Areas of partial stand replacement were dispersed throughout the watershed. Within these areas, isolated incidents of stand replacement occurred as fire encountered concentrations of heavy fuels, or where weather and topographic features affected fire behavior. Partial stand replacement fires would have burned through the undergrowth and ground fuels at lower intensities, occasionally burning into the overstory and torching individual trees and clumps of trees. This fire behavior creates a diverse mosaic, leaving not only openings in the canopy, but unburned patches of fuels throughout the burn area. This kind of fire is less likely to burn intensely in riparian or other moist areas. Subsequent fires moving through these areas would burn the previously unburned fuels, and possibly the fine fuels that had accumulated since the earlier burn.

It is unlikely that the human ignited fires had any significant effect on watershed structure or processes. Most of these types of burns would have been low intensity fires ignited outside what we would now call fire season.

Fire History, Occurrence, and Intensity Levels

Fire History Study

Data for a fire history study was collected from a selection of units within the Layng Creek Watershed, using techniques and standards similar to the Augusta Creek Fire History Study (1991). Determination of historic fire occurrence, intensities, and associated regimes began with an assessment of wildfire history based on tree ring counts of fire scars and tree origin dates. Maps of fire episodes displaying single or a series of fire episodes were then generated by evaluating fire event dates and tree origins for spatial and temporal affinity. Successive events were also compared geographically. Episode boundaries were estimated based on patterns of regeneration (from fire history data, stand exam data, and historical aerial photos), fire scars, and topographic features.

15th and 16th Century

Most of the oldest trees in the study area originated between 1447 and 1550. This implies that a series of stand replacing events occurred during that time period. These fires removed much of the existing forest and new stands of trees eventually regenerated across the landscape. The oldest trees were located in the June Mountain/Junetta Creek area.

17th Century

Fire Episode 1668-1679: Fire scars and tree origin data for stand ages in the June Mountain/Junetta Creek area indicate that an episode occurred between 1668 and 1679, where many trees survived the low intensity, localized fire. Though primarily a series of ground fires, there would have been occasional torching of individual trees or concentrations of slash. This episode encompassed approximately 960 acres, which was 2% of the total watershed acres.

Fire Episode 1690-1699: In this episode, fire burned through the majority of the watershed. Stand replacement, partial stand replacement, and low intensity fire created a mosaic pattern throughout the area. Areas of significant stand replacement fire are located primarily in the Upper Silverstairs Creek and East Fork Layng Creek subwatersheds. The Upper Dinner Creek and Layng Creek subwatersheds had areas of significant partial stand replacement fire as well. This episode encompassed approximately 42,164 acres, which was 100% of the total watershed acres.

18th Century

Fire Episode 1726-1734: This was a small, localized fire on Dinner Ridge in the Upper Layng Creek/headwaters of Dinner Creek area. This episode burned at mostly lower intensities, except for a small pocket of stand replacing fire on Dinner Ridge. This episode encompassed approximately 1600 acres, which was 4% of the total watershed acres.

Fire Episode 1760-1769: In this episode two fires burned in large areas. In the first fire, most of the Dinner Creek drainage burned. The Harvey Creek and Upper Layng Creek area also burned in this complex. An area of stand replacing fire occurred at the top of Dinner Ridge. The remainder of the area burned at low intensities, interspersed with occasional partial stand replacing and total stand replacing events. The second and smaller fire burned in the Upper Saltpeter Creek drainage. This fire also burned down into Patterson and Alex Creeks. For the most part, this was a low intensity fire. Some partial stand replacement occurred on Patterson Mountain. This episode encompassed approximately 9,382 acres, which was 22% of the total watershed acres.

Fire Episode 1778-1786: A low intensity fire occurred in the Junetta Creek/June Mountain area. This episode encompassed approximately 7040 acres, which was 17% of the total watershed acres.

Fire Episode 1789-1800: In this episode, fire burned a large portion of the eastern Layng Creek watershed. Fire burned in a mosaic pattern of low, moderate, and high intensities, leaving areas of both partial stand replacement and total stand replacement in Saltpeter, Alex, and Patterson Creeks, and in the headwaters of Layng Creek. The area between Dinner and Harvey Creeks also experienced stand replacement fire. This episode encompassed approximately 29,760 acres, which was 71% of the total watershed acres.

19th Century

Fire Episode 1834-1839: In this episode, the eastern portion of the watershed burned again, in a mosaic pattern of low, moderate, and high intensity fire. Stand replacement occurred in pockets in the area between the headwaters of Alex and Patterson Creeks. Another area of stand replacement occurred in the headwaters of Upper Layng Creek, near Holland Point. The area from the mouth of Dinner Creek down into the main stem of the Layng Creek drainage also burned at stand replacing intensities. This episode encompassed approximately 25,920 acres, which was 61% of the total watershed acres.

Fire Episode 1843-1849: Two large fires occurred in this episode. In the Curran Creek to Patterson Creek area, and down into the main stem of Layng Creek, a fire burned in a mosaic of low to high intensity. Stand replacement occurred in the June Mountain to Hardesty Mountain area. A second fire event burned at what appears to have been a low intensity in the headwaters of Dinner and Layng Creeks. This episode encompassed approximately 14,880 acres, which was 35% of the watershed acres.

Fire Episode 1875-1882: In this episode, a fire appears to have spread from the easternmost ridge of the watershed. It may have burned at a low intensity and backed down the slopes. There was at least one small pocket of stand replacement, which may have occurred as a result of spotting below the main fire. This episode encompassed approximately 1760 acres, which was 4% of the total watershed acres.

Unknown: In the lower Layng Creek drainage and in the vicinity of the railroad logging, there was little opportunity to gather fire scar data. Given the evidence surrounding this "unknown" area, we will assume that fire was as common an event there as elsewhere in the watershed.

Fire Regimes and Range of Variability

The results of the fire history study indicates that the June Mountain/Junetta Creek area is a high severity fire regime. This regime is characterized by very infrequent fire (more than 100 years between fires) that is usually high intensity, stand replacement. Old District records, personal accounts, and early aerial photographs validate this determination. Ground verification in the June Mountain/Junetta Creek area has not been done due to time constraints.

The remaining watershed area is best described as a moderate severity fire regime. This regime is characterized by infrequent fires (25-100 year intervals). They are generally partial stand replacement, with significant areas of both high and low severity. The fire history study supports this determination. Agee's description of the southern portion of the western hemlock zone as a moderate regime (see excerpts in Chapter 3's Fire Regime discussion) appears to be validated by this analysis.

The mean fire return interval in this watershed appears to be approximately 26 years, with a natural fire rotation of 71.3 years. (This is the length of time necessary for an area equal in size to the study area to burn. In this case, the study area was the total acres within the watershed.)

Table 16. Wildfire Return Interval

Mean Fire Year	Fire Episode	Time Since Prev Fire	Sites With Scar Record	Sites With Tree Regen Record
1674	1668-79	N/A	2	2
1695	1690-99	21	8	23
1730	1726-34	35	3	4
1765	1760-69	35	8	12
1782	1778-86	17	3	1
1795	1789-1800	13	11	22
1837	1834-40	42	15	22
1846	1843-49	9	5	9
1879	1875-82	38	4	2

Air Quality

Prior to Euro-American settlement, it is evident that fire was a common occurrence, regardless of ignition source. With the combination of Indian and settler burning in the Willamette Valley and Calapooya Mountain foothills in the spring and fall months, the lightning fires in the summer months, and with possible human ignited fires in select areas of the watershed for grazing, game, or gathering purposes, it is obvious that smoke was present at varying densities throughout much of the year. Air quality ranged from a light haze from distant fires to a dense layer over areas in which fires were large, intense and of extended duration. Smoldering fuels probably contributed much of the emissions, given the nature of the fires that occurred in the watershed.

Smoke was undoubtedly common in present day "designated areas." Residual smoke from fires within the watershed can be assumed to have drifted into the Oakridge area, with the predominantly westerly winds. Localized drainages would have accumulated smoke during the evenings and early mornings, and been lofted somewhat with the lifting of the inversions typical at certain times of year. East wind conditions would have carried smoke into the Row River valley and at times, down into the Cottage Grove area (the southern end of the Willamette Valley). Smoke in this area usually would have accumulated during evening hours, as a result of inversion conditions.

Role of Fire on the Historical Fuels Condition

"Morrison and Swanson (1990) point out that, if all recorded fires in [the] central Cascades study area had been stand replacement fires, very little old growth habitat would have existed over the past 500 years. The observed frequency of fires of low to moderate severity, however, suggested that such events may have sustained extensive areas of old growth conditions through multiple disturbances and through many centuries..."
(Swanson, et al 1993)

In the June Mountain/Junetta Creek area, the fire disturbance regime appears to have sustained most of the area in an old growth condition. It has been a long time since a stand replacement fire occurred; but numerous low intensity fires are likely to have burned through these older stands, reducing litter, smaller understory vegetation and pockets of concentrated fuels. Some partial stand replacement or individual torching probably occurred when fire encountered these concentrations. Given the topography and southeasterly aspect of the area, sustained crown fire would have been possible. Strong winds, especially those coming from a southeasterly direction which were channeled up the Junetta Creek drainage, would have contributed to crown fire conditions.

The types of fuel models that we see today were probably similar in reference times. The differences would be in the distribution and amount of each fuel model over the landscape. Rather than the patchy distribution seen today, due primarily to dispersed timber harvest activities, fuel models in reference times were maintained over larger, contiguous areas. Fire was a random event in terms of location, intensity and extent, and created and maintained a mosaic that is not evident today. An exception may be the administratively withdrawn area (AWA) in the June Mountain/Hardesty Mountain/Junetta Creek area, as described above.

Vegetation and Wildlife Habitat

At the turn of the century, at least 75% of the vegetation in Layng Creek Watershed was late successional. Approximately 57% of this late successional vegetation was old growth. The earliest records available for reference conditions date from 1920. By this time, the Prather Creek and Lower Layng Creek subwatersheds had been harvested by the railroad logging which began in 1900 on private lands. There is some evidence this area had burned before the harvest activity. If not, the percentage of late successional vegetation would be close to 90%. Although fires were relatively frequent, the intensity was usually low to moderate, with stands essentially being underburned, which maintained from 15% to 70% of the canopy cover.

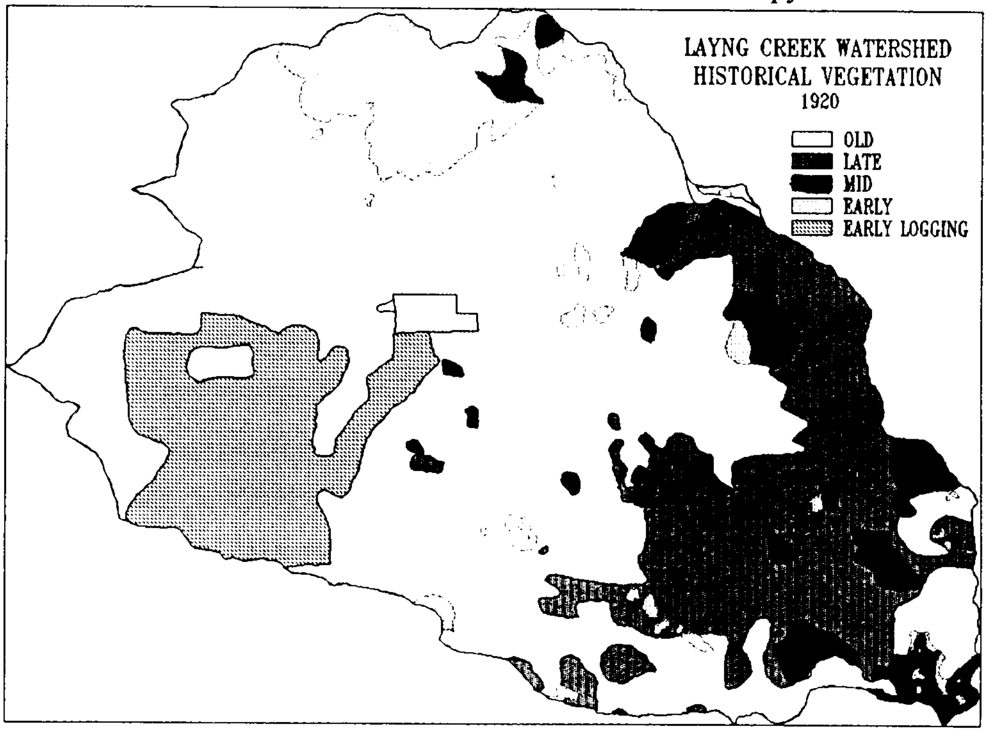

Figure 25. Historic Vegetation

The oldest stands grew in areas such as Junetta Creek, Herman Creek, Layng Corridor and Dinner Creek. Tree origin data shows that trees in this area originated in the 1450's. The east and southwest part of the district appears to have had more fires and hence less old growth. Hardesty Mountain area was also in an early seral stage. The following chart shows the percentage of vegetation by condition.

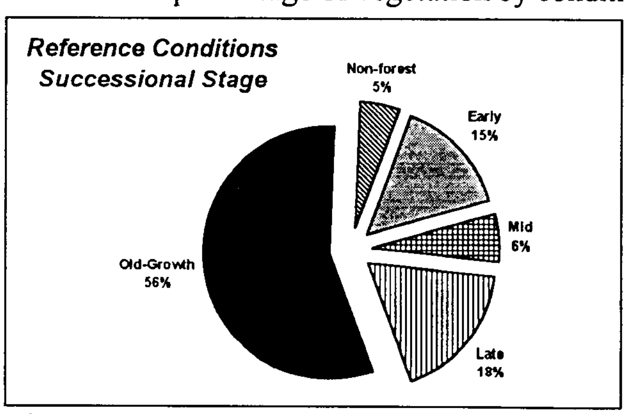

Figure 26. Reference Vegetative Conditions.

Natural Range of Variability (NRV)

The Regional Ecosystem Assessment Project (REAP) assessed the range of ecological conditions between 1600 and 1850 at the regional level by river basin using an approach entitled Sustaining Ecological Systems (SES). This approach is based on the principle that when an ecosystem element moves outside its range, the element, and those elements depending upon it, may not be sustained naturally. The assessment was designed to gain a "first approximation" or "coarse filter" analysis of ecological sustainability. Although there are many assumptions and limitations to this approach, the patterns and trends are valuable as an approximation of pre-European conditions. In this analysis terrestrial and riparian conditions were assessed as having the same natural range of variability (NRV). In the REAP analysis, there was no assessment of the proportion of mid seral vegetation.

Table 17. Riparian and Terrestrial Natural Range of Variability for the Row River Basin (REAP)

Vegetation Condition	Range
Early seral with snags	10 - 40%
Late seral, multi-layered	45 - 75%

Species Diversity

Records from 1920 show that western red cedar, incense cedar and hemlock made up approximately 12% of the mature trees in the stands surveyed.

Special Habitats, T & E Plant Species, Noxious Weeds

The following assumptions are made for the reference conditions for special habitats, T&ES plant species and noxious weeds since there is little available information:

Historically, special habitats have made up only 5% of the forested landscape. Mosaics and meadows were more likely to have experienced fire and thus have fewer conifers (Tooker-Dilley 1994). Threatened, endangered and sensitive species populations were within their natural range of variability. Few noxious weeds were present since their occurrence is based on European influence.

Snags and Large Woody Material

No records exist for snags or large woody material (LWM) conditions in Layng Creek prior to 1920. However, as noted in the wildfire section of this chapter, the types of fuels in reference times were likely similar to what we see today in natural stands. Historically, under a moderate fire regime, fuel levels varied according to the pattern and intensity of fires across the basin, and stands often reburned or underburned. In the high intensity fire regime, fuel levels built up steadily after a stand replacement fire.

Typically, an unmanaged old-growth Douglas-fir stand has an average coarse woody debris accumulation of about 80 tons/acre (Spies and Cline, 1988). After a major stand replacing fire occurs, some of the existing woody debris is consumed, leaving about 67 tons per acre. The fire itself creates new woody debris (standing and down) bringing the fuel level to between 240 and 500 tons per acre. However, by the time the new stand reaches 100 years, coarse woody debris has decayed and is at a low point. At this point, the additions of new dead woody debris from developing stands are less than the loss from decomposition. As the stands mature, woody debris gradually increases until accumulation peaks at about stand age of 400 to 600 years (Spies and Cline, 1988). Figure 27 illustrates predicted changes in coarse woody debris in a 450 year old stand.

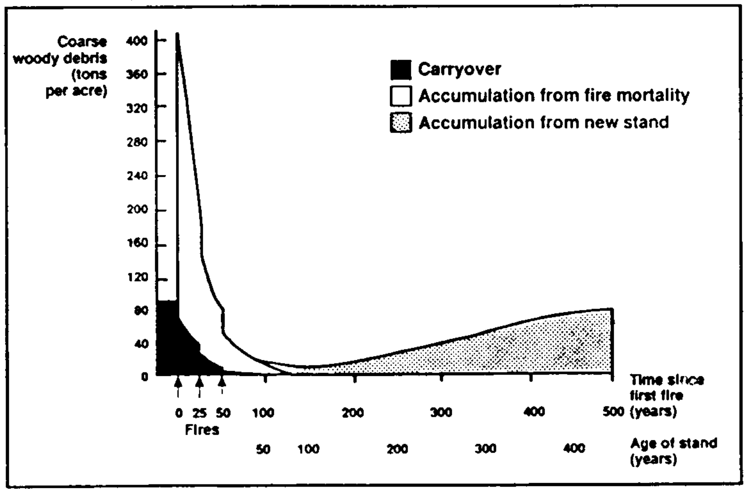

Figure 27.Predicted changes in coarse woody debris after a catastrophic fire in a 450 year-old stand. From Spies and Cline, 88.

Because of the similarity of fuel conditions historically to fuels in natural stands, reference conditions for snags and large woody material can be assessed by looking at average conditions for old growth forests in the Cascade Province. Habitat requirements are best evaluated as numbers of large woody debris pieces (snags and logs) by diameter class, rather than total mass. Table 18 shows the data from Spies and Cline, 1988, applicable to the Layng Creek Watershed.

Table 18. Down Woody Debris in Oregon Cascade Province

	Pieces DWD per Acre by Successional Stage		
Piece Diameter	**Young**	**Mature**	**Old-Growth**
1" to 12"	145/ac	113/ac	77/ac.
12" TO 23"	78/ac.	42/Ac.	65/ac.
> 23"	22/ac.	13/Ac.	26/ac.
	Snags per Acre by Successional Stage		
Snag Diameter	**Young**	**Mature**	**Old-Growth**
1-20" dbh	71/ac	38/ac	14/ac
>20" dbh	11/ac	6/ac	14/ac
avg dbh	13"	13"	22"

Research on the Willamette National Forest (Hemstrom 1987) revealed the frequency of snags exceeding 20" dbh in the same type plant associations that occur in Layng Creek watershed. Timber stands in western hemlock plant associations had an average of 9 snags/acre. In Douglas-fir stands there were an average of 5 snags/acre, and in

Pacific silver fir associations, 9 snags/acre were found. The average snag density by decay class (snag decay class according to Neitro 1985) were: Class I = .5/acre; Class II = 1.5/acre; Class III = 3/acre; Class IV = 3/acre; and Class V = 1/acre. Information gathered from stand exams on the Cottage Grove District in western hemlock associations averaged 9 snags per acre.

Decay condition was strongly related to wildlife use in Hemstrom's samples, with heaviest amount of use in classes III and IV snags, and the least in classes I and V. Class III and IV snags have become softer, bark is loose and the interior of the snag is usually easily excavated to cavities. Generally, it takes large Douglas-fir trees 20 years after mortality to reach decay class III. These snags may persist in decay class III and IV for an additional 100 years. Snag diameter is also strongly related to wildlife use (Hemstrom 1987). Cavity presence increases as a function of snag diameter with the most and largest cavities in snags over 40 inches.

Connectivity, Edge and Landscape Patterns

Reference landscape patterns in Layng Creek reveal that late successional vegetation was the matrix and early successional vegetation was patch. The matrix was homogenous with low contrast between the old growth, late and mid seral vegetation. Connectivity was extensive. There were two patches of early seral vegetation larger than 2,000 acres. Table 19 shows the number of patches and average size.

Table 19. Patches in Layng Creek Watershed.

Patch Size Group in Acres	Average Patch Size in Acres	Number of Patches
> 2000	3,451	2
> 100	185	1
> 500	73	3
> 25	40	3
<25	9	25

Other Reference Conditions Affecting Vegetation and Wildlife Habitat

Soils were not compacted, and there were no roads. Flooding caused by beaver was probably more prevalent. Insect and disease were for the most part at endemic levels except when associated with large fires, episodes of severe weather conditions, or other major disturbance scenarios.

Wildlife

Reference conditions for wildlife species are based on habitat analysis and general knowledge of historic ranges for certain species.

The landscape was primarily late successional vegetation with 20% to 30% early seral vegetation present at any one time. Species such as the gray wolf, grizzly bear, California wolverine and Pacific fisher historically occurred on the District.

Because of habitat fragmentation, suitable habitat is no longer present. The following species currently have suitable habitat.

Threatened, Endangered And Sensitive Species

Northern Spotted Owl

Historically the landscape consisted of large blocks of connected suitable habitat or large blocks of unsuitable habitat. As the forest vegetative successional process progressed, suitable habitat was again occupied by spotted owl. Because of the large amount of coarse woody debris and residual old-growth trees that remained after most natural disturbance events, habitat recovery could occur within fifty years.

Northern Bald Eagle

Eagles were more abundant over their range, but not necessarily more abundant within the watershed. Reference conditions would have been favorable for this species because greater opportunities existed for foraging on winter kill and fish. There was also more potential for preferred roosting sites (large old-growth trees) and human disturbance was far less extensive.

Peregrine Falcon

There are no known historical nest sites in the Layng creek watershed. Management activities have not impacted potential nesting habitat.

Northern Goshawk

Historically the watershed was comprised of 78% late-successional forest, providing large blocks of habitat and abundant prey species. There would have been enough habitat for at least seven pairs of goshawks within the watershed.

Townsend's Big-Eared Bat

Townsend's big-eared bats were historically considered common; they now have discontinuous distribution throughout Oregon. No known nursery sites exist within the Layng Creek watershed. An individual big-eared bat was observed roosting under a bridge over Junetta Creek in the summer of 1984.

Northwestern Pond Turtles

The first two miles of the lower end of Layng creek provide habitat for pond turtles. Historically, in-stream habitat was in good condition with more pools available and little human disturbance.

Riparian Interface

Human Activities

In the pre-1900 period there was negligible human activity in the riparian area within the watershed. There may have been some type of hunting camp in the lower flatland areas but this has not been verified. It is not known if there was any significant use of fire to control vegetation in the riparian area in this pre-European period.

Riparian Vegetation

The vegetation on the floodplains of the larger channels were directly affected by the occasional flooding which effectively removed the existing vegetation. Overall, the riparian vegetation was typical of the LSOG (Late Successional Old Growth) ecosystem and was directly integrated with the terrestrial component. This provided a virtually continuous LSOG environment on the landscape scale.

Table 20. Distribution of riparian vegetation by age class under historical and current conditions.

Age Class	**Reference** (1900)	**Current** (1995)
0-20 years	14%	17%
20-80 years	6%	60%
80 + years	81%	33%

Wildlife

The wildlife habitat was also dominated by the large old growth and large woody debris which directly affect the associated species. These conditions extended up to the ridge tops; there was abundant interior habitat.

The reference animal and plant population distributions reflected the relative change in interior habitat and large wood. Under reference conditions, riparian zones had a high degree of connection with other habitat types and served as important travel routes for movement and dispersal of many wildlife species.

Of all the animals that occurred in Western Oregon under historical conditions, 89% utilized riparian zones or wetlands (Brown 1985). Riparian habitats are utilized by 72% of the raptor species in Western Oregon for their primary foraging and nesting sites. There are also mammals like the beaver, muskrat, and shrews, and a large number of aquatic species (including invertebrates, fish and herptiles) that are totally dependent on the riparian zone.

Wildfire

The intensity of underburns were generally less in the lower riparian areas which contributed to a higher proportion of larger trees and woody debris. The stand replacing fires had the potential to burn through the riparian areas as well.

Hydrology

Based on 59 years of records, there is no apparent indication that, on the watershed level, peak flows are increasing (See Figures 28 & 29). At a local site level, the effects of the presence of the large wood on hydrology was highly significant. Debris movement in the channel would tend to be held in place by the large, heavy material. However, if the debris did break loose, the effect would be much more devastating than a similar event with smaller material. The large wood would also increase the hydraulic resistance of the channel, causing more turbulence and channel scour, lower velocities and higher flow levels. This would cause more frequent flooding of the upper bank and riparian terrace areas *(see the Peak Flows - Appendix B).*

A higher percent of debris torrents entering the channel was effectively stopped by the LWM, and much of the associated sediment would remain in place for an indefinite period of time. The net result was a higher pool/riffle ratio with a more diverse stream bed composition. Water storage was also greater in these channels due to the larger number of pools.

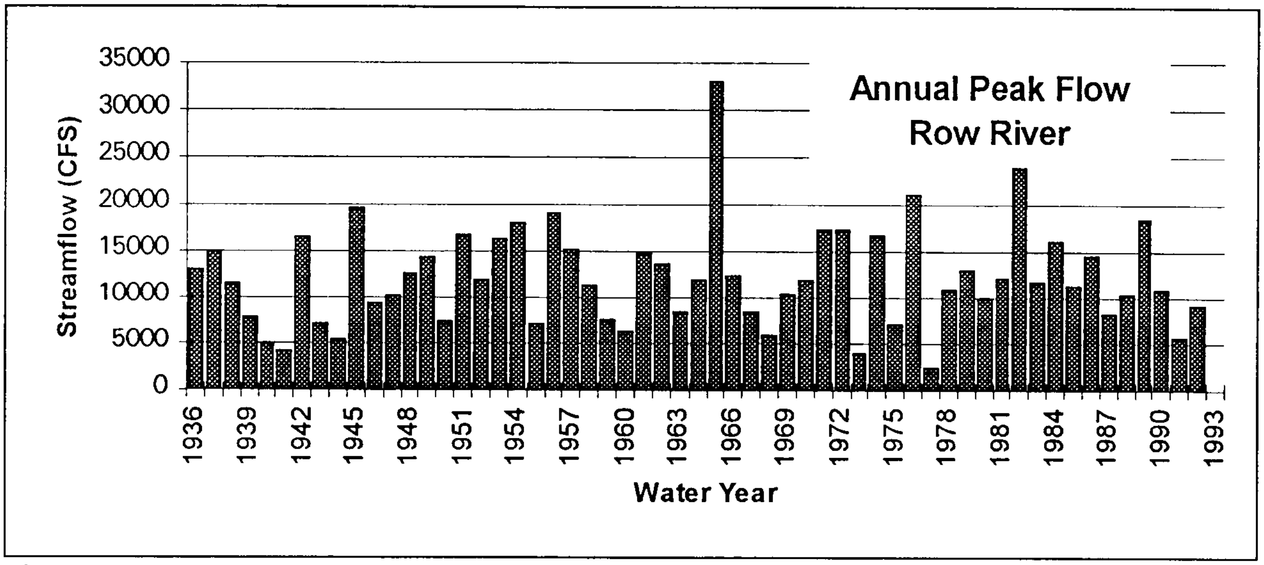

Figure 28. Annual Peak Flows for Row River.

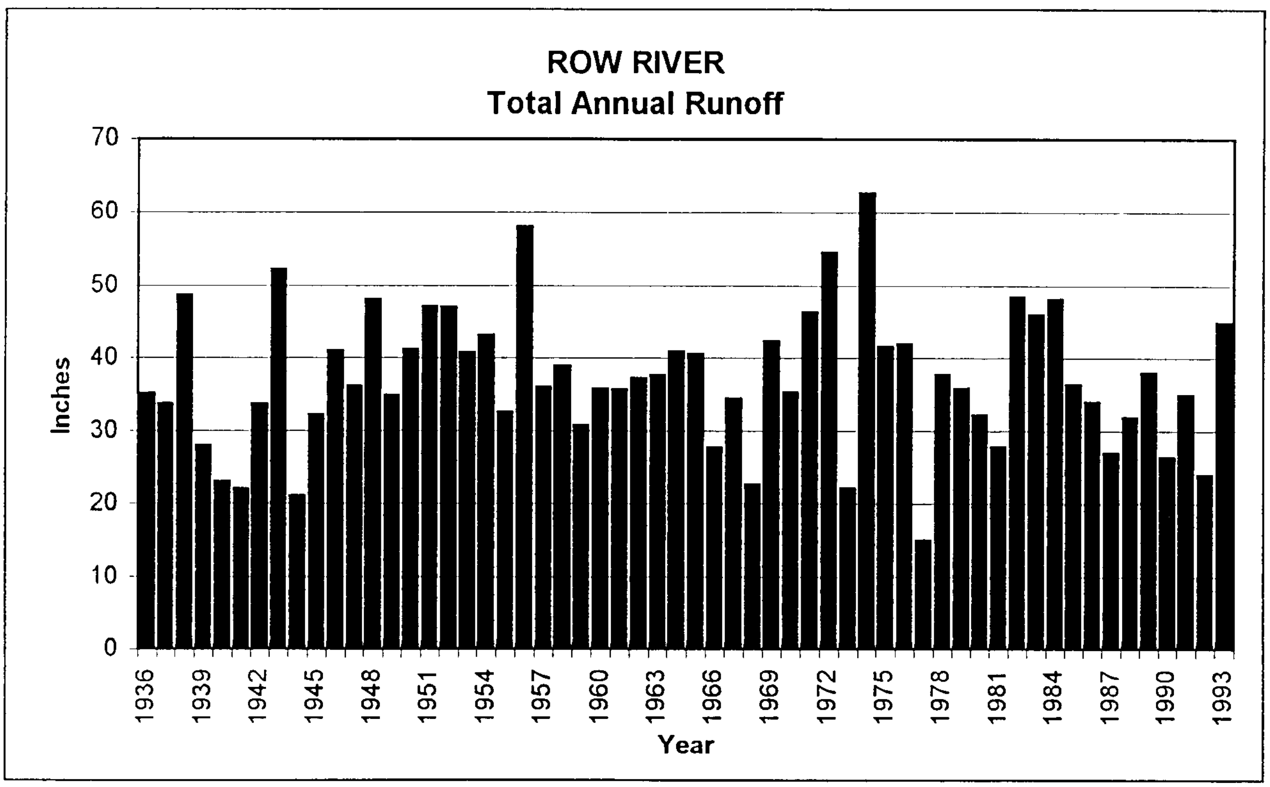

Figure 29. Annual Runoff for Row River.

Aquatic

Aquatic life

Land management activities such as timber harvest and road building have changed aquatic habitat conditions so dramatically that reference conditions are difficult to determine on a watershed basis. Prior to land management activities, west side cascade streams tended to have intact riparian areas with large conifers. As these trees fell over and provided down woody material, they enhanced channel stability and stream complexity (Sedell et al., 1988). Both are important factors for providing a healthy aquatic habitat. The large wood in the stream channel is essential for scouring out pool habitat, providing cover and dissipating the energy of the flow. It also retains substrate, such as spawning gravels and the cobbles that provide macroinvertebrate habitat, and facilitates the collection of other debris and leaf litter which increases nutrients. Large wood deposited on floodplains and in off-channel areas are also important, providing protective cover for juvenile fish during winter high flows (Everest et al., 1985).

The geology of the area correlates with erosion and slide potential. The steep rugged debris flow areas (refer to the geology section of this analysis) are prone to natural slides, where the deep soil earth flow areas are more prone to slides once disturbed.

The number of channel width pools per mile and pieces of instream large woody material per mile are two parameters commonly used to assess habitat conditions. Large material such as large wood or boulders enables the channel to scour out pools and provide cover habitat. Large conifers growing in the riparian area supply the channel with future recruitment of the required down wood.

The reference condition for the number of pools and large woody material per mile has not been established. However, impacts from management activities have created a current condition of much lower amounts than would be found in a pristine condition. This indicates that the overall objective would be to increase the number of pools and large woody material per mile throughout much of the Layng Creek Watershed. Protecting or enhancing riparian areas, along with instream work where appropriate, can help reach this objective.

PACFISH (an inter-regional, inter-agency strategy to provide habitat conditions that contribute to the conservation and restoration of naturally-reproducing stocks of Pacific salmon and anadromous trout) indicates a desired condition of channel width pools per mile based on channel width, with the number of pools increasing as channel width decreases. This model works fairly well for low gradient streams. The survey will only distinguish pools that are channel width and longer than they are wide. This eliminates identification of much of the pool habitat in the higher gradient, stair-step type of habitat, where pools tend to be shorter than wide. The number of pools per mile estimated by PACFISH for the mainstem of Layng Creek is more appropriate for Reaches 1 through 4 (see figure 30). The channel gradient steepens and the width decreases in Reaches 5 and 6 of Layng Creek. The PACFISH desired future condition (DFC) is therefore not appropriate for Reaches 5 and 6.

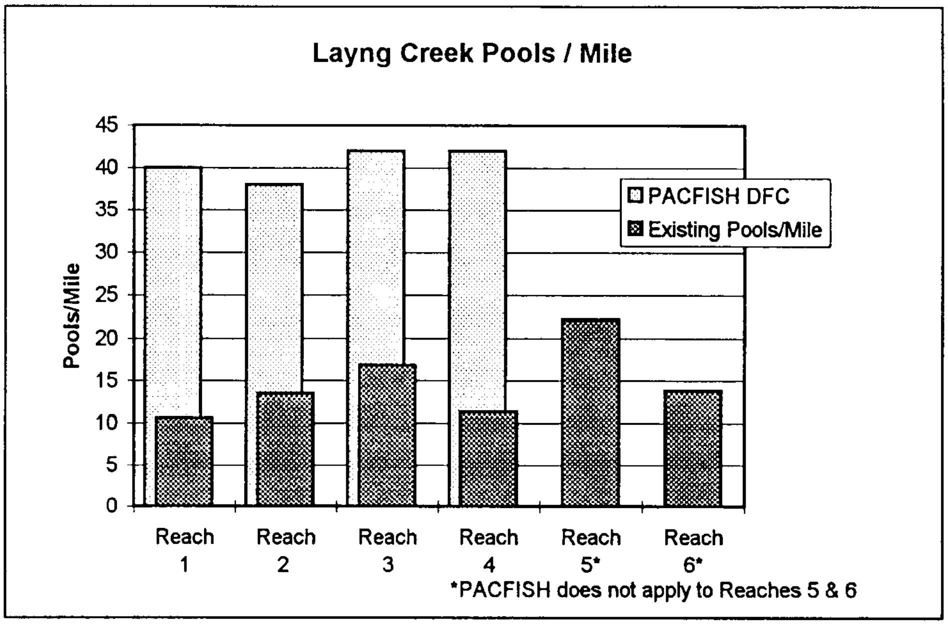

Figure 30. Pools per Mile in Layng Creek

The desired condition of instream large woody material in PACFISH is measured at 80 pieces per mile for all streams.

The Aquatic Conservation Strategy of the NWP indicates the need for establishing a desired condition and recognizes that these conditions can be site specific and not similar throughout the region. Several pristine streams within the Willamette Province have been surveyed and are currently being analyzed. This data will lead to a more site specific desired condition, but there are several limiting factors, such as fire history and elevation.

Parts of the Layng Creek drainage have a high severity fire regime which means fire occurs infrequently, tends to be intense, and may be stand replacing. This high severity regime is found in the upper Junetta subwatershed. The majority of the watershed historically has a higher fire frequency, which maintains lower fuel loads and therefore diminishes the probability of a stand replacing event. This is called a moderate severity regime. The overall historic riparian condition is believed to have been around 70% in a late seral condition. Timber management has drastically reduced the percent of late seral condition within riparian areas. Fire suppression has also altered historic conditions. The increasing fuel loading alters portions of the watershed to more of an infrequent high severity fire regime.

Water Quality

Examination of the topography and geology of Layng Creek indicates that historically, the watershed's numerous earthflow type areas strongly affected the existing drainage patterns, and were associated with high sedimentation rates. The data from Layng Creek showed that a recently active earthflow may have produced turbidity levels which are an order of magnitude above background level, and that the effects of these earth flows could persist for many years. Debris slides also occurred, which often delivered material to the channels. However, this type of slide appeared to have a much smaller effect on downstream turbidity. Water surges from debris-dam breaks move rapidly downstream as a wall of water and debris. Often the channels experiencing this type of event would be "sluiced-out" to bed rock.

Periods of flooding and fire also create conditions for accelerated erosion to take place. The effects of the 1964 flood event are still very apparent within Layng Creek floodplain zones. However, as discussed in Chapter 3 (Hydrology), the current rate of sediment production seems to be near a minimal level. This minimum level may be somewhat higher than neighboring watersheds because of the distinctive geology of Layng Creek.

Human activities can affect the rate of sedimentation in Layng Creek. However, the monitoring data indicates that recent management activities have not affected the system to the extent possible from a natural earth flow event, with the possible exception of stream channel modification. The variability of sediment production characteristics resulting from natural processes seem to greatly out-weigh the effects of management activities. Nevertheless, a significant difference between current and past conditions is the reduction of large woody debris in the channels and riparian zones. Much of this wood has been removed for salvage and channel improvement projects. This material directly affected the channel storage characteristics and bank erosion processes at the site level. Even though the overall net effects may not be significant, the ecosystem characteristics of the local sites have changed dramatically.

Chapter Five

5. Interpretations

Societal

Domestic Water Supply

It is assumed that the federal lands in the Layng Creek watershed will continue to be managed as Matrix and Riparian Reserve lands as directed in the Northwest Forest Plan. This will represent a reduction in timber harvest activities compared to past levels. Restoration activities may increase and the roads will need continued maintenance.

The City of Cottage Grove will probably continue to want to use Layng Creek as a water source indefinitely for the following reasons:

- This water has a head at the Cottage Grove end and does not have to be pumped as does water from the Row River site.
- The Layng Creek water is cleaner with reduced associated treatment costs.
- The City has an obligation to supply water to users distributed along the pipe line.

Protection of the City intake is a real concern. Demand for forest recreation experiences will probably continue to increase, resulting in increased activity within the Layng Creek watershed. But there are serious risks associated with maintaining a large municipal watershed open to the public. Vehicle accidents along Layng Creek are a primary risk factor. A chemical spill within the watershed also has potential for significant impact. Even the unlikely event of deliberate sabotage represents a significant risk. On the other hand, closing a watershed to public use is costly and inconvenient and not particularly effective. In the future, the City may ask for more security around the intakes.

Concerns and Issues About Drinking Water Supply

Water quality is a primary concern for the City and their customers. Suspended sediment is a directly related issue since the City must meet State turbidity standards; water treatment costs relate directly to the turbidity levels of the raw water.

Giardia is a constant concern of the water treatment plant operators. Beavers are active in the vicinity of the intakes and are known to be carriers of the Giardia parasite, but there have not been any cases associated with the Layng Creek supply in recent history. Chlorination is the primary defense against this organism.

Chemicals used or transported within the watershed are a concern, particularly those classified as potential carcinogens. The probability of an adverse effect from chemical contamination is higher in a watershed where larger quantities of water are being consumed by a larger number of people. As a result, the District policy is to not allow chemicals in the watershed that do not have an established EPA drinking water standard.

Accidents: Accidental spills are another possible source of chemical contamination. The most likely spill would involve gasoline or diesel. Spill hazard reduction strategies include:

- Use of lead-in vehicles when bulk chemicals are being transported within the watershed. Studies have shown that most transport accidents on forests involve lost drivers.
- Guard rails or berms to reduce potential of vehicles accidentally entering the stream channel.
- Pre-deployment of spill booms across the stream above the intake during periods of high activity. Note: this is effective only during the summer low flow period.
- Maintain a cache of spill containment and sampling equipment in the vicinity so that it is available for rapid deployment by trained personnel.
- Have an active spill response training program.
- Have a Forest Spill Plan to assure agency response and to assist with situation assessment and monitoring.
- Coordinate actively with the City during high risk projects.

Bacteriological contamination from forest users is an on-going concern which has led to a prohibition against over-night camping and swimming in the portion of the watershed above the intakes. The Forest Service also assures that special precautions are taken by operators on projects in the vicinity of the open water.

Timber Harvest

Adoption of the Northwest Forest Plan has resulted in a drop in harvest levels from an average of 286 acres per year on a suitable (for harvest) base of 31,529 acres to 135 acres per year on a suitable base of 14,467 acres. A harvest rate of 135 acres per year on Forest Service land equates to a 92-year rotation. With an average of 41 mbf per acre , this results in a harvest of approximately 5.4 million board feet per year. An additional 300 acres of commercial thinning adds 500,000 board feet to this harvest level.

There are two aspects to the question of what is a sustainable harvest level in Layng Creek. The first aspect is to define sustainable. The second aspect is scale at the temporal and landscape level.

If sustainability is defined as maintaining vegetation in conditions within the natural range of variability, a harvest rate of 135 acres per year is eventually sustainable. Assuming all reserved and unsuitable acres are restored to, or are maintained in a late successional condition, this eventually restores 54 percent of the watershed to a late successional condition, well within the natural range of variability. However, the consequences of this harvest rate will have at least 2 significant effects:

- In the near term, the proportion of late successional vegetation will drop another 5 to 8 percent over the next 25 years from the current 37 percent to approximately 30 percent of the watershed.
- In the long term, the length of time required to return to 54 percent late successional vegetation is at least 100 years.

The district or forest may be a more appropriate scale to determine sustainability. The fifth field watershed scale may not be the appropriate scale to address natural range of variability issues. Matrix lands are designed to emphasize timber production and early seral vegetation while maintaining old growth components and connectivity.

The use of landscape analysis techniques combined with careful scheduling of timber harvest can provide commodities while creating a diversity of patch sizes, the desired acres of edge habitat and connectivity.

Riparian Reserves encompass 16,014 acres. A majority of the Reserves (58%), are in a pole/sapling stage. Thinning to promote larger diameter trees is a practice that may help achieve ACS objectives and provide commodities at the same time. Areas needing treatment and which are available for thinning should be identified at the project level.

Other opportunities to increase commodity production include:

- Partial harvest prescriptions for areas unsuitable for regeneration harvest because of reforestation concerns (2,033 acres).
- Identification of Western red cedar plant associations and implementation of intensive culturing of both Douglas-fir and shade tolerant species on these sites.
- Shortened rotations to enhance big game habitat.
- On highly productive sites, prioritize funding and implementation of intensive management techniques such as multiple thinnings, fertilization and pruning.

Demand for special forest products is not expected to increase significantly in the near future in Layng Creek watershed. Only 28 permits were issued for miscellaneous products such as boughs, cones and plant material for the entire district in the period between October 1994 and June 1995. Demand for poles, firewood and Christmas trees is expected to remain steady.

Roads

Under the terms of the Northwest Forest Plan, there may be increased emphasis on road closures to enhance wildlife management areas and facilitate watershed restoration. Also, with a reduced timber sale program, there may be reduced road maintenance funds. As a result, there may be more road closures and associated drainage stabilization projects.

The road system interfaces with the ecosystem in several significant ways:

- The roads can serve as barriers to various species and organisms. Road culverts at stream crossing points often impose barriers within the channel and the roads themselves can serve as barriers to small terrestrial organisms.
- Roads which encroach on the riparian zone can also affect the riparian habitat characteristics and directly affect the channel function. The latter can, in turn, affect the channel hydraulics, which also affects the sediment regime and the flooding characteristics.
- Water run-off from the road prisms into live streams can contain elevated quantities of suspended sediment. The quantity of this contribution varies with the amount of source material, length and slope of road.
- Roads can affect the natural drainage patterns of both groundwater and surface flow at the local level. Precautions must be taken to avoid significantly affecting water sources for ponds and moisture sensitive areas. Particular concerns would be unique habitat areas and potentially unstable areas.
- Increased sedimentation from culvert failures and road associated debris slides needs to be minimized. Geotechnical evaluations should be made of designs in high risk areas. Likewise, road crossings need to be evaluated and high risk culverts identified for restoration or corrective design.
- The access provided by roads can affect the degree of seclusion or isolation of a site. This can affect the quality of the habitat for various species. For example, during certain seasons, elk can be stressed by near-by motor traffic.

Geology and Soils

Although a number physical processes have contributed to current conditions in the Layng Creek watershed, the change in the timing and mechanisms of erosion is noteworthy. The pattern of natural slides occurrence has changed dramatically, from 69% of the total slides in 1946 to 12% in 1988. The fact that a large portion of the watershed was in an unmanaged state in 1946, and natural disturbances were the predominant contributor to landslide frequency largely explains these figures. There was also a strong relationship between steep slopes (60% +) and landslide occurrence.

The landslide analysis revealed a pattern that associated roads with a series of management actions and climatic events. There were relatively few miles of road in the watershed in 1946 (the year of the first aerial photos of Layng Creek) and in the years prior to that, there wasn't a strong pattern of major storm events or wet years. The pattern of road related landslides interpreted from 1946 photos indicated that 19% of the slides were directly associated with roads. Photos from 1966 indicate that 45% of the total slides were related to roads, and the 1988 flight identified 24% of the slides related to roads. The large increase in road related slides identified on the 1966 photography was almost certainly a result of the large storms that occurred in 1964, usually identified as a 100 year event. Several factors are believed to have contributed to this pattern. The primary factor was the existence of a large amount of relatively new roads (less than 10 years old) that were designed and constructed with traditional cut and fill methods. In some areas, large amounts of sidecast fill was deposited on moderate to steep slopes. The combination of marginally stable fills and the highly saturated conditions probably contributed to a large number of failures that often reached stream channels below. In addition to the fill failures a number of slides were identified within the riparian areas and associated with stream crossings, where these crossings failed due to plugging associated with high flows and debris.

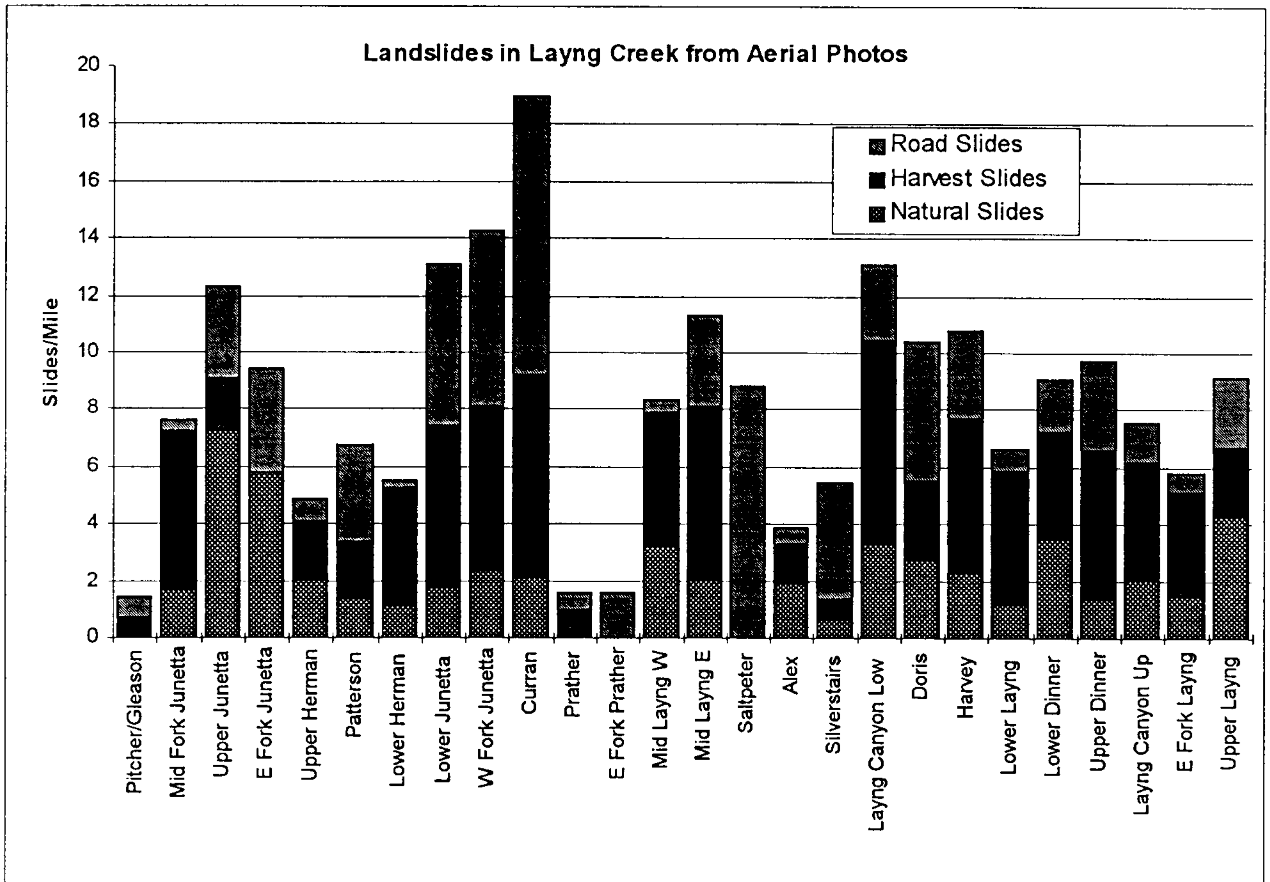

Figure 31. Slides in Layng Creeks

The road related slides identified in the 1988 flight suggest that the number of road miles constructed during this period decreased proportionately and construction standards were raised after the failures of 1964. In fact, the Forest Service developed a number of specific guidelines during this period to reduce the potential for road related failures.

The estimate of landslides associated with timber harvest units interpreted from the 1946 photography identified a small number (8%) in harvest units. The 1966 slides made up 37% of the total and in 1988, the harvest related slides represented 64% of the total. These numbers suggest that the disturbance associated with cutting and removing trees was fairly proportional to the amount of harvest through 1966. The large increase of slides in the last 30 years could be explained by recognizing that the terrain managed during this period was more unstable.

The terrain concerns are focused on the fact that a large portion of the harvest prior to this period was focused on ground that was relatively easy to access such as the flatter earthflow terrain. After these areas were cut out, there was little choice but to move to the steeper slopes. As described in the geologic conditions, a number of these areas are naturally subject to periodic landslide events. The removal of vegetation and disruption of the soil allowed for increased landslide occurrence.

The fact that the landslide rates appear to be significantly higher than they were prior to management in the watershed may not be as important as the fact that the spatial relationships appear to be out of balance with the natural regime. Under a natural disturbance regime it would be unlikely to see high concentrations of landslides occurring in some of the areas where they, in fact, have occurred. Of particular importance are the number of landslides that have occurred on slopes less than 60%, where natural instability is not typically expected.

Another concern identified as a result of this analysis is the type of slides that traditionally occurred, which contributed sediment and organic material that the system required, particularly large wood (whole trees) and sediment that ranged in size from sand to boulders. A large number of the slides associated with roads and harvest units have produced material that is vastly different from what occurred naturally. Road slides tend to provide a high proportion of fine sediments that probably have a negative impact on aquatic habitats, and slides in the harvest units rarely have a high proportion of large wood. Usually there are a lot of stumps and cut ends in the deposits down slope.

Trends

There are several trends that will be evolving concerning landslides in the Layng Creek watershed. The natural rate of slides in unmanaged areas will probably remain well within the historic range of 0-8 slides/square mile, with the variance dependent on terrain, climate and natural disturbance. The landslides associated with roads appear to be on a downward trend; this may reflect the lack of climatic events that trigger landslides. A continued focus on water quality in Layng Creek will encourage adequate maintenance and restoration of the roads in the future. If this assumption is not valid and the maintenance of the existing system is reduced significantly, the downward trend may be reversed.

The trend for landslides associated with timber harvest is expected to increase in the short term and decrease in the long term (after about 20 years). The rationale for this is there are a number of harvest activities that have occurred in the past 10-15 years that have not been tested, either by a significant climatic event or the decay of root strength, which would result in failure. These units, particularly those located on steep slopes, would be subject to failure even if there was no additional activities in the watershed. Over the long term, a higher level of analysis and better understanding of appropriate physical processes will allow activities that are designed to minimize future risk of failure. This should reduce the trend in the future.

Landslide Hazard Rating

An evaluation of the landslide history and frequency in the watershed was used to develop a rudimentary hazard classification. This evaluation involved compiling a GIS slope map and the landslide layer to determine presence and proximity to roads and riparian areas.

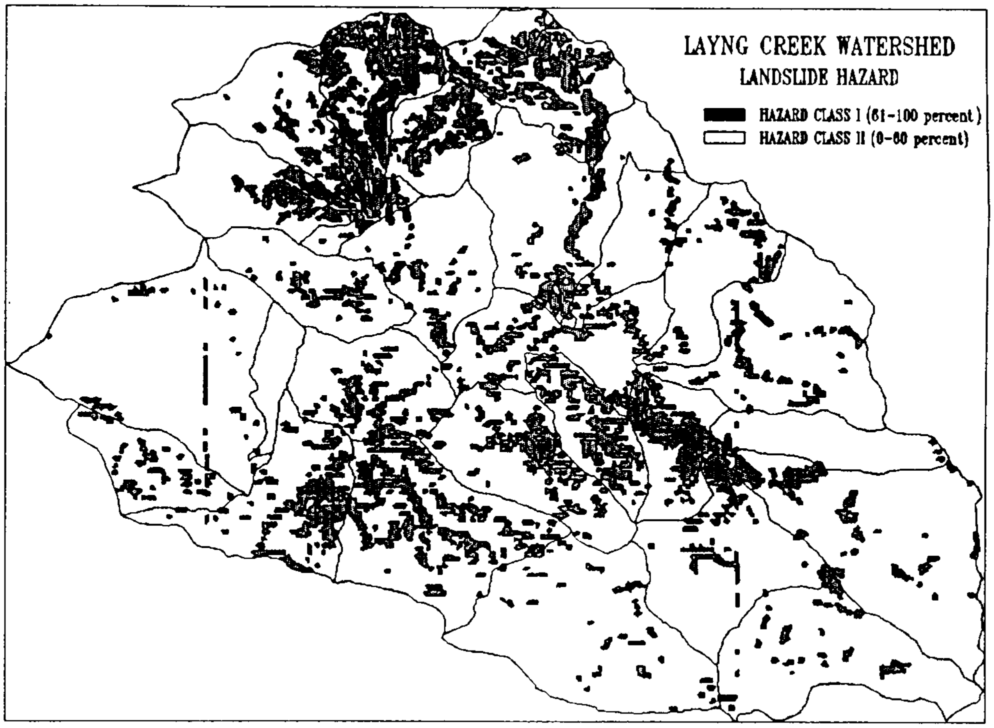

Figure 32. Landslide Hazard Map of Layng Creek Watershed

Further analysis reveals that the relative proportion of landslides on steep slopes (> 60%) was significant. Approximately 55% of the total slides that had been recorded were associated with steep slopes, which occupy only 14% of the landscape. Based on this information, a landslide hazard map was developed, which identifies those areas as high hazard for landslides (see Figure 32). This map can be used for project scoping, but is not intended to be used for site specific project design.

Table 21. Landslide Risk Summary by Subwatershed

Subwatershed	Acres	# of Slides By Aerial Photo Year 1946	1966	1988	Total Slides	On Slopes > 60 percent # Slides	% Slides	% of Sub Watershed
Pitcher/Gleason	892	0	1	1	2	1	50.0%	23.5%
Mid Fork Junetta	1515	4	1	13	18	17	94.4%	21.4%
Upper Junetta	1407	16	7	4	27	21	77.8%	59.3%
E Fork Junetta	884	8	5	0	13	7	53.8%	33.9%
Upper Herman	1570	5	2	5	12	12	100.0%	39.2%
Patterson	946	2	5	3	10	3	30.0%	7.8%
Lower Herman	2315	4	1	15	20	12	60.0%	11.3%
Lower Junetta	1463	4	13	13	30	15	50.0%	10.6%
W Fork Junetta	1344	5	13	12	30	26	86.7%	17.7%
Curran	1194	4	18	13	35	14	40.0%	9.7%
Prather	3307	0	3	5	8	4	50.0%	2.3%
E Fork Prather	405	0	1	0	1	0	0.0%	0.5%
Mid Layng W	1376	7	1	10	18	15	83.3%	16.6%
Mid Layng E	1587	5	8	15	28	22	78.6%	15.8%
Saltpeter	1306	0	18	0	18	1	5.6%	10.8%
Alex	2318	7	2	5	14	6	42.9%	7.6%
Silverstairs	940	1	6	1	8	1	12.5%	2.4%
Layng Canyon Low	980	5	4	11	20	17	85.0%	40.5%
Doris	925	4	7	4	15	15	100.0%	37.5%
Harvey	1656	6	8	14	28	14	50.0%	21.9%
Lower Layng	1637	3	2	12	17	17	100.0%	23.1%
Lower Dinner	2391	13	7	14	34	25	73.5%	24.6%
Upper Dinner	2833	6	14	23	43	5	11.6%	3.4%
Layng Canyon Up	1868	6	4	12	22	10	45.5%	11.2%
E Fork Layng	2980	7	3	17	27	4	14.8%	8.5%
Upper Layng	2095	14	8	8	30	9	30.0%	5.9%
TOTAL	**42134**	**136**	**162**	**230**	**528**	**293**	**55.5%**	**16.1%**

Soils

The predominant concerns about soil resources are the amount of surface erosion and the presence of conditions that indicate soil compaction. Surface erosion is associated with a number of different sources. The primary difference between the current condition and reference conditions is the change in the type of source and the ability of sediment to be transported and delivered to the aquatic system. Prior to management activity in the basin, localized sediment sources existed and, under normal conditions, revegetation would occur and allow for recovery of the site.

Current erosional sites, specifically those associated with roads, respond quite differently. They are often difficult to revegetate and in many cases allow for effective transport of the eroded material to another location, often to a road ditch or into a stream. Inventory of a number of roads in the watershed suggested that while the most persistent erosion sites had been actively treated for a number of years, there will continue to be road related erosion as long as the system is in place. While the water quality monitoring data suggest that turbidity is improving, the effect of road related sediment on the aquatic ecosystem is not well understood. As discussed previously, the trend of the road related erosion will depend on the level of maintenance and restoration that occurs over time. As long as there is a program in place to reduce road related sediment, the trend should continue downward.

Compaction

As discussed in the reference conditions section, it is highly unlikely that widespread soil disturbance occurred that resulted in compaction, changes in soil productivity or in water holding capacity. Although there were only a few units that were identified as specifically harvested with ground skidding equipment, there is sufficient evidence that widespread compaction probably exists. Research shows that harvest associated with conventional ground based yarding and in some cases historic railroad logging on fine textured soils has a high probability of some level of detrimental disturbance, usually compaction and/or puddling. The Standards and Guidelines described in the 1990 Umpqua Forest Plan for Soil Productivity may be a concern in a large percentage of the gentle ground in Layng Creek. Additional work will be necessary to define the level of concern for this issue at the project level.

At the present time, while there are recognized techniques to reduce the level of compaction for site specific areas, there is no clear understanding of the cumulative effects that compacted soils have on the geohydrologic regime. If there is widespread compaction that presently exists in Layng Creek, it will probably take at least a rotation of the present vegetation before we could expect to see a measurable reduction at the watershed level.

Wildfire/Natural Disturbance

"The question as to what is the "natural" condition of...forests is a problematic one...Are "natural" forests only those in which humans have played no significant role? Under that definition, there would have been few natural forests, even in 1500---for humans have occupied and influenced...forests since the time these forests migrated northward behind the retreating continental glaciers more than 8000 years ago." (MacCleery 1994)

"An important question in defining natural...variability is how to treat burning practices by native people. In many areas intentional and unintentional burning by native people probably occurred over a sufficiently long period (perhaps thousands of years) that effects were thoroughly incorporated in the ecosystem. Alteration of fire regimes by suppression or ignitions by people of European descent has been of shorter duration, sometimes greater magnitude, and commonly accompanied by grazing, logging, or other practices that in some areas have caused the system to deviate markedly from conditions before influence of Europeans." (Swanson, et al 1993)

Changes in Fire Intensity Levels

The immediate impact of Euro-American settlement was a significant reduction in the frequency and extent of land burned by local Indian tribes. Settlers used fire, but for different reasons and with diverse results. While Indian burning tended to be patterned in terms of seasonal variations, frequency, and intensity, settler ignited fires were more random in nature. It cannot be determined whether the pre-settlement fire history in the Layng Creek watershed was influenced by Indians or lightning, nor whether the settlers had any significant influence on the fire history in the last half of the 1800's.

Fire suppression policies were developed to protect the forest reserves after the devastating fires of 1902. Severe fires occurred in almost every county west of the Cascades. Fires found in the watershed were extinguished, often before they attained any size or intensity. With few exceptions, most lightning and human caused fires were extinguished at less than one acre. Today full suppression (control) is still the primary action taken; occasionally limited suppression (contain) is used; rarely is nothing more than monitoring a low risk fire (confine) done. A full suppression fire policy has had a direct and significant effect on the role fire played in the watershed.

Slash burning has also had a significant effect on the watershed. Since at least 1904, slash burning has been a common practice on the District. Since 1900, over 18,153 acres of the Layng Creek watershed has been either broadcast or underburned. Past harvest practices have created a patchwork mosaic of land, which was then burned and replanted. In many places these burns were probably more severe than the area had experienced previously, while in other places the opposite was probably true. Prior to the mid-80's slash burns often took place in the summer and fall months when fuels were at their driest. These burns were generally more intense, and had greater negative effects overall. Since spring burning began, overall intensities and negative effects have lessened.

Changes in Fire Regimes and Range of Variability

The optimal conditions for interpreting natural disturbance regimes are a long, pre-European settlement record with a high frequency, low severity disturbance regime, which permits sampling numerous events per site with dendrochronologic methods. In general, the fire history study of Layng Creek watershed meets this criteria, except for areas of repetitive stand replacing fire.

Current Condition: Fires appear to have been a frequent occurrence within the watershed in the last 94 years; most were small in size. When the fires grew in size, overall intensities tended to be moderate. Had suppression policies not been in place, it is very likely the size class A fires would have become larger, with higher intensities. The advent of fire suppression, however, has gradually set up an artificial regime which is characterized by infrequent, high intensity, stand replacing fires.

Reference Condition: Again, fires were a frequent occurrence in the watershed. A wide range of fire intensities occurred, resulting in an extremely complex, dynamic mosaic of forest composition and stand age structure. Throughout the centuries, the overall fire regimes have been maintained (high severity in the June Mountain/Junetta Creek area, moderate severity in the remainder of the watershed).

Changes in Air Quality

In the past, air quality was often poor. Regardless of ignition source, fires burned longer and more intensely, resulting in increased fuels consumption and resulting emissions. Down canyon and down wind effects would have varied, depending on weather conditions. Smoke in the Willamette Valley and Willamette River watersheds (such as the Oakridge area) would have been a common occurrence, and inversions would have contributed to prolonged poor air quality in the valleys. Wood burning for heat in the winter months would also have contributed to poor air quality. Inversions are most common at this time of year and sole reliance on firewood as a heating fuel resulted in high emissions on a daily basis for several months.

In the early to mid-1900's air quality began to improve. Indian ignited fires were no longer a regular occurrence, and settler fires were decreasing as land was cleared for homes and pasture land. Logging was starting to pick up in the forest, however, and slash burning smoke filled the air, mostly in the summer and fall months. It was during this time period that comprehensive fire suppression policies became pervasive and most fires of other origins were suppressed before intensities were such that significant emissions were produced. Wood burning in the winter months was still a major contributor to poorer air quality.

In the 1950's, logging activities increased dramatically, as did slash burning emissions. For the next three decades, slash burning was still the accepted and preferred method for fuels management, and was usually carried out in summer and fall. In this four decade period, the use of firewood as a heating fuel decreased somewhat.

With the passage of the Clean Air Act in 1967 and amendments in the 70's, regulations were put into effect which restricted activities that contributed to air quality degradation. By the mid-80's prescribed burning techniques were being implemented which further reduced negative impacts to air quality. Restrictions were imposed which also reduced winter wood burning impacts.

In the 1990's, only 329 acres have been burned within the watershed, all within the spring burning period. None of these burns impacted air quality outside the immediate vicinity of the burn. Through the techniques employed to comply with current regulations, there has not been a smoke intrusion due to prescribed burn activities for several years.

Since pre-settlement times, air quality has gradually improved. Technologies have advanced to the point that most smoke management and air quality concerns can be mitigated. The exception might be the uncontrolled wildfire.

Changes in the Role of Fire on the Fuel Condition

Fire once played a major role in creating, modifying, or maintaining fuels conditions within the watershed. Both low intensity and partial stand replacement fires served to keep the forest floor relatively clear of large build-ups of fuels that would contribute to stand replacement fires. These fires also maintained a dynamic mosaic of fuel models over large areas of land. Stand replacement fires burned in areas where fire occurred infrequently, completely consuming most of the heavy fuels that would have built up in the area over time due to disease, insects, blow down, or other reasons.

The role fire played in manipulating the natural environment was one of maintaining conditions for hunting, gathering, traveling, and grazing. Most of the time these fires would be of lower intensities, usually to clear out brush or burn off grasses. Exceptions probably occurred when higher intensity fires resulted, but for the most part, intentional burning was used by humans to maintain previously established fuels conditions

In this century, fire has played the role of hazard reduction. Clearcuts and other harvest areas have been burned primarily to reduce wildfire risk, an objective that goes back to 1902. A secondary role has been to use fire as a silvicultural tool to clear slash and brush for replanting. Fire has not been allowed to burn after natural ignitions (prescribed natural fire), nor has it been re-introduced to the watershed purposefully (prescribed management ignited fire).

Changes in Effects of Fire on Watershed Structure or Processes

"Reduction in historic fire has had the effect of creating forests with stands that are older on-the-average than historically...[these] older and [denser] forests function much differently ecologically than they did a century ago. In some forests a type conversion is going on from a fire resistant species to fire susceptible ones. Due to both forest density and to the kinds of tree and other plant species that are emerging to replace the existing forest overstory, they will be forests which are decidedly more unstable than the ones they are replacing, i.e. more susceptible to...catastrophic fire. When fires do occur in such forests...they will be intense, stand replacing, soil damaging fires, beyond that which would have been typical in pre-European forests." (MacCleery 1994)

"The environmental costs incurred from a policy of fire exclusion can be an artificial advance of forest succession in some fire regimes. This can result in dense thickets of small, slow growing trees in what were once open stands of large trees; extensive forest mortality from insect and disease epidemics; loss of seral tree, shrub, and herbaceous species important for natural diversity and wildlife habitat; and heavy fuel build-up leading to larger, more severe wildfire. The change to the ecosystem can alter the numbers, locations, and actual species of both plants and animals that inhabit an area. The larger more intense wildfires that eventually will occur are expected to result in more significant impacts to water, soil, and air resources." (Region One 1993)

The quotes above are relevant to the Layng Creek watershed. Fire played a major role in maintaining or modifying the watershed condition in reference times. Exclusion and suppression of fire has either allowed fire to become ineffective in maintaining and modifying structure and processes, or has set the stage for a major, destructive fire event at some point in the future.

While slash burning plays a part in reducing fire hazard within an isolated area, it does not necessarily benefit surrounding areas, since the surrounding landscape doesn't receive the treatment it may require to effectively mitigate the hazard over the total potential burn area. For example, a clearcut burned within an area susceptible to stand replacement fire may not be an effective control point to slow or stop a fire's spread.

Potential Effects of Future Activities

Should silvicultural and fuels management use of prescribed fire continue as it has in the past, the watershed will continue to experience limited prescribed fire in isolated pockets, to the neglect of the area as a whole. Eventually a large, stand replacing fire will occur which will have severe effects on the watershed and on air quality.

Instituting a program of prescribed natural or management ignited prescribed fire may not immediately or effectively mitigate any current stand replacement fire risk, but over time may decrease the risk significantly. Application of fire to select areas may have the added benefit of restoring fire's maintenance role to portions of the watershed.

Relationship to Standards and Guidelines - Fuels Management and Fire Suppression

Both the Umpqua Forest Plan (UFP) and the Northwest Forest Plan were reviewed to insure that any recommendations made would fall within requirements of both plans.

Page C-35 of the Northwest Forest Plan discusses fuels treatments and fire suppression activities affecting Riparian Reserves. Any prescribed burning done within these areas must contribute to attaining Aquatic Conservation Strategy (ACS) objectives; strategies should be planned to avoid damage to long term function. Wildfires and fire suppression activities carry an element of risk to riparian areas as well. Trade-offs and consequences of not carrying out prescribed burning in select areas of the watershed should be evaluated in terms of fire, human, and chemical effects, in the event wildfire occurs.

Page C-40 of the Northwest Forest Plan discusses maintenance of coarse woody debris. This may be accomplished by maintaining areas that simulate the reference condition of a moderate severity regime by means of silviculture, prescribed fire, or utilization. Page C-44 recommends minimizing intensive burning. Maintaining portions of the watershed in near reference conditions might minimize potential stand replacing fire events, though not immediately. Continued light spring burning in harvest units is one method that can play a maintenance role.

Appendix Eight of the Northwest Forest Plan contains the Fire Management Standards and Guidelines. It's content can be summarized as recognizing fire's role as part of ecosystem function, and that fire should either be used or suppressed in the context of achieving ecosystem management objectives at the landscape level.

Guidelines within this appendix include writing fire management plans that cover the use of prescribed fire for ecosystem management, fuels hazard reduction, and wildfire suppression. The overall goal would be a reduced risk of large scale, high intensity wildfire. This fire/fuels analysis is a first step in developing any future fire or fuels plans for areas within the watershed. (The remainder of Appendix B expands on the guidelines discussed above, and can be found on pages B-135 and B-136.)

The UFP contains several standards and guidelines to which planned fire/fuels activities must adhere. These include provisions for recreation; visual quality; cultural resources; fisheries; wildlife habitat and threatened, endangered, or sensitive species; water quality; soil productivity; protection; pest management. This analysis does not attempt to address each of these standards and guidelines. Prior to any prescribed fire activities, a thorough fuels analysis is done which includes detailed discussion of the methods by which these guidelines would be met. In the event of a wildfire, an interdisciplinary fire situation analysis would be done to evaluate resource concerns and strategies to mitigate them.

From a fire/fuels standpoint, there are no obvious conflicts with any of the standards and guidelines. They allow for both prescribed natural and management ignited fire within the watershed, once approved plans are in place. Current suppression policies are adequate, as well.

Summary

The Augusta Creek Project (Willamette National Forest) yielded some general lessons about historic vegetation patterns that appear to be relevant to the Layng Creek watershed as well. Both areas have the same fire return interval of 25 - 26 years, and both have similarities in fire regimes. Three main points were made in the Augusta Project summary:

1. Fire has been a significant and persistent component of the ecosystem, resetting stand conditions and influencing stand development.
2. The resulting vegetative patterns have been highly variable in time, space, and structure.
3. Fire and vegetation patterns appear to be correlated with topographic features.

The opening paragraph of the Augusta Fire History states: *"Fire has been an important disturbance process in the western Cascade Mountain landscape...Fires of varying intensities and of diverse temporal and spatial extent have resulted in an extremely complex mosaic of forest composition and stand age structure. This complexity of forest composition and structure has created a diversity of habitats for biological organisms. The maintenance of this rich...diversity might be achieved by managing the forest landscape more closely along the patterns of natural disturbance. The patterns of historical fire occurrence and extent might be used as a 'template' for forest management."* (Connelly and Kertis 1991)

Ultimately, a focus on maintaining or restoring the ecosystem to something resembling reference conditions will require evaluating wildfire suppression methods and the potential use of prescribed fire, as well as addressing air quality and municipal watershed concerns.

Wind

The distribution of patterns of blowdown indicate that the Layng Creek drainage has a high to moderate susceptibility to wind damage. Harvest activities have frequently contributed to the incidence of repeated blowdown incidents. There is some uncertainty as to how well the reserve system will function given the risk of high winds in this area. Feathering, stage harvesting and buffers may all serve to mitigate the effects of wind on the reserves. Riparian Reserves that are parallel to the wind have a better chance of withstanding heavy winds than reserve boundaries which are perpendicular to the wind direction. A parallel edge still has blowdown potential, but this edge could be expanded away from the riparian zone.

Terrestrial

Vegetation and Wildlife Habitat

Timber harvest, road construction and fire suppression are processes that have had the most prominent large-scale impacts on the vegetative conditions in Layng Creek. These activities have caused changes in the proportions of seral stages, increased fragmentation, simplified canopy structure and reduced species diversity.

Less obvious impacts include the loss of site productivity from soil compaction and severe burns. Changes in the populations of certain wildlife species such as cavity excavators, beavers and old growth-dependent species may affect vegetative conditions in ways that cannot be measured at this scale. The effects of management activities on successional pathways is another less obvious influence. Harvesting, planting, prescribed burning and fire suppression all impact how plant species survive, prosper, germinate and maintain genetic viability across the landscape. Again, we can only speculate on what trends might result from these activities at this scale . Land allocations such as matrix and Riparian Reserves will reverse some trends and accelerate others in Layng Creek.

Trends Affecting Vegetation

With 37% of the vegetation in the Layng Creek watershed in a mature and late seral condition, the current condition is well below the reference condition of 75% and below the NRV (natural range of variation) of 45% to 75%. Early seral conditions are deficient in snags and are above the reference condition of 25% and also above the NRV of 10 to 40%.

The trend in the short term is to decrease the percentage of late seral vegetation to 30% over the next 50 years, 15% below the lowest threshold of NRV. However, as the Riparian Reserve vegetation matures, the percentage of late successional vegetation will begin to increase and in a 100 years, 54% of the vegetation in Layng Creek will be above 80 years in age. This is based on a suitable land base for harvest of 12,440 acres on Forest Service lands plus 5,142 acres on private land. This is within the NRV, though well below the reference condition.

Table 22. Trends in Percentage of Vegetative Successional Stages.

Stage	Natural Range of Variation	Reference Condition	Current Condition	50 years from now	100 years from now
Early with snags	10 -40%	2-20%	5%	30%	30%
Early without snags	0-2%	0-2%	58%	40%	12%
Mature and Late	45-75%	80-90%	37%	30%	58%

Riparian Vegetation

Reference conditions are inferred from the percentage of terrestrial late and early seral vegetation. The NRV for riparian vegetation is accepted as similar to the terrestrial NRV of 45 to 75 percent.

Currently 36% of the riparian vegetation is in a late successional condition. Within 50 years, about 45% of the riparian vegetation will be over 100 years old. Within 100 years, 70% of the riparian vegetation will be 100 years in age or older. It will be 150 years before the entire Riparian Reserve system on Forest Service land will be functioning as late successional forest. At that time, 88% of the vegetation adjacent to streams in Layng Creek watershed will be late successional. Only the land adjacent to streams on private land will have significant proportions of riparian zone vegetation in early seral or mid seral stages.

Snags and Large Woody Material

There is a wide range of differing conditions in the occurrence of snags and large woody material between the present and the pre-European era. As noted earlier, only about 30% of the watershed contains suitable snag habitat. Conversely, under reference conditions, 98% of the landscape capable of supporting vegetation retained some level of snag habitat. As a result, primary and secondary excavator populations will remain low in Layng Creek because of the scarcity of snags and because the territorial behavior of most cavity nesters limits the population density of these species groups.

Reference and current conditions for coarse woody material, including large material, are difficult to compare because of the lack of survey data in plantations that date back to the 1920's.

Assessment of coarse woody debris (coarse woody debris defined as any standing or down wood material greater than 2.5 cm in diameter), (Harmon et al. 1986) on clear cut harvest units from 1985 to 1991 revealed that the average tons of coarse woody material (0-20" on ground) retained in harvest unit was 70 tons/acre, compared to 67 tons after a fire. Typically, 180 to 450 tons/acre of new coarse woody debris are added after a natural stand replacement fire. After a period of 30 to 40 years this material is reduced by decay more than 50% (Spies and Cline 1988) in a natural stand where there is still some mortality occurring from residual trees.

The reduction in coarse woody debris in most stands which have regenerated after clearcut harvest is close to 60%, because no residual trees were retained, all snags were felled, and most larger (30 inch diameter) woody pieces were removed during harvest operations. This equates to 28 tons/acre in clear cut harvest units after 30 to 40 years, which represents 10% of the coarse woody debris habitat that might be expected to occur after a natural stand replacement fire. If rotations are short (80 to 150 yr.) on matrix plantations, during the second rotation the total coarse woody debris will continue to decrease unless additional large woody debris is allowed to enter the system. Figure 33 show the change in coarse woody material after stand replacement fires. Figure 34 shows the amount of CWD (coarse woody debris) if the area were to reburn.

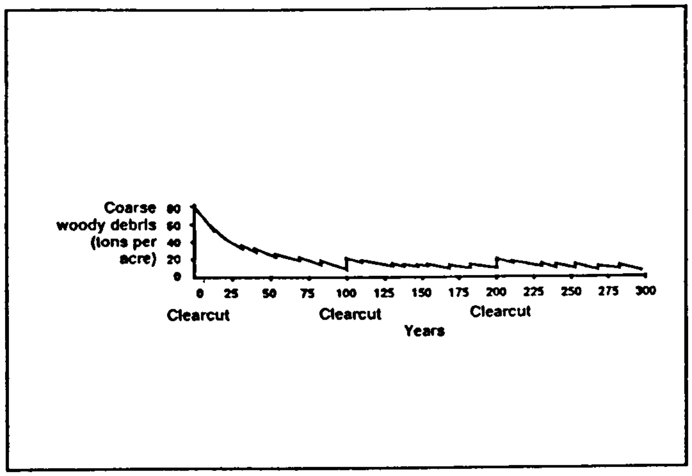

Figure 33. Predicted changes in coarse woody debris in three rotations of an intensively managed forest after clearcutting. (From Spies and Cline 1988).

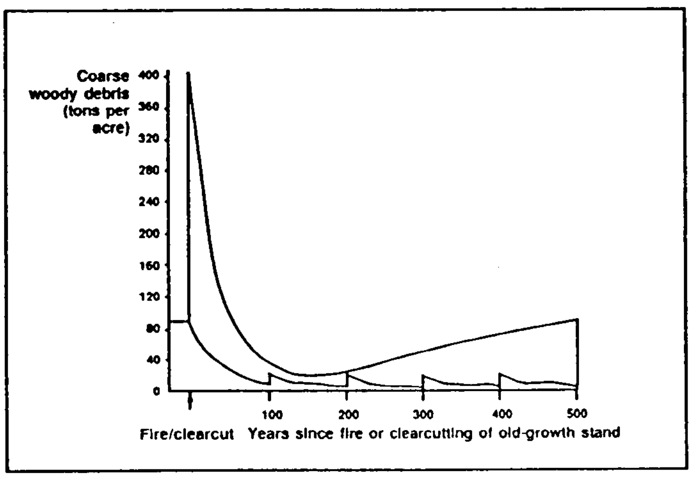

Figure 34. Predicted changes in coarse woody debris during 500 years of natural Douglas-fir development and five rotations of an intensively managed Douglas-fir forest. (From Spies and Cline 1988)

As reported in Spies and Cline (1988), there are several differences between coarse woody debris in old growth stands and plantations.

- There is six times as much wood retained in a stand after a wildfire in old growth than would be retained after a typical regeneration harvest of an old growth stand.
- The retained CWD is present and decaying for the next 90 to 100 years in the old growth stand after a fire, and then begins to accumulate for the next 400 to 500

years. In a plantation, there is little wood left for the first 100 years, then harvest prevents new additions of large wood to accumulate.

- Input rates differ between forests and plantations. In the forest, self thinning and other mortality continually adds debris and snags. In a plantation, this mortality is captured during harvest.
- There are no periodic inputs of CWD in managed stands. The size, severity and patterns of disturbance will vary less in a managed setting.

In the future, about 54% of Layng Creek will be allowed to develop old growth conditions. The remaining 46% could be subject to harvest activity on short rotations. Of the 54% not subject to harvest, 35% is currently in a late successional condition. It will take up to 200 years before significant amounts of LWM are available in the harvested stands that are recovering to old growth conditions.

Retaining snags and LWM in plantations is critical during this transition period. Retention of the majority of all decay classes of large woody material is important as habitat for over 100 wildlife species including salamanders, reptiles, birds and small mammals, as well as many species of arthropods, vascular plants, fungi, liverworts, mosses and lichens. LWM is a critical element in the function of healthy forest ecosystems.

Connectivity, Edge and Landscape Patterns

Dramatic changes have occurred to landscape patterns in the Layng Creek watershed since 1900. What was once a matrix of late successional vegetation is now a matrix of early successional vegetation. Connectivity between the old growth patches is low. Patches are dispersed; only one patch is larger than 1,000 acres in size and connected to the Late Successional Reserve. (See Figures 35 and 36).

The total length of edge has increased significantly in the modern era of forest management; from 49 to 314 miles. Wildlife managers once considered edge effect to be a benefit to wildlife and made it standard practice to maximize edge for the benefit of game species such as elk, black-tailed deer and ruffed grouse. While these species, and many others, benefit from edge because they are generalists and use multiple habitats, biologists have since recognized the negative impact of edge on habitat-interior species.

As Matrix lands are harvested, the trend will lead to a reduction in the acres of interior habitat, fewer old growth patches and the loss of connectivity between the patches. This will lead to a deterioration and elimination of suitable habitat for many old-growth dependent species in the Layng Creek watershed.

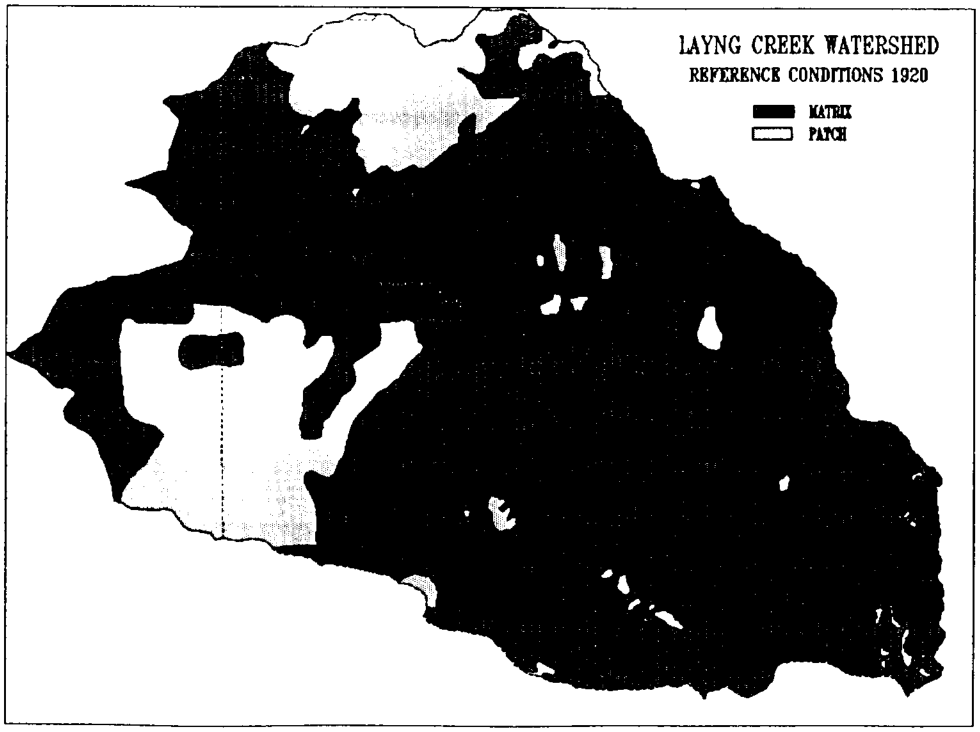

Figure 35. Reference Matrix and Patch Conditions

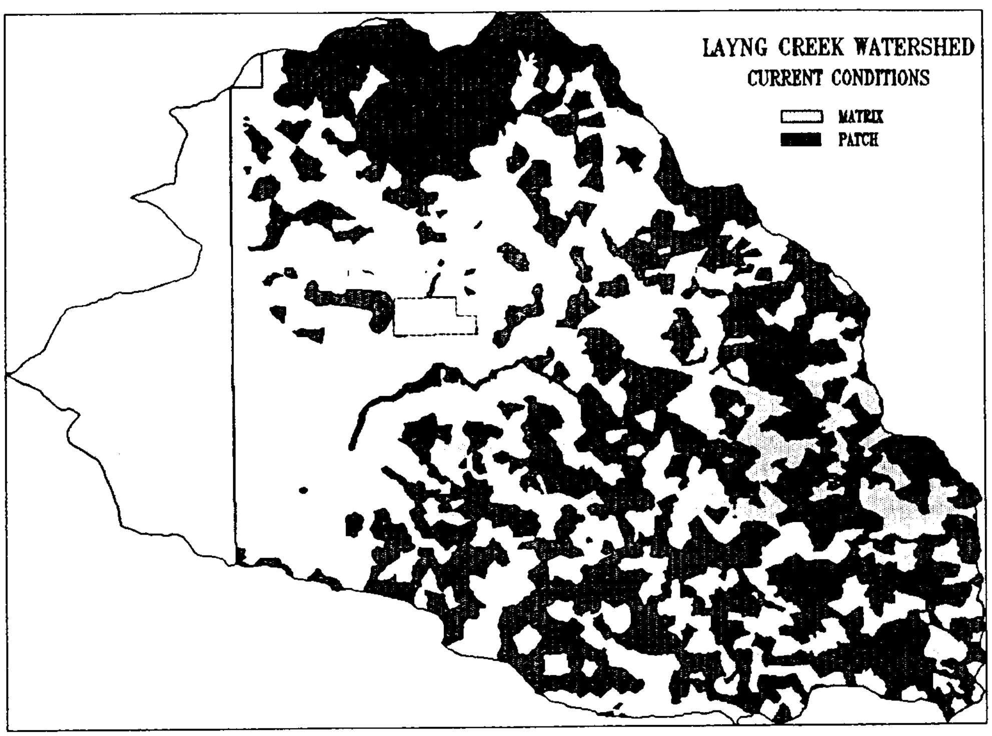

Figure 36. Current Matrix and Patch conditions

Lehmkuhl and Ruggiero (1991) complied a list of 93 Douglas-fir old-growth related species and ranked their likelihood of extinction based on frequency of occurrence, abundance, variation in abundance, body size and migratory status, all factors affecting the sensitivity to fragmentation of vertebrates. They found that over 80% of the species ranked had high to moderate risk scores. Species in the highest risk categories all had low frequency of occurrence and abundance, and fell into one of three categories: 1) small body size and low vagility , 2) small to medium body size and medium vagility and 3) large body size and high vagility.

Species in the first category, particularly amphibians, are at risk due to their inability to acquire the necessary resources in small patches and due to the risks of small population size. Species in the second category, which includes the spotted owl, marten, fisher, goshawk and pileated woodpecker, are at primary risk due to their high energy demands which cannot be met within small patches and at secondary risk from isolation. Species in the third category, predominantly large predators and ungulates, are at risk from the limited resources available in small patches. Large Late-Successional Reserves were designed to function as required habitat for large and medium body species with medium to high vagility as well as the small body size and low vagility species. However, small body and low vagility interior species require connective corridors of suitable habitat over the landscape to allow for migration between sub-populations.

Need for Connecting Corridors

Large to medium body size and medium to high mobility species such as the spotted owl, marten, fisher, goshawk and pileated woodpecker will require connecting corridors throughout out the Matrix areas of Layng Creek watershed to Late-successional Reserve areas of 360 to 500 meters wide. The intent is not to maintain viable populations of these species within Matrix land, but to allow some interaction with other species within Matrix.

Species with low vagility and small body sizes, are subject to population fragmentation within Matrix lands. The result is small, isolated populations with increased risk of extirpation. This group generally includes amphibians, such as the Pacific giant salamander, tailed frog, Red legged frog and aquatic garter snake, red tree vole , western red-backed vole, Enstina, and Clouded salamander The effects of fragmentation are not well understood for this group, making it difficult to plan for the needs of these species.

General information on the biology of amphibians leads to several conclusions. Most amphibians require access to at least two habitats, ponds or standing pools of water for breeding and terrestrial habitat for foraging. This requirement illustrates the dependence of amphibians on microclimate, moisture in particular. Edge effect increases desiccation and enhances variation in moisture levels in particular, which limits the range of amphibians to deep, within habitat patches and may eliminate them from late-successional patches and corridors. Consequently, maintaining microclimate integrity within late-successional patches and corridors is crucial to the conservation of amphibian populations in the ecosystem.

For corridors to be of use to these species, corridors should consist of high quality habitat and be buffered wide enough to maintain the internal microclimate. Small animals such as amphibians also require corridors be wide enough to support resident populations, since their travel distances are too small to cross entire corridor lengths during dispersal (Bennett 1990). Benefits from corridors for these species will only be achieved if populations between fragmented patches are able to exchange individuals with neighboring corridor populations.

Riparian corridors are particularly valuable habitat for small, low mobility species associated with moist microclimates. However, the corridors would need to be at least 600 to 700 meters wide to minimize edge effects and provide internal habitat for amphibians. Habitat patches need to be widely distributed through out the range of the species because the small travel distances of amphibians will make it difficult for them to disperse to and colonize widely distant patches. Given the small area requirements of amphibians, patch sizes on the order of 50 acres will probably support populations, although larger tracts are desirable as a safeguard.

Not all species (Ensatina, Clouded salamander and Western red-back vole) are associated with riparian areas; some appear to avoid riparian conditions, probably because of some similar species occupying that niche. Connection corridors should be maintained for these species in late-successional upland habitat.

Roads in Riparian Areas

The current road system will have some direct effects on 26% of the riparian habitat. The impacts of these effects can not be fully ascertained without an on-the-ground assessment. It appears that the greatest impacts to riparian areas occur along the lower main portion of Layng creek and Junetta creek. Currently 2.8% of the riparian area is occupied by roads.

Threatened, Endangered And Sensitive Species

Northern Spotted Owl

Even though the proposed average harvest levels of 135 acres per year would have an impact on dispersal opportunities, retaining dispersal habitat does not appear to be a problem within the watershed. Assuming that silviculturally appropriate methods of stocking level control are utilized, an average annual growth rate of 0.5 inches diameter growth can be expected on dominant trees. Consequently, within ten years, there should be a net increase of 10,551 acres of dispersal habitat or 88% of the watershed managed by USDA Forest Service.

It is expected that the watershed will provide habitat to support seven viable pairs of spotted owls over time, based on current management direction and the recommendations in this assessment. Late-successional habitat will continue to decline but at a much slower rate (135 ac/yr.) than in the past.

The lack of large woody debris is another factor that will slow the recovery of the habitat over the landscape.

Northern Bald Eagle

The watershed will never play an important role in the recovery of the bald eagle. Habitat conditions will continue to improve over time, as will water quality.

Northern Goshawk

Habitat exists within the watershed for Goshawks and will be maintained via the management plan for the Northern Spotted Owl. Although the Goshawk will prey upon owl fledglings there is no direct competition between the two species. Many Goshawk locations have been identified during owl surveys, but no nest sites have been found.

The loss of mature forested stands and associated prey species habitat has led to a sensitive status for this species. The reduction of large trees used as nest trees, and human disturbance, has resulted in reduced nesting success.

Townsend's Big-Eared Bat

There is a potential for nursery and roosting sites for this species within the watershed. When these sites are detected, they should be managed to restrict human disturbance. The reduction of large old-growth and snag habitat as roost and hibernation sites by a factor of 48% should effect a corresponding reduction in population size.

Northwestern Pond Turtles

Human disturbance and the loss of pool habitat has reduced, if not destroyed, any viable population of pond turtles within the watershed.

Red-Legged Frog

Red legged frogs require aquatic habitat suitable for egg laying and tadpoles, and terrestrial habitat suitable for foraging and cover. Aquatic habitat for red-legged frogs can be either a permanent body of water or one lasting into late June or July, having egg attachment sites (sturdy underwater stems or dead tree branches), and at least 1 to 2 feet of water in the area where eggs would be deposited. Water temperatures must be between 39 and 70 degrees F. High water quality is critical during egg and larva development; frogs at all stages of their lives have very permeable skin/membranes.

When the forest floor is moist, red legged frogs forage widely and have been found at least 300 meters from water (Brodie, Nussbaum, Storm, 1982). Coarse woody debris, small mammal burrows and root holes offer refuge during periods of low relative humidity, thereby preventing water loss through their skin. Habitats of high probability are areas which remain saturated during most of the year, such riparian areas, old-growth, active land flows, and areas surrounding moist to wet meadows.

To maintain a viable population of red-legged frogs on the Cottage Grove Ranger District, careful assessment of their habitat components must occur before management activities.

Riparian Interface

Management

The ROD requires that the Riparian Reserve be managed in a manner consistent with the ACS Objectives. Appendix I provided interpretation of how the Riparian Reserve can be managed for typical forest management projects.

Effects of Past Management Activities

Stand Composition: The preponderance of young stands in the watershed has a direct effect on late successional species. ACS Objective #1 requires that late successional aquatic habitat be preserved on federal lands. Older trees are needed to provide a constant supply of LWM. Average stand age in Layng Creek Riparian Reserve is about 90 years. An average age of 180 years is needed to fully meet the objectives of the ACS.

Road Encroachment: Valley bottom roads reduce the average age of the stand and provides a lateral barrier between the stream channel and the upslope areas. Associated road fills may increase the risk of slides into the creek channel. The road runoff can add to the background sediment of the system and cross-slope roads can intercept surface and ground water, altering the down-slope hydrology. These roads also alter the habitat characteristics of the area. For example, a road may reduce the refuge qualities of an area or act as barriers for certain organisms.

Road Crossings: Culverts associated with road crossings can become barriers to small organisms and fish that move up and down the channel. Plugging of culverts can lead to fill failure and increased sedimentation. A worst case situation is a culvert failing and the flow going down the road to another crossing point. Typically the volume of material washed into the channel is many times greater under this scenario than that associated with a simple fill failure. Crossings also are sources of ditch line runoff which may contain sediment generated from the upslope road cuts.

Riparian Reserve Width: The ACS is designed to ensure protection of species, populations and communities associated with the Riparian Reserves. When examined at the detailed, point level, this environment is very complex and its full function with regard to the resident species is not well understood. Further study is needed to assure compliance with ACS objectives before Riparian Reserve width can be reduced.

Removal of LWM: A significant effect of past management practices has been a drastic reduction in the amount of LWM available within the channels. Early logging left ample amounts of cull material but poor stream buffers left few sources of large woody material. The more recent logging did buffer the larger streams, but greatly reduced the in-place material in all of the streams through YUM yarding and stream clean-out requirements. Of the Riparian Reserves for Class I & II streams, 66% appear to lack critical LWM and snag habitat for wildlife.

Riparian Vegetation

There is great variability in both the size and vegetative complexity of riparian areas because of the many combinations possible between physical characteristics (stream gradient, aspect, elevation, water quality and quantity, etc.) and biological characteristics. A wide variety of habitats and niches occur within these riparian zone because of these varying conditions.

The range of diversity of the vegetation in the Riparian Reserve is very high because it includes aquatic species and the species associated with transition to the dryer upland. Commonly known species include types of algae, moss, fungi, ferns, as well as the cedars, willow, alder, willow skunk cabbage, etc. The natural succession of vegetative types following major disturbances determines the kind of vegetation occurring in riparian zones. The vegetative structure defines the number and types of wildlife habitats present. Habitat diversity is controlled by the stratification or structure of vegetation both vertically and horizontally (Kelly et al. 1975). In general, the greatest structural diversity in riparian areas in the Layng Creek watershed is provided by old-growth forest.

Protected plant species associated with Riparian Reserves are *Cypripedium fasciculatum, Frasera umpquaensis, Gentiana newberryi, Polystichum californicum,* and *Romanzoffia thompsonii.*

Wildlife

The riparian corridors along streams and wet depressions are important habitat areas for many species of plants and animals. These areas are high in species diversity, population density, and productivity of both plants and animal species. There are continuous interactions among the aquatic, riparian, and adjacent uplands through exchanges of energy, nutrients, and species. Wildlife use is extensive in riparian zones because of the three essential survival elements found there; food, cover, and water.

Of all the mammals that occur in Western Oregon, 89% utilize riparian zones or wetlands (Brown 1985). There are 1.5 times more small mammals found in riparian habitats than in uplands. Riparian habitats are utilized by 72% of the raptor species in Western Oregon for their primary foraging and nesting sites. Many bats and birds exclusively forage in riparian areas. Mammals such as beaver, muskrat, and shrews and a large number of aquatic species including invertebrates, fish, and herptiles are totally dependent on the riparian zone.

Extremes in climate are moderated in riparian areas, producing a microclimate more suitable for plants and animals year round. Forested riparian areas help maintain water temperature within the narrow limits required by the aquatic larva stages of some species. Examples are the tailed frog and the torrent salamanders. Both are found in small streams, seeps, and springs, and are vulnerable to alterations in these habitat conditions.

Populations of amphibians require an extensive system of riparian forest to maintain microclimates that allow for foraging , protection from predation, and genetic exchange between populations. The elongated riparian zones provide natural migration routes and connective corridors for many wildlife species.

Table 23. Threatened, Endangered, And Sensitive Species that use riparian areas for habitat.

Common Name	Scientific Name	Status
Northern spotted owl	*Strix occidentalis caurina*	Threatened
Bald eagle	*Haliaeetus leucocephalus*	Threatened
Harlequin Duck	*Histrionicus histrionicus*	Category 2
Willow Flycatcher	*Empidonax trailii*	Category 2
Townsend's big-eared bat	*Plecotus townsendii*	Category 2
Long-eared myotis	*Myotis evotis*	Category 2
Fringed myotis	*Myotis Thysanodes*	Category 2
Long-legged myotis	*Myotis volans*	Category 2
Yuma myotis	*Myotis yumanensis*	Category 2
Cacade frog	*Rana cascadae*	Category 2
Red legged frog	*Rana aurora*	Category 2
Western pond turtle	*Clemmys marmorata*	Category 2
Clouded Salamander	*Aneides flavipunctatus*	OR state sensitive
Foothill Yellow-legged frog	*Rana boylii*	OR state sensitive
Olympic Salamander	*Rhyacotriton olympius*	OR state sensitive
Oregon Slender Salamander	*Batrachoseps wrighti*	OR state sensitive
Tailed Frog	*Ascaphus truei*	OR state sensitive
Bank swallow	*Riparai riparia*	OR state sensitive
Northern Pygmy-owl	*Glaucidium gnoma*	OR state sensitive

Early Successional Riparian Habitat

Early successional riparian habitat is deficient in the watershed. Historically, the watershed was comprised of 16% early successional habitat as opposed to the current proportion of 6%. Based on information from the historic vegetation map, 23% of class I and II riparian areas, and 14% of class III and IV riparian areas were in early-successional condition. The level of resolution of the historic vegetation map does not reflect a true picture of the class I and II riparian areas. As discussed earlier, the class I and II riparian areas were not necessarily similar to the adjacent matrix land because of deeper soils, broad flood plains, and the effect of fire behavior on flat, broad slopes. However, the conditions within class III and IV riparian areas mirror the adjacent matrix land much closer.

Mid-Successional Riparian Habitat

Mid-successional riparian habitat is also outside the range of natural variability. Review of the historic vegetation map suggests that mid-successional habitat would comprise 5% of the watershed instead of the current condition of 62%.

Hydrology

The topography of the typical Riparian Reserve is strongly influenced by the local geology and the flow related channel forming processes such as floods and debris torrents. A channel area will typically show, to some degree, signs of deposition and/or scour associated with the stream. The depositional areas occur in the flood plains and the associated material can range from fine silts up to the largest movable bedload material. Stream scour can effectively wash out all of the erodable material leaving only the large boulders or bed rock. In western Cascade streams, LWM is an integral part of the structural component.

The stream banks and sideslopes are also strongly associated with the channel. Since most of these headwater channels are relatively "new" by the standards of geological time, they are still actively eroding and the banks and sideslopes are typically in an "over steepened" condition. As a result, these headwater areas are generally more susceptible to gravity-driven erosional processes such as ravel and slumping.

The typical longitudinal profile of channels consists of a series of step-like features over which the water cascades. As water flows over a control point (edge of the "step") the velocity vector of the water points down to a more vertical direction and the associated energy of the water is dissipated into the pool area located below the step. The water then starts to move downslope to the next step where it goes into another pool. The maximum speed that the water reaches determines its channel cutting capability and this influences the distance between the steps.

The length, height, and frequency of these steps are dependent upon the historic stream flow regime and the erosional resistance of the material within the stream channel. This resistant material is found at the face of the "step" and serves as a control point for the channel. This material can be bedrock, large boulders, or large woody debris. The large extent of LWM controls is an important distinctive characteristic of the Western Cascade headwater channels. Removal of this material can quickly destabilize a channel.

Key factors affecting turbidity/sedimentation within the Layng Creek watershed

Surface erosion: Erosion of exposed earth surfaces can contribute to turbidity / sedimentation if the eroded material is transported to the stream. The amount of material reaching the stream depends upon several factors including amount of exposed area, erodability of the soil, delivery coefficient and intensity of the storm event. The effect on water quality will depend on the composition of the material, channel configuration and flow conditions.

Mass wasting: Landslides, slumps, and earth flows are usually associated with failure in unstable areas during large storm events. If this material reaches the stream, it can have a significant effect on water quality. Often the effect of this impact greatly diminishes within a relatively short time (hours or days) but, in the case of large earth flows, may persist for several years.

Bank erosion: The forces of moving water tend to remove available material from the stream banks. Over time, the banks tend to become stabilized with resistant material, but this protection can be removed by weathering, decay, or unusually high flows. The erosion may then proceed at a fairly rapid rate until the banks are restabilized.

Channel storage release: As water flows over the stream gravels under non-storm conditions, a portion of the suspended material settles into the low water velocity zone between the rocks at the bottom of the channel and drops down deeper into the gravel layer. During storm flows, the higher flow velocities across the rock bottom reduce the pressure between the rocks and forces the stored material into the main flow. The effect causes a predictable relationship between moderate storm flow and turbidity which has been identified and measured for Layng Creek. During very large storms (bank full and larger), the gravels become activated and proportionately larger quantities of sediment material are released. Also, material deposited in the channel by the landslide and earth flow processes described above may be stored in the channel area and partially released during periods of higher flow.

As described in the Reference Condition section, at the watershed level, the magnitude of the natural processes appear to greatly dwarf the effects associated with management activities. In short, the current level of human influence appears to be having a negligible effect on the net sediment production characteristics of the Layng Creek watershed during this particular time period. With the implementation of the ACS, the effects associated with management should be reduced even further.

However, at the stream reach level, the physical integrity of the channel has been grossly altered and the LWM needs to be replaced to approach the historical conditions.

Aquatic

Aquatic life

Migration Barriers

Several migration barriers affect the Layng Creek Watershed. The largest of these is the Dorena Dam, blocking all anadromous runs to Layng Creek. As mentioned earlier, the original anadromous runs were low in numbers, but during years of high flow Spring Chinook are believed to have been able to pass over Wildwood Falls and access Layng Creek. Guy Leabo, a local resident, remembers it was common to see Chinook salmon up Layng and Brice Creek. This indicates passage above Wildwood Falls. Past records are extremely limited.

Currently, there are three small manmade dams in the watershed which block upstream passage of resident fish and cause genetic isolation to occur in these local populations. These dams are found on Layng Creek at the municipal water intake, on Dinner Creek just upstream from the confluence with Layng Creek, and on Prather Creek, near the confluence with Layng Creek

In addition to these, several culverts and fire pump chances may also impede upstream passage. One of these pump chances are located on Harvey Creek and another on Silverstairs Creek. Others do not appear to be in fish bearing sections of the streams.

Habitat Conditions

The habitat in the mainstem of Layng Creek tends to be improving as the riparian condition improves over time. The majority of the stream is confined by the 17 Road, which limits floodplain use. In addition, many of the logjams have been removed, decreasing the amount of LWM and pool habitat. These impacts have also caused the stream to downcut over time. Spawning appears to be most common within Reaches 4 and 5 (see Figure 37). Adults are found in the first 4 reaches, then drop out in Reaches 5 and 6. Large woody material and channel width pools are limited in the lower reaches, and improve in Reach 5 and 6, but the stream is small here and is not expected to provide habitat to a diverse amount of age classes.

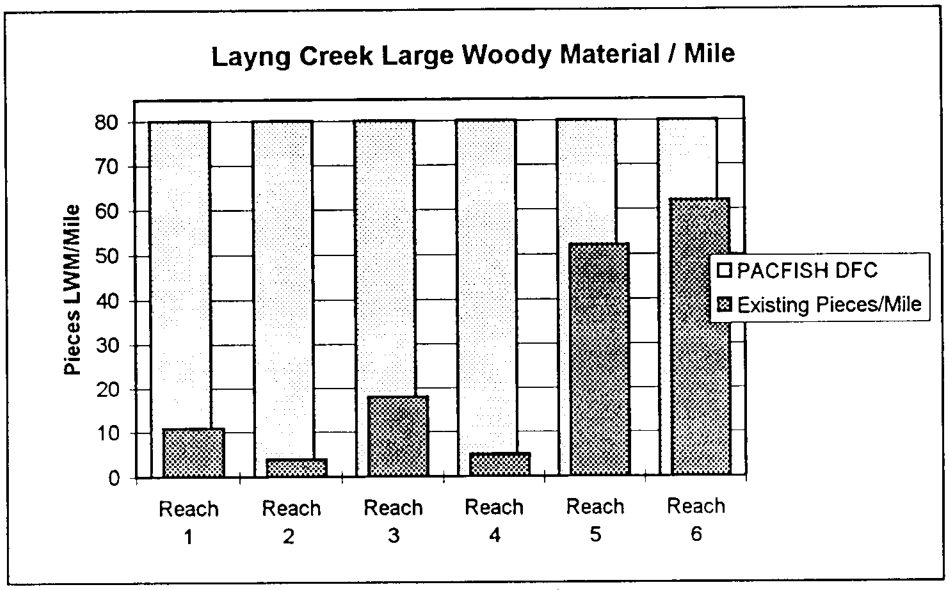

Figure 37. Large Woody Debris in Layng Creek

Within the Junetta watershed it appears that some areas, such as the first two reaches of Junetta Creek, the first reach of Curran Creek and the East Tributary, are all important spawning areas. Adult holding within Junetta is limited to larger pools within some of the reaches. (See Figure 38).

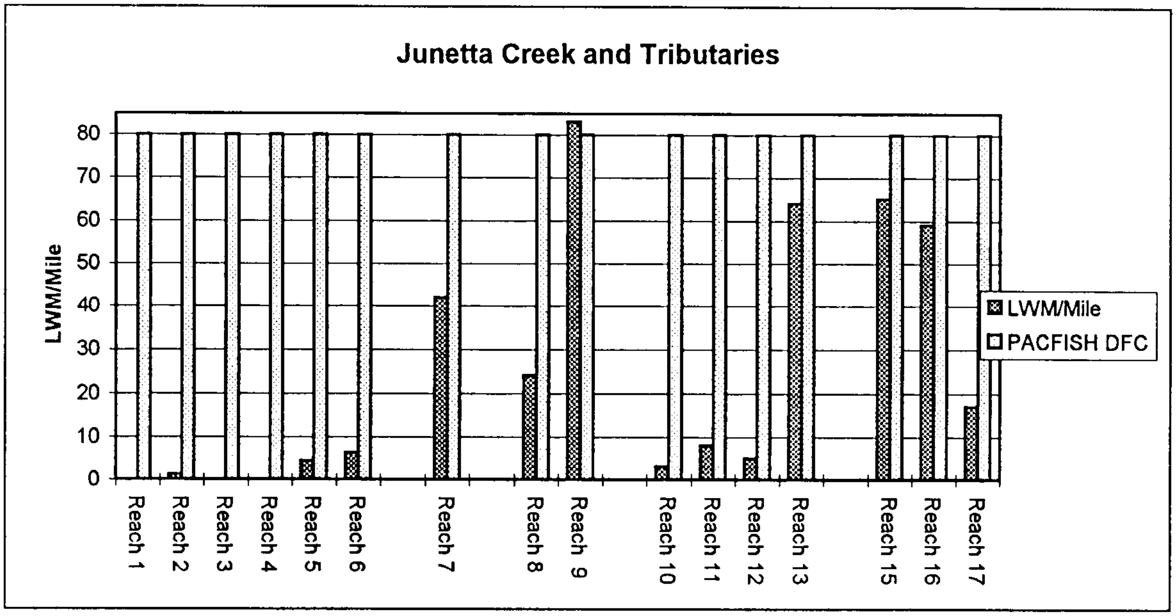

Figure 38. Large Woody Debris in Junetta Creek

Dinner Creek has good trout populations which include some adults large enough (9-12") to be particularly notable for the size of stream. Large woody material and pools per mile were below desirable conditions, indicating the stream may be even more productive as habitat improves over time. Many other factors, such as macroinvertebrate production and potential would have to be considered. The removal of the dam at the mouth of the stream would improve access, allowing trout in Layng Creek to move upstream into Dinner Creek.

The lower reach of Harvey Creek had poor habitat conditions and poor fish numbers. This may be due to past management activities and a fairly recent fire. Pool and large wood numbers greatly increased within the second reach, as did fish numbers and age class distribution. (See Figure 39).

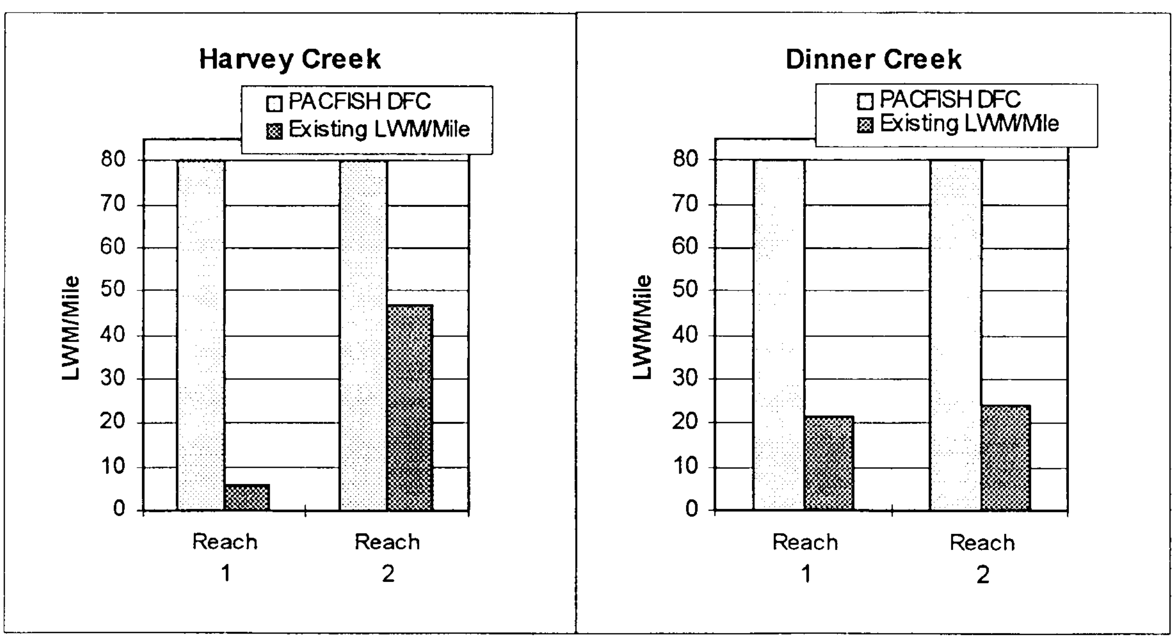

Figure 39. Large Woody Debris for Harvey Creek and Dinner Creek

Riparian seral condition

Riparian seral condition was compared to pieces of large woody material per mile for the streams surveyed (See Figure 40). Riparian condition was determined by a GIS generated Riparian Habitat Condition map. For purposes of this comparison, the riparian seral condition was separated into two areas, Large Timber/Old Growth (greater than 80 years old), or Shrub/Small Tree (less than 80 years old). The Large Timber/Old Growth condition was chosen if 50% or more of the riparian trees were in that age class. Of the 25.5 miles surveyed within the watershed, 10.5 are in reaches where 50% or more of the riparian trees are greater than 80 years old and have an average of 44.7 pieces of large woody material per mile. The other 15 miles are found in reaches with riparian trees less than 80 years old and have an average of 9.7 pieces of large woody material per mile. This verifies the assumption that areas with a healthy Large Tree/Old Growth riparian vegetation tend to be associated with greater amounts of large woody material and higher quality aquatic habitat.

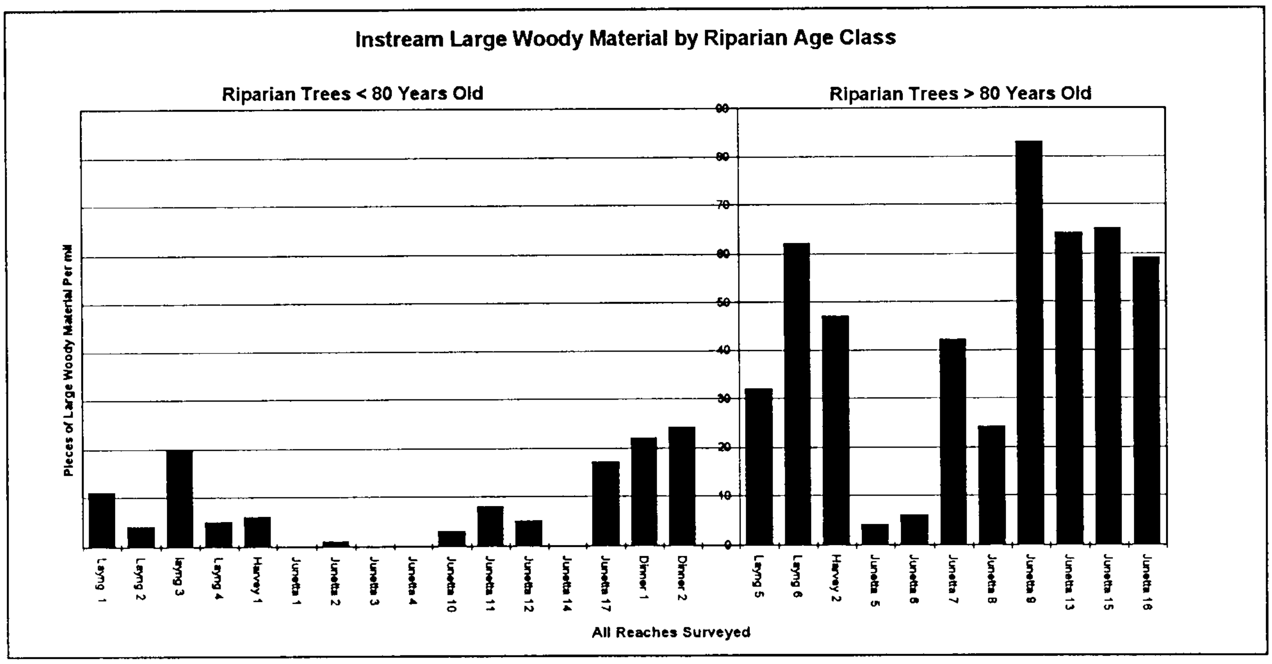

Figure 40. Riparian Seral Conditions

In addition, these riparian conditions provide stability to the channel, good shade to keep the water cool and are areas where future recruitment of large woody material is available. If the stream channels were salvaged, the large trees in the riparian areas are still expected to provide good habitat and will allow the stream to recover naturally over time. Using these assumptions and trends, the riparian areas of Large Trees/Old Growth found on the Riparian Condition Map was then used to help determine possible areas of good aquatic habitat and potential areas of refugia. Streams were classified as either Fishbearing, Perennial Non-Fishbearing or Intermittent. Riparian seral condition was classified as either less than 80 years old or greater than 80 years old. Table 26 displays a list of streams ranked by habitat condition, miles of stream for each classification, and the percent of riparian trees greater than 80 years old.

Table 26. Riparian Seral Condition.

Streams in Better Condition

Fishbearing			Perennial Non-Fishbearing			Intermittent		
Stream	*miles*	*% > 80 yrs old*	*Stream*	*miles*	*% > 80 yrs old*	*Stream*	*miles*	*% > 80 yrs old*
Doris	0.5	80%	Saltpeter	2.3	74%	East Fork	26.6	61%
East Fork	3.9	77%	Doris	3.2	66%	Patterson	3.6	47%
Upper Layng	2.6	77%	Silverstairs	1.9	58%	Silverstairs	6.5	46%
Patterson	1.0	70%	Upper Layng	10.3	55%	Saltpeter	8.3	40%
Layng Corridor	9.0	48%	East Fork	6.9	54%	Upper Layng	31.5	35%
Herman	29.6	46%						

Streams in Poor Condition*

Fishbearing			Perennial Non-Fishbearing			Intermittent		
Stream	*miles*	*% > 80 yrs old*	*Stream*	*miles*	*% > 80 yrs old*	*Stream*	*miles*	*% > 80 yrs old*
Lower Layng	1.7	0%	Lower Layng	1.0	0%	Lower Layng	7.2	0%
Prather	6.9	12%	Prather	6.3	0%	Prather	22 .0	0%
Harvey	1.2	25%	Patterson	3.1	10%	Layng Corridor	43	21%
Silverstairs	1.1	27%	Layng Corridor	6.3	17%	Doris	6.5	21%
Junetta	6.6	29%	Junetta	19.2	42%	Junetta	48.8	25%
			Harvey	3.6	42%	Harvey	12.6	28%

**Tributaries not mentioned are considered negatively impacted but not to the extent as those listed above.*

In summary, the results indicate that East Fork Layng and Upper Layng subwatersheds are possible areas of good water quality and some of the best habitat available in the watershed. Both these subwatersheds are high up in the drainage and have a steep gradient. The steep land in these subwatersheds is probably what kept harvest and road building activities from occurring. The biological sampling in Layng Creek indicated that Upper Layng was an important spawning area. No biological sampling was conducted in East Fork. Other tributaries of potentially good habitat include Patterson, Saltpeter, and Silverstairs.

Riparian areas in the worst condition are found on the private land in the Lower Layng-Private Subwatershed and Prather. Most of the Junetta tributaries, particularly the upper West Fork Junetta also ranked as poor riparian condition. Of the tributaries on federal lands, Harvey and Junetta tend to be the worst condition overall. The intermittent and perennial non-fishbearing tributaries within the Layng Corridor subwatersheds have also been severally impacted. The riparian condition is poor throughout the watershed, with much of the riparian in stands less than 80 years old.

Landslide frequency is discussed in the geology section of this analysis. In summary, high natural occurrences are found throughout most of the Junetta subwatersheds, the Upper Layng and the Lower Dinner subwatersheds. High landslide frequency due to timber harvest has occurred in the Junetta, Lower and Mid Layng, Harvey and Upper Dinner subwatersheds. Road related slides are highest in Junetta, Curran, Saltpeter, Silverstairs, Doris and Harvey subwatersheds. A large landslide was identified along the East Fork of Layng Creek which impacted the stream channel for approximately 1,000 feet. The slide caused the opposite bank to slough off, causing the mature trees in the riparian area to fall into the stream channel. The large wood provided stability and limited impacts, which indicates the importance of LWM in retaining the structural integrity of healthy riparian areas.

Water Quality

At the site specific, micro-scale, the water quality is expected to slowly return to a level that is characteristic of a LSOG ecosystem as the surrounding vegetation and the local channel conditions return to a state similar to reference conditions.

In 1976 extensive turbidity and flow data collection was started within Layng Creek and an analysis of this data was completed in 1985 . This analysis indicated that, for analysis purposes, the sediment production of the watershed could be divided into three general source components:

- **Component One** is the sediment that accumulates in the channel during the low flow period and is flushed out during the first fall storms.
- **Component Two** is the sediment that is associated with moderate storm flows. This material comes from background erosion and removal of stored sediment material within the channels.
- **Component Three** is the sediment produced during the larger than bank-full (channel forming) events. Under this flow condition channel debris and bed-load is activated and entrained sediment is released. Also the upper flood plains are exposed to flows and subsequent erosion. Because of these different process mechanisms the turbidity-flow ratios are higher than for component two.

Figure 41 shows the results of the analysis for the eight years studied. It is important to realize that the component three material was the result of only seven storm events. Likewise, the annual turbidity-flow ratio associated with component two showed a 75% decrease over the period of the study. This data is shown in Figure 42. A likely explanation for this decrease is the depletion of sediment source material associated with the Layng slide (earth flow type) which stopped moving into Layng Creek in the 1980s. Using this explanation, the data suggests that it took several years for the stream to flush out the excess slide material that had been stored in the channel.

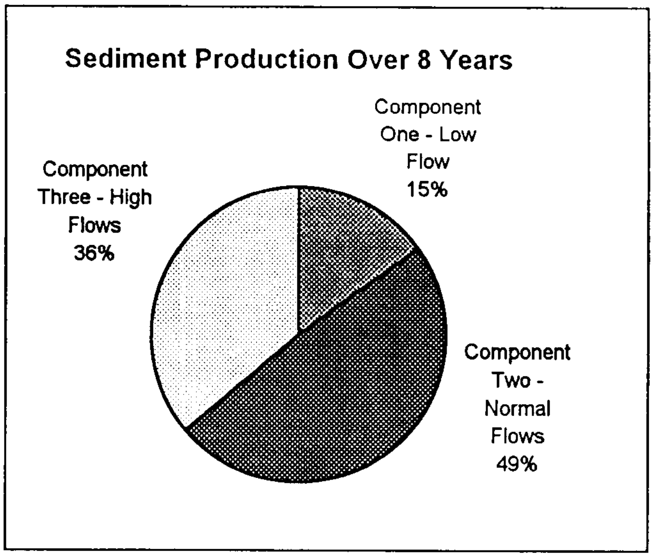

Figure 41. Sediment Production by Component

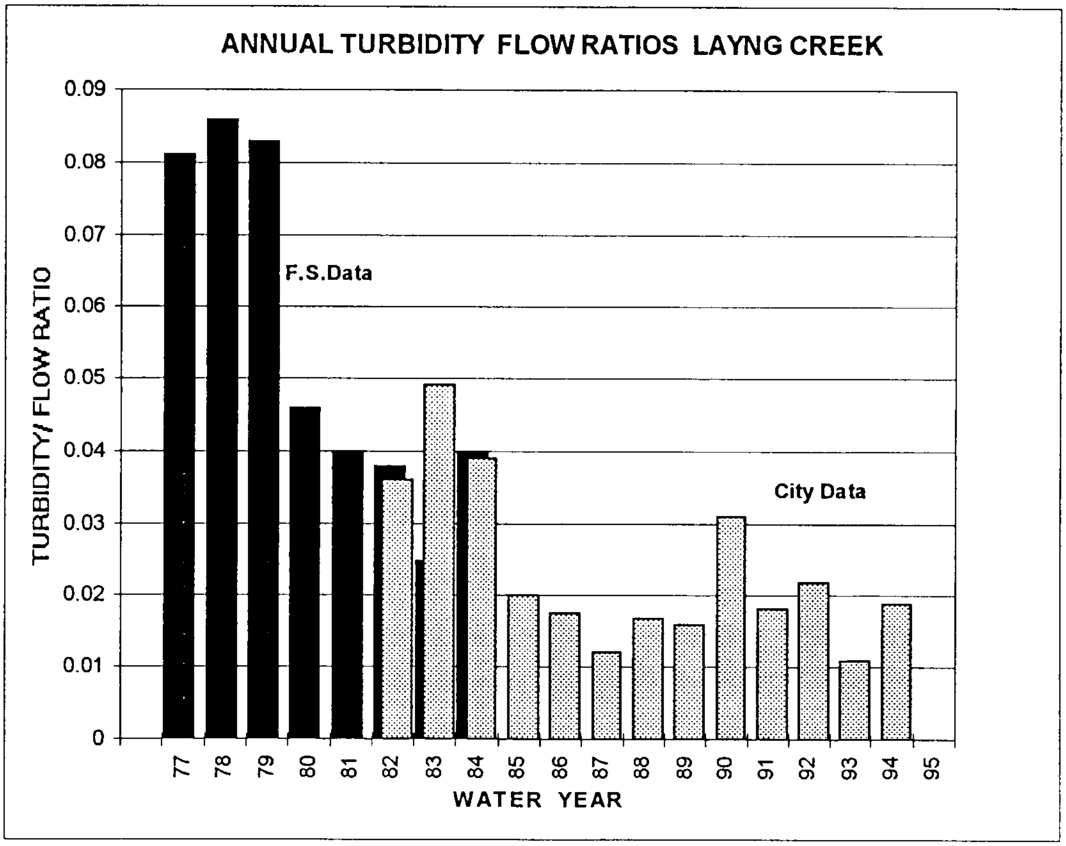

Figure 42. Turbitity / Flow Ratios

Variations in timber harvest, road construction, and the occurrence of debris slides within the watershed did do not seem to have a noticeable effect on the suspended sediment output of Layng Creek when taken in the context of the current background levels. The current value of the turbidity-flow ratio is about .02 ntu/cfs (nephelometric tubidity unit per cubic feet per second) and appears to be holding fairly steady for the past 10 years. It appears that further improvement, if any, will be a gradual process. For example, it may take as long as 100 years without a major upset to get the ratio down to .01 ntu/cfs.

At the site specific, micro-scale, all of the water quality parameters are expected to slowly return to a level characteristic of a LSOG ecosystem as the surrounding vegetation and the local channel conditions return to a state more reminiscent of the reference conditions.

Chapter Six

6. Recommendations

Societal

Domestic Water Supply

Discussion

Continue current management strategies.

Recommendations:

1. Keep an open watershed.
2. Maintain an active spill prevention / response program.
3. De-emphasize non-permitted public use.
4. Maintain roads to a high standard or close them with maintenance free drainage in place.
5. Keep chemicals that do not have established drinking water standards out of the watershed.
6. Continue open communications with Cottage Grove Public Works.
7. Keep Rujada as the most developed campground on the District.
8. Maintain a presence on the District as much as possible; camp host, people at work center, lookout, water treatment plant for example.
9. Continue Law Enforcement program.

Discussion

Some new initiative are needed above and beyond current management strategies.

Recommendations:

1. Develop better special forest products policies to assure consistency with ecosystem management objectives.
2. Provide public education on ecosystem management objectives. In particular, emphasize the importance of large wood in the natural system.

Timber Harvest

Discussion:

Layng Creek is very productive for growing timber and will continue to be in the future. Practices such as thinning, pruning and fertilization are appropriate for these high site grounds. Recommendations for mitigating the effects of timber harvest in the watershed are dispersed throughout this chapter. The key recommendations for implementing a sustainable harvest program are listed below.

Recommendations:

1. Use landscape level techniques to determine priorities, connectivity and patch size.
2. Stress species diversity, stand structural diversity and temporal diversity (age classes).
3. Consider repeated harvest and short rotations on land already harvested to slow the rate of harvest of natural stands.

Roads

Discussion:

In order for the extensive road system in the watershed to continue to serve it's purpose, a reasonably well-funded maintenance and restoration program is required. Detailed discussions and recommendations regarding roads in the Riparian Reserves can be found in the Riparian Interface section of this chapter.

Terrestrial

Geology and Soils

Discussion:

The focus of the recommendations for these resource areas is to achieve a level of disturbance (landslides and other erosional events) that will allow for the maintenance of healthy and functional ecosystems. To meet this objective, erosional events should be considered as a part of the healthy watershed when they occur at the rate and location where they would be expected to occur naturally. When these processes are not in balance, as in the current condition, steps should be taken to minimize the risk for slides to occur where they would not have positive effects. This can be accomplished in several ways.

Recommendations:

1. Recognize that certain situations are prone to stability concerns in the initial stage of project development. The use of the geomorphic mapping and hazard mapping at the subwatershed level can help identify site-specific concerns and facilitate the

development of an analysis process that will address the issues. Incorporation of procedures identified in the proposed subwatershed analysis process (Smith, 1995) will ensure that stability concerns are addressed.

2. The areas identified as slide management areas in the Layng Creek Plan should not be considered separate and aside from the remainder of the landscape. Through subwatershed assessments, these areas should be refined and those areas that are currently mapped as unsuitable will be accurately portrayed. These assessments should involve a geologic and geotechnical specialist.
3. Identify areas where disruptive erosional events are likely to occur. Roads that are located in high landslide hazard lands often can indicate future problems. In some cases, these areas can be treated effectively, reducing the risk of failures in the future. Some examples of these sites are incorporated in the culvert risk assessment that was completed for the analysis area.
4. Identify areas where compaction is suspected and assess the situation. This process should occur as part of the subwatershed analysis process and be followed up to assess the impacts to soil productivity on a case by case basis. If practical, steps should be taken to mitigate the impacts to the soil resources.
5. Identify all potentially unstable areas within the watershed and assure that the contributing water inflow is not increased through management activities.

Wildfire

Discussion:

With the exception of the June Mountain/Junetta Creek area, the fire regimes of the majority of the watershed have been gradually replaced with an artificially high intensity regime. The primary causes have been fire suppression and lack of landscape prescribed fire. Several components which determine fire regimes have been affected by fire suppression.

Fuel loadings are increasing; overall the fuels condition is deteriorating gradually, and stands are becoming more susceptible to fire. The role of fire as a maintenance function has changed significantly throughout the watershed due to changes in fire intensities. For the most part, fire effects are currently either ineffective or destructive.

If we maintain the status quo, continuing full fire suppression and doing little prescribed burning other than for silvicultural or hazard reduction purposes within timber sales, fuels will continue to build; the artificially high regime will be maintained; eventually an intense, stand replacing event will occur.

Recommendations:

1. Identify and evaluate opportunities for prescribed natural or management ignited fire in select areas to restore fire's role of maintenance.

   Priority areas would be:

   - Those that have historically experienced moderate intensities, and recurrent partial stand replacing fires;
   - Meadows and winter range habitat within the influence zone of the thermal belt;
   - Planning areas for which an analysis shows prescribed fire would be beneficial, either inside cutting unit boundaries or adjacent to them;
   - Low intensity areas;
   - High intensity areas.

2. Assess risk of using or excluding fire in these areas. Include these factors:

   - Values at risk;
   - Potential fire behavior;
   - Cost analysis;
   - Air quality concerns;
   - Fire effects;
   - Road access or potential closures.

3. Identify opportunities for partnership projects.
4. Prepare prescribed fire plans for areas within the watershed that would be high priority for application of fire.
5. Identify landscape prescribed fire skills required to carry out any proposed projects.
6. Identify opportunities for monitoring and evaluating prescribed fire applications and effects beyond what is currently required.
7. Use an interdisciplinary approach to assess areas that would benefit from prescribed natural or management ignited fire.
8. Develop fire behavior predictions for use in Escaped Fire Situation Analysis (EFSA) and fire planning for the administratively withdrawn Hardesty area.
9. Identify several prescription windows to maximize opportunities for a variety of landscape scale treatments.
10. Model potential smoke management emissions given proposed projects.
11. Delineate proposed habitat connectivity zone (see vegetation and wildlife recommendations) on Hazard Reduction Standards Risk Map and identify protection priority. For the near future, Wildlife desires full suppression within these corridors.
12. As the landscape surrounding the proposed habitat connectivity zone develops, consider opportunities for prescribed fire within the corridors.

Areas Needing Further Study or Research

The June Mountain/Junetta Creek AWA is one area which will be evaluated more thoroughly. Fire management personnel will survey representative areas to gather data such as visible fire scars, tree age samples, fuels and stand characteristics. The information collected will be used to validate assumptions made in this assessment regarding the fire regime for the AWA. This survey will also be an opportunity for other disciplines to collect data, and could be a collaborative effort.

Areas identified as possibilities for prescribed natural or management ignited prescribed fire may require pre-burn preparation. Those areas requiring reduction of understory fuels as a pre-burn preparation could be expensive. An economic evaluation of potential costs and losses associated with this type of preparatory work would be necessary.

Significant Issues or Areas of Concern

In order to implement management ignited and prescribed natural fire programs, and to meet current management suppression policies, qualified personnel with good suppression training and experience are needed. Also, skills in landscape prescribed burning need to be emphasized in the following areas:

- fire and fuels planning for landscape projects
- knowledge of fire effects
- prescribed fire behavior analyst skills
- complex prescribed fire manager, burn boss, and specialist skills

Air quality has been gradually improving since the early 1900's. This trend should continue, and any prescribed burning would need to be planned to meet air quality standards and restrictions. With any larger scale prescribed fire project, an assessment of the public's concerns relative to potential smoke emissions would need to be addressed.

Other public concerns that would need to be addressed in any prescribed fire planning effort for the watershed would be not only the issue of using prescribed fire but also the risks and consequences of human use or lightning triggering a wildfire. At a minimum, human use of the watershed, especially in fire season, and the potential use of chemicals (i.e. retardant) during fire suppression activities would need to be addressed.

There are strong public expectations for protection and fire suppression programs. Through educational opportunities, people can be taught the role of fire and its effects. They will better understand the historical role fire has played in the watershed prior to our management activities. An increased public awareness of fire management issues may lead to more tolerance for prescribed fire after understanding some of the trade-offs and risks associated with fire.

Vegetation and Wildlife Habitat

Vegetation

The most critical vegetation issue in Layng Creek is the loss of large woody material in snags and down wood, especially in the Riparian Reserves. Full reserve widths are recommended because of the loss of large woody material in the watershed, the sensitivity of earthflow terrain and the risk of blowdown. Full reserve widths are described in the ROD and are recommended on both perennial and intermittent streams. Implementation should be monitored.

The second priority is to mitigate the effects of fragmentation and loss of late seral vegetation. Connecting the blocks of remaining natural stands and prioritizing areas for retention are recommended to mitigate this fragmentation. Another way to mitigate the trend in the loss of late seral vegetation and the reduction of large woody material is to use partial harvest prescriptions where the fire intensity is low or moderate, the earthflow sensitivity is high and plant associations indicate it would be appropriate.

Prescriptions that are reminiscent of reference stands will provide the structure, diversity, protection and health expected under naturally sustained conditions. Information from fire history, earthflow sensitivity analysis, soil types and plant associations can be used to design partial harvest prescriptions that are site specific.

Other recommendations involve 1) inventory of compacted areas and, 2) mapping plant associations to link with down wood and snags and; 3) appropriate prescriptions.

The following list of recommendations are designed to reverse or mitigate the downward trends in the watershed. They are based on Matrix, Forest Plan and ROD standard and guidelines.

Recommendations

1. Increase snag and large wood in Riparian Reserves.

   Rationale: To meet Aquatic Conservation Strategy (ACS) objectives, riparian silviculture techniques such as thinning and release can be used to accelerate development of old growth characteristics in conifer and hardwood stands and within Riparian Reserves.

   Priorities:

   - Confluence of Harvey Creek and Layng Creek
   - Habitat Connectivity Zone
   - Dinner Creek
   - Upper Layng Creek
   - East Fork Layng
   - Subwatersheds with >70% in sapling/poles

2. Prioritize old growth and late seral vegetation for deferral of harvest. Connect blocks of natural stands with other reserved areas or unsuitable ground. Reduce fragmentation by blocking up harvest areas.

   Rationale: The strategy set forth in the ROD provides an ecological framework for managing National Forests through retention of late seral species habitat. Protecting interior habitat and providing connectivity between Late Succesional Reserves (LSR's) is key to the success of this strategy. Fragmentation can be reduced in matrix lands by aggregating harvest and deferral areas into larger patches. The Habitat Connectivity Zone is one step in this strategy (See Recommendation #1 in Connectivity, Edge And Landscape Patterns section of this chapter).

   Priorities: See figure 43 for harvest and deferrals as well as recommendations under landscape connectivity.

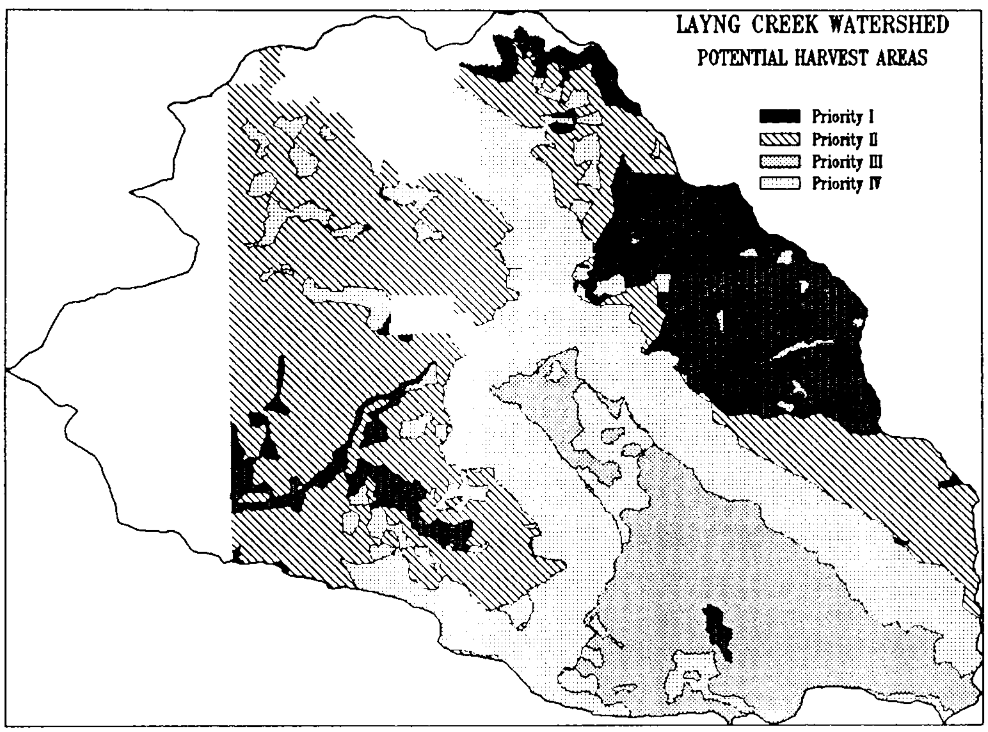

Figure 43. Priority Harvest Areas.

3. Design partial harvest prescriptions based on fire history, earthflow sensitivity and plant associations for unsuitable sites using an Interdisciplinary Team process.

   Rationale: There are several hundred acres of earthflow terrain and rocky terrain designated unsuitable because of slope failure potential or reforestation concerns. These acres may be suitable for harvest with partial harvest prescriptions designed to retain cover and stability.

   Method:
   1. Identify >60% slope areas on earthflow terrain.
   2. Identify low and moderate fire intensity sites.
   3. Identify plant associations typically multistoried.
   4. Survey unsuitable ground based on reforestation concerns.
   5. Develop benchmark prescriptions for these sites.

4. Restore compacted sites where unacceptable soil condition exceeds 20%.

   Rationale: Compaction is above the Forest Plan standard of 20 percent on some sites. An inventory is needed to identify and assess all sites in the watershed with greater than 20% unacceptable soil condition.

   Method:
   1. Inventory all compacted sites in the watershed.
   2. Develop restoration strategy
   3. Assess and prioritize for restoration.

   Monitoring: Forest Plan standards and guidelines should be adequate for future harvest activities.

5. On a subwatershed basis, map ecological units.

   Rationale: Ecological Units are one way to tie together information about a site. Climate, soil, geology, and plant associations are used to develop ecological units These can be used to make management decisions, provide guidelines and link to prescriptions.

   Method:
   1. To begin the process, identify geological units, soil types and plant associations on a subwatershed basis.
   2. Begin grouping into logical units.
   3. When enough information has been gathered, develop management guidelines based on these units.

6. Link guidelines for leaving snags and large woody material to plant associations.

   Rationale: Plant associations can be used to develop guidelines for harvest prescriptions and appropriate amounts of snags and large woody material to be left on a site.

   Method:
   1. By subwatershed, map plant associations.
   2. Use exams and ecology plots to refine guidelines for the number of snags and logs to be left in harvest units.

7. Continue planting and selecting for diverse species in precommercial and commercial thinning.

   Rationale: Species diversity is an ecologically sound concept which increases stand resiliency, reduces the spread of disease and insects and also provides for different forest products.

   Method: 1. Plant mixed species.

   2. Retain mixed species in leave areas.

   3. Interplant other species in existing plantations.

   4. Select for a diversity of species when precommercial thinning and commercial thinning.

8. Mitigate risk of blowdown.

   Rationale: Blowdown has occurred on ridges and saddles in high risk areas. At risk are Riparian Reserves and retention clumps.

   Method: 1. Keep reserve boundary parallel to wind.

   2. Add extra buffer where necessary.

   3. Partial harvest to develop wind firmness, then return later for further harvest. This may be especially effective in younger, dense stands.

   Monitor: Review all harvests near Riparian Reserves. Use this information to modify future prescriptions.

Wildlife Habitat

Discussion:

Snags and Large Woody Material

The removal and reduction of snags and large woody material throughout the Layng Creek watershed is one of the most critical downward trends and affected processes identified in this analysis. Although maintenance and restoration of snags and LWM is critical to achieving ACS objectives within the Riparian Reserves, a renewable supply of snags and large down logs within the matrix lands is also necessary.

The following recommendations, which are a goal to apply across the landscape, are based on information from District stand exams, the Willamette Plant Association Guide (Hemstrom 1987) and Umpqua ecology plots.

Recommendations

1. On the average, retain a minimum of 9 snags per acre with at least 6 snags greater than 20" diameter and a minimum of 3 snags greater than 30" diameter per acre in all Western hemlock and Pacific silver fir association harvest units. Refine the goal for number of snags per acre by tiering to plant associations where possible.
2. Retain a minimum of 4 snags per acre greater than 20" in all Douglas-fir associations.
3. Count only snags in decay classes I, II, III, & IV.
4. The density of snags should be retained over time and should allow for some loss of this structure.
5. Retain 12 pieces of down woody material greater than 20" x 10' (larger the piece the better) and 12 down logs 20" x 20' at an average density of 24 pieces per acre distributed across the unit in decay classes I, II and III in all harvest activities in Western hemlock and Pacific silver fir associations. All existing large down woody material should be retained and protected from disturbance. The minimum total lineal feet is 360 feet. Refine this number with plant association groups where possible.
6. In all harvest units activities in Douglas-fir associations, retain large down woody material greater than 20" x 20' at the density of 15 pieces per acre of decay classes I, II & III. The minimum total lineal feet is 300 feet. Insofar as possible, all existing large down woody material should be retained and protected from disturbance. Disturbance is defined as that occurring during harvest activities; mitigation should take place prior to any planned fuels treatment.

Connectivity, Edge And Landscape Patterns

Discussion:

Watershed analysis is an opportunity to look at large-scale patterns and the connectivity of a landscape. Layng Creek has transitioned from a matrix of old growth with extensive connectivity and few patches of early seral vegetation to a matrix of early seral vegetation with patches of late seral vegetation. Connectivity is declining because of current and proposed harvest activity.

Riparian Reserves will reestablish connectivity but not for 30 to 80 years. One solution, in addition to recommendations to connect existing blocks of late successional vegetation, is the establishment of temporary corridors. These corridors would encompass many of the existing blocks of late successional vegetation and defer harvest to less sensitive areas for the next few decades.

Recognizing that one corridor cannot provide for the needs of every species, a few general guidelines should be considered. First, elements of connectivity and natural corridors that exist in the natural landscape such as ridge lines, stream channels and remaining old-growth patches should be utilized. These natural corridors and travel ways should be maintained whenever possible, given the higher probability of effective use. Second, the most important aspect of any corridor is that it be wide enough to provide interior habitat and not just edge (Chapel et al. 1992). A corridor with interior habitat can provide resources in addition to mobility between sites. This is particularly important for small species which may only achieve the positive benefits of corridors through resident populations, due to their small travel distances (Bennett 1990).

Riparian corridors tend to be used for movement by many species and provide valuable habitat. They also protect aquatic habitats from the negative impacts of fragmentation. However, riparian corridors alone are not sufficient as some species specifically avoid these areas (Soule and Simberloff 1986, Simberloff and Cox 1987). The western red-backed vole, Ensatina and Clouded salamander are known to avoid riparian areas. (McComb et al. 1989) Roosevelt elk, red tree voles and lichens are suspected to be strongly associated with ridgelines in late successional habitat. The red tree vole was rated as most vulnerable of the arboreal rodents to local extirpations resulting from loss or fragmentation of old growth Douglas-fir forest (Huff et. al 1992) and is classified as a survey and manage species (ROD 94).

Patches should be large enough for wind and other abiotic elements to equilibrate with the internal dynamics of the patch. In old-growth forests, abiotic elements of edge effect are thought to predominate up to 160 to 200 meters into a patch (Harris 1984, Chapel et al. 1992). Biotic elements occur up to 200 to 300 meters from the edge.

By designing the landscape so that there is variation in patch size of both early and late successional vegetation, forest diversity is maximized at the large scale (Hunter, 1990). Corridors connecting patches that are oriented east to west and north to south, along riparian zones and mountain ridges, and between watersheds and LSR's, offer the best security for habitat flows, gene flows, travel corridors and dispersal routes.

The prioritization of harvest areas (see recommendation #1) allows for the aggregation of both harvest and deferral areas and the creation of patches of different size, age and types of habitat.

Recommendations:

The following recommendations are designed to provide both connectivity and a diversity of patch sizes across the landscape.

1. Create a 4,000 foot wide Habitat Connectivity Zone that will be low priority for harvest by utilizing existing connected late successional vegetation patches, high concentrations of Riparian Reserves, unsuitable ground and reserved areas. This zone will run south from Hardesty Mt. area, along Herman Creek to Layng Creek, continue up the main fork of Layng Creek to East Fork Layng Creek and follow East Fork up and over the ridge to LSR #022. An east/west zone from Holland Point will move down the main fork of Layng Creek to Harvey Creek then up Harvey Creek over the ridge to the upper end of Dinner Creek, then along Dinner Ridge , which is the divide between Layng Creek watershed and the Brice Creek watershed. The Dinner Ridge zone will be 2,500 feet wide. See Figure 44.
2. Manage Habitat Connectivity Zones to retain and enhance late-successional forest conditions.
3. Design timber harvest to maintain connectivity for riparian and upslope dependent species.

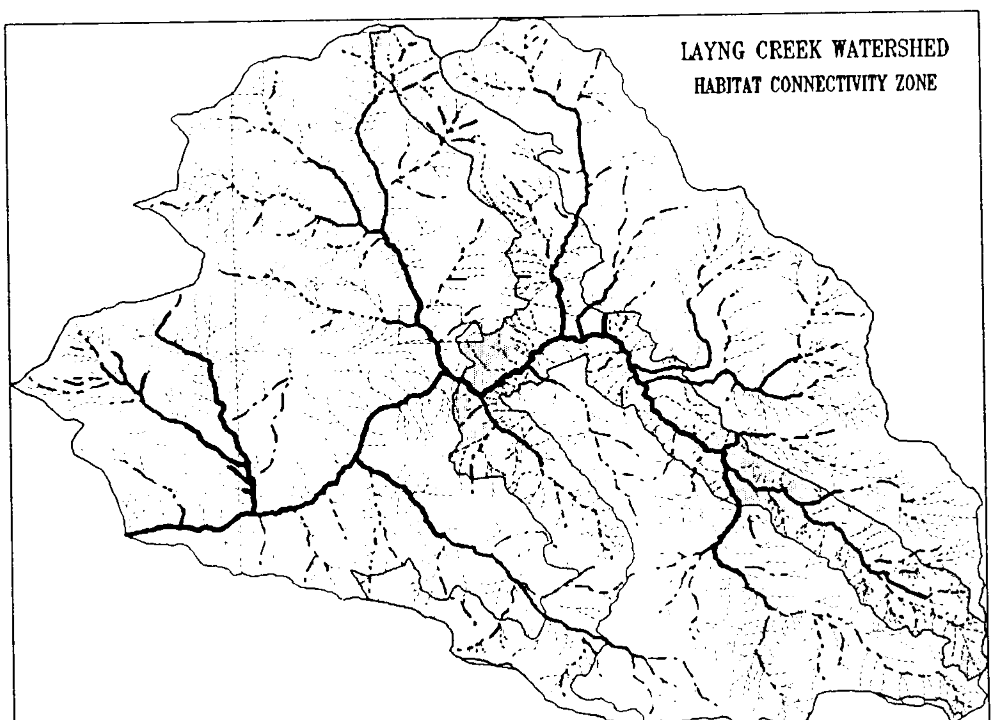

Figure 44. Connectivity Zone.

4. Give high priority to maintaining connected stands within the watershed until habitat conditions improve within the zone.
5. Concentrate harvest activities in high priority harvest subwatersheds to reduce the effect of edge and fragmentation in low priority harvest subwatersheds.
6. Provide fire suppression to protect late-successional condition within the zones.
7. Consider the Habitat Connectivity Zones as the highest priority for restoration projects such as the creation or enhancement of snags and large down woody debris, diversifying tree species, and creating layered canopies.

Wildlife Recommendations:

Threatened, Endangered And Sensitive Species

Northern Spotted Owl

1. Retain large blocks of late-successional habitat and maintain connectivity to these blocks.
2. Restore large woody debris over the landscape.

Northern Bald Eagle

3. Follow recommendations to enhance fish habitat by increasing the number of pools and waters quality.

Peregrine Falcon

4. Monitor potential nest sites using cliff survey protocol (Pagal 1991).

Northern Goshawk

5. Retain large blocks of late-successional habitat.
6. Retain largest old-growth trees in harvest units.

Townsend's Big-Eared Bat

7. Retain large old-growth trees and snags over the watershed landscape.
8. Increase the density of snag habitat to something close to 100%.
9. Monitor potential nursery and roosting sites within the watershed. Increase the number of snags and artificial structures for roosts.

Northwestern Pond Turtles

10. Minimize disturbance.
11. Survey and monitor populations.

Red-Legged Frog

Discussion:

Management activities must be assessed to determine impacts to red legged frog aquatic habitat for the following reasons:

- Higher or lower temperatures will kill the eggs.
- Drainage from a nearby road may carry enough oil residue to kill developing eggs or tadpoles. Any chemical which could potentially drain into a frog pond could wipe out all the individuals in the pond.
- Suitable cover both in and adjacent to the pond is needed for escape from predators.
- Heavy siltation from soil displacement associated with logging or road construction will probably destroy a spawning site.
- The affects of the microclimate on suitable spawning and terrestrial habitats needs to be assessed
- Removing woody debris, which is important for moisture recovery sites and cover can have negative impacts on habitat.

The Layng creek watershed provides the only known habitat for red-legged frogs on the District. The Junetta and the Herman drainages contains all known breeding sites within the watershed.

The introduction of fish in the upper reaches of streams and ponds has provided direct competition for red-legged frogs and may result in the loss of habitat though changes that may occur in the aquatic ecosystem.

Recommendations for red-legged frog:

12. Monitor conditions at breeding sites and assess for habitat improvement projects.
13. Discontinue stocking ponds and streams with fish or other non-native aquatic species where they did not historically occur.
14. Develop additional ponds after assessment of the impact of such a project.

Riparian Interface

Meeting ACS Objectives

The NWP standards and guidelines for Riparian Reserves prohibit or regulate activities in Riparian Reserves that retard or prevent attainment of the ACS Objectives. One purpose of the Watershed Analysis is to determine the appropriate management strategy to assure that projects and activities meet these objectives. The recommended strategy for the Layng Creek watershed is to require a Standard ACS Objectives Assessment of the subwatershed affected by the proposed project. This assessment would be a part of the project scoping process and would serve as a reference for the NEPA documentation. Subsequent projects within the same subwatershed could tier off of the original standard assessment.

To develop the Standard ACS Objectives Assessment a set of goals were developed by the WA analysis team for each of the nine ACS objectives to serve as an evaluation standard. It is the opinion of the team that projects and activities that met these goals would be consistent with the ACS Objectives and no further analysis would be required to show consistency with ACS Objectives. In the event that a goal isn't met, further analysis would be required within the NEPA to demonstrate that the project or activity is consistent with the particular ACS Objective. Likewise, there may be projects and activities proposed that are not covered by these goals. In that case, further analysis would also be necessary.

In the event that continued application of the Standard Assessment indicates that a goal is not appropriate or sufficient, this methodology can be updated with appropriate specialist review and approval of the District Ranger. The rationale and supporting documentation for the modification will be included in the District WA analysis file.

Width of Riparian Reserves in Layng Creek

The typical site tree for Layng Creek was found to be 200 feet in height. Consequently the slope distance of the Class 2 and Class 3-4 riparian buffers are 400 feet and 200 feet respectively. This distance equates to a 186 foot horizontal distance for a 40% side slope.

Methodology for Assessing ACS Objectives for Riparian Reserves in Layng Creek

A detailed discussion of the development of the Standard Assessment Methodology is contained in Appendix A. An example the Standard Assessment as applied to the Harvey Creek Subwatershed is contained in Appendix C. The following is a summary of the methodology:

Objective 1: Restore the distribution, diversity and complexity of watershed and landscape-scale features

Goal 1.1 Establish 80% of RR stands in LSOG condition.

Rationale: With current knowledge, full restoration to the LSOG condition within the RR is the only way to ensure protection of the aquatic systems for species adapted to a LSOG ecosystem.

Method:

1. No harvest of LSOG type material (includes wood greater than 20" dia - standing or down) until baseline condition (as described in goal 3.1) is achieved.
2. Harvest of the smaller sizes will be done only to promote the conversion to a LSOG stand.

Objective 2: Restore spatial and temporal connectivity within and between watersheds.

Goal 2.1 For fish bearing channels: 100% of the channels free of artificial barriers.

Rationale: Federal lands provide the main habitat for LSOG adapted aquatic species and elimination of the artificial barriers will assure optimal utilization of this habitat. Restoration of fisheries are high priority under the ROD.

Method:

Develop an inventory list of artificial in-channel barriers.

1. Set priorities for restoration consistent with the overall wildlife/ fish management strategy.
2. During project planning, require barrier removal in subwatersheds as a mitigation requirement prior to project implementation.

Goal 2.2 For non-fish channels: In any subwatershed, at least 50 % of the non-fish channels will be free of artificial barriers.

Rationale: Our knowledge of small aquatic associated organisms is limited, but it is known that some move up and down the channel zone in response to life cycle needs and varying stream flow/ climate conditions. The 50% maximum goal is rather arbitrary but will assure that this component is at least maintained, and should serve until better knowledge about the particular needs of the species is available.

Method:

1. Develop an inventory list of artificial in-channel barriers.
2. Set priorities for restoration consistent with the overall wildlife/ fish management strategy.
3. During project planning, require barrier removal in subwatersheds as a mitigation requirement prior to project implementation.

Goal 2.3 For barriers in the terrestrial portion (not the channel / aquatic area) of the RR that impede travel in the longitudinal direction (parallel to the stream): In any subwatershed, at least 25 % of the tributary channels will be completely free of artificial barriers in the longitudinal direction.

Rationale: A road would probably be the most common type of longitudinal barrier and, as it relates to impeding travel, probably is not as critical as a channel barrier. This goal is intended to assure that some of the small tributary side channels will be completely barrier free from mouth to ridge.

Method:

1. Prior to project development identify road crossings and any other terrestrial RR barriers in the subwatershed.
2. Provide the necessary restoration to meet the goal. RR associated with tributaries that are nearly 100% barrier free within a subwatershed will have higher priority for restoration.
3. Restoration of RR should be a mitigation requirement for projects planned within a subwatershed.

Goal 2.4 For barriers in RR terrestrial portion that impede travel in the lateral direction (perpendicular to stream): No more than 10% of the total RR length in any subwatershed will contain a lateral barrier such as a road.

Rationale: With limited knowledge of the effect of these barriers it is difficult to set a meaningful goal however, this goal should serve as a useful benchmark. If it is exceeded it will trigger additional assessment.

Method:

1. Inventory encroachment zones and identify the restoration priorities based on relative issues and needs of the Access and Travel Management Plan.
2. Mitigation should be tied to planned projects within a subwatershed.

Objective 3: Restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations

Goal 3.1 Within each acre of the RR maintain between 1500 and 6000 cubic feet of wood greater than 24" dia with at least 30% of this wood greater than 36" dia.

Rationale: High levels of LWM (large woody material) are needed to restore the physical integrity of the aquatic system within the RR. This goal applies to 100% of the RR because LWM has historically been an essential component of all riparian areas, even those areas that are not in LSOG condition. Generally, in these areas large quantities of LWM would remain even after a large natural disturbance converted the LSOG stand.

Method:

1. No harvest of LSOG type material (standing or down) until LWD objectives of this goal are achieved for the affected RR area.
2. Road crossings or other in-channel structures are to be designed to not degrade the physical integrity of the channel area.

Goal 3.2 Repair/ restore channel conditions for fish habitat and water quality as needed.

Rationale: If restoration funds are available, the physical integrity of the channels can be improved with designed structures.

Method:

1. Use stream inventory data to identify the high priority sites.
2. Implement restoration when funds are available.

Goal 3.3 Protect existing structures and/ or improvements in a manner that has the least impact on the natural dynamics and function of the channel. Avoid new structures in the RR as much as possible. Remove unnecessary structures.

Rationale: Structures or other improvements that alter the channel, banks, and floodplain can change the dynamic function of the stream system and which can, in turn, change the characteristics of the system for a significant distance downstream. These changes can cause a reduction of diversity and complexity of stream channel characteristics and a general departure from the targeted LSOG condition.

Method:

1. Inventory all structures within the subwatershed.
2. If the structure is essential, fully consider the effect on the natural dynamics of the channel including channel meandering and floodplain function.
3. Remove structure if not essential.

Objective 4: Restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.

Goal 4.1 Maintain WQ at current levels or better.

Rationale: Water quality has been actively managed in Layng Creek because of its use as a municipal supply. Overall water quality as determined at the municipal intake is considered to be good. Water quality throughout the watershed is expected to better match the water quality typical of LSOG systems as the baseline objective is reached.

Method:

1. New projects within the RR must be strictly controlled to assure that the WQ in the project zone is not degraded.
2. Existing projects such as road crossings and campgrounds need to be assessed and the chronic problem sites need to be systematically improved.
3. Continue to monitor WQ to assure that the WQ is being maintained or improved. (See next objective for sediment objectives.)
4. Do not transport or apply chemicals within the watershed which do not have an established drinking water standard.
5. Evaluate all proposed chemical applications or use for consistency with ACS objectives.
6. Recognize that some risk of drift and misapplication is inherent in the use of fire retardant in mountainous terrain. To the extent possible, avoid application of fire retardant in Riparian Reserves.
7. Determine compatibility of retardant with drinking water standards at the start of the field season.

Objective 5: Restore the sediment regime under which aquatic ecosystems evolved.

Goal 5.1 Each subwatershed has less than 600 feet of road feeding directly into a stream channel per mile of stream channel. No net increase in feeding road distance to occur in any subwatershed.

Rationale: Direct contribution from roads is a small but potentially significant source of sediment which does not match the natural regime.

Method: Prior to project implementation complete the crossing inventory for the subwatershed and determine the relative amount of road contribution. If the result for the entire subwatershed is greater than 600 feet per mile, seek opportunities to reduce the excess by at least 25% per project. Road outsloping may be an effective way to reduce the crossing contribution. For new construction assure that there is no net increase in the amount of road contributed sediment. This may require that mitigation of existing roads takes place concurrent with the construction.

Goal 5.2 Each subwatershed will have no road crossing with a risk rating of greater than 500 and an average risk rating more than 500. New projects are not to cause a net increase in the risk values for the subwatershed.

Rationale: Road crossing failures have the potential of creating excessive amounts of sediment which could adversely affect the local ecosystem. Particularly significant are failures that cause the effective channel to be diverted down the road into another drainage area. This situation causes an over load on the receiving channel and can cause excessive damage all the way down to the mouth of the affected stream. Also, it is reasonable to assume that fish bearing streams will generally have relatively higher resource values than non-fish bearing streams. These differences in risk and values should be reflected in a final evaluation.

Method:

1. Prior to implementing a new project, inventory all crossings in the project subwatershed and determine the risk ratings.
2. If the goals are not met, mitigate to reduce the excess total risk score by at least 25%.
3. Continue to apply this strategy for each new project until the goal is met.
4. If the goal is met provide appropriate mitigation so that there is no net increase in risk after the project is completed.

Objective 6: Maintain in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats...

Goal 6.1 Avoid alteration of flow pathways or water storage areas within the RR by new road construction. Inventory known problems within the subwatershed and arrange to correct the high priority items.

Rationale: Road construction can alter local hydrology and indirectly affect riparian, aquatic, and wetland habitats. Existing roads need to be assessed for their effect on the hydrology of the local wet areas greater than 1/4 acre. Also, water directed to unstable areas can result in accelerated rates of mass wasting.

Method:

1. Review new road designs to assure a minimal impact on local hydrology.
2. Put particular emphasis on protection of wet area and unstable areas.
3. On existing roads review the drainage of roads in the vicinity of wet areas or unstable areas greater than 1/4 acre.

Objective 7: Maintain the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands...

Goal 7.1 Strive for LWD levels in floodplains that are characteristic of LSOG systems and manage the floodplains to function in a manner that is characteristic of LSOG systems.

Rationale: The LWD material can directly affect the floodplain characteristics and need to be managed to achieve LSOG levels both in size and quantity of material. Because of the large wood, LSOG systems tend to have a relatively higher hydraulic resistance through the main flow zone. On areas with larger floodplains, there may be opportunities to simulate this effect until the LWD accumulations are restored.

Method:

1. Manage the RR for maximum LWD.
2. If appropriate, simulate the floodplain hydraulic characteristics of a LSOG system.

Goal 7.2 Minimize the effect of road encroachment on floodplains. (Less than 4% encroachment on fish bearing streams within any subwatershed.)

Rationale: Road encroachment in the floodplain may increase the effective height of flood flows in the affected reach and may also alter the channel dynamics.

Method:

1. Prior to project development, inventory the affected subwatershed for miles of encroachment.
2. Consider appropriate mitigation.

Objective 8: Restore the species composition and structural diversity of plant communities in riparian areas and wetlands...

Goal 8.1 At a minimum maintain the restoration rate of 01.1% per year for the unique habitat areas. Strive to complete 10% of the total enhancement projects for the subwatershed per basin project. Proactively control natural disturbance within the RR.

Rationale: Rapid restoration of the baseline diversity of the RR is consistent with the overall ROD objectives.

Method:

1. Review the RR associated unique habitat areas within the subwatershed and identify potential site enhancement projects.
2. Assure that these areas are not going to be set back by the planned matrix activity.
3. Look for opportunities to enhance some of the plant habitat.
4. Continue an active sensitive plant management program.
5. Manage for maximum growth within RR until the baseline level is reached.

Goal 8.2 Within any subwatershed the road crossing density is not to exceed 2 crossings per mile of stream.

Rationale: Road right-of-way reduces the amount of growing sites within the RR. This goal limits the maximum reduction to about 2% of the total RR area within the subwatershed. This is equivalent to about two years of recovery growth at the rate of 1.1% per year.

Method:

1. Limit road crossings per the goal.

Goal 8.3 Within any subwatershed, created openings (non-road) needed for management of matrix lands will be less than .4% of the total RR within any decade.

Rationale: There may be an occasional need to affect the vegetative structure of an RR to best manage the adjacent lands. Use of a logging corridor is a possible example. These openings will not be a permanent set back and will eventually recover. The net new growth of the RR is about 11% per decade and this goal would represent a maximum reduction in the natural restoration rate of about 4%. The effect of this opening can be further reduced by leaving in the RR any cut wood material greater than 24 inches dia.

Method:

1. Keep created openings within the RR to a minimum.
2. If an opening is necessary, leave wood greater than 24 inches within the RR.
3. Consider placement options to best meet the ACS objectives.
4. Track number of newly created openings (dated from 1995) within the subwatershed and limit the running total of openings in the Riparian Reserve to .4% per decade for the affected subwatershed.

Goal 8.4 Manage regeneration plantations that encroach on RR for maximum conversion to LSOG conditions.

Rationale: New plantations within the RR may need management to assure a optimal transition to LSOG conditions. Left unattended the stand may become a Douglas- fir thicket.
Method:
1. Develop an appropriate precommercial thinning prescription for each specific site to stimulate growth while meeting ACS Objectives.
2. Manage for LSOG type diversity.
3. Recommend leaving all non-conifer species and leaving all western red cedar.
4. Leave all hardwoods and woody brush vegetation on over-steepened (greater than 60%) slopes adjacent to the stream channel.

Objective 9: Restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species...

Goal 9.1 At a minimum maintain the natural recovery restoration rate of 01.1% per year for the unique habitat areas. Attempt 10% of the total enhancement projects for the subwatershed per basin project.

Rationale: Increasing the size of sensitive species populations is consistent with the overall ROD objectives.
Method:
1. Review the RR associated unique habitat areas within the subwatershed and identify potential habitat site enhancement projects.
2. Assure that these areas are not going to be set back by the planned matrix activity.
3. Attempt to accomplish 10% of the identified enhancement projects within the subwatershed.

Goal 9.2 Identify opportunities in the adjacent Matrix land to provide effective connectivity corridors across the watershed.

Rationale: A connectivity corridor network within the Layng Creek watershed will increase the effectiveness of the RR to support riparian-dependent species.
Method:
1. Develop a plan for the Matrix portion which will provide additional connectivity across the watershed.
2. To be fully effective, the corridor should have a minimum width of 4,000 feet.
3. This corridor region would have a low priority for project development.

Aquatics

Aquatic Life

Discussion:

The Aquatic Conservation Strategy indicates the need to proceed with watershed restoration projects such as riparian silviculture, instream structures and upgrading or decommissioning roads. Stream inventories are helpful in determining the need for these types of projects and for establishing baseline data for future monitoring of stream conditions.

General Restoration Strategy: Identify and protect high value areas

An approach to habitat restoration has been presented by The Pacific Rivers Council (Frissell, unpublished) and is one of the main objectives within the ROD. The approach consists of developing a strategy for the watershed, and then develop restoration tactics. In the past, we have done a lot of restoration based on tactics with no strategy. This approach is commonly referred to as a "band aid" approach to problems within the watershed. The strategic approach would include finding the areas of highest quality habitat, and continue to protect or enhance those areas. In addition, problem areas would be enhanced, such as working upslope in areas where erosion can be occurring as opposed to placing instream structures in areas where fine sedimentation seems to be a problem. This strategic approach is logical and should be pursued whenever practical.

The loss of large woody material through instream salvage and removal of riparian vegetation has had a large impact on the aquatic habitat in the Layng Creek watershed. Riparian silviculture projects can release large conifers within the Riparian Reserves to help provide shade and future recruitment of large woody material. Some riparian silviculture techniques may enhance this goal. However, the best approach would be to maintain the Riparian Reserves so that large conifers will shade streams and eventually fall in the stream channel.

Recommendations:

1. Complete stream inventories in areas needing baseline data and information for restoration projects.

2. Until more information is available assume that areas with high quantities of LWM are high quality habitat areas.

3. Retain full buffers on all streams including intermittent streams. Manage all Riparian Reserve areas to achieve LSOG conditions in the shortest possible time.

4. Install instream structures in areas where wood is expected to have accumulated but has been removed through past management practices.

5. Perform the Standard Assessment of ACS Objectives (Appendix A) in all subwatersheds as projects are proposed to obtain more specific inventory information.

6. Conduct priority assessments for the following subwatersheds.

   First Priority:

   Upper Layng Creek
   Mainstem of Layng Creek
   East Fork of Layng Creek

   Second Priority:

   Junetta Creek (including Curran)
   Harvey Creek

   Third Priority:

   Saltpeter
   Silverstairs
   Doris

Road Related Recommendations

Discussion:

Roads can have negative impacts on the aquatic system by altering the hydrologic regime and by increasing the amount of fines entering the system. Undersized culverts can result in debris torrents if failures occur during storm events. Culverts may also cause migration barriers to fish. Priorities should be developed when maintenance funds are limited.

Recommendations/Projects:

1. Storm proof roads with cross ditches and outslope roads in areas where maintenance levels are expected to be low.

2. Consider decommissioning or obliterating roads in areas where densities are high and roads are not necessary for management activities.

3. Update the Access and Travel Management Plan to incorporate ROD and ACS objectives.

4. Replace culverts that will not accommodate an 100-year event.

5. Replace culverts creating migration barriers across fishbearing streams.

Potential Restoration Projects

The following discussions identify some general areas with high potential for restoration. Specific methodology needs to be developed after more detailed field inventory and assessment.

Layng Creek Stream Enhancement

The section in Layng Creek with the highest priority is found in Reach 3, above and below the confluence of Harvey Creek. The area is a long riffle with small trees along the riparian area, limiting the recruitment of future large wood. Reaches 1 and 2 were also identified for installing structure to retain spawning gravel.

Junetta Creek

The Junetta survey indicated several opportunities for habitat restoration projects. They include riparian silviculture in Reach 2 (mainstem Junetta-private land), Reach 4 (mainstem Junetta) and Reach 7 (East Tributary). Instream structure work is recommended in Reach 2 (mainstem Junetta-private land), Reach 3 and 4 (mainstem Junetta) to create spawning habitat, cover and adult pool habitat, and in Reach 11 and 12 (Middle Fork Junetta) to add diversity and cover. Direct road related problems appear to be occurring in Reach 2, 3 (mainstem Junetta), and Reach 10 (Middle Fork Junetta). These sections of the road need to be assessed for restoration potential.

Harvey Creek

Reach 1 in Harvey Creek was identified for instream habitat enhancement and for possible riparian silviculture projects. The culvert on road 1746-707 and the fire pump chance impede passage and should be replaced or modified. The pump chance is also holding back a lot of gravel substrate, limiting downstream recruitment. Directly upstream from the pump chance the channel has been scoured to bedrock. Instream structures would help gravel and other substrate in this area. Roads were extensively surveyed in the Harvey Creek watershed, creating an opportunity to develop a strategic approach to restoration. (See Appendix C - Harvey Creek).

Dinner Creek Dam Removal

This creek appears to be in good aquatic condition and is expected to improve over time as riparian conditions improve. The restoration opportunity is to remove the manmade structure at the mouth of the stream. This would remove the barrier genetically isolating the upstream population and allow fish to freely migrate up Dinner Creek. It would also allow gravel to easily move downstream into an area of Layng Creek deficient in spawning habitat. This existing barrier is currently not meeting the goals and objectives of the Aquatic Conservation Strategy.

Water

Water Quality

Discussion:

At the project level, most water quality concerns will be met by applying the Standard Assessment of ACS Objectives described in the Riparian Interface section.

At the watershed level, continuation of the strategies identified in the Societal section will contribute to the goal of maintaining a high level of water quality.

Recommendations:

1. Continue to determine and evaluate the annual turbidity / flow ratio for Layng Creek. This information is useful for assessing cumulative effects.
2. Support the continuation of the Layng Creek and Row River gauging stations which provide a valuable flow record.
3. Continue the City of Cottage Grove water quality monitoring activities, specifically for pH, turbidity, alkalinity, CO_2 and temperature.
4. Continue the macro-invertebrate monitoring activities.
5. Establish a test reach with an intensive, detailed survey to track the changes in channel composition and form.