildlife.

Species	Habitat Association	Known Distribution
Western red-backed salamander (Plethodon vehiculum)	Riparian areas of class I, II, III, and IV streams. Seeps and Upslope.	Mainstem Jackson Creek near Cover Camp. Likely in other areas of the corridor. Rocky seeps above Serviceberry Creek.
Pacific giant salamander (Dicamptodon tenebrosus)	Stream and riparian area of class I, II, and III streams. Lakes, Ponds and Wetlands.	Basin wide
Foothill yellow-legged frog (Rana boylii)	Stream and riparian area of class I and II streams.	Lower 8 miles of mainstem Jackson Creek.
Northern red-legged frog (Rana aurora aurora)	Stream and riparian area of class I, II, and III streams. Lakes, Ponds, Wetlands and Upslope.	Mainstem Jackson Creek below 4000'. High numbers found in Beaver Creek. Found in streams including; Whiskey Soup, Donegan, and Squaw Creeks. Found in ponds of Beaver, Donegan, Squaw, and Black Canyon drainages.
Bullfrog (Rana catesbeiana)	Stream and riparian areas of class I and II streams. Ponds.	Lower 5 miles of mainstem Jackson Creek.
Rough skinned newt (Taricha granulosa)	Stream and riparian area of class I, II, III, and IV streams. Lakes, Ponds, Wetlands, and Upslope.	Mainstem Jackson Creek corridor and other subdrainages. Ponds near Maverick Creek.
Cascades frog (Rana cascade)	Stream and riparian area of class I, II, III, and IV streams. Lakes, Ponds, and Wetlands.	Mainstem Jackson Creek above 10 miles and other subdrainages. Widely distributed in Upper Jackson. Jackson (generally above 3000'). Found in class IV's up Donegan, Serviceberry, and Lonewoman. Ponds in Serviceberry, Poole, and Triangle Lake drainages.
Western pond turtle (Clemmys marmorata)	Stream and riparian area of class I and II streams. Lakes, Ponds, and Wetlands.	Lower 5 miles of Jackson Creek. Blue Bluffs and Skookum Ponds.
Red-sided garter snake (Thamnophis sirtalis fitchi)	Stream and riparian area of class I, II, and III streams. Lakes, Ponds, Wetlands, and Upslope.	Stampede Creek Pond
Western terrestrial garter snake (Thamnophis elegans elegans)	Stream and riparian area of class I, II, and III streams. Lakes, Ponds, Wetlands, and Upslope.	Black Canyon Creek Pond
Northwestern garter snake (Thamnophis ordinoides)	Stream and riparian area of class I, II, and III streams. Lakes, Ponds, and Wetlands.	Serviceberry Creek
Tailed frog (Ascaphus truei)	Stream and riparian area of class III streams. Also found upslope	Highly likely to be present in basin
Western toad (Bufo boreas)	Aquatic and riparian area of lakes, ponds, and wetlands. Also found upslope.	Huckleberry, Triangle, and Poole Lakes.

Table 49. Semi-aquatic amphibian and reptile species known to be present in Jackson Creek watershed.

Species	Habitat Association	Known Distribution
Oregon garter snake (Thamnophis couchii hyrophila)	Stream and riparian area of class I, II, and III streams.	Suspected to be present
California mountain kingsnake (Lampropeltis zonata)	Riparian areas of class I, and II streams especially rocky areas and logs.	Suspected to be present
Rubber boa (Charina bottae)	Riparian areas of class I, II and III streams, especially near logs.	Suspected to be present
Dunn's salamander (Plethodon dunni)	Riparian areas of class III and IV streams.	Suspected to be present
Southern torrent salamander (Rhyacotriton variegatus)	Stream and riparian area of class III and IV streams. Rocky seeps.	Suspected to be present

Table 50. Semi-aquatic amphibian and reptile species suspected of occurring in Jackson Creek watershed.

WPT is known to occur throughout western Oregon, and in a few places in eastern Oregon. Geographic range stretches into Washington where few if any viable populations presently occur and down through California with a disjunct population in Nevada. Some of the largest known populations of WPT occur in northern California. Present rangewide distribution of WPT is marginally smaller than when European man first arrived on the west coast (Wray unpubl. 1994). However, populations throughout its range currently show declining trends, including local population extirpations and lingering non-viable populations (Holland 1991, 1994).

Umpqua and Roque River basins are believed to have the highest and most viable populations in Oregon. However, these basins also show signs of declining populations with high adult/juvenile ratios (>90%) in places in the mainstem of the Umpqua versus the South Umpqua which had a 70% adult to juvenile ratio (Holland 1991). Generally, population conditons get worse from upper to lower portions of the basins. The upper South Umpqua, especially above Days Creek is known to have the largest present populations with viable levels of recruitment.

Based on recent studies in the Tiller area (Holland 1991, 1994), the present upper South Umpqua River populations are likely lower than historic. Suspected limiting factors are:

1) Loss of historic nesting areas to road construction along the main South Umpqua River and its tributaries;

2) Annual mortality due to traffic when turtles attempt to cross existing roads (esp in or near riparian areas) along the main South Umpqua and it tributaries including Jackson Creek;

3) Introduction of the bullfrog which has been shown to prey upon hatchling turtles;

4) Lack of aquatic habitat complexity especially for hatchling pond turtles;

5) High nest predation which may have always been naturally high or may be a result of increases in generalist species such as racoons and skunks favored by timber harvest.

6) Direct human impacts by shooting. Anectdotal information also supports higher historic population numbers (**Appendix AA**).

Until recently, little was known about WPT life histories in the South Umpqua Basin. A five year interagency cooperative effort has provided the most extensive gain in information regarding nesting, aquatic and terrestrial habitats. The least is known about terrestrial habitats yet observations and radio telemetry efforts have shown that this species spends a considerable amount of time on land. They have been found to overwinter in riparian and upslope forest.

Main stem Jackson Creek and lower Beaver Creek were sampled in association with this watershed analysis to determin distribution of WPT in Jackson Creek. Results indicate the highest use occurs in the the lower main stem of Jackson Creek (lower 5 miles). Individual WPTs have been observed as far up Jackson Creek as an unnamed small pond above Jackson Creek off the 2925 road, and Skookum pond. Blue Bluffs pond in the Beaver Creek drainage, also has a population with a nearby nesting area discovered this year. However, observers (Bury and others pers. com.) were suprised by the small number of individuals at Blue Bluffs pond compared to the available habitat.

A hatchling WPT was found in the mainstem of Jackson Creek at the mouth of Beaver Creek. Until this time it was suspected that WPTs in Jackson Creek was an extention of adult habitat use from the main South Umpqua. Documentation of a hatchling indicates the presence of a breeding population in Jackson Creek.

Aquatic Habitats

Based on what is known about aquatic habitats, conditions are likely the most limiting to hatchling WPT. Hatchlings use slow to stagnant water with emergent vegetation, highly productive invertebrate communities, and structural complexity such as that found in secondary channels and floodplain overflow areas. Complexity and amount of these habitats have been reduced in Jackson Creek (See "Effects of Altered Processes on Aquatic Habitat").

Adults prefer larger streams and rivers with high solar input. They are most often observed using pool habitat and prefer rocks and logs for feeding, basking and hiding cover. Ponds are also used. Larger ponds such as Blue Bluffs Pond and Skookum Pond can retain year-round residents. The importance of smaller perennial and vernal ponds is unknown though pond turtles have been observed using these ponds for short periods in spring and early summer large distances away from regular resident aquatic habitats.

Riparian Habitats

Riparian and upslope habitats may have nesting habitat which is characteristically different and rare compared to the predominant riparian and upslope forest vegetation. Nesting habitats are associated with southerly aspects, open, dry grassy conditions, and are often found near where rock comes close to the surface. Nesting soils are clay loam and are located above areas subjected to deposition by water. Locations of nesting areas are unknown in Jackson Creek except for the newly discovered nesting area near Blue Bluffs pond in the Beaver Creek tributary. Nesting areas along mainstem Jackson are likely very rare and important to population maintenance. Nesting areas may have been lost due to construction of Jackson Creek road 2900. With a favorable aspect on the north side of Jackson Creek in the present condition, if nesting occurs north of the 2900 road, hatchling pond turtles and adults must cross the road to get to aquatic habitat. Roads, especially with high traffic levels cause mortality and are therefore barriers to movement. Given the wpt is a long lived species with naturally low population recruitment levels, such factors as road mortality and nesting habitat loss or predation can significantly change population size.

Common vegetation types in riparian and upslope forested habitats are used as wpt overwintering areas. Radio telemetry and continued monitoring of movements of individuals on the main South Umpqua found wintering adults mainly below the duff layer in forested areas with high canopy closure. Similar habitat use can be expected in Jackson Creek. More information is needed to determine overwintering habitat requirements.

Foothill Yellow Legged-frog

The foothill yellow-legged frog (YLF) is one of several species of ranid frogs native to the pacific northwest. YLF is listed by the USFWS as a category 2 candidate for listing under the Endangered Species Act and as sensitive by the State of Oregon (undetermined status 1992). YLF ranged from the lower Willamette drainage to Baja California Norte. YLF has been extirpated from approximately the lower third of its range (southern and central California). Status in Oregon is unknown (Marshall 1992) though it is likely that it has been moderately to severely reduced in parts of its range in Oregon. In particular, populations in the Willamette valley may be reduced (pers. com. Storm.). Though distribution in the Umpqua drainage is poorly understood, most known localities in the state are in the Rogue and Umpqua Drainages. A survey in Jackson Creek associated with this watershed analysis documented occurrencein the lower 8 miles of Jackson Creek. Six adults and 31 tadpoles were observed.

Foothill yellow-legged frogs are habitat specialists, restricted to river and stream systems with specific substrate characteristics including streams with >40% riffles, with cobble for egg deposition (Hayes and Jennings 1988), and channel complexity for tadpoles (pers. obs. Barkhurst). Elevation range is from sea level to approximately 4000 feet, although most populations are found at less than 3000 feet.

Major threats to species include alteration or loss of stream and riverine habitat from construction of dams, water diversions, stream channel and substrate habitat loss, erosion and siltation, and exotic species introductions (fish and bullfrogs). Recent studies in northern California document atypical flows from dam releases for salmonid management may eliminate or severely reduce the number of egg masses present in downstream areas (Lind, A. R5 PSW). Bull frogs not only prey directly on YLF but bullfrog larvae compete with YLF larvae for available habitat. Introduced fish species such as smallmouth bass may also prey upon YLF (Hayes and Jennings 1988, Holland pers. com.). Smallmouth bass have been documented in the main South Umpqua river, 11 miles up from the Tiller Ranger Station. They are not known to occur in Jackson Creek.

The main South Umpqua, having no dams may be an important area for maintenance of this species. The lower 8 miles of Jackson Creek, if absent of exotic fish species, may be an important refuge area for the YLF.

Tailed Frog

The tailed frog, (TF)is listed as sensitive "vulnerable" by the State of Oregon. Very little is known about population conditions of the tailed frog in the South Umpqua basin and Jackson Creek though they have been observed occasionally during fish stream surveys. TF is a habitat specialist with very specific aquatic habitat requirements. The egg and tadpole stages are highly sensitive to habitat and water quality changes (Bury and Corn 1988). Increases in water temperature and sedimentation in streams may have negative impacts to tailed frog aquatic habitats. Tailed frog populations in Jackson Creek have likely been reduced due to increases in water temperature as well as sedimentation (see "Aquatic Habitat" discussion).

Northern red-legged frog

The northern red-legged frog (NRLF) is listed by the USFWS as a category 2 candidate for listing under the Endangered Species Act. NRLF is also listed as sensitive by the Regional Forester and sensitive "undetermined status" by the State of Oregon. NRLF ranges geographically from northern California (north of San Francisco Bay), to southwest Br itish Columbia.

Population status of the NRLF is unknown. Distribution of this species in the Umpqua Basin is not well documented although it is probably widespread. NRLF breeds in ponds and has a largely unknown terrestrial component of its life history. In the spring and summer months adult NRLF have been observed in stream side riparian habitats and transition zones often where canopy closure and relative humidity was high. In Jackson Creek watershed, the highest number of individuals have been observed in the Beaver Creek drainage. In summer 1994, 52 individuals were seen in the lower 1 mile of Beaver Creek, compared to an average of only X seen in other streams surveyed in the watershed. Bury and Corn (1988) and others (Ruggerio et. al. 1991) observed NRLF in greater abundance in mature/late successional forests near ponds.

Processes which may affect pond habitat conditions include hydrology, sedimentation, duration of water flow, water chemistry, water temperature, wind and air temperature.

Since this species has been frequently observed using stream riparian habitats (all stream classes), changes in microclimate in these habitats (increases in light, wind, temperature, and reduced humidity) may displace or restrict habitat use. Riparian reserve buffer widths may be too small to maintain favorable microclimate conditions.

Aquatic Habitat

Main Stem Jackson Creek

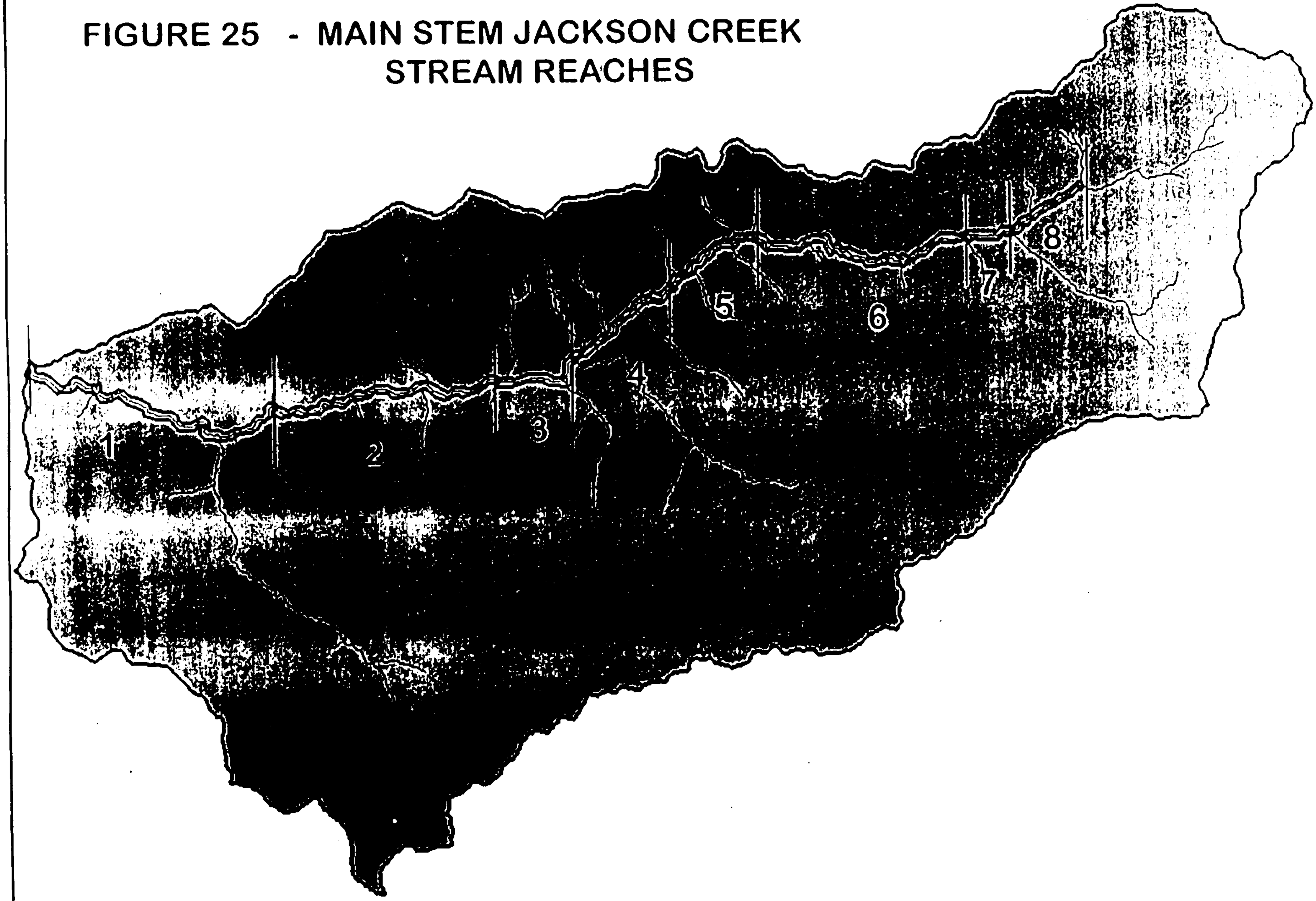
Aquatic habitat in Jackson Creek is much different today than it was historically. One major component of complexity now lacking is large wood. Historical accounts dating back into the 1930s through the 1960s suggest that wood accumulations used to be "frequent" in the main stem. In the lower main stem, wood jams did not span the channel but instead tended to be partial jams along stream margins. Two accounts specifically mention that spanning logs across Jackson Creek became more common above Deep Cut Creek (about River Mile 9). One account also describes a log jam "too large to remove" at the mouth of Twomile Creek (approximately River Mile 15) in 1961.

Stream surveys conducted in 1989 and 1994 portray different conditions than those described in historical accounts. To summarize stream survey results, the main stem was broken down into eight morphological reaches (Figure 25). Physical characteristics of the stream channel as determined during summer low flow stream surveys are displayed in Table 51.

Reach	Length Miles	Salmonid Species	Reach Gradient	% Pools	Large Wood/Mile (Structural Additions)	Valley Width
1	5.1	St, Ch, Co, Cu	0.90%	42%	2	<300'
2	4.2	St, Ch, Co, Cu	1.10%	51%	11(7)	<300'
3	1.7	St, Ch, Cu	1.20%	40%	7(6)	<300'
4	2.4	St, Ch, Cu	1.60%	44%	11(8)	<300'
5	2.2	St, Ch, Cu	1.40%	22%	5(3)	<600'
6	4.2	St, Cu	2.50%	34%	18	<100'
7	0.8	St, Cu	2.20%	24%	15	<600'
8	1.5	St, Cu	3.70%	13%	14	<300'

Table 51. Selected stream survey results from summer low-flow stream surveys of main stem Jackson Creek in 1994. Large wood is >50' long and >24" diameter. Species codes are St = winter steelhead, Ch = spring chinook, Co = coho, Cu = cutthroat.

FIGURE 25 - MAIN STEM JACKSON CREEK
STREAM REACHES



Surveys indicated that all reaches of the main stem have very little large wood (maximum of 18 pieces per mile, weighted average of 9.7 pieces per mile for all of main stem). For comparison, results of stream surveys in wilderness and roadless area tributaries of Jackson Creek indicated large wood values of 30 to 62 pieces per mile. Most of these values represent mid-seral vegetation conditions as most wilderness and roadless area stream reaches in Jackson Creek basin have undergone stand replacement fires in their watersheds within the last 60 to 100 years. Large wood values ranged from 50 to 110 pieces per mile in roadless area stream reaches in the North Umpqua River basin (Harkleroad, 1994). These streams are second to third order channels with watershed sizes ranging from 542 to 8,676 acres. Prior to road construction and timber harvest, Jackson Creek above reach 3 and all tributaries are believed to have ranged from 60 to 110 pieces of large wood per mile when riparian vegetation was in a late seral condition. Reaches 1 through 3 of Jackson Creek probably had less wood.

Aside from the amount of large wood in Jackson Creek, the configuration of the wood is also important for channel morphology and aquatic habitat. In general, smaller streams (first to third order) have the greatest amount of large wood. This wood is configured as a combination of channel spanning logs which may create a stair-step channel profile, and wood jams across the channel or along channel margins (Marston, 1982, Robison and Beschta, 1989). Based on historical data Jackson Creek above reach 3 would generally fall into this category. Larger streams (fourth order and larger) tend to have less wood than smaller streams. Wood in these streams tends to be configured as accumulations (jams) along channel margins and in floodplains or as single pieces angling off banks (Keller and Swanson, 1979, Bisson et al., 1987). This character would apply to lower Jackson Creek (reaches 1-3). Historical accounts of the nature of large wood in Jackson Creek are generally consistent with these findings in the scientific literature.

Approximately 8 miles of main stem Jackson Creek (from approximately River Mile 6 to River Mile 14) have been treated with hundreds of habitat improvement structures over the last 8 to 10 years. Structure types include root wad/boulder clusters, angle logs, log weirs, channel spanning logs placed at natural nick points, and side channel enhancement. Most of the wood used in these structures do not meet R6 size criteria for small and large wood (>24" diameter, >50 feet long). While some of these structures have had localized benefits to habitat conditions, their overall potential effectiveness has been overshadowed by watershed scale disruptions of sediment, flow, and large wood regimes as well as reduced floodplain connectivity in the main stem..

Since 1937, the low flow wetted width of Jackson Creek has apparently widened throughout the main stem (Dose and Roper, 1994). Widths were measured during stream surveys in 1937 (Roth, 1937). Comparative measurements taken in 1989 showed a 63% to 101% increase in wetted width in all reference reaches. Loss of large wood (stream cleanout), timber harvest, and road construction were suggested as potential causes for this channel widening (Dose and Roper, 1994).

Streambed substrate composition also appears to have changed since 1937. The 1937 survey indicated that "gravel" (pea to baseball sized rocks) was the dominant substrate throughout the length of Jackson Creek. Stream surveys from 1989 and 1994 indicate that "cobble" (baseball to basketball sized rocks) is currently the dominant substrate. This change is consistent with the process of stream bed scour that would occur after the loss of large wood (Keller and Swanson 1979, Marston, 1982). Such scour would tend to erode the smaller gravels out of the system and retain larger cobbles as the dominant substrate (Beschta, 1979).

Large Tributaries

Squaw Creek (14,000 acres) and Beaver Creek (22,500 acres) are two major tributaries to Jackson Creek which have direct importance to salmonids. Squaw Creek supports high numbers of juvenile steelhead during summer and is a cold water source for Jackson Creek. Beaver Creek is probably an important refuge area for coho salmon and red-legged frogs, as well as a tributary with unusually high native aquatic vertebrate species richness (13 species). Some of the major physical attributes of each stream are summarized below. More detailed descriptions of these streams are located in Appendix Q.

Squaw Creek

At its mouth, this stream provides a large quantity of water 8 to 10°F cooler than Jackson Creek (see "Temperature" and "Stream Flow" sections). Squaw Creek also provides summer rearing habitat for a disproportionate number of age 1 and older steelhead, probably due to its relatively high flow and cooler temperatures. Aquatic habitat complexity is low within the steelhead distribution (the lower 4.3 miles) as this stream averages about 16% pool habitat by area, only 19 pieces of large wood per mile, and ranges from 4% to 13% gradient. The lower 1 mile has occassional side channels and a valley width of 300 to 600 feet while the upstream 3.3 miles are more confined within a 100 to 300 foot wide valley controlled by bedrock. Channel banks are very stable and this stream is prone to high scour as evidenced by the lack of channel complexity and macroinvertebrate communities described in the "Aquatic Species" section.

Beaver Creek

The lower 1.5 miles of Beaver Creek have a unique character relative to most other streams in the Jackson Creek basin. This reach has a wide valley bottom (up to 600 feet) with low stream gradient (1.5 to 2%), high sinuosity, and extensive side channel development. Although relatively short, this reach is an important stronghold for coho salmon and red-legged frogs. Because of this stream's importance to aquatic communities, more intensive data collection was undertaken here as part of watershed analysis.

Beaver Creek's importance to aquatic communities is probably due to its inherent channel morphology. Habitat conditions are currently degraded and there is evidence that this is affecting aquatic communities. Cutthroat trout, once observed to be "common" (Roth, 1937) in Beaver Creek, are now quite rare. Channel characteristics likely contributing to aquatic species richness include low stream gradient, high pool component, and presence of side channels. These features are all present because of the inherent channel morphology. There is evidence that pools are filling with fine sediment and localized downcutting of the channel may soon isolate some of the side channel habitats and prevent their inundation even under winter flow conditions.

In spite of Beaver Creek's importance to aquatic communities, a number of habitat deficiencies are evident. Although pools make up 44% of the habitat by surface area, habitat complexity within the lower 1.5 miles of Beaver Creek is low with a total of 9 pieces of wood per mile. Stream banks are poorly armored (25-50% ground cover) and actively eroding in portions of the stream. Cobble embeddedness was evaluated as >35%. Analysis of stream bed substrate based on pebble counts showed that 36% of the surface particles in the stream bed were fine sediment <2mm diameter, compared to 14% in a nearby reference stream (see Appendix R for details).

There are several key causes likely responsible for the current degraded conditions. The riparian area in the lower 1.5 miles of Beaver Creek had 40% of its length clearcut down to the streambanks approximately 30 years ago. The stream and floodplain show ample evidence of stream cleanout as part of these acitivities. The loss of large wood from these activities likely generated excessive bank erosion and appears to have triggered localized downcutting. Similar timber harvest practices in tributary streams (Winters, Burnt, and Stampede Creeks) in the northwest corner of the Beaver Creek watershed appear to have triggered downcutting and bank erosion processes in these streams that began 30 years ago but are still active today. These streams are located in earthflow terrain where soils are deep, fine-textured, and highly sensitive to erosion. Much of the fine sediment observed in the lower 1.5 miles of Beaver Creek appears to be chronically transported there from these small tributaries.

Small Tributaries

Aside from Beaver and Squaw Creeks, there are an additional 24 small fish-bearing tributaries to Jackson Creek. These streams were surveyed using R6 level II stream survey in summer 1994. Table 52 and 53 display selected stream survey and watershed parameters for these tributaries. Detailed descriptions of each stream are located in Appendix Q.

Significance of Geomorphology to Tributary Stream Conditions

Channel conditions and character differed relative to geomorphology. We found patterns of fish distribution, land use, and aquatic habitat characteristics to differ greatly between streams in earthflow terrain compared to those in non-earthflow terrain (see "Geomorphology" section) (Appendix S).

Non-Earthflow Tributaries

		Miles of Fish Habitat								Dominant		Watershed Harvest		Riparian Reserves	
Watershed	Acres	Cut-throat	Steel-head	Grad	% Pools	Pools Per Mile	Lg Wood	Grd Cover	Embedd-edness	Bank Substrate	Road Density	% Regen	% Partial	% Regen Harvest	% LS Veg
Abbott	3050		0.5	7%	29%	72	62	51-75%	> 36%	Sm Bould	2.01	15%	10%	18%	47%
Cougar	1920	0.6		9%	25%	45	60	51-75%	< 35%	Bedrock	1.23	12%	3%	10%	44%
Crooked	1892	2.4	1.3								4.12	39%	2%	39%	62%
Reach 1		1.5	1.3	4%	13%	32	30	26-50%	> 36%	Sand					
Reach 2		0.9		12%	11%	30	63	26-50%	> 36%	Cobble					
Reach 3				31%	4%	17	55	51-75%	< 35%	Cobble					
Donegan	4360	0	0.3	11%	15%	49	49	76-100%	< 35%	Sm Bould	2.13	10%	1%	13%	63%
Eden	1345	1.3		10%	12%	73	24	51-75%	< 35%	Cobble	3.29	23%	3%	20%	58%
Falcon	8220	3.8	3.8								1.3	7%	4%	10%	66%
Reach 1	8220	0.8	0.8	2%	15%	31	13	51-75%	< 35%	Cobble					
Reach 2	2200	2.2	2.2	5%	21%	39	9	51-75%	< 35%	Cobble					
Reach 3	1800	0.8	0.8	10%	18%	43	34	51-75%	< 35%	Cobble					
Falcon Trib	1340	1	1	8%	28%	64	62	51-75%	> 36%	Cobble	0.12	0%	0%	0%	N/A
Paradise	980	0.4		10%	16%	60	28.6	76-100%	< 35%	Bedrock	2.28	NA	NA	NA	NA
Pipestone	3240	1		10%	46%	68.3	70	51-75%	< 35%	Bedrock	4.96	33%	37%	26%	30%
Saboo	600	0.6		14%	27%	101	9	51-75%	> 36%	Cobble	3.74	39%	14%	36%	42%
Serviceberry	1550	1.3	0.4	13%	12%	40	19	76-100%	< 35%	Cobble	2.82	22%	7%	17%	58%
*Three Cabin	1000	0.3		11%	25%	85	85	51-75%	> 36%	Sm Bould	N/A	27%	38%	NA	NA
Tributary C	1280	1.2	0.2	10%	13%	51.3	40	51-75%	< 35%	Sand	1.93	28%	0%	25%	70%
Tributary D	800	1.2	0.05	8%	20%	48	32	51-75%	> 36%	Cobble	3.37	29%	4%	33%	32%
Tributary E	840	0.8		14%	30%	107	24	51-75%	> 36%	Cobble	2.95	15%	14%	10%	70%

Table 52. Selected stream survey and watershed parameters for fish-bearing tributaries of Jackson Creek (non-earthflow streams). * indicates an earthflow tributary w/in a predominantly non-earthflow subwatershed.

Earthflow Tributaries

		Miles of Fish Habitat								Dominant		Watershed Harvest		Riparian Reserves	
Watershed	Acres	Cut-throat	Steel-head	Grad	% Pools	Pools Per Mile	Lg Wood	Grd Cover	Embedd-edness	Bank Substrate	Road Density	% Regen	% Partial	% Regen Harvest	% LS Veg
Bean	730	0.6		6%	39%	47	30	26-50%	< 35%	Sand	6.57	41%	7%	44%	46%
Black Canyon	6086	2.2	2.2								4.11	32%	4%	21%	55%
Reach 1		0.7	0.7	6%	22%	33	18	76-100%	< 35%	Bedrock					
Reach 2		1.5	1.5	5%	28%	30	35	51-75%	< 35%	Bedrock					
Reach 3				11%	27%	46	48	51-75%	A	Bedrock					
Reach 4				17%	15%	34	18	51-75%	> 35%	Sand					
Blk Canyon Trib	870	1.1	0.1	9%	31%	86	24	51-75%	< 35%	Cobble	4.25	37%	24%	31%	50%
Deep Cut	2560	1.7		5%	41%	45	16	51-75%	> 35%	Bedrock	4.58	26%	20%	30%	42%
Deep Cut Trib	830	0.3		17%	33%	83	27	51-75%	> 35%	Bedrock	5.35	39%	6%	27%	61%
Freezeout	1940	1.2		11%	34%	106	40	76-100%	< 35%	Bedrock	2.25	31%	16%	25%	17%
Lonewoman	6090	3.1	1.1								0.48	2%	2%	1%	67%
* Reach 1		1.2	1.1	4%	24%	41	38	51-75%	> 35%	Cobble					
Reach 2		1.9		11%	15%	40	62	51-75%	> 35%	Sand					
Lonewoman Trib	700	0.4		7%	28%	64	20	51-75%	> 35%	Sand	0	0%	0%	0%	N/A
Luck	650	1.2		5%	35%	55	25	26-50%	< 35%	Sand	4.97	49%	5%	40%	56%
Nichols	650	0.2		11%	41%	31.5	1	51-75%	< 35%	Sm Bould	3.5	64%	0%	81%	19%
Ralph	750	2		6%	21%	16	15	26-50%	> 35%	Sand	5.02	56%	21%	77%	0%
Tallow	1370	1.7		5%	34%	39	27	26-50%	> 35%	Gravel	5.41	41%	23%	32%	38%
Tributary F	520	0.6		11%	22%	56	50.7	51-75%	> 35%	Sand	7.32	39%	42%	43%	19%
Tributary G	300	0.4		9%	16%	65	65	51-75%	> 35%	Sand	7.28	30%	59%	40%	0%
Twomile	730	1.1		5%	37%	57	15	26-50%	> 35%	Sand	3.4	35%	2%	46%	52%
Upper Jackson	3740	0.8	0.2	6%	36%	79	42.6	51-75%	> 35%	Bedrock	3.65	28%	25%	30%	34%
Winters	2340	0.8	0.8	9%	41%	46	13	26-50%	> 35%	Sand	5.71	61%	23%	70%	6%

Table 53. Selected stream survey and watershed parameters for fish-bearing tributaries of Jackson Creek (earthflow streams). * indicates a reach in non-earthflow terrain w/in a predominantly earthflow watershed.

Hicks (1989) made a similar comparison of streams in sandstone and basalt geology in Oregon coastal systems.

Approximately 62% of Jackson Creek watershed is comprised of landforms which contain a high percentage of younger volcanic rocks, such as basalt, andesite, and tuffaceous rocks, that are lightly weathered and relatively resistant to erosion. These landforms comprise the non-earthflow terrain and are characterized by shallow, rocky soils, steep hillslopes, and high densities of landslides. Non-earthflow stream channels tend to be well armored with cobble, boulders, and bedrock. Due to the high concentration of rock, streams are relatively stable and have a great amount of aquatic habitat complexity provided by boulders and bedrock. These channels are likely to be more resistant to the impacts of land management activities than less armored stream channels (Hicks, 1989).

The remaining 38% of the Jackson Creek watershed has landforms associated with dormant landslide deposits (see "Geomorphology" section) which form the earthflow terrain. This terrain is characterized by deep, fine-textured soils, gentle slopes, and low density of landslides. Earthflow stream channels tend to be poorly armored due to the deep, fine-textured soils, and low rock content of the stream banks. These channels have less rock and are more dependent on large woody material to provide aquatic habitat complexity and channel stability. Stream channels in earthflow terrain are susceptible to chronic sedimentation stemming from bank erosion, earthflow movement, and secondary mass wasting into stream channels. These streams are highly sensitive to land management activities. They tend to respond to peak flow increases and loss of large wood by downcutting or eroding stream banks. In many cases these effects have been occurring for many years and will continue until the erosion and sedimentation processes reach equilibrium.

Fish Distributions

In Jackson Creek tributaries, proportion of miles of fish-bearing stream by terrain type was consistent with proportions of the basin in earthflow and non-earthflow terrain (Table 54). Earthflow streams were disproportionately important to headwater cutthroat trout pópulations, providing nearly 60% of cutthroat dominated stream miles, while steelhead were found in relatively few miles of earthflow streams (Table 54). This disproportionate use of earthflow streams by cutthroat trout may in part be due to a lower average stream gradient in earthflow streams than non-earthflow streams. The division of habitat between steelhead and cutthroat trout is consistent with findings in other systems where cutthroat trout tend to use smaller headwater streams with generally more marginal habitat than do other anadromous salmonids (Johnson et al., 1994).

Earthflow (29 reaches)	Non-Earthflow (25 reaches)
• 38% of Jackson Creek watershed is earthflow terrain	• 62% of Jackson Creek watershed is non-earthflow terrain
• 44% (21.4 mi) of the total fish-bearing miles	• 56% (27.1 mi) of the total fish-bearing miles
• Of the total stream miles dominated by cutthroat trout, 57% (13.8 mi) are in earthflow terrain	• Of the total stream miles dominated by cutthroat trout, 43% (10.4 mi) are in non-earthflow terrain
• 7.6 miles dominated by steelhead	• 16.8 miles dominated by steelhead
• Average channel gradient is 8%	• Average channel gradient is 10%
• 62% of reaches have < 10% gradient	• 44% of reaches have < 10% gradient

Table 54. Comparison of fish distributions between earthflow and non-earthflow streams excluding the main stem of Jackson Creek.

Land Use

Earthflow and non-earthflow terrain have been managed differently for road construction and timber harvest (Table 55). Earthflow watersheds have the highest concentrations of roads, timber harvest, and cattle grazing. As Table 55 displays the amount of timber and road management in each terrain type, it is also the case that impacts due to cattle grazing are most extensive in earthflow streams. Cattle appear to prefer grazing in earthflow terrain because it is flatter than non-earthflow terrain. Riparian areas along earthflow streams are wider and flatter than in non-earthflow streams. This creates an even more hospitable habitat for cattle so they spend a disproportionate amount of time grazing the riparian areas and trampling sensitive erosive banks along earthflow streams.

Earthflow **(29 reaches)**	**Non-Earthflow** **(25 reaches)**
• Average road density is 4.8 mi/sq mi	• Average road density is 2.8 mi/sq mi
• Average percent of total road length in riparian reserves is 15%	• Average percent of total road length in riparian reserves is 18%
• Average percent of the watershed in regeneration harvest is 40%	• Average percent of the watershed in regeneration harvest is 23%
• Average percent of regeneration harvest in riparian reserves is 39%	• Average percent of regeneration harvest in riparian reserves is 21%

Table 55. Comparison of road density and timber harvest between earthflow and non-earthflow watersheds.

Channel and Aquatic Habitat Condition

Channel complexity and stability were generally found to be lower in earthflow streams than in non-earthflow streams (Table 56). Earthflow streams tended to have less large wood, shallower pools, less stable banks, and higher cobble embeddedness with fine sediment than non-earthflow streams.

Amounts of large woody material were found to be low in both earthflow and non-earthflow streams. Land management activities such as the removal of both standing and down trees adjacent to the stream channel, stream clean-out, and road right-of-way clearing have reduced both current and future sources of large woody debris in many managed basins (Bisson et al., 1987). This was definitely the the case in Jackson Creek streams with large wood regimes being more heavily impacted in earthflow streams due to more intensive timber harvest in earthflow terrain.

Earthflow (29 reaches)	**Non-Earthflow** (25 reaches)
• Average pieces of lg wood/mi is 28	• Average pieces of lg wood/mi is 37
• 59% or reaches had < 30 pieces of lg wood/mi	• 40% or reaches had < 30 pieces of lg wood/mi
• Pools averaged 28% of the habitat (excluding reaches with > 10% dry habitat)	• Pools averaged 23% of the habitat (excluding reaches with > 10% dry habitat)
• Average of 47 pools per mile	• Average of 55 pools per mile
• 45% of reaches had < 1' mean residual pool depth	• 16% of reaches had < 1' mean residual pool depth
• 48% of reaches dominated by sand banks	• 16% of reaches dominated by sand banks
• 31% of reaches had 25-50% ground cover	• 8% of reaches had 25-50% ground cover
• 3% of reaches had > 75% ground cover	• 28% of reaches had > 75% ground cover
• 72% of reaches had > 35% cobble embeddedness	• 36% of reaches had > 35% cobble embeddedness
• 41% of reaches had W/D < 10	• 24% of reaches had W/D < 10
• 38% of reaches had dry channel exceeding 10% of the total surveyed length	• 4% of reaches had dry channel exceeding 10% of the total surveyed length

Table 56. Comparison of the aquatic habitat between earthflow and non-earthflow streams as determined by Region 6 level II stream inventories during the summer of 1994.

Wilderness stream reaches with mid seral riparian vegetation in the Jackson Creek watershed were found to have 30-62 pieces per mile. Although these values do not represent large wood loading in streams with late seral riparian vegetation, they still demonstrate depletion of large wood in non-wilderness streams, especially in earthflow streams where woody material is more vital to channel complexity than in non-earthflow streams. See "Desired Future Conditions" for estimated large wood loadings in streams with late seral riparian vegetation.

The majority of streams surveyed in the Jackson Creek watershed have been subjected to riparian timber harvest and stream clean-out which has resulted in the loss of the current and future large wood sources. Small pieces of cut wood that resulted from timber harvest were common during the surveys, especially in the earthflow streams. Although logging slash can provide complexity to streams in the absence of natural wood, it is usually less effective than larger uncut pieces in influencing channel morphology (Hicks, 1989). Short pieces of wood tend to lie parallel to the streamflow and are less effective in the formation of pools (Hicks, 1989).

The percent of pool habitat by area was greater for earthflow channels (28%) than non-earthflow channels (23%). The number of pools per mile was greater in non-earthflow streams (55 per mile) than in earthflow streams (47 pools per mile). Streams in earthflow terrain tend to have lower gradient channels and a greater percentage of pool habitat formed by relatively large pools, whereas non-earthflow stream channels tend to be higher gradient with shorter step-pools but more of them per mile than in lower gradient streams. This accounts for the greater surface area of pools in earthflow streams but higher pool frequency in non-earthflow streams.

The average residual pool depths were less in earthflow streams than in non-earthflow streams (Table 56). These low averages in earthflow streams may be explained by the relative lack of large wood in these streams. Earthflow streams are more dependent on large wood for complexity and pool formation than non-earthflow streams because many pools in non-earthflow streams are formed by boulders. Non-earthflow streams may have a larger percentage of pools created by boulders (similar to basalt terrain streams in Hicks, 1989) but still may be deficient in pool habitat because of past land management activities.

Low residual pool depths in earthflow streams might also be explained by pools filling with fine sediment. The deep, fine-textured bank material (high dominance of "sand" as stream bank substrate) of earthflow channels along with the low ground cover due to the lack of rock and past vegetation manipulation appear to have exacerbated downcutting of these channels and erosion of the stream banks. Evidence of this increased erosion and sedimentation is shown with a high percentage of the earthflow reaches having > 35% cobble embeddedness (Table 56). Non-earthflow streams, which are better protected against bank erosion and downcutting due to high rock content, had half as many reaches with > 35% cobble embeddedness.

Bankfull width to depth (W/D) ratios may also provide indication of the erosive nature of the earthflow streams. Streams have been found in other studies to increase in width and decrease in depth with increasing timber harvest (Hicks 1989, Beschta and Platts 1986), including streams within the South Umpqua Basin (Dose and Roper 1994). In Jackson Creek this trend was not clear in small earthflow streams with high timber harvest and road densities. Instead, 41% of earthflow reaches were found to be quite narrow with bankfull W/D ratios < 10. Many of these streams appeared to be highly entrenched and had a "gully-like" appearance. When woody material was removed from these channels, channel stability was lost apparently resulting in channel downcutting and creation of their gully nature. This trend was most pronounced in smaller (< 1500 acre) watersheds where channels appeared to be inordinately downcut and narrow. Fewer non-earthflow streams had W/D ratios < 10 suggesting that these streams may tend to widen instead of downcut when subjected to land management activities.

Habitat can be lost as streams begin to dry up during the low flow period of the summer months. This period of low flows can cause a dramatic loss in habitat and create increased mortality due to competition for habitat, increased predation in shallow pools, lethal water temperatures, oxygen depletion, and loss of drift as a food source. Earthflow streams had less surface water at low flows and a greater percentage of dry sections than non-earthflow streams (Table 56). Since earthflow streams are disproportionately important to cutthroat trout, this probably had a higher direct impact on cutthroat trout populations in small earthflow tributaries than on steelhead populations which tend to be in larger streams.

Headwater Stream Conditions

Intermittent and perennial headwater streams provide habitat for macroinvertebrates and several amphibian species. As these streams are intricately linked to larger fish-bearing streams, processes and conditions in these streams are important aspects of the aquatic environment (Vannote et al., 1980). As part of watershed analysis, 79 miles of headwater streams divided into 380 reaches were surveyed using a modified version of the Pfankuch survey methodology (Pfankuch, 1975). With this methodology, higher numerical scores generally indicate poorer condition or higher channel sensitivity to morphological change. Detailed results of this work are documented in Appendix V. A summary of key results follows.

Geomorphology profoundly effected channel conditions. Streams in earthflow terrain consistently rated out in poorer condition than streams in non-earthflow terrain. This trend was consistent regardless of land use.[4]

Land use also had a major effect on channel conditions (Table 57). Stream reaches with regeneration harvest rated out in poorest condition (highest numerical score), followed by those adjacent to partial harvest. Reaches with late seral vegetation adjacent to them rated out in the best condition regardless of geomorphology.

Comparison of Earthflow vs. Non-earthflow by Land Use Treatment			
	Regeneration Harvest	Partial Harvest	Late Seral Vegetation
Earthflow	88.3 (n=87)	80.9 (n=43)	72.5 (n=44)
Non-Earthflow	82.5 (n=46)	74.1 (n=25)	64.7 (n=45)

Table 57. Mean rating scores for all reaches grouped by geomorphology and land use.

A number of areas sampled had a disproportionate number of stream miles in poor condition. Problems associated with these streams generally included severe bank erosion, channel downcutting, high sedimentation, severe secondary mass wasting, or landslides from upslope areas. These areas included Soup Creek, Ralph Creek, Tallow Creek, Bean Creek, Twomile Creek, Luck Creek, upper Jackson Creek (WAA "E"), Crooked Creek, Burnt Creek, Stampede Creek, Winters Creek, and an unnamed tributary (tributary "C") in WAA "O". Most of these streams are in earthflow terrain and are undergoing high channel erosion rates percieved to be contributing to fine sediment problems in lower Beaver Creek as well as main stem Jackson Creek. Effects of timber harvest , road construction, and cattle grazing have created or exacerbated poor channel conditions in these streams. Additional unsampled areas with similar terrain and land management histories include the headwaters of Deep Cut Creek, Freezeout Creek and tributaries in WAAs "A", "V", and the western earthflow portion of WAA "D". These areas likely have poor channel conditions similar to those identified above. See Appendix V for details. Detailed stream survey reports are on file for each stream surveyed.

A number of subdrainages were identified where a disproportionate percentage of stream miles rated out in good or excellent condition. These areas are Lonewoman Creek, Deadhorse Creek, Saboo Creek, and Pipestone Creek. Of these areas, Lonewoman and Deadhorse Creeks have had little timber harvest and road construction relative to overall basin averages because these streams are either in wilderness or roadless areas. See Appendix V for details.

Salmonid Habitat Utilization

Different species and life history stages of salmonids have different habitat utilization patterns. Many of these patterns during summer are driven by water temperature regimes but features such as channel morphology, geology, and habitat complexity come into play as well.

Habitat utilization by adult spring chinook salmon illustrates the importance of summer temperature regimes as well as channel morphology. Many adults hold from approximately River Mile 7 to River Mile 11 (Reaches 2-3) where there are many deep bedrock trench pools and lateral scour pools. These pools are geologic features of a resistant, basaltic bedrock gorge. Adult spring chinook also appear to be somewhat focused on thermal regimes. They tend to aggregate for summer holding in slightly disproportionate numbers just below Squaw Creek, apparently keying in to the cooler water brought in by Squaw Creek. Amount of stream flow may also be determining adult chinook holding in this area because Jackson Creek loses half its flow above the mouth of Squaw Creek.

Water temperature probably plays the single greatest role in regulating summer habitat use of the main stem by juvenile chinook (Roper et al., 1994). Although the chinook distribution encompasses the lower 16.6 miles of Jackson Creek, the majority of chinook spawn in the lower end of their distribution (below the mouth of Squaw Creek, approx. River Mile 11). In summer 1989, juvenile chinook salmon were found in highest densities at the upper end of the chinook distribution (from the mouth of Whisky Creek at River Mile 9.2 up to the upstream end of the chinook distribution. Chinook densities at this upper end of their distribution were 3 to 15 times higher than in the lower reaches where the majority of spawning takes place (Roper et al., 1994).

This contradictory observation may be explained by summer water temperature regimes. The line demarking the two zones with different rearing densities coincides with diffferent temperature regimes. Summer maximum temperatures generally reach 75°F throughout the zone of high densities but reach 79°F in the zone of very low densities. This is right at the upper lethal temperature for chinook salmon of 79°F reported by Brett (1952) as cited by Bjornn and Reiser (1991). Since most chinook spawn within the zone of low summer rearing densities and chinook fry from this area would not be capable of migrating to upstream reaches in Jackson Creek for summer rearing, this suggests that a disproportionate number of young in this zone may be forced to emigrate from Jackson Creek by high water temperatures where they might originally have been inclined to reside for an entire year. Another possible scenario is that higher spring temperatures cause higher growth rates in chinook fry, prompting a greater proportion of them to emigrate their first spring rather than reside in-stream for an entire year.

If high water temperatures are forcing chinook fry to emigrate prematurely, a potentially important component of spring chinook life history, that of stream-type residence, may be getting eliminated from the population. Such a reduction in life history diversity would increase the vulnerability of the chinook population to extinction (Lichatowich, et al., 1995).

Juvenile coho also apparently key into summer water temperatures. Roper and Scarnecchia (in progress) found that juvenile coho and chinook salmon densities are disproportionately high in the lower 100-200 yards of many tributaries to the South Umpqua River than in the adjacent main stem riverine habitat. In addition, the localized areas around the mouths of many of these tributaries also support high numbers of juvenile salmonids. These areas whose summer temperatures range from 4 to 7°F cooler than main stem South Umpqua River apparently provide thermal refugia for these fish.

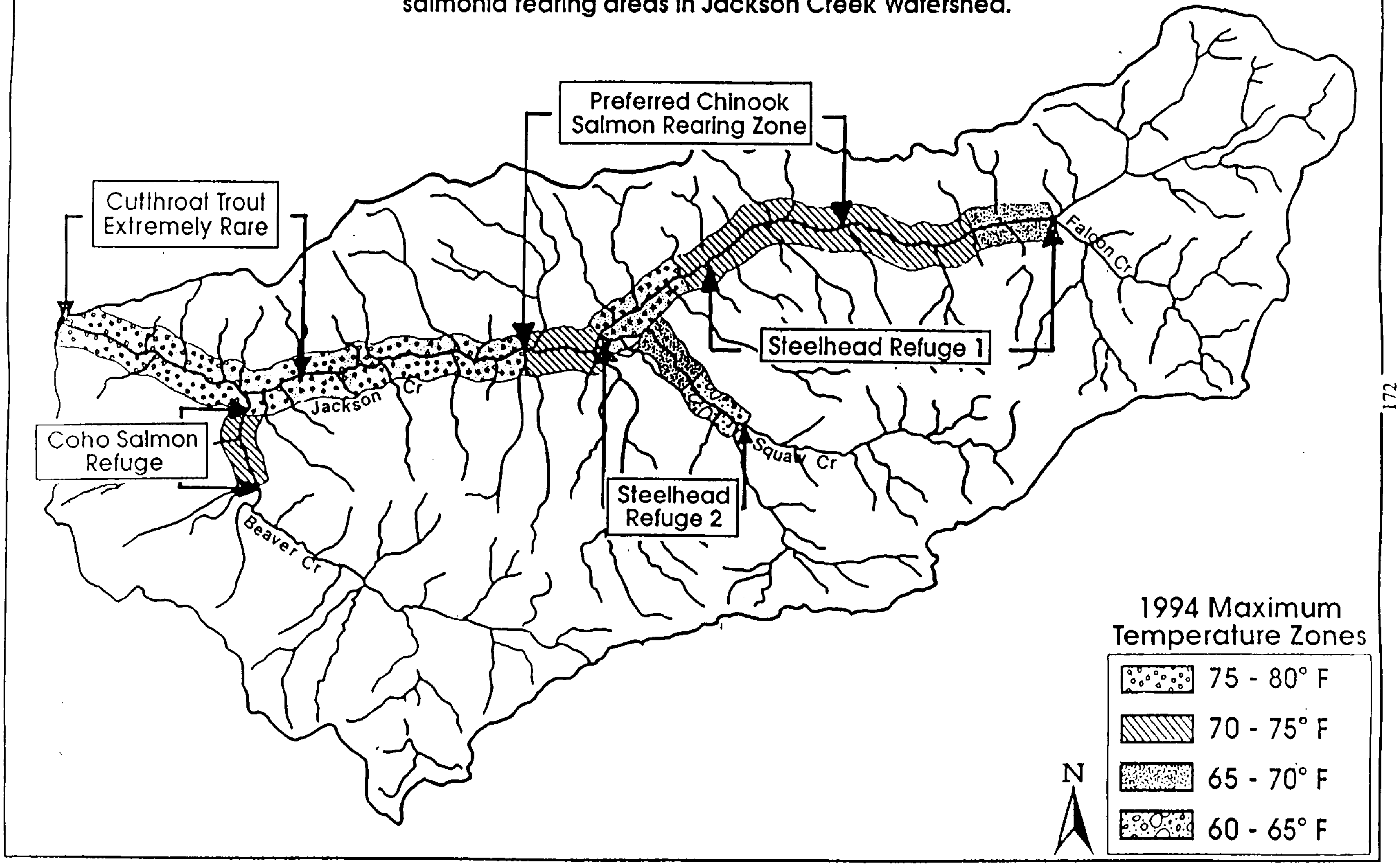
This phenomenon was also observed in Jackson Creek where juvenile coho (as well as other salmonids) were seen "clustering" up near the mouth of Beaver Creek. In summer 1994 maximum water temperature in Beaver Creek was 73°F while temperatures reached as high as 79°F within the lower 8 miles of Jackson Creek (Figure 26) well beyond the temperature range preferred by coho salmon (53 to 58°F). Coho salmon fry in main stem Jackson Creek are also susceptible to forced emigration at the onset of high summer water temperatures just as described for chinook above (unpublished smolt trapping data from 1989-1994 in Jackson Creek).

Juvenile steelhead summer habitat utilization in Jackson Creek appears to be strongly regulated by summer water temperatures (Figure 26) and habitat complexity. Like chinook and coho salmon, juvenile steelhead rear in relatively low densities in the lower 9 miles of Jackson Creek compared to the upstream portions of the main stem where rearing densities are 1.5 to 2.5 times their values in the lower main stem (Roper et al., 1994).

Figure 26

Jackson Creek Watershed - Fish Temperatures

Maximum water temperature thermal zones as related to key salmonid rearing areas in Jackson Creek Watershed.



In summer 1989, main stem reaches 5 through 7 (Steelhead Refuge 1 on Figure 26) made up approximately 20% of the habitat by surface area but reared approximately 40% of the age 1 and older steelhead in the entire basin. Habitat features which appear to make this portion of the stream preferable to steelhead include slightly lower water temperatures, increased pool depths, and increased habitat complexity due to greater abundance of large wood and boulders. About 50% of this refuge (reach 6) is a confined bedrock gorge where channel gradient increases slightly (from 1.5% to 2.5%) and the amount of boulder substrate increases. Pools are shorter, somewhat deeper, and more associated with fast water due to a stair-step nature to channel. The channel generally has a more cascading character which tends to be preferred rearing habitat for juvenile steelhead (Dambacher, 1991, Harkleroad and La Marr, 1992).

The reaches surrounding the gorge (reaches 5 and 7) are depositional reaches with wide valley bottoms. These areas may be desirable summer rearing habitat for steelhead because they tend to have high macroinvertebrate production due to high nutrient retention and processing rates (Reeves, personal communication, Gregory et al., 1991).

Squaw Creek is also an important rearing area for juvenile steelhead (Steelhead Refuge 2 on Figure 26). In summer 1989, Squaw Creek supported 14% of the steelhead in the basin while comprising only 9% of the habitat by area. Squaw Creek supported a disproportionate number of age 2 and older juveniles relative to the rest of the basin. This is consistent with historic accounts of former residents which indicate that Squaw Creek was a good place to go "trout" fishing dating back into the 1930s. These anglers were undoubtedly catching age 2 and older juvenile steelhead known to still rear in large numbers in Squaw Creek. While physical habitat conditions in Squaw Creek appear to be of moderate quality (see "Aquatic Habitat" section), it is likely that its relatively high flow of cold water during summer accounts for Squaw Creek's direct importance to steelhead (see sections on "Temperature" and "Streamflows").

High summer water temperatures may allow redside shiners to outcompete salmonids for food in the lower 5 miles of Jackson Creek. Redside shiners have been found to outcompete juvenile steelhead in laboratory conditions (Reeves et al., 1987, as cited by Dambacher, 1991) at constant water temperatures above 66°F, although shiners remained subordinate to steelhead in Steamboat Creek at maximum temperatures of 75°F (Dambacher, 1991). As maximum temperatures reach at least 79°F in Jackson Creek, it is unknown whether steelhead and other salmonids remain dominant over redside shiners for feeding positions.

Critical Salmonid Habitat Deficiencies.

Spring Chinook Salmon

As documented in the "Aquatic Species" section, egg to smolt survival rates for spring chinook in Jackson Creek are well below expected values. Poor quality juvenile rearing habitat and poor quality spawning habitat are two key components that may account for low egg to smolt survival rates. These features, along with high water temperatures and low escapement are currently believed to be primary limiting factors for spring chinook production.

Preliminary investigations made on spring chinook spawning habitat conditions in Jackson Creek suggest that spawning habitat deficiencies exist. As with coho spawning habitat, known chinook spawning areas were sampled to determine substrate composition. Twenty five percent of the sampling sites had gravel too shallow (<10 inches deep) to provide adequate spawning conditions. Nearly half of the sites (47%) had high levels of fine sediment. See Appendix T for detailed analysis.

The condition of juvenile chinook rearing habitat is also of great concern in Jackson Creek. Chinook fry emerge from their redds into the stream environment from February to April. During the 2 to 3 month rearing period before ocean-type chinook emigrate, they rear in low velocity channel margin areas and backwater pools at up to 10 times the densities observed in other available habitats (Stein et al. 1972, Lister and Genoe 1970, McCain 1989). These studies concluded that fry strongly sought out margin and backwater habitats because these areas provided low velocity zones behind large boulders, fallen trees, rootwads, and beneath overhanging banks. These habitats are used until fry either emigrate or attain large enough size to reside predominantly in main channel areas with higher water velocities.

Favorable habitat for juvenile chinook is lacking in Jackson Creek. The bulk of current chinook spawning and rearing habitat lies in the lower 11 miles of Jackson Creek. In this lower 11 miles, riprap and fill from the valley bottom road occupies 36% of the active channel length on the north bank. Within the entire chinook distribution (lower 16 miles), 24% of the road length lies within the bankfull channel. The structural nature of riprap serves to directly simplify fish habitat by precluding the presence of riparian vegetation, accumulations of large wood along channel margins, and backwater pool habitats. The amount of margin and backwater habitats crucial for chinook fry has been severely reduced by the presence of the road. This would at least partially explain the low egg to smolt survival rates seen in Jackson Creek chinook.

Another key aspect of chinook rearing habitat complexity is the amount of large wood present in the stream. In the lower 11 miles of Jackson Creek there is an average of 7 pieces of large wood per mile. Within the entire chinook distribution (lower 16 miles of Jackson Creek) this value is 8 pieces per mile. This is considerably lower than would be expected and indicates poor habitat complexity with very few low velocity refugia during high flow periods. Lack of large wood indicates a reduced ability of the stream to: retain and process organic matter, retain gravels desirable for macroinvertebrate production, and provide adequate cover and low velocity refuge areas for juvenile chinook and other aquatic organisms (Bustard and Narver, 1975a; Anderson and Sedell, 1979; Keller and Swanson, 1979; Bilby, 1981; Bisson et al., 1987; Prochazka et al., 1991). Large wood has also been shown to be important to retention of adult salmon carcasses (Cederholm et al., 1989) which have been shown to contribute up to 40% of the nitrogen and carbon in the biota of some streams (Bilby, 1994).

Coho Salmon

Poor quality rearing habitat for juvenile coho is believed to currently be a limiting factor to coho production in Jackson and Beaver Creeks. Coho rearing habitat lacks complexity in both of these streams. Juvenile coho prefer to reside in pools associated with wood debris accumulations. During winter they also prefer side channels, and interstitial spaces between cobble and boulder substrates (Bustard and Narver, 1975a and b; Swales et al., 1986). Within the current coho distribution in main stem Jackson Creek (lower 8 miles), there is an average of 5 pieces of large wood per mile. Coho habitat in Beaver Creek is slightly more complex with 9 pieces per mile. Local wilderness and roadless area streams on the Forest have been found to have 60 to 110 pieces per mile.

The valley bottom road along Jackson Creek has contributed to simplification of coho rearing habitat. Throughout the current distribution of coho in main stem Jackson Creek, 45% of the length of the road has riprap within the active channel margin (1.5 year recurrence interval storm). The presence of riprap in the active winter channel precludes the presence of riparian vegetation and stable large wood and wood jams along channel margins in these areas. The close proximity of the road to the creek has also facilitated chronic stream cleanout activities which, have left the stream with little large wood.

Another overwintering habitat deficiency specific to Beaver Creek is high sedimentation (See Appendix R for detailed analysis). Large amounts of fine sediment documented above basically bury the interstitial spaces that coho and other fishes need for cover and refuge from high water velocities in order to survive through winter.

As part of watershed analysis, spawning substrate was sampled in known coho salmon spawning locations in Beaver Creek to determine substrate composition. Coho spawning habitat in Beaver Creek was found to be severely impaired with regard to excessive fine sediment (83% of sampled sites), poor gravel sorting, and poor gravel patch depth necessary for successful spawning (67% of sites). See Appendix T for detailed analysis.

Poor spawning conditions in Beaver Creek are not currently believed to be a primary limiting factor for coho salmon production. Problems regarding low escapement, lack of juvenile habitat complexity, and high summer water temperatures are believed to currently be the primary limiting factors for coho salmon production in the Jackson Creek watershed. This does not preclude the possibility that spawning habitat quality may become a limiting factor in the future if other factors currently limiting coho production improve. These statements are based on a combination of available information and professional judgement.

Cutthroat Trout

Habitat deficiencies pertaining to cutthroat trout are similar to others already discussed for other species. High summer water temperatures in the main stem and lack of structural complexity in stream channels have been discussed. In small tributaries, most notably earthflow streams, lack of surface water during summer low flows and reduced stream bank stability are also major concerns. Resulting sedimentation from in-channel erosion may also impede cutthroat trout spawning success and macroinvertebrate production in earthflow streams or in non-earthflow streams with high watershed landslide rates.

Habitat Connectivity

Connectivity between streams is a potential impediment to connectivity of steelhead and cutthroat populations in 12 tributaries to Jackson Creek (Table 58). Impassable culverts are potential barriers to connectivity between portions of stream within tributaries, or between tributaries and main stem Jackson Creek. Most connectivity concerns are due to culverts along the valley bottom road into fish-bearing tributaries on the north side of Jackson Creek. See Appendix U for more detailed analysis.

The ODFW standard for fish passage through culverts is for age 1 salmonids (about 3 - 4 inches long) to be able to pass upstream through any culvert on a fish-bearing stream. All culverts listed here (Table 58) have artificial bottoms and most artificially bottomed culverts are not passable to juvenile salmonids. Some of these culverts are likely barriers to upstream migrating adult salmonids. Each culvert must be field evaluated to assess passability for both adult and juvenile salmonids. More detail is provided in Appendix U, including an assessment of salmonid potential intended to guide prioritization of order in which to evaluate culverts.

Cutthroat trout and steelhead trout are the species potentially effected by impassable culverts. Cutthroat trout are more likely to be effected than steelhead because they tend to spawn in smaller streams above steelhead distributions (Johnson et al., 1994) and would therefore require access to the small streams in Jackson Creek with culverts near their mouths. In addition, fish communities upstream of culverts in these streams are currently dominated by cutthroat trout.

	Road	River Mile	Culvert Dimensions					
Stream	Number	Of Culvert	Length	Diameter	Gradient	Grad Upstream	* Pool Depth	Species of Concern
Tallow	29	0.2	65'	9'	2%	2%	1.9'	RC, AC (?), FC (?), ST (?)
Twomile	29	0.01	45'	5'	4%	4%	NA	RC, AC (?), FC (?), ST (?)
Bean	29	0.01	61'	4.5'	5%	3%	NA	RC, AC (?), FC (?), ST (?)
Ralph	29	0.01	55'	5'	4%	0%	NA	RC, AC (?), FC (?), ST (?)
	050	1	?	3'	?	?	?	RC
Black Canyon	2950	1.1	66'	?	4%	7%	3.2'	RC, AC (?), FC (?), ST
Blk Canyon Trib	2950	0.1	60'	5'	3%	?	3.2'	RC, AC (?), FC (?), ST
Crooked	200	1.5	82'	6'	5%	4%	1.8'	RC, AC (?), FC (?), ST
Falcon	300	2.5	88'	10'	8%	10%	5.6'	RC, AC (?), FC (?), ST
Saboo	29	0.02	48'	5'	6%	9%	1.4'	RC, AC (?), FC (?), ST (?)
Luck	29	0.07	50'	5'	2%	6%	NA	RC, AC (?), FC (?), ST (?)
Deep Cut	010	1.1	90'	7'	2%	3%	4.7'	RC
Deep Cut Trib	010	0.1	80'	6'	8%	7%	NA	RC
Tributary D	100	0.8	92'	5'	6%	7%	2.5'	RC
Winters	3114	0.6	60'	12'	2%	2%	1.3'	RC and Resident Rainbows
Nichols	29	0.01	85'	5'	4%	5%	NA	RC, AC (?), FC (?), ST (?)
Freezeout	29	0.02	65'	6'	3%	21%	NA	RC, AC (?), FC (?), ST (?)

Table 58. List of artificially bottomed culverts within fish distributions in the Jackson Creek watershed. Species listed for each stream include a combination of known and potential (?) fish present. RC = resident cutthroat, AC = anadromous cutthroat, FC = fluvial cutthroat, ST = winter steelhead. ,

Effects of Altered Processes on Aquatic Habitat Conditions

Many disrupted processes have contributed to current aquatic conditions in the watershed. These altered processes have been discussed in many portions of this document but are summarized along with a discussion of the valley bottom road below.

Sediment Regimes

Sediment regimes in Jackson Creek watershed have been disrupted by land management activities. The nature, amount, storage, and transport of sediment have all likely changed (see "Geomorphic Processes" section). Many erosive streams in earthflow terrain (See "Headwater Stream Conditions" section) are actively downcutting, eroding their banks, and introducing inordinate amounts of fine sediment into streams. Timber harvest, stream cleanout, road construction, and grazing all appear to have accelerated stream bank and channel erosion in these streams.

A number of WAAs are of high concern because of accelerated landslide rates due to timber harvest and road construction (Table 59). Each of these WAAs has its own set of aquatic resources that have been affected by these landslides. Beaver Creek values involve 13 native aquatic vertebrate species including all three fish stocks at risk, winter steelhead, and red-legged frogs. Main stem Jackson Creek values involve 13 to 18 native aquatic vertebrate species including all three fish stocks at risk, winter steelhead, foothill yellow-legged frogs, and western pond turtles.

WAA	Percentage of Slides Induced by Management	Aquatic Resources Affected
C	24%	Cutthroat, Steelhead Refuge 1, Main Stem Jackson Creek
E	44%	Cutthroat, Steelhead Refuge 1, Main Stem Jackson Creek
J	41%	Cutthroat, Steelhead Refuge 1, Main Stem Jackson Creek
L	19%	Migratory Cutthroat, Steelhead Refuge 2, Main Stem Jackson Creek
N	25%	Spring Chinook Stronghold, Main Stem Jackson Creek
O	32%	Cutthroat, Spring Chinook Stronghold, Main Stem Jackson Creek
R	45%	Cutthroat, Beaver Creek Values, Main Stem Jackson Creek
S	30%	Devils Knob Creek (cold water source), Beaver Creek Values, Main Stem Jackson Creek
V	36%	Main Stem Jackson Creek
X	35%	Donegan Creek (cold water source), Migratory Cutthroat, Steelhead Refuge 2, Main Stem Jackson Creek

Table 59. List of WAAs with greater than the basin average proportion of their landslides related to land management activities. Basin average proportion of landslides related to management =16%. Migratory cutthroat include sea-run as well as fluvial fish.

The link between higher than natural landslide rates and aquatic values in main stem Jackson Creek cannot be specifically made for each WAA. Macroinvertebrate communities and chinook spawning habitat condition suggest that aquatic biota in main stem Jackson Creek are being impacted by excessive fine sedimentation. Therefore, all portions of the watershed where excessive erosion can be identified are potentially contributing to poor aquatic conditions in the main stem.

Large Wood Regimes

As discussed previously, large wood regimes have been disrupted by timber harvest and stream cleanout. There is far less large wood in streams today than historically (see "Riparian System" and "Aquatic Habitat" sections).

Riparian Vegetation

Riparian vegetation communities are currently well outside the range of natural variability. Currently only 28% to 57% of riparian reserve acres are in a late seral vegetative condition, compared to the historic range of 60% to 90% (See "Riparian System" section).

Peak Flow Regimes

Peak flows regimes have also likely been altered such that peaks are now artificially high due to extension of drainage networks from roads as well as upslope removal of canopy closure. Many WAAs with high extension of the drainage network also contain earthflow streams in poor, erosive conditions. These WAAs include C, S, T, U, E, N, and probably B, W, and D. If extension of the drainage network increases peak flows, then these increases are likely one cause of poor stream conditions in earthflow terrain.

Temperature Regimes

Summer water temperatures in the lower 9 miles of Jackson Creek currently reach lethal limits for salmonids on a regular basis (see "Water Temperature" and "Salmonid Habitat Utilization" sections). These temperatures probably increased as the channel widened and riparian vegetation was lost due to timber harvest and road construction.

Effects of the Valley Bottom Road

Jackson Creek is paralleled by a valley bottom road on its north bank for approximately 22 miles of its length, up to its confluence with Lonewoman Creek. This road was constructed in segments from 1947 to the early 1960s. The road has had many direct and indirect effects on aquatic and riparian conditions in main stem Jackson Creek and continues to affect aquatic resources today. The road has contributed to disruption of floodplain connectivity, large wood and nutrient storage regimes, peak flow routing, aquatic habitat complexity, temperature regimes, and channel morphology.

Many effects of the road have acted synergistically to change channel morphology and simplfy aquatic habitat. For example, one indirect effect has been facilitation of chronic stream cleanout of large wood from Jackson Creek. Stream cleanout originally took place due to concerns about fish passage as well as concerns about damage to the road, particularly after the 1964 (100 year flood) and 1974 (25 year flood) storms. Large wood removal led to channel downcutting to bedrock in many places and scouring out of desirable gravel substrates from the stream.

Artificial straightening and localized narrowing of the channel has disconnected the stream from its floodplain. This has increased the stream's ability to scour and transport its substrate and bedload. The channel has been straightened and locally narrowed where riprapped road fill was placed within the bankfull channel margin and floodplain areas (Table 60). This channelization has prevented the stream from overflowing its banks and allowing stream energy to dissipate in floodplain areas during floods. Instead, the channel has been unnaturally kept within its banks during floods. This creates higher water velocities which increases the stream's ability to transport bedload and substrates out of the creek during winter flows. This effect acts synergistically with the lack of large wood from stream cleanout activities to facilitate chronic high scour and reduced ability of the stream to retain gravel substrates desirable for aquatic habitat complexity. It also facilitates rapid transport of any large wood which falls into the creek naturally from the riparian area or is transported into the main stem from tributaries. The result is a lack of large wood and gravel substrate (See "Aquatic Habitat" section) with chronically high transport rates of this material so these critical habitat components never have a chance to become re-established.

	Percentage of Road Within Margin		
Road Segment	Low Flow	Banfkull Flow	100 Yr. Floodplain
Total Chinook Distribution	6%	24%	35%
Spring Chinook Stronghold	7%	36%	50%
Current Coho Distribution	10%	45%	60%
Entire Main Stem	5%	26%	37%

Table 60. Percentages of valley bottom road length with fill within summer low flow channel, bankfull channel (1.5 yr. storm), and 100 year floodplain in Jackson Creek for selected strata. Total Chinook Distribution =lower 16.6 miles. Spring Chinook Stronghold = lower 11 miles. Current Coho Distribution = lower 8 miles. Entire Main Stem = 21.2 miles.

Another impact indirectly brought on by the presence of the road is chronic removal of riparian vegetation. Currently only 39% of the riparian reserve vegetation throughout the length of the main stem is in a late seral condition. In comparison, the historic condition was likely >80% in late seral stage (see "Riparian Vegetation" section). Loss of large trees from stream banks made these banks more susceptible to the scouring processes facilitated by channel straightening and large wood removal. In addition, there are now far fewer large trees available to fall into the stream and re-establish in-stream large wood. This is due to removal of these trees as well as the presence of the road in areas formerly occupied by large trees. Loss of large trees from the riparian area has also decreased canopy closure over the stream and has contributed to increased summer water temperatures.

Processes and functions were further altered by increased peak flows due to upslope canopy removal, road construction, and possibly compaction. Upslope canopy removal has been shown to cause increases in rain-on-snow peak flows (Harr and Coffin, 1992). Roads have been shown to contribute to increased peak flows as well (Jones and Grant, in progress). Increased peak flows in Jackson Creek in its current simplified condition have a more severe effect than if the channel still had its historic flodplain connectivity and in-stream large wood. These increased peaks exacerbate channel scour, increase sediment and large wood transport, and reduce the availability of low velocity areas needed by aquatic biota for overwintering habitat.

Once the channel downcut to bedrock in many places, the channel may have widened overall. Since a greater proportion of the bed had downcut to bedrock, the scouring energy could no longer downcut. Instead, these forces worked laterally to scour out stream banks. Jackson Creek is 1.5 to 2 times wider today than it was prior to construction of the road and onset of timber harvest in the basin (Dose and Roper, 1994).

Channel widening and shallowing allow for increased water temperatures (see equations in Brown et al., 1971, Smith, 1979). Although Jackson Creek has probably always been a relatively warm stream (Roth, 1937), channel widening and loss of riparian vegetation associated with the valley bottom road have likely further increased summer stream temperatures. Summer maximum stream temperatures routinely exceed lethal limits for salmonids and play a major role in regulating summer habitat utilization by salmonids throughout the entire main stem (see "Salmonid Habitat Utilization" and "Temperature" sections). The makeup of macroinvertebrate communities has also been effected by high temperatures in Jackson Creek (see "Aquatic Species" section).

Channel widening, reduced canopy closure, and increased scour down to bedrock substrate may indirectly increase stream pH. Current channel conditions in Jackson Creek provide a beneficial environment to algae in terms of increased solar radiation, increased surface area for occupation (widened channel), and increased amount of bedrock substrate at summer low flows. Increased algal blooms may in turn be causing an increase in stream pH such that pH is known to exceed the state water quality standard of 8.5 throughout much of the main stem as well as in a number of tributaries during summer. During sampling in summer 1994, pH was measured as high as 8.5 - 9.0 in Jackson Creek. Altered pH regimes may affect aquatic faunal communities.

Conditions and trends in salmonid abundance as well as macroinvertebrate communities indicate severe impairment of aquatic habitat conditions (see "Aquatic Species" and "Aquatic Habitat" sections). Impaired habitat conditions specifically tied to spring chinook and coho salmon are most obvious. The portions of the road with the most encroachment into the active channel occur within the distributions of the two salmon species (Table 60). The presence of the road fill within the active channel precludes the presence of complex channel margin habitats known to be important habitat for chinook fry during spring, as well as overwintering habitat for all salmonids (see "Aquatic Habitat" section).

Where the road fill has the most direct impact on the channel is where the greatest number of aquatic vertebrate species live. The portion of the road with the most severe encroachment occurs from approximately River Mile 2 to River Mile 7 where 61% of the road length lies within the active channel margin (Broeker, 1994). The highest degree of native aquatic vertebrate species richness in the entire watershed occurs in this portion of the stream with 13-18 species of fish, reptiles, and amphibians occurring here.

Of further concern, this lower portion of Jackson Creek is also occupied by western pond turtles. This species generally prefers to nest above the active channel margin on north sides of streams with a south aspect (Barkhurst, personal communication). Western pond turtles are known to occur in the lower 11 miles of Jackson Creek, including the stretch most heavily impacted by the road. The riprap fill from the road likely reduces the amount of nesting habitat for western pond turtles. The road also serves as a barrier to turtles as they attempt to migrate upslope from the creek. The effect of the road in this context is as a barrier to migration as well as a direct source of mortality to turtles due to traffic.

The valley bottom road has interrupted the connectivity of several watershed features. Most directly, there are 10 stream crossings over fish bearing streams along the road, 8 of which are artificially bottomed culverts which likely pose a passage problem to salmonids. This applies to juvenile as well as adult cutthroat and steelhead trout. There are 40 - 45 stream crossings, including non-fish bearing streams where stream flow, sediment, and large wood transport regimes from these streams into the main stem have been disrupted by the presence of the road. Normally large floods would transport sediment and large wood from these tributaries into Jackson Creek. Since construction of the valley bottom road, material which should have gone into Jackson Creek during storms gets piled up on the upstream sides of culverts and is later removed during road maintenance activities. This material is prevented from ever reaching Jackson Creek.

In summary, channel morphology has been altered and aquatic habitat has been simplified in Jackson Creek due to the cumulative effects of all of the following: removing large wood through stream cleanout, straightening the channel, filling the floodplain with riprapped road fill, removing riparian vegetation, and increasing peak flows by removal of upslope canopy cover and road construction throughout the watershed, have all combined to alter channel morphology and simplify aquatic habitat in Jackson Creek. These impacts have clearly affected the three anadromous fish stocks at risk as well as macroinvertebrate communities. Other biota have certainly been affected although less is known about specific effects to other species.

Social

Prehistoric

Archaeological information for the Jackson Creek watershed is limited and no systematic inventory has been completed to date. However, forty archaeological sites have been recorded and the archaeological evaluation of one site resulted in a determination of eligibility for inclusion on the National Register (Appendix Z). Twenty-one locations have been noted to have cultural material during past work but have yet to be investigated. Surveys have often been in conjunction with timber sales and may not reflect the intensity of use in the Jackson Creek area.

Human occupation of the Jackson Creek drainage has left its mark on the landscape. Archaeological evidence indicates the South Umpqua Basin has been occupied for more than 8,000 years.

The number and variety of archaeological sites recorded in the wateshed had lend credence to the Cow Creek determination that Jackson Creek was "a large watershed extensively used by their people (Cow Creek Reservation Plan 1986).

Historic

At contact with Euro-Americans in the 1800's, the Cow Creek Band of the Umpqua Indians occupied the South Umpqua basin including the Jackson Creek drainage. The landscape has changed significantly, due to human caused fire and resource utilization. Ethnohistoric sources indicate the Cow Creek occupied the "Myrtle Creek, Cow Creek, and the South Umpqua River drainage from the mouth of Myrtle Creek to approximately Elk Creek, near Tiller, Oregon" (Beckham and Minor 1992: 103). The Jackson Creek watershed analysis Area is included within the lands formerly occupied by the Cow Creeks. This watershed has been identified by the Cow Creek as a "large watershed extensively used" in the Reservation Plan (1985).

Population decimation of the Cow Creek Band was caused by the introduction of diseases and the ensuing epidemics. Decimation was further acerbated by incursions of Hudson's Bay Company traders in the 1830's, and settlers, during and after the 1840's.

Explorers and Hudson's Bay Trappers entered the interior of southwestern Oregon around 1820s through the 1840s. Little information was written on what became of Forest Lands during this period. Hudson's Bay policy during this time was to "trap out" beaver in the remote streams of southwestern Oregon on the edge of their territory. Jackson Creek may have been included in these streams. A number of French-Canadian and Meti ("mixed blood") trappers working for the Hudson's Bay Company took Cow Creek women as wives. This pattern of

Cow Creek/ Euro-American intermarriage persisted throughout the 19th century. The fur trade lost impetus in the 1840s.

Euro-American settlers began to filter into the lower valleys in the 1840s and 1850s. However, there was little impact in areas such as Jackson Creek by these settlers until after the 1850s. After the 1853 treaty with the Cow Creeks and the subsequent removal of the Indians to distant reservations, the remaining Cow Creeks dispersed into the mountainous regions of the Umpqua in the 1850s and 1860s (Beckham and Minor 1992). During the 1860s and 1870s the Cow Creeks and Euro-Americans established small farms and livestock ranches in suitable areas under various homestead laws. The Jackson Creek drainage was probably first settled for livestock ranches during this period. Suitable areas probably included those areas already burned (cleared) and otherwise occupied by the Indians previously.

Burning the landscape to provide openings for wildlife grazing started in prehistoric times and this practice continued into the historic period. Reference to burning by the Cow Creek is found in the ethno-historical data. Homesteaders and cattle ranchers continued this pattern of burning. Burning continued until after the Forest Service established an effective fire prevention system. This burning pattern had significantly altered the landscape.

Resource utilization altered the landscape in a variety of ways. Prehistoric peoples used the resources the landscape offered. Hunting, fishing and gathering was a part of their daily lives. This utilization may not have had a significant impact until fur trappers and early hide hunters entered the area. Homesteaders relied heavily on what the natural landscape offered to supplement what they could raise through agriculture and cattle ranching. Timber resource utilization did not become a factor until after 1945, steadily increasing its impact until 1990. Hunting, fishing and some gathering by the Cow Creek and Euro-American population continue to the present day.

Current Indian Land Uses

Although the Cow Creeks have no reserved treaty rights, they continue to affirm their commitment to and use of three Special Interest Areas identified by the Umpqua National Forest as within Forest Service jurisdiction. One of these areas is the Huckleberry Lake/Neal Spring vicinity on the southwest extending to the Huckleberry Gap/Quartz Mountain area on the northwest. This use area extends into the Jackson Creek Watershed. This is the setting for the annual huckleberry harvest by tribal members. The Huckleberry Patch, as it is customarily called, possesses religious significance to the Cow Creek. "These feelings appear to be driven by a legacy of former religious use of these sites as well as their association with golden memories of childhood outings to these traditional use sites with their grandparents and great grandparents early in this century." (Beckham and Minor 1992:124).

Recreation Use

The general pattern of recreation in the Jackson Creek watershed is based upon landscape characteristics and management direction. Factors include distance from Roseburg, Grants Pass, and Medford, topography, climate, and roaded access. Much of the watershed is low in elevation and allows a long season of use. Snow levels are transitional and limit winter recreation opportunities. Overall use is moderate compared with other watersheds on the district, but low compared to the main South Umpqua corridor. Management direction prohibits anadromous fishing in Jackson Creek, and at selected pools swimming is discouraged and panning and dredging is prohibited. There are few developed recreation sites. The watershed provides access to the Rogue-Umpqua Divide Wilderness. Recreation opportunities range from road-based to unroaded primitive. Recreation activities in the watershed include driving, developed and dispersed camping, hunting, trout fishing in streams, lakes, and ponds, trail hiking and riding, gathering forest products, huckleberry picking, and limited environmental education.

Developed Recreation

Cover Camp is located on Jackson Creek, about 12 miles up the watershed. It has 7 campsites, vault toilets, and is managed at a reduced service level. Use is low to moderate in the summer, high and often over-capacity during fall hunting seasons. A Forest Plan "Recreation Old Growth Grove" of 15 acres is located west of Cover Camp. There is currently no development.

Industrial Camps were developed to accommodate forest contract workers and also receive some recreation use:

- Black Canyon Industrial Camp is located near the confluence of Black Canyon and Jackson Creek. Developed in 1987, it has 1 vault toilet and 2 tables with fireplaces. Use is low in the summer, and high during reforestation activities. Recreation use is low in the summer and moderate during fall hunting seasons.

- Falcon Creek Industrial Camp is located near the confluence of Falcon and Jackson Creek. Developed in 1987, it has 1 vault toilet and 2 tables with fireplaces. All use is low.

- Pickett Butte Lookout is available for rent by Special Use permit during the winter when it is not used for fire detection. Use has been low compared to Acker Rock Lookout, which is reserved every day it is available and often a year in advance.

Dispersed Camping

The pattern of dispersed camping in the Jackson Creek watershed is somewhat different than the general pattern of the South Umpqua drainage. Use is higher during fall hunting seasons than during the summer. Total recreation use is approx. 30,000 visits of varying lengths of stay and is primarily based on camera-classified vehicle counters.

The Corridor

A 1988 survey of corridor dispersed site visitors found over half were from Myrtle Creek, Canyonville, Riddle, and Days Creek, 25% from Roseburg and Medford, 19% from over 100 miles away in Oregon or California. Eleven dispersed sites were inventoried along the Jackson Creek corridor in 1990 and included in the Forest Plan. Most roads accessing these sites are not surfaced, not on the transportation system, and do not receive maintenance. All of the sites are in the riparian area and traffic barriers were placed at two sites in an attempt to keep vehicles away from the stream bank. Some sites are also fire engine water sources, but there have not been any conflicts. Soil compaction, tree damage, vegetation loss, and human waste impacts vary widely between sites. Disturbance and taking of resting spring chinook salmon has occurred.

Upland Sites:

- Skookum Pond has a vault toilet and three campsites with tables. Two are in the riparian area. Use is related to fishing.
- Blue Bluffs Pond is small and use is low. An adjacent rock pit is used for target practice.
- Whisky Camp Guard Station has a cabin, shelter, and vault toilet. It is currently being restored to add to the rental system. Current use is during fall hunting seasons.
- Butler Butte Aircraft Warning Service site has a cabin and shed. It is also being restored for future addition to the rental system. Current use is low.
- The Rogue-Umpqua Divide along the 2925-800 road is popular in the late summer and fall for huckleberry picking and hunting camps.

There are numerous roadside camps during fall hunting seasons. Some could be considered special places in aesthetic settings. Many are located at landings, rock pits, and open areas.

Environmental Education

The Tallest Sugar Pine is a point of interest on the Forest Recreation Map. The site consists of a turnout and a small sign. An interpretive trail is planned. Six signs are placed along the Jackson Creek corridor near fish habitat enhancement projects. A trail is planned for the Cover Camp Old Growth Grove to interpret the fish structures. A trail is planned to interpret a Native American "medicine tree" grove of peeled Ponderosa Pine trees.

Recreational Driving

Although every road has some level of recreational driving, the main 29, 30/68, and 2925-700/800 roads have consistent recreation use.

Scenery

- The Rogue Umpqua Divide Wilderness, Road 2925-800, Donegan Trail #1431, and Rogue-Umpqua Divide Trail #1470 outside wilderness are Sensitivity Level 1.
- Cover Camp, the Donegan-Neal Unroaded Recreation Area, and trails accessing the Rogue-Umpqua Divide Wilderness are Sensitivity Level 2.

The Scenic Quality Objective for the majority of the watershed (outside the Wilderness) is Modification/Maximum Modification consistent with other resource standards and guidelines. The direction for inventoried recreation sites is a Scenic Quality Objective of Modification in foreground seen areas and Partial Retention within the site plus any trail access to the site.

The Recreation Opportunity Spectrum Setting for the majority of the watershed is Roaded Modified due to the substantially modified environment. The direction for recreation sites is a Roaded Natural Setting within the sites.

The condition of the Scenic Resources of the watershed has changed according to the events, activities and uses that have occurred within its boundaries over a extended period of time. Prior to the development of road access into the watershed the condition of the Scenic Resources was that of a natural appearing landscape shaped by a long history of natural processes, marked by periodic events of flooding, landslides and wildfire. The basic landscape structure of steep slopes and long ridges covered by a coniferous forest, punctuated with rock formations and meadow openings, and dissected by numerous streams tributary to Jackson Creek form the basic scenic resource of the watershed

Human initiated disturbances within the watershed include roads, campgrounds, harvest activities, grazing, fire lookouts, shelters and cabins. By the mid-sixties increased timber harvest activities and associated roading represented the most significant alterations of the natural appearance of the watershed.

Currently the condition of the scenic resource is that of ever present geometric evidence of past timber harvest activities. It is the size, visibility, distribution and in some instances, their concentration in contrast with older un-cut stands that contribute significantly to the scenic resource. The Existing Visual Condition (EVC) of the watershed on the whole (with over 50% cutover) is Heavily Altered. The upper eastern end of the watershed is part of the Rogue-Umpqua Divide Wilderness. It has a Scenic Quality Objective of Preservation and an EVC of Unaltered.

Wilderness

Over 11,000 acres of the Jackson Creek watershed are in the Rogue-Umpqua Divide Wilderness. Before designation in 1984, trails in the area were open to motorized travel. Total numbers, and patterns of use have not changed significantly, but mode of travel is by foot or horseback only. Attractions include Cripple Camp shelter, Triangle Lake, Abbott Butte, rock formations, old-growth forests, sub-alpine meadows, and vistas from the ridge tops. Activities include hiking, hunting, and horse riding. Triangle Lake is small and occasionally stocked with eastern brook trout. The trail to it is not signed or maintained, but it receives light camping and day use related to fishing.

Wilderness conditions are monitored by the Limits of Acceptable Change process using Standards and Guidelines found in FSM 2300-90-11. Ecological elements have not been monitored adequately for the Rogue-Umpqua Divide, but several campsites have been inventoried, photographed, and are monitored on patrols. Three campsites at Triangle, and one at Poole Lake were inventoried in 1990. All campsites exceed the Standard and Guideline of location less than 200 feet from water. Two sites at Triangle exceed tree loss guidelines. There have been some unacceptable horse impacts in wet meadows near Abbott Butte, but campsites do not receive use every year, and have not been inventoried. Social Standards throughout the Jackson Creek watershed are being met due to relatively low overall use. There have been visitor complaints due to range cattle impacts along the divide in Prospect District allotments and unauthorized grazing by cattle straying out of allotments.

Trails

There are about 40 miles of maintained trails in the watershed. The following trails are open to hiker and horse use only as they are in wilderness, access wilderness, or are in a Research Natural Area:

- Cougar Butte Trail #1432 and #1432-N
- Pup Prairie Trail #1434
- Cripple Camp Trail #1435
- Sandstone Trail #1436
- Acker Divide Trail #1437
- Rogue-Umpqua Divide Trail #1470 and #1470-A
- Grasshopper Trail #1574
- Grasshopper Mtn. Trail #1580
- Donegan Prairie Trail #1431 is in a non-motorized Unroaded Recreation Area and is open to hiker, horse, and bicycle use.
- Beaver Creek Trail #1426 is the only trail open to hiker, horse, bicycle, and motorcycle use. Old system trails connecting this trail are currently being opened by a volunteer horse group. They include Elkhorn and Bunchgrass trails, which will connect Bunchgrass Shelter with Beaver Creek and Whisky Camp Guard Station.

In the Jackson Creek watershed overall, hiker use is predominate. Horse use is increasing slightly. Current use by mountain bikes, motorcycles, and off-highway vehicles is low.

Research Natural Areas

Two Research Natural Areas (RNAs) occupy 3169 acres of unique ecological niches in the Jackson Creek watershed. The purpose is to provide natural ecological areas for research to provide a comparison between naturally occurring changes and those influenced by humans. Direction is to discourage any recreational or other public uses which could threaten serious impairment of research/educational values, unless the uses were occurring at the time of the RNA establishment. The scenic quality objective is Preservation. The current condition of the RNAs shows some impact from cattle grazing but is generally in a natural state.

Chapter 5 Condition Trends

We have attempted to describe the past and current environmental processes and conditions in the Jackson Creek watershed in a very specific way. In this chapter, we describe relatively long-term trends for the Jackson Creek ecosystem, in broader terms. The inherent risks of predicting the future are enormous. However, certain discrete events are nearly inevitable, and, if we interpret the history of the watershed correctly, then many of the trends which we describe in this chapter must be considered probable. In order to successfully describe these probable trends for the Jackson Creek watershed, it was necessary to make certain assumptions about management practices that would help shape those trends. For the purposes of writing this chapter, we assumed a custodial approach to land management would be in effect, using the assumptions summarized below:

- an aggressive fire suppression policy will remain in effect
- there would be no additional timber harvest
- there would be no additional road construction
- there would be no additional restoration projects

Terrestrial System

Landscape- and Stand-level Vegetation

During the Twentieth Century, the landscape has become increasingly dominated by mid-seral vegetation in the stem exclusion stage. The proportions of early and late seral stages have declined. Of these seral stages, stem exclusion supports the lowest level of diversity (Franklin and Spies 1991). The spatial arrangement of these conditions has changed as well. Since 1900, the following changes have occurred:

* The proportion of stands in the successional establishment stage has declined from 19 to 11 percent of the landscape. The number of establishment patches has increased from 838 to 2421 while their average size has declined from 30 to 7 acres.

* The stem exclusion stage--including selectively logged stands--has increased from about 20 to 40 percent of the landscape. The historic spatial arrangement of these patches is unknown. It is probable that they, like the establishment patches, have increased in number and decreased in size.

* The proportion of late successional forest stands in the watershed has declined from about 54 to 39 percent. The number of late successional patches has increased from less than 75 to 178 and their average size has decreased from 975 to 221 acres.

* The current landscape is highly fragmented. Historically, a continuous 95,000 acre closed-forest stand dominated Jackson Creek. It provided abundant interior mid and late seral habitat. That patch has been fragmented into 405 pieces. Thirty two of these are larger than 220 acres and account for about 64,000 acres of the closed forest in the watershed. This includes cut and uncut forest. There are very few connections among the remaining interior, late successional stands. There has been a 38 percent increase in open to closed forest edge.

During the Twentieth Century, tree density has increased considerably in all stand types. Intentionally regenerated stands are simpler in structure and species composition than native stands. Since 1900, the following changes have occurred:

* In the late seral type, hardwoods and intolerant, early seral understory trees are declining. They will be replaced by climax species. In the long term, the overstory cohort of early seral trees will die and be replaced by climax species. Incense cedar will occur only where it has a competitive head-start in the intermediate crown classes. Drouth and excessive tree density have predisposed sugar pine and ponderosa pine to mountain pine beetle mortality. In the high frequency fire regime area, large woody debris levels have increased. Without disturbance and understory reinitiation, there will be no recruitment of early seral trees or intolerant herbs and shrubs.

* Dense single species stands existed historically. However, they are more abundant now because of reforestation practices. Some stands are so dense that individual tree crown ratios and diameter growth rates have slowed considerably. The dominant tree species are Douglas-fir and ponderosa pine. Ponderosa pine levels are higher than in native stands because of reforestation practices. Although other species exist in the understory they are unable to compete with the overstory fir and pine and future species diversity will be low. In many stands, tree density is so high that future management options, to meet any management objective, will be limited.

* Areas that have been selectively logged have structure and composition characteristics approaching those of the late successional type. Most of the tree species diversity is in the understory. Increasing competition will kill the intolerant, understory conifers and hardwoods. For some stands of this type, removing large overstory trees and leaving behind a dense understory of tolerant trees approximated an intense wind disturbance, similar to those more common further north in the Cascades and Olympics, rather than the more typical fires of Jackson Creek.

* The duration of establishment conditions has been reduced considerably by aggressive, successful reforestation efforts. The life histories of some plant and animal species have probably been disrupted.

- Where disturbance has been excluded, there has been a reduction in species which thrive in an environment of recurring disturbance.

- The stand-level trends discussed above apply to the riparian zones of most intermittent streams. In fact, the absence of disturbance may cause a decline in species diversity in riparian areas that otherwise are capable of twice the species richness of adjacent upslope communities (Gregory et al. 1988).

- Unique habitats have been altered: fire-perpetuated oak woodlands are declining; conifers are becoming more common in other hardwood areas; the low-contrast edge between dry meadows and the surrounding forest has become high-contrast; and the productivity of huckleberry fields is declining.

- The increased transpiration associated with increased tree density may have caused the drying of some historic wetlands and perennial streams.

- Introduced plant species have outcompeted natives, particularly in unique habitats. It is likely that most of the grazing-related ascendance of alien plant species occurred early in this century (White, personal communication). However, continued high grazing intensity may prevent the recovery of native plants in oak woodlands, riparian zones and unique habitats (Sugihara et al. 1987, Saenz and Sawyer 1986).

Combined, these trends have created a condition with diversity and sustainability implications.

- Sugar pine and, to a lesser extent, ponderosa pine are being attacked and killed by the mountain pine beetle. The losses area quite dramatic and both species are being eliminated from some stands. Sugar pine may be all but eliminated from the mixed conifer ecosystem (Marshall 1994).

- The watershed's susceptibility to fire has increased considerably. Tree densities are well in excess of those required to sustain a wind-driven crown fire throughout Jackson Creek. The existing continuous canopy provides the ladder by which surface fire can move into the crowns. Under certain burning conditions, drought and high winds, these two factors are enough to sustain a fire of stand replacing intensity. Historically, the high frequency fire regime maintained a combination of grass (Fuel Model 2) and light timber litter (Fuel Model 8). Now, heavy timber litter (Fuel Model 10) occurs on over 59 percent of the high frequency fire area. These fuel conditions frequently generate intensities capable of initiating and supporting a crown fire in the absence of high wind. They occur on high frequency fire regime areas throughout Jackson Creek and are out of synch with the present hot, dry weather pattern. Jackson Creek is ripe for uncontrolled fire at a scale and intensity that has not occurred for more than two centuries. The above scenario applies to the riparian zones of all intermittent and many perennial streams as well.

Wildlife

Status and trends of wildlife in Jackson Creek are described in the context of relative abundance and biological diversity. Abundance is important to maintain genetic diversity and therefore resilience to environmental change. Further, abundance is important to allow wildlife species to carry on the roles they play in the health of the forest landscape. Reducing the number of biological entities in a system or making some of them less abundant reduces diversity (Langer and Flather 1994). Biological diversity is defined as interactive levels of genetic diversity, species diversity and community diversity (Langer and Flather 1994, USDA Forest Service 1994a).

Species associated with late successional habitats and species associated with late successsional features and processes (microclimate), both in riparian and upslope habitats, are currently at risk of loss of genetic diversity. Particularly those species having small home ranges and low mobility. Though population trends have not been monitored, reductions in species abundance are likely proportional, or more than proportional (Lehmkuhl et. al. 1991) to habitat loss. Sixty percent of the late successional habitat has been lost in the past 50 years with the addition of other factors, such as roads and exotic plant and animal species. Species associated with early successional habitats and generalist species are probably still increasing with recent and currently active timber harvest.

Species diversity issues are most apparent with regard to the fisher and red tree vole which may be at or near extirpation. The eradication of the grizzly bear and wolf in the late 1800's and early 1900s have also affected species diversity.

Community diversity issues involve the timing and loss of both late and early successional forest habitats in the next 50 years and a trend in loss of vegetation species composition, structure and developmental processes affecting wildlife recovery within managed stands.

Regional trends in population declines of certain neotropical migratory birds have been documented. Some of these species occur in Jackson Creek. Analysis of neotropical birds in Jackson Creek is in process.

Special Habitats

The trend of habitat condition and function for plants and animal species using special habitats has been a reduction in habitat quality, and loss of habitat potential. Recovery of habitats is slow and in some cases structural damage to soils and climatic trends could make recovery unlikely. Roads, timber harvest, grazing and species introductions are the main factors contributing to habitat condition. Of greatest concern are wetlands and dry habitats. Microclimate conditions have changed in up to half of the mapped habitats. Cattle use a high percentage of special habitats changing the character and composition of those habitats. Given the rarity of different habitat types such changes may be important. Forest encroachment on the Rogue/Umpqua divide may continue if drought continues and fire is excluded. Removal of adjacent mature forest habitats has likely affected species which use both habitats. In some cases reforestation has initiated forest encroachment. Ponderosa pine reforestation has changed adjacent forest habitat conditions throughout much of the drainage.

Roads

Several trends associated with the road network in Jackson Creek have serious implications for implementation of the ACS. In describing these trends, a continuing decrease in the availability of road maintenance funds, from both appropriated and purchaser credit sources is assumed as well as the decrease in road maintenance staffing. This could result in a dramatic decrease in both the quality and quantity of maintenance in the future.

Specifically, there are a large number of stream crossings in the watershed; 822 were identified in a GIS retrieval. Anecdotal information from the district road managers and others suggest that a large percentage of these crossings were not designed for 100 year flows as recommended in the ROD. In addition, personal experience in this area (Schmidt, personal communication) suggest that road drainage features tend to fail in storm periods that result in 5-10 year events. This has been the history when high levels of road maintenance was occurring. It should be expected that these failure rates will continue, however reduced maintenance will allow failure under less extreme conditions.

In addition to the concern over road drainage, the level of water diversion and associated slope failures is expected to increase. A typical scenario is that the lack of culvert maintenance and ditch grading will allow diversion of ditch flow onto a fill slope and under certain circumstances result in a fill failure. In essence a reduction of road maintenance could result in an increase in road related landslides. The discussions of landslides in the geomorphic processes section suggest that there was a disproportionate relationship between road related slides and debris flows that affected aquatic habitat.

Aquatic System

Hydrologic Function

Jackson Creek has become wider and warmer over the last 50 years. Under the assumptions of this chapter, it won't get narrower and stream conditions aren't likely to change for decades, or longer.. Meanwhile, annual floods and low flows will continue to shape the stream and water quality will reflect the channel shape, landslides and vegetation upstream.

The next 25 year flood will plug culverts and cause landslides from unstable hillslopes and road fills, especially in Coffin Creek, Whiskey/Soup Creeks, Chapman/Freezeout/Surveyor Creeks, Cougar Creek., and Black Canyon Creek, and other basins where most slides have occurred in the past. Where lots of road and harvest has occurred on high risk ground since the 1974 flood in Upper Jackson, Ralph/Tallow/Two Mile, and some tributaries of Beaver Creek, landslides and debris flows down streams are likely. Using the 1974 flood as an indicator, 12 miles of stream might be scoured, adding to the 25 miles of debris flow streams in the most recent large floods.

Jackson Creek and the 400 road to Lonewoman will be cut in spots where it is built in the floodplain, probably below Squaw or Beaver Creeks where the largest streams enter. Road crews won't be able to get past the first damaged crossings, and flood repair money won't likely be available to restore travelways where access is not essential. Even where fills and crossings could be replaced, that often won't be the best strategy for salmon , steelhead or cutthroat, if the roads were occupying floodplain habitat. Logs and debris will be piled up behind bridge piers, reducing the flows that bridges will pass the next time. If access is cut off to slides and crossings, further damage will occur later-even during smaller storms.

In the meantime, higher flow velocity in simplified earthflow streams will continue, until ditchlines feeding streams and gullies fill in or are interrupted by road restoration work. As time passes, more old-growth trees will topple into streams and build bars where trees can start to grow. In twenty to forty years canopies will shade most of Jackson's tributaries and water temperature will fall long before it does in the mainstem. If nitrogen runoff is higher below clearcuts now, concentrations will fall and reduce algae growth and pH in water in the same forty year period. If adult salmon return in large numbers in any years, calcium in water and detritus will increase when carcasses decompose. Insects and juvenile fish will use those nutrients in those years, and may improve smolt size and survival.

Building overstory canopy throughout the Jackson Creek watershed will take longer , especially on poor growing sites on the north side of the creek. Within thirty to sixty years, snow accumulation and melt during warm storms will decline, and accelerated runoff from that source won't occur. Higher floods from road surfaces and ditchlines during all kinds of storms will continue, but trees falling in streams will slow flood peaks and reduce their effect on aquatic life.

Growing old growth conifers large enough to shade Jackson Creek's south side, and old enough to die and fall into streams, will take the longest -- two-to-three hundred years. It will be important to leave trees that fall into streams now, both for the habitat they create and to get people used to seeing streams that aren't "clean". After eighty to a hundred years, trees shading Jackson Creek will cool the stream from Lonewoman downstream, and that will continue if bars deposit around down trees and the channel narrows. Without removal of some of the road fills from floodplain areas, that's unlikely to happen.

Finally, unused roads in the basin will eventually fail in all the unstable fill, hillslope and culvert sites. The cutbanks will ravel into ditches, trees will occupy much of the road surfaces , and litter will build that will allow water to infiltrate the soil mantle. Eventually, streamflow , water quality and stream habitat will start to look like it did at the turn of the century. Large fires will set recovery back in portions of the basin, but more frequent low-intensity fires probably won't change hydrologic processes substantially. If some aquatic species are extirpated, that might mean that fewer aquatic insects, no salmon carcasses or no females digging redds would leave a different channel environment for other aquatic life. We can't speculate on some of the effects plants and animals have on each other and their habitat, and how that would change if they weren't there.

Aquatic Habitat and Fish Populations

Riparian vegetation seral stage distributions are currently outside the natural range of variability in 15 out of 24 WAAs and in 17 out of 24 fish-bearing tributaries. Structural recovery will occur over 200 years but species composition will remain out of the range of natural variability due to continued fire suppression.

Peak flows have been artificially increased due to forest canopy removal and extension of the drainage network from road construction. Peak flow increases in rain-on-snow events should gradually reduce to some degree as upslope forest canopy becomes hydrologically recovered. Peak flow increases that may be due to drainage network extension will remain the same as long as the roads are present.

Many erosive stream channels in earthflow terrain that have been impacted by timber harvest, stream cleanout, and peak flow increases are actively eroding and will continue to erode until channel complexity and peak flow regimes recover. Total recovery is unlikely because peak flow increases associated with extension of the drainage network from roads will not recover as long as the roads are present. Riparian vegetation communities may recover structurally to late seral conditions within the range of natural variability. During that time large wood recruitment to streams will also recover so channel complexity will increase. This should take over 200 years.

Aquatic habitat complexity in fish-bearing streams has been reduced by reduction of the current and future source of large wood due to stream cleanout and timber harvest. Channel complexity should recover slowly over the next 200 years if vegetative communities progress toward late seral structural conditions and large wood recruitment to streams increases.

Aquatic habitat in Beaver Creek is impacted by large wood removal, chronic sedimentation from tributary streams and peak flow increases. Large wood and sediment regimes should gradually recover as large wood recruitment increases over 200 years in all streams. Peak flows will likely remain the same due to the presence of the roads.

Main stem Jackson Creek is disconnected from its floodplain due to the presence of the valley bottom road. This disconnected condition will continue as long as the road is present.

Spring chinook salmon, coho salmon, and sea-run cutthroat trout populations have declined dramatically over the past several decades and will remain the same, gradually recover over 200 years, or go extinct. It is not possible to predict with confidence.

Juvenile salmon rearing habitat in main stem Jackson Creek has been simplified by the substitution of rip-rap for complex channel margins. This will remain the same due to the presence of the valley bottom road along Jackson Creek.

Currently, fine sedimentation is impacting aquatic communities in main stem Jackson Creek. Salmon spawning gravels have a high percentage of fine sediment which may be impacting egg to fry survival. Macroinvertebrate communities reflect high sedimentation. This trend will likely continue because in the absence of upslope watershed restoration projects, earthflow streams will continue to erode, culverts at stream crossings will continue to plug and blow out, and landslides will continue to occur from roads. The impact of these erosive events may be tempered somewhat by increased recruitment of large wood into streams over the next 200 years as riparian vegetation progresses toward late seral structural conditions.

Semi-Aquatic Species.

Western pond turtle populations are in decline. Populations in the upper South Umpqua are likely less in number than historic populations. WPT population structure in the main South Umpqua above Days Creek is presently 74% adults.

Trends of other amphibian and reptile species associated with aquatic habitats are unknown in Jackson Creek though population declines have occurred in other areas within their geographic range. Processes generated by forest management activities and exotic species introductions have affected habitat conditions which have probably developed a trend toward population decline.

Social System

Demand for hunting opportunities will continue but with decreasing deer and elk populations, hunter frustration is expected to increase.

The anadromous fishing closure in Jackson Creek is expected to continue. Fishing is expected to increase faster than big game hunting.

Horse use on trails will increase, especially with expansion of the Beaver Creek Trail system.

Industrial Camps may be needed for developed recreation sites to attract campers to sites with toilet facilities.

Traditional dispersed camping use along Jackson Creek will be difficult to change.

There will be increasing demand for recreation sites near water (along streams and lakes). Roaded recreation is anticipated to increase 1.7% per year.

Overall, pressure will increase for recreation opportunities in the Jackson Creek corridor as surrounding area populations continue to grow. Roseburg and Medford areas are expected to increase by 50-100% by 2030.

The nature of recreation use and facilities in the watershed provide opportunities for barrier-free design. Existing facilities however, do not currently provide access for people with disabilities.

The Scenic Resource of the watershed has been significantly altered. Vegetative alterations are not permanent however and can recover over time to again exhibit a natural appearing landscape.

Wilderness use is anticipated to increase from the Rogue Valley. Conditions may decline slightly but are expected to remain within S&G and management direction.

Conclusion

A strong theme of this chapter is a scenario of relatively slow recovery of some aspects of the ecosystem, as natural processes are allowed to occur. We feel that many of these natural processes can be enhanced and advanced by:

- using the desired future conditions described in chapter 6 as a template for change.
- adhering to recommendations described in chapter 7 to achieve those conditions.

Chapter 6 Desired Future Conditions

Basin-wide Desired Future Conditions

A number of desired future conditions (DFCs) have been identified at the basin-wide scale. DFCs have been formulated for aquatic resources, wildlife populations and habitats, vegetation, special habitats roads, recreation, scenery, and wilderness.

The following desired conditions pertain to aquatic habitat conditions as well as key processes affecting aquatic conditions. They are discussed here in the context of meeting Aquatic Conservation Strategy Objectives throughout the watershed. Detailed descriptions of aquatic desired future conditions can be found in Appendix W.

Sediment regimes have been altered in that landslide rates as well as chronic sediment inputs due to in-stream erosion are greater than under natural conditions. Debris flow rates appear to be higher than historically and debris flows now travel farther down streams than historically due to reduced structural complexity of stream channels. The desired future condition is for sediment regimes to recover to more natural conditions. This includes amount, character, and routing of sediment through stream channels.

Floodplain connectivity has been severely disrupted due to the presence of the valley bottom road along Jackson Creek as well as the presence of a valley bottom road along the lower 3 miles of Falcon Creek. The desired future condition is for connectivity between stream channels and floodplains to be re-established.

Peak flows are currently higher than historically due to upslope canopy removal as well as the presence of 3.5 miles/square mile of roads throughout the watershed. The desired future condition is for peak flow regimes to recover toward their historic range.

Sediment, flow, and large wood routing from tributaries on the north side of Jackson Creek into Jackson Creek has been disrupted by the valley bottom road. The desired future condition is for re-establishment of these routing processes.

Fish population connectivity has been disrupted by up to 17 potentially impassable culverts in fish-bearing tributaries throughout the basin. The desired future condition is for all these potential migration barriers to allow passage of age 1 salmonids (3 to 4 inch fish) as well as adult salmonids upstream.

Note: pH values in the following table pertain to main stem Jackson Creek as well as tributaries. Pfankuch scores pertain to stream channel conditions assessed in generally small, non-fish bearing streams throughout the watershed.

Basin Wide Desired Future Conditions
Aquatic

Aquatic Condition	Current	Desired
Connectivity		
Stream Channel to Floodplain	Disrupted	Not Disrupted
Sediment regime	Disrupted	Not Disrupted
Flow regime	Disrupted	Not Disrupted
Large wood regime	Disrupted	Not Disrupted
Water quality and Flow	Peak flows	Historic Flows
	Low flows	
	High pH	pH < 8.5
Pfankuch Scores		
Earthflow Terrain	82 (Mean)	32-68
Non-earthflow Terrain	73 (Mean)	32-62

Basin Wide Unique Habitat Desired Future Condition

Basin Wide - Unique Habitats
Desired Future Conditions

Special Habitats	Current	Desired
Adjacent Forest Habitat	42% Adj to establiment	> 95% Late Successional
Habitats Influences by Roads	48% w/i 600' of Road	< 1% w/i 600' of Road
Bunchgrass Communities	Low Abundance	High Abundance
Habitats influenced by livestock grazing	~35%	< 1% livestock use

Basin Wide Vegetation Desired Future Condition

We don't have the technology to design a landscape that will provide habitat for all the desired plant and animal species that live in Jackson Creek. However, disturbance processes throughout the last two centuries have provided that habitat at the stand and landscape levels. We have considerable knowledge about those processes and conditions. A reasonable assumption is that habitat for most of the desired species will be provided by approximating historic processes to approximate historic conditions. The vegetation Desired Future Conditions are based on that assumption.

Disturbance

- Disturbance processes, tailored to maintain ecosystem function within the framework of climate and site conditions, are applied throughout Jackson Creek, regardless of land allocation.

Landscape-Level

- Landscape structures are similar to those occurring since the 18th century and provide interior, closed forest linkages along Jackson Creek, within the watershed and among adjacent watersheds.

Stand-Level

- Tree density is at levels that maintain fire, insect, and disease mortality within an acceptable spatial and temporal range. Generally, stand structure and composition are consistent with fire regime.
- Diverse structural and compositional conditions occur within and among stands in each seral stage. These conditions provide adequate habitat for species currently found in the watershed.
- Snag and down-woody-debris densities are consistent with fire regime or other specific management objectives.
- High fire frequency areas are maintained at the current basin-wide average densities for late seral stands, minus one standard deviation.
- Low fire frequency areas are maintained at the current basin-wide average densities for late seral stands.
- The Late Successional Reserve is maintained at the current basin wide average density for late seral stands, plus one standard deviation. Stands are managed to provide these structures when they reach a late seral condition.

Roads

Jackson Creek has a variety of road related concerns that have the potential to have adverse affects on a variety of resources. Three desired conditions have been identified based on the existing processes. The desired condition for erosional processes, would be to reduce the number of erosional sites that would produce sediment detrimental to the values in Jackson Creek. In addition, there is a desired condition to restore the natural hydrologic regime that existed prior to the development of the road system. The debris flows occurrence in this drainage has had severe impacts in several of the tributaries. The desired condition would be to eliminate the potential for management related debris flows.

Recreation

The desired trend for recreation, scenic, and related amenity values in Jackson Creek is to manage projected increase in demand in a way which is compatible with goals and objectives in the President's Forest Plan and the Umpqua Forest Plan. Dispersed recreation sites in riparian reserves are to be managed as a functioning part of the riparian ecosystem.

Within the Recreation Opportunity Spectrum, the 1988 SCORP showed a deficiency in Primitive and Semi-Primitive recreation opportunities in southwest Oregon. Nature study/wildlife observation and visiting interpretive centers are projected to be two of the highest growth outdoor activities. Tiller District recreation management meetings in 1992 created a focus for future management direction. Since Jackson Creek is less developed than the South Umpqua, the desired trend is to provide dispersed recreation opportunities; to increase semi-primitive opportunities with trail expansion; to expand the rental system to include Whisky Camp and Butler Butte; and to increase environmental education and interpretation. The district interpretive goals and objectives are:

-Enhance visitor's recreation experiences and understanding of natural systems.
-Promote recognition of the need to protect our natural and cultural heritage for present and future generations.
-Promote a land and outdoor ethic among users.
-Complement potential or existing interpretive opportunities in the surrounding area.
-Enhance the economic viability of communities in the area.