Layng Creek
Watershed Analysis Iteration 1.1

Prepared by the Umpqua National Forest Timber Planning Team
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Approved By:

Deborah G. Schmidt 12/20/05

Deborah Schmidt, District Ranger **Date**
Cottage Grove Ranger District

ABSTRACT

This iteration of the1995 Layng Creek Watershed Analysis (WA) expands upon the original WA by considering new information not available 10 years ago. The original WA is not replaced, however specific aspects are deleted, replaced, modified, or clarified. The changes to the 1995 WA made through this WA iteration are all noted by page number of the original WA to avoid confusion, since both the original WA and this iteration are now in force. The main changes are associated with a Forest-wide landscape analysis and an assessment of fire risk prompted by national direction to assess fire regime condition class. These new land strata were also used as the basis for updating certain recommendations for snags and down wood in conjunction with the results of an inventory of these habitat structures and the use of the DecAID` decayed wood advisor. Recommendations related to the Aquatic Conservation Strategy (ACS), were either clarified, deleted, or replaced based on the 2004 amendment to the Northwest Forest Plan regarding the ACS and recent literature regarding riparian area management. Finally this WA iteration includes a plan for the Dinner slide, satisfying a standard and guideline from Appendix G of the 1990 Umpqua NF Land and Resource Management Plan.

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INTRODUCTION

The Northwest Forest Plan states that Watershed Analysis (WA) is an on-going, iterative process that should expand as appropriate to consider additional available information. The federal guide for watershed analysis describes it as a stage-setting process, where the results of watershed analysis establish the context for subsequent decision making processes (RIEC, 1995). This iteration of the Layng Creek WA is based on the need to provide an updated context for the planning of timber sales, focusing on scientific findings that have developed within the last 10 years. An iteration of the Layng Creek WA is also timely, since the Northwest Forest Plan was amended in 2004 to clarify the role of the Aquatic Conservation Strategy. The 2004 amendment requires project decision makers to consider and use any relevant information from watershed analysis. This is true of WA findings for stand-level management in riparian reserves as well as landscape-level management strategies presented in WAs related to disturbance regimes at the watershed scale.

Layng Creek covers about 42,164 acres. Layng Creek converges with Brice Creek, jointly becoming the Row River, which flows into Dorena Lake, above the Dorena Dam. The Row River enters the Coast Fork of the Willamette River below Dorena Dam. Layng Creek has mostly National Forest lands, with approximately 5,000 acres in private ownership. The 1995 WA provides a detailed characterization of the subwatershed.

LANDSCAPE ANALYSIS

A landscape analysis was carried out in the Layng Creek subwatershed, implementing a recommendation in the 1995 WA, and using methods outlined in the Augusta Creek Landscape Plan (USDA, 1998).

Coarse Scale Vegetation Patterns

Landscape vegetation patterns, composed of different forest structural classes, were assessed for the Layng Creek subwatershed (Figure 1). As described in the 1995 Layng Creek WA, the level of fragmentation in the subwatershed is high. Today, late-successional habitat only covers 37% of Layng Creek, and it is mostly composed of small patches compared to larger patches present in the 1930s. The small patch sizes found today reflect the pattern established by staggered clearcuts mostly from 1950 through the 1980s. Fire exclusion has also played a role in today’s vegetation pattern, since stand-replacement fire has not created any new large patches for many decades.

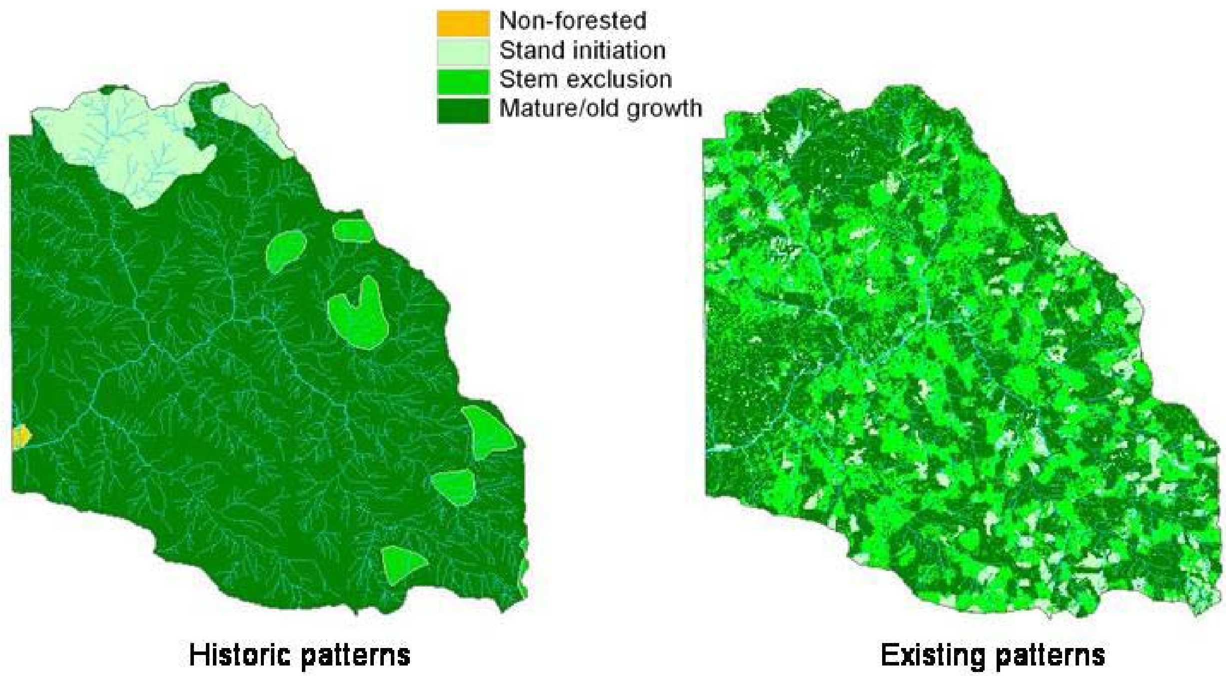

Figure 1. Historic and existing landscape patterns on federal ownership in the Layng Creek sub-watershed. The historic condition is based on historic timber maps produced in the 1930s and some coarse-scale aerial photo interpretation (Harrington, 2003). The existing condition is based on 1998 satellite imagery (IVMP).

The large patch of dark green present today on the west side of the map represents mature forest that developed from the railroad logging about 80 years ago. The large northern patch developed from a stand replacement fire in the watershed's steepest terrain in the headwaters of Junetta Creek sometime between 1843 and 1849.

The subwatershed was stratified into four broad landscape areas based on relationships between forest vegetation, climate, and physiography[1] (Figure 2). The delineations in Figure 2 each represent broad areas of land that tend to have similar disturbance processes. Inclusions of land that differ from this rule can be found at this broad scale of mapping.

The Gentle Valley Bottom landscape areas are the most likely refuge from fire. Historically, surface fire dominated in this area of the landscape with limited amounts crown-fire. Gentle Mountain Slopes are upper slope areas with fewer barriers to fire spread and historic evidence of larger patches of stand replacement fire compared to the gentle valley bottoms. The Steep Terrain is composed of areas dominated by steep slopes where fire intensity is generally greater and stand replacement more frequent. The High Elevation landscape area is above 3,900 feet in elevation where the climate is cooler than the other landscape areas. The natural fire return interval is infrequent so stand replacement patches are typically larger than in other areas.

[1] Physiography--geographic characteristics such as the slope of the terrain (steep vs. gentle)and the aspect of the terrain (north facing vs. south facing).

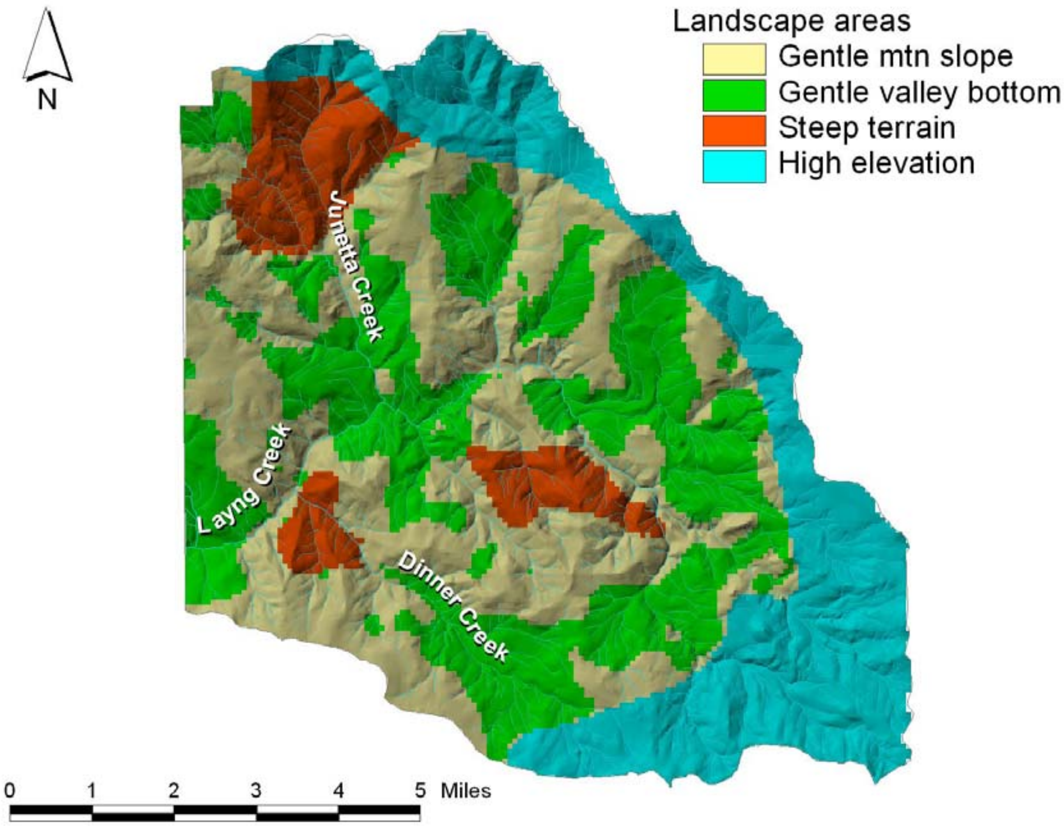

Figure 2. Landscape areas established on the federal ownership in the Layng Creek sixth-level watershed. The remainder of the watershed to the west (about 5000 acres) is in private ownership.

The landscape analysis provides information about landscape scale disturbance and subsequent vegetation patterns. This information is useful in developing management strategies that consider the ecological effects of disturbance. 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. This is in keeping with the Aquatic Conservation Strategy of restoring disturbance regime and managing landscape-scale features.

A coarse-scale comparison of current and historic landscape patterns provides some perspective on landscape areas of Layng Creek (Figure 3). The current condition was compared to historic conditions based on a historic range of variability[2]. The range was established using two reference points—the coarse-scale 1930s map and reference conditions published in Version 1.2 Interagency fire regime condition class (FRCC) guidebook, referred to as FRCC in Figure 3.

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2 The definition for historic range of variability is adopted from the 2005 FRCC guidebook. It represents conditions that would have existed prior to Euro American settlement under current climatic conditions. Reference conditions do not necessarily equal desired future conditions because desired future conditions may integrate many other values.

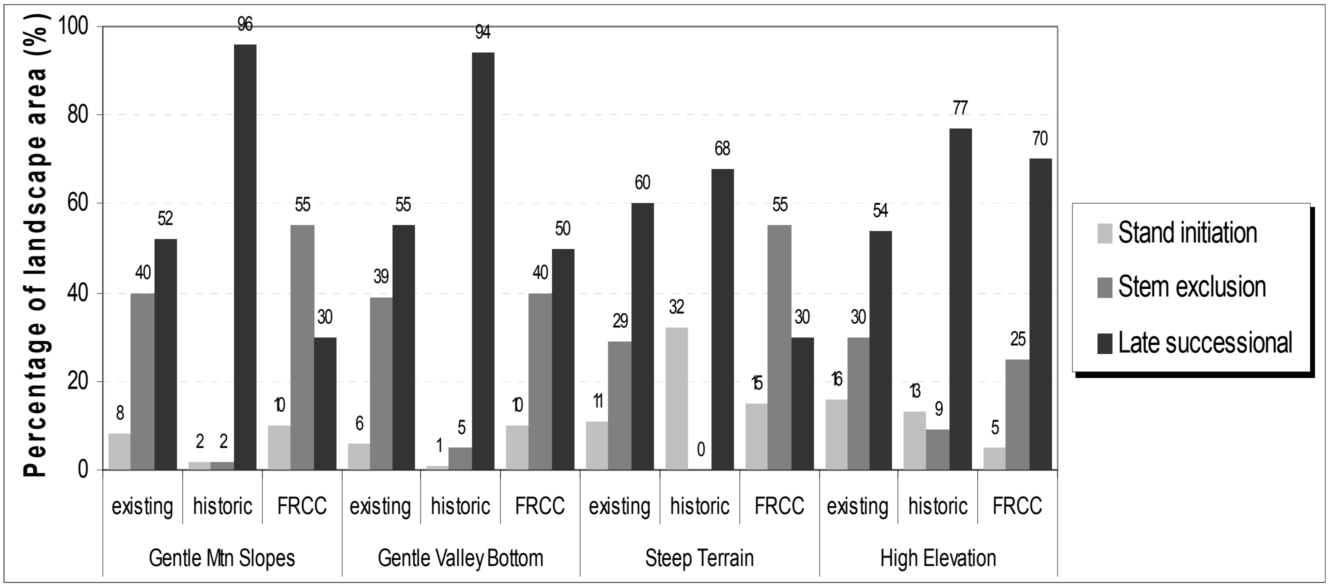

Figure 3. The current distribution of three vegetation stages compared to two reference conditions for each of the four landscape areas in Layng Creek.

At the broad landscape scale, the stem exclusion[3] vegetation stage (depicted by mid-gray bars) covers proportionately much more of the various landscape areas than it did during the 1930s. The amount of late successional vegetation[4] present today (depicted by the black bars in Figure 3) is near the low end of the range of variability in both the gentle mountain slope and gentle valley bottom landscape areas, while it is below and outside the historic range in the high elevation landscape area. In contrast, the current amount of late successional vegetation in the steep landscape area is now very close to the amount that was estimated to exist in the 1930s. This is mainly due to a large patch of mature/old-growth forest that has been developing in the steep headwaters area of Junetta Creek where no disturbance has occurred for several decades.

Except the high elevation landscape area, the fire regime condition class (FRCC) reference points broaden the range by having a low percentage of late successional compared to the 1930s. FRCC historic reference conditions are based on non-spatial vegetation and disturbance models (VDDT)[5] to estimate historic amounts of vegetation strata that existed prior to Euro American occupancy. The ecological categories represent broad biophysical settings; there are presently 34 of these settings to represent the forest of the western United States (FRCC guidebook, 2005). The broad reference ranges for late-successional in the four landscape areas (Figure 3) seem appropriate since they are similar to the range of 45-75% reported in the 1995 Layng WA based on the Regional Ecosystem Assessment Project (REAP, USDA, 1992).

[3] Stem exclusion is a forest structural stage where new trees are prevented from establishing and existing live trees die due to competition and are thus excluded from the stand. This structural stage typically develops after a stand replacement fire or clearcut where the developing forest has a dense even-aged, closed canopy and where suppression mortality occurs through intense competition for space, sunlight, and water.

[4]The definition for late successional is adopted from the Northwest Forest Plan: Stands that are at least 80 years old. Therefore, late successional is composed of both mature stands (that have reached their maximum height potential) and old growth stands (that are at least 180-220 years old).

[5] VDDT or Vegetation Dynamics Disturbance Tool is a model used for estimating reference conditions. It is calibrated through review of the literature, expert opinion and field data where available.

At the landscape scale, opportunities exist to blend together some of small landscape patches (i.e. 20-80 acre old clearcuts) into larger patches more representative of historic conditions with less landscape fragmentation. Treatments can be applied to plantation based on their location as well as their age in order to advance seral development. Historically, the largest patches would have occurred in the gentle valley bottom landscape areas.

Fine Scale Patterns

The historic pattern portrayed in Figure 1 is useful for visualizing large forest patches. However, it does not depict the fine scale patchiness that existed within the large mature/old growth area in the 1930s map, since that mapping did not recognize patches smaller than about 20 acres. Morrison and Swanson (1990) used field observations to create a fine-scale map of fire mortality patches that burned between 1800 and 1900, 60 miles north of Layng Creek. This reconstructed fire history study included a 2,300 acre study area similar in topography and elevation to Layng Creek. Most (88%) of the stand replacement patches found during the study were less than 25 acres. These small patches accounted for 31% of the total stand replacement that occurred during a 100-year period before the onset of fire exclusion. They found that 53% for the area was composed of stand replacement patches that were less than 74 acres, while two large patches, each about 260 acres, accounted for 39% of the area burned as stand replacement fire between 1800 and 1900.

The findings of Morrison and Swanson are corroborated by research done on the Cottage Grove Ranger District on old-growth forest development (Zenner, 2005). In his inventory of mature and old growth stands at Cottage Grove, Zenner concluded that moderate severity fire was the primary disturbance agent that historically created canopy gaps in older forest. This is in contrast to the process of gap formation in less frequent fire regimes where dominant, decadent trees eventually die allowing the initiation of layers over hundreds of years. In Layng Creek, however the multi-layered structure of old growth developed through what Zenner termed a chronic/partial fire model in 150-200 years. This chronic/partial fire process thinned the pioneer Douglas-fir trees and advanced shade tolerant hemlock and redcedar. When fire is excluded in places like Layng Creek, the natural pathway of old growth structural development is hindered. If the natural fire process is not replaced with some kind of thinning or prescribed fire, stands are not on a natural path of succession. This is particularly problematic in the riparian reserve land allocation where late successional forest structure is the long-term desired condition.

At the stand-scale, even-aged stem exclusion and mature vegetation stages present opportunities to advance these vegetation stages in ways that approximate the disturbance regime and successional pathways described by Zenner (2005). Many of the unmanaged mature stands in the subwatershed lack species and structural diversity because fire has not functioned during their development. Without treatment, these mature stands are not likely to develop on a natural pathway. Moreover, such mature stands may not be resistant to future fire disturbance and may be less likely to develop into old-growth due to fuel build-ups and the potential of uncharacteristic fire effects in the future.

Most of the stem exclusion stands in Layng Creek represent conditions that are unnaturally dense, and that lack diversity due to the selection of Douglas-fir over other species during planting and thinning operations. If left untreated many stands are on a track to develop as closed, homogeneous stands that do not represent desired conditions for either the matrix or riparian reserve land allocations.

General Landscape Recommendations

At the landscape scale, enlarge patches to approximate the acreage of large-scale disturbance events in order to reduce the current amount of landscape fragmentation. Treat groups of adjacent patches simultaneously to accelerate structural development and ultimately lower the effects of fragmentation. The desired future pattern of patches would be more variable than today's pattern with would include patches hundreds of acres in size.

Identify areas where blocking up acreage will facilitate thinning and use of prescribed fire for fuel reduction at a scale larger, and more economically efficient, than managing the scattered, individual patches established by the clearcutting pattern.

At the stand scale, focus vegetation treatments in the mature and stem exclusion stages to restore missing species and structural diversity. In existing old growth stands that have experienced substantial ingrowth, apply treatments to reduce understory density and to increase resilience to stand replacement fire.

Recommendations Specific to Landscape Areas

Gentle Valley Bottoms

1) Thin stem exclusion patches that are adjacent to late-successional patches in order to accelerate stand development and decrease fragmentation.
2) Apply thinning treatments and create small canopy gaps (¼ to ½ acres) in early seral, stem exclusion, and mature structural stages in order to restore species and structural diversity characteristic of a mixed severity fire regime.
3) Where appropriate, initiate an uneven-aged management regime in order to culture a shade tolerant understory layer.
4) Allow higher levels of fuel loads based on the CWD inventory[6]

Gentle Mountain Slopes

1) Apply thinning, canopy gap creation (up to 2 acres), and underburning to restore structural and species diversity (characteristic of a mixed severity fire regime) in areas of stem exclusion, mature, and unnaturally dense understories of older stands.
2) Use fire to create snags and coarse woody debris.
3) Manage for moderate levels of fuel loading based on the CWD inventory.

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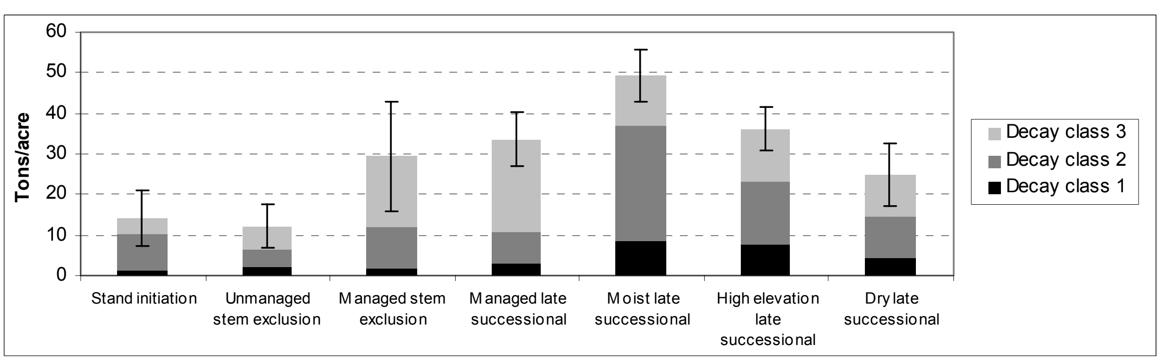

Average percent ground cover and 90% confidence intervals of down wood measured in ton/acre.

Steep Terrain

1) Manage all forest stages to improve resilience to fire by opening canopies and raising canopy base heights.
2) Manage stands to maintain even-aged characteristics.
3) Manage for lower levels of fuel loading based on the CWD inventory levels.

FIRE REGIME CONDITION CLASS

Landscape areas and their associated fire regime condition classes (FRCC) provide a new approach to assessing fire risk. The use of FRCC in planning is a requirement of the 2003 Healthy Forest Restoration Act (HFRA); it allows agencies to compare landscapes based on a standardized nation-wide process. Fire regime condition classes are coarse-scale measures of the degree of departure from the natural fire regime. This departure results in changes to one or more of the following ecological components: vegetation characteristics; fuel composition; fire frequency, fire severity and pattern; or other associated disturbances processes. Departure is measured in three broad classes: low (FRCC 1), moderate (FRCC 2) and high (FRCC 3) departure from the central tendency of the natural or historical regime. Low departure is considered to be within the natural range of variability, while moderate and high departures are outside of that range. In FRCC 2 and 3, one or more fire return intervals have typically been missed due to fire exclusion. Areas of high departure increase the risk of losing key ecosystem components due to fire effects.

The delineation of Fire Regime condition classes for Layng Creek followed the process outlined in the Interagency Guidebook (2005). The landscape areas shown in Figure 2 were assigned one of the biophysical settings from the FRCC options. These standard classifications have a set of reference parameters that are used in determining the level of departure. It is important to note that the national process has limited biophysical settings to choose from that represent a moderate severity fire regime such as Layng Creek. As such, the cedar-hemlock biophysical setting was determined to be the best available fit for the gentle valley bottoms and so forth (Table 1).

Based on the assumptions underlying the biophysical settings applied to the landscape areas, there are no high departure areas in Layng Creek (Table 1). Even though fire has been essentially excluded from Layng Creek for several decades, none of landscape areas were found to have a high level of departure for either of the two FRCC aspects considered (Vegetation/Fuels or Fire Frequency/Severity).

Table 1. Fire Regime Condition Classes for Layng Creek based on Landscape Areas.

Landscape Area	Biophysical Setting (acres)	Vegetation/Fuel Condition Class score*/rating	Fire Frequency/ Severity Condition Class score/rating	Treatment Acres to lower Condition Class
Gentle Valley Bottom	Cedar/Hemlock (11,162 ac.)	13/ Low	17/ Low	0
Gentle Mountain Slopes	Grand fir/ Douglas-fir (13,492 ac.)	42/ Moderate	44/ Moderate	1,214
Steep	Grand fir/ Douglas-fir (3,452 ac.)	42/ Moderate	57/ Moderate	311
High Elevation	Silver-fir/Douglas-fir (8,945 ac.)	15/ Low	38/ Moderate	0

*FRCC ratings are based on the following ranges:
Low, (0-33); Moderate (33-65); High (65-100)

The gentle mountain slopes were assigned to the Grand-fir/Douglas-fir biophysical setting. This landscape area was determined to have a moderate departure for fire frequency and severity as displayed in the 4th column of Table 1. The Grand-fir/Douglas-fir biophysical setting comes with the following parameters for the reference condition—a 59-year fire frequency and a fire severity rating of 30, meaning that 30% of the area would have burned as a stand replacement fire under reference conditions. To calculate the degree of departure for fire frequency in this biophysical setting, the Layng Creek fire history study (USDA, Umpqua NF, 1995) was used to determine that it has been about 160 years since the last substantial fire. Since this is dissimilar from the reference frequency (160 years vs. 59 years), the departure score for fire frequency is 64, which is on the high end of the range for moderate departure[7]. The departure score for fire severity [8] on the other hand was only 25, since the estimated amount of stand replacement fire under today's conditions does not depart much form the reference condition (40% estimated today vs. 30% under reference conditions). Finally, the averaged departure score of 45 (listed in the 4th column of Table 1) was calculated considering both frequency and severity combined[9]. The averaged score of 44 falls in the middle of the range of a moderate departure.

In the gentle terrain and moist microclimate of the gentle valley bottom landscape area (Figure 2), the FRCC analysis revealed very limited departures from reference conditions. In this case, the Cedar-Hemlock biophysical setting was applied, which under reference conditions, has a fire frequency of 233 years and a fire severity rating of 77% stand replacement fire. The estimated current condition of 160 years for fire frequency (since the last major fire) and 75% for the

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[7]The departure score for fire frequency for the Grand-fir/Douglas-fir biophysical setting was done as follows: Similarity was first calculated as (59 years/160 years) x 100 = 36; next departure was calculated with the equation of 100-similarity, thus 100 – 36 = **64.** Moderate FRCC ranges from 34-66, so 64 is on the high end of the moderate range for fire frequency in this particular setting.

[8]The departure score for fire severity for the Grand-fir/Douglas-fir biophysical setting was done as follows: Similarity was first calculated as (30 years/40 years) x 100 = 75; next, departure was calculated with the equation of 100-similarity, thus 100 – 75 = **25** Low FRCC ranges from 0-33.

[9] Fire frequency and severity condition class is the averaged score of the two departure scores calculated as frequency departure + severity departure/2; or (64 + 25)/2 = **44.5**

estimated amount of stand replacement fire that would occur under current conditions show little departure from the reference conditions for this biophysical setting. As such the gentle valley bottom landscape has an averaged score for both frequency and severity of only 17, ranking it a low departure from reference conditions. The steep and high elevation landscape areas also have moderate departure scores for fire frequence/severity. The steep landscape area in Layng Creek departs more from historic conditions compared to the other landscape areas based on the departure score in (Table 1).

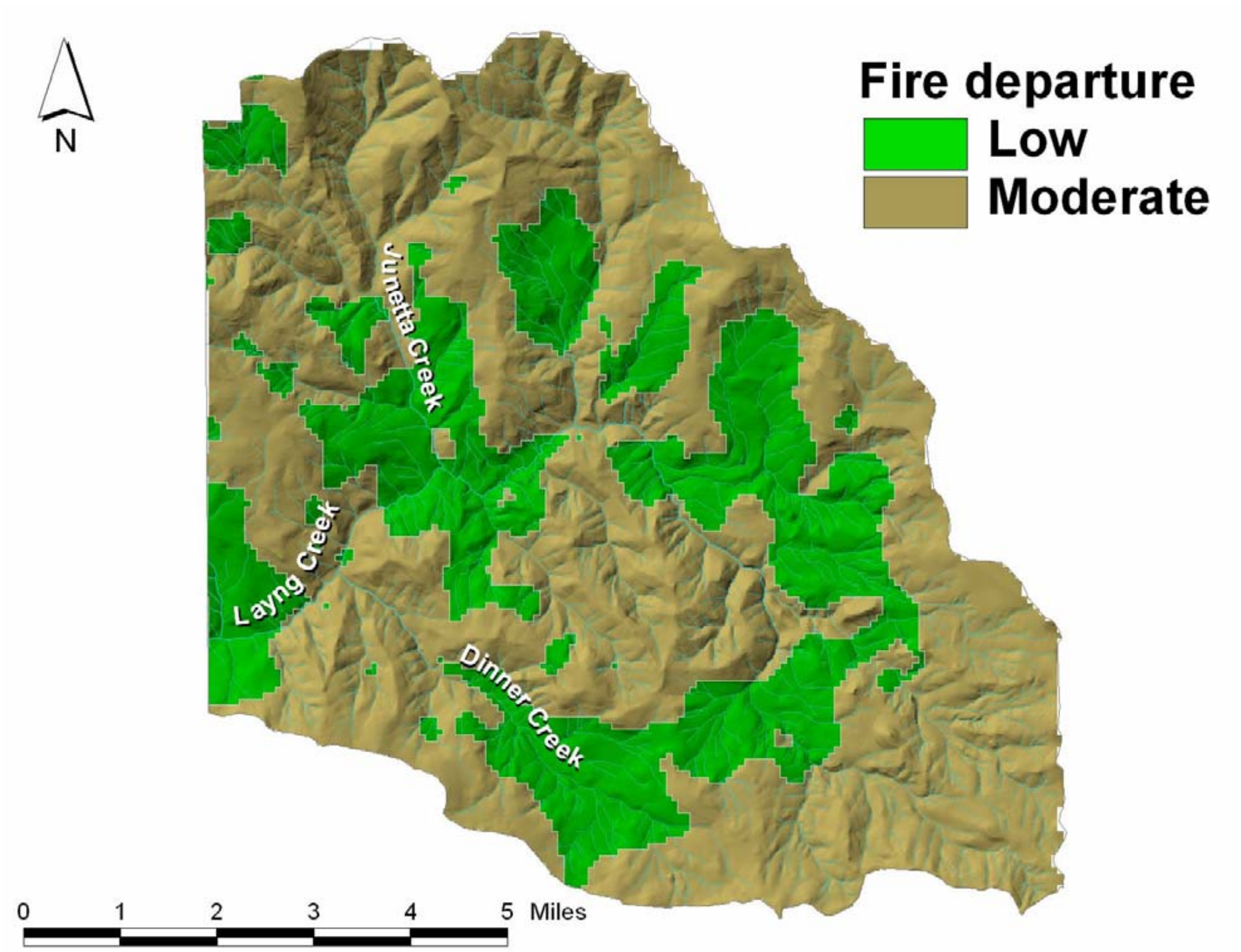

Figure 4. Layng Creek fire regime condition classes for fire frequency and severity. Departure for vegetation conditions is not displayed.

FlamMap Modeling

Since the FRCC process uses non-spatial reference parameters derived from data over large areas, a more site specific tool was used to further asses the risk of stand replacement fire and help validate the results of the FRCC analysis in Layng Creek. The FlamMap model (Finney, 2005) is a spatial fire behavior mapping and analysis program that uses local terrain, fuel, and weather data to make fire behavior calculations such as flame length and crown fire for specific locations. The model was populated with local data and then calibrated with actual site-specific fire effects form the Boulder Fire that burned in 2002 about 35 miles south of Layng Creek. Model inputs were adjusted (calibrated) so that the output closely resembled the actual map of stand replacement fire that occurred in the 48,000 acre Boulder fire that burned with 32%

moderate to high severity fire. Once calibrated, the model was then applied to Layng Creek (Figure 5).

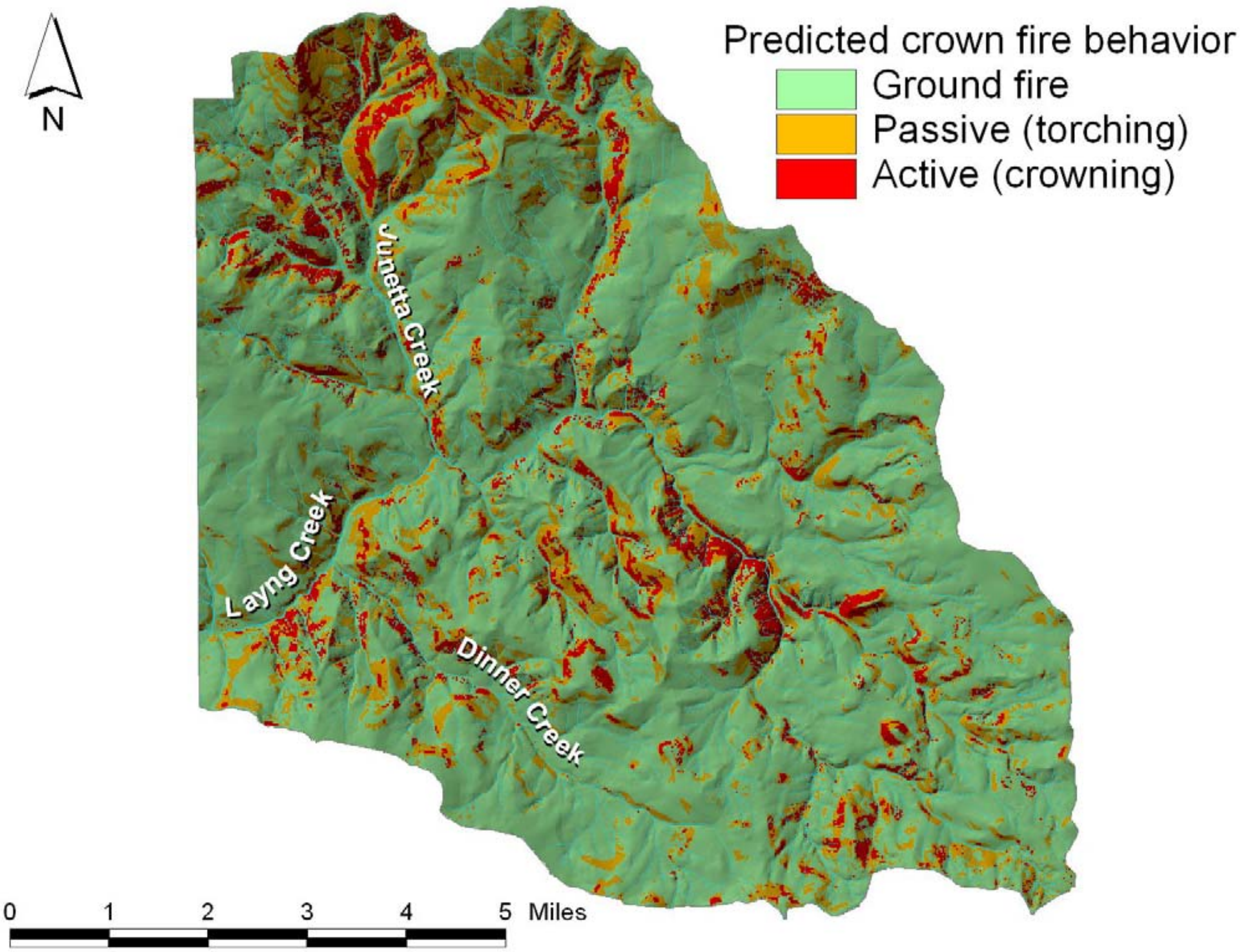

Figure 5. Predicted areas of crown fire mapped in the Layng Creek subwatershed using FlamMap (Finney, in press).

In general the FlamMap model validates the low to moderate levels of departure from the historic range of variability since large areas of continuous active crown fire were not predicted, even under extreme weather conditions. Areas of passive crown fires (torching) are expected to kill individual trees or small groups of trees.

FlamMap modeling indicates that the main elements that result in active crown fire were slope steepness and stand age. Based on the Layng model run, about 19% of the stands less than 20 years of age were predicted to burn with active crown fire[10] compared to 5% for the stands 20-80 years old. Stand age regulates crown separation, crown density, and canopy base height. Younger stands have low canopy base heights where tree crowns are close to the ground. As such, active crown fire is more likely, plus the precommercial stands pose additional risks to adjacent landscape areas due to the intensity at which they burn.

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[10]Active crown fire is defined as very active, rapidly moving fire that travels between tree crows killing substantial areas of forest by burning the entire canopy fuel complex.

Passive crown fire[11] was also associated with stands of precommercial age and steeper slopes with the same general trend of more crown fire in the stands less than 20 years old.

The results of the FlamMap model in Layng Creek showed less stand replacement effects in young stands compared to that reported in the Umpqua National Forest wildfire effects evaluation project. During the 2002 fire season, plantations less than 20 years of age experienced disproportionately higher amounts of mortality compared to the total area that plantations occupied within the 88,000 acre analysis area. In fact, 74% of the plantations, 20 years or younger, experience stand replacement mortality, while mortality was 40-50% in plantations between the ages of 21 to 50 years. (USDA Umpqua NF, 2003). The 2003 fires occurred in the North and South Umpqua drainages, typically on steeper terrain that in Layng Creek and further south where the mixed severity fire regime can be expected to result in more stand replacement fire behavior than in Layng Creek.

Though the steep landscape area in Layng Creek (Figure 2) is mapped as a moderate departure in Figure 4, Table 1 reveals that the steep landscape in Layng Creek is on the high end of the range for moderate departure. A comparison of the FlamMap results in Figure 5 with the landscape areas in Figure 2 shows that the steep landscapes display an increased risk of active crow fire. This may warrant more emphasis, in terms of lowering risk, than other moderate departure areas in Layng Creek.

Recommendations Related to Disturbance Processes

1) Focus thinning and fuel treatments in the gentle mountain slope landscape areas where partial stand replacement fire played a more active role and where treatments can lower risks to adjacent steeper terrain. Priority treatment areas are along roaded ridge systems that are adjacent to steep terrain. Underburning is preferred over handpile burning or no treatment.

2) In gentle valley bottom landscapes, avoid large investments in fuel reduction, including activity-related fuels, since risk is relatively low in this landscape area and the cost of fuel reduction is high. Higher CWD levels are natural in these areas.

3) In the steep and gentle valley bottom landscape areas, increase fire resiliency in all stand ages. This can be measured by surface fuels, canopy base height, and crown bulk density.

4) To lessen the chances of crown fire spread between young stands and to older stands, continue the aggressive program of precommercial thinning. Apply prescriptions that thin to a variable density. Emphasize reducing risk in areas that border older stands and owl cores. Preserve healthy live crowns ratios that result from precommercial thinning by implementing timely commercial thinning before crowns significantly recede and tree stability is compromised.

5) Thin plantations located in vicinities of relatively unfragmented late successional forest and in the connectivity corridors (established in the 1995 WA) in order to accelerate large tree development.

6) Reintroduce fire's role throughout the watershed by creating large treatment areas from otherwise smaller patches.

[11] Passive crown fires (torching) kills individual trees or small groups of trees.

AQUATIC CONSERVATION STRATEGY (ACS)

Spatial and Temporal Scale of the Strategy

On March 22, 2004 the Northwest Forest Plan was amended to clarify the direction pertaining to the Aquatic Conservation Strategy. The 2004 amendment clarifies that the nine ACS objectives listed on page B-11of the 1994 ROD are not standards and guidelines nor are they to be applied at the project scale. The confusing wording in the 1994 ROD for the Northwest Forest Plan had been interpreted to require a finding of consistency with ACS objectives for every project. Thus during the development of the 1995 Layng Creek WA, several recommendations were made to accomplish work as part of individual timber sales so that all nine ACS objectives could be met with each project. However since progress toward attainment of ACS objectives can only be assessed at the large scale over the long term, it is not appropriate to require individual timber sale projects to attain all ACS objectives as stated in several of recommendations in the Layng Creek WA. Thus, based on the clarification provided in the 2004 amendment, the "Standard Assessment Methodology for assessing ACS" which is contained in the 1995 WA (p. 135) is deleted. Consequently, the following recommendations associated with the Standard Assessment for attaining ACS objectives over the short-term and at the site-scale are also deleted:

> *p.136--During project planning, require barrier removal in all fish bearing streams in the subwatershed as a mitigation requirement prior to project implementation.*
>
> *p. 136--During project planning, require barrier removal of 50% of all artificial barriers in non-fish bearing streams in the subwatershed as a mitigation requirement prior to project implementation.*
>
> *p.137--In any subwatershed, at least 25% of the tributary channels will be completely free of artificial barriers that run parallel to streams (refers to impeding travel of terrestrial organisms in the RR).*
>
> *p.137--No more than 10% of the total RR length in any subwatershed will contain a lateral (perpendicular) barrier such as a road.*
>
> *p.138--Within each acre of the RR maintain between 1500 and 6000 cubic feet of wood greater than 24" diameter with at least 30% of this wood greater than 36" diameter.*
>
> *p.138—Remove any unnecessary structures in streams determined to not be essential.*
>
> *p.141--Prior to project implementation, inventory road encroachment on floodplains and develop appropriate mitigation.*
>
> *p.142--Within each subwatershed, the road crossing density is not to exceed 2 crossings per mile of stream.*
>
> *p.142—Keep created openings w/in the RR to a minimum, consider placement options to best meet ACS objectives, limit the running total of RR openings to 0.4% per decade for the affected subwatershed. If an opening is necessary, leave wood >24" w/in the RR.*

Treatments and Disturbance in Riparian Reserves

Some aquatic recommendations from the 1995 Layng Creek WA related to vegetation treatments can be clarified and amended in order to address the specifics of restorative riparian treatments and the role of fire in this land allocation. Modifications to recommendations in the 1995 WA are made in the context of recent guidance regarding riparian treatments (USDA/ USDI, 2005) and recent information regarding the role of fire in riparian areas.

One recommendation in the 1995 WA for riparian management is ambiguous:

> *p.144--Retain full buffers on all streams including intermittent streams. Manage all Riparian Reserve areas to achieve LSOG conditions in the shortest possible time.*

The term buffer typically implies a no cut area. Yet the second sentence of this recommendation says to manage in the riparian reserves in order to accelerate the development of late-successional conditions. Two other recommendations in the 1995 WA are clear about the need to manage riparian reserves.

> *p.126--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.*

> *p.143—Manage plantations that encroach on RR for maximum conversion to LSOG conditions. Manage for LSOG type diversity. Leave all non-conifer species and all western redcedar.*

The 1995 WA does not mention fire in riparian reserves. The FlamMap modeling shows that the areas most susceptible to active crown fire are young dense stands and forests in steep terrain. Research has shown that dense forest canopies with homogenous and continuous horizontal and vertical stand structures have an increased potential for crown fires. These types of homogenous forest structures have dramatically altered how wildfires burn in these forests from how they burned historically (Peterson et al, 2004; Powell et.al, 2001).

A 2000 fire history study that compared riparian and upslope areas in the nearby Steamboat Creek watershed on the Umpqua National Forest, showed no significant difference between fire return intervals in riparian compared to upland sites (Olson, 2000). Reeves et al. (1995) suggested that disturbance in riparian areas may be a required ecological process to provide coarse woody debris, and multiple riparian successional stages for the proper functioning of the aquatic-land interface. Recommendations from another fire history study comparing uplands with riparian areas published by Everett et al, (2003) suggest the need to integrate riparian and sideslope forests through shared disturbance events (as opposed to keeping fire out or riparian areas) in order to maintain ecosystem function.

The Northwest Forest Plan TMDL Implementation Strategies (USDA/USDI, 2005) provides a recent perspective on the topic of riparian reserve treatments. This guidance document, recently approved by Oregon Department of Environmental Quality, addresses the fact that vegetation treatment may be necessary to restore the ecological health of sites that were harvested previously or have been degraded due to lack of natural disturbance processes. Riparian treatments can accomplish the restorative functions of reducing density, diversify species composition, accelerate development of late successional conditions and enhance the long-term large wood recruitment potential. Short-term effects on water quality would ultimately translate to enhanced sustainability of riparian and aquatic resource conditions (USDA/USDI, 2005).

Based on analysis done for this WA iteration and the recent literature cited above, the three management-related recommendations from the 1995 Layng Creek WA (on pages 123, 143, and 144) are replaced to read as follows:

Recommendations for Management in Riparian Reserves--Perennial Streams & Wetlands

Apply silvicultural treatments such as thinning, activity fuel treatments, and/or prescribed underburns outside the primary shade zone[12] when it is determined that such activities can benefit effective shade and other riparian functions over the long term (UDDA/USDI, 2005), thus meeting the long-term objectives of the Aquatic Conservation Strategy. Such treatments are recommended when:

1. Vegetation density is high and stand health will benefit from thinning and/or underburning.

2. Vegetation thinning in the secondary shade zone will generally not result in less than 50% canopy closure. Exceptions to this will be analyzed on a case-by-case basis considering the scale and duration of the treatment and weighing the long-term benefits against short-term impacts.

3. Vegetation and fuel conditions are contributing to an increased risk of stand replacement fire.

4. Long-term bank stability and sediment delivery would not be substantially compromised, as determined by interdisciplinary site-specific evaluations.

Treatments within the primary shade zone may be considered when the above criteria apply and when a site specific analysis using the tools available in the TMDL Implementation Strategy (USDA/USDI, 2005) shows that any short-term risks of increasing stream temperature are outweighed by the loss of ecological benefits by not treating a stand in the primary shade zone.

Recommendations for Management of Riparian Reserves--Intermittent Streams

Apply silvicultural treatments such as thinning, activity fuel treatments, and/or prescribed underburns when it is determined that such activities can benefit the long-term objectives of the Aquatic Conservation Strategy. Variable-width, no treatment buffers may be needed to provide slope stability and lower sediment delivery associated with certain types of yarding. The size of such no treatment buffers will be prescribed based on site-specific conditions such as soil conditions and channel incision, in the context of the proposed silvicultural prescription and logging system. On intermittent channels lacking substantial incision or other constraining characteristics, the above treatments (vegetation manipulation and fuel reduction) are

[12] The primary shade zone is an area along a perennial stream that provides shade between 10:00 AM and 2:00 PM. The primary shade zone provides shade throughout the day, while the secondary shade zone contributes shade only when the sun is lower in the sky and less able to lead to stream heating. Though the primary shade zone can be substantially affected by stream orientation (the south bank of an east-west flowing stream is more critical than the north bank), the following table is useful in helping define the primary shade zone based solely on tree height and slope.

Height Of Tree	%Hill Slope <30	%Hill Slope 30 to 60	%Hill Slope >60
Trees < 20 feet	12' buffer	14' buffer	15' buffer
Trees 21 to 60 feet	28' buffer	33' buffer	55' buffer
Trees 61 to 100 feet	50' buffer	50' buffer	60' buffer

recommended throughout the riparian reserve in order to maximize restorative treatments in the riparian area.

ROADS ANALAYSIS

Since 1999 when the Forest Service Roads Analysis guidebook was published, assessments of an area's road network have been carried out during timber sale planning. This analysis is done in order to weigh the various costs of road-associated effects to ecosystem values and benefits of access. The 1995 WA included several recommendations regarding roads in Layng Creek that relate now to the roads analysis process:

> *p.140--Prior to project implementation, inventory stream crossings to determine if there are more than 600 feet of road feeding directly into a stream per mile of stream in the subwatershed. If more than 600'/mile, seek opportunities to reduce the excess by at least 25% per project (e.g. timber sale). Road outsloping may reduce the problem.*
>
> *p.140--Prior to project implementation, inventory all stream crossings in a project's subwatershed to establish a risk rating--no net increase in risk w/any new projects.*
>
> *p.141--Inventory existing roads for their effect on altered flow pathways associated with wet areas or unstable areas greater than 1/4 acre within subwatersheds and correct high priority areas.*

The roads analysis process will be used instead of the above 1995 recommendations. No watershed literature was found to support the threshold of 600 feet of ditchline described on page 140 of the WA. During the roads analysis, if malfunctioning and scoured ditches are found, recommendations will likely be made to apply maintenance or reconstruction as funds are available. Typically, the stream crossings that would be inventoried or otherwise assessed as recommended on p.140, would be those within a project area that are deemed to be connected.[13] Such inventories would be carried out at a level of intensity deemed reasonable to meet the intent of riparian reserve standard and guideline RF-3 of the Northwest Forest Plan (ROD, C-32) and as guided by the District Ranger (USDA, 1999).

DINNER SLIDE PLAN

The Layng Creek Municipal Watershed Management Plan is part of the Umpqua National Forest Land and Resource Management Plan (Appendix G). This watershed management plan includes standards and guidelines that apply to projects in the Layng Creek municipal watershed. One such guideline (guideline #5) is the development of individual management plans before any additional roads or timber harvest activities are planned in any of the eight delineated earthflows in Layng Creek (page G-8). These eight delineated earthflows are displayed on the "Unsuitable Land" map included with the 1990 LRMP. The Dinner earthflow is located within the Dinner thin planning area.

Guideline #5 also states that in addition to the eight mapped earthflows, others may be delineated in the future, and that they must be treated carefully. Indeed, other earthflow areas have been mapped within Layng Creek since the publication of the LRMP. For instance earthflow terrain has been mapped within the dinner planning area at a coarse scale by a

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[13] Connected actions are considered to be part of the base project. For instance, if road work can be accomplished because of its association with a timber sale then the road work is considered connected.

geologist, and the soil scientist has mapped finer-scale areas of unsuitable ground at the scale of individual units proposed for thinning. This level of refinement is in keeping with a 1997 Watershed Analysis recommendation which refers to the eight mapped earthflows-- "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." (USDA, Umpqua NF, 1995)

Field reconnaissance, road inventories, thinning unit investigations and interdisciplinary discussions have revealed several important findings about the earthflow terrain in Dinner Creek as discussed below. This section of this WA iteration satisfies guideline #5 of the Layng Creek Municipal Watershed Plan.

Historic Context of the Earthflow Mapping in the LRMP

Jim DeLapp (retired Soils Scientist, Cottage Grove Ranger District) delineated eight earthflow landforms in the Layng Creek in the late 1980s due to the concern that extensive clear cutting would cause more sediment to reach streams. The earth flow terrain that DeLapp delineated was classified as unsuitable soil due to slope instability in the 1990 LRMP (Figure 6).

DeLapp's primary concern was an increase in water yield associated with clearcutting in earthflow landforms. Large trees have an extensive network of roots that function like 'pumps' removing water from the soil through the process of evapotransiration[14]. Thus, the soil mass remains more thoroughly saturated until the forest progressively grows back. Theoretically, the additional water could activate dormant earthflow features that would potentially increase the level of sediment delivery into streams.

[14] Evapotranspiration is the removal of water from the soil by the capillary action of plant roots and the use of that water in the growth process (transpiration) plus the evaporation of any excess water from the surface of the leaves. When trees are harvested in a clearcut, little to no evapotranspiration takes place until the regenerating stand of trees and shrubs reestablishes to begin using water again.

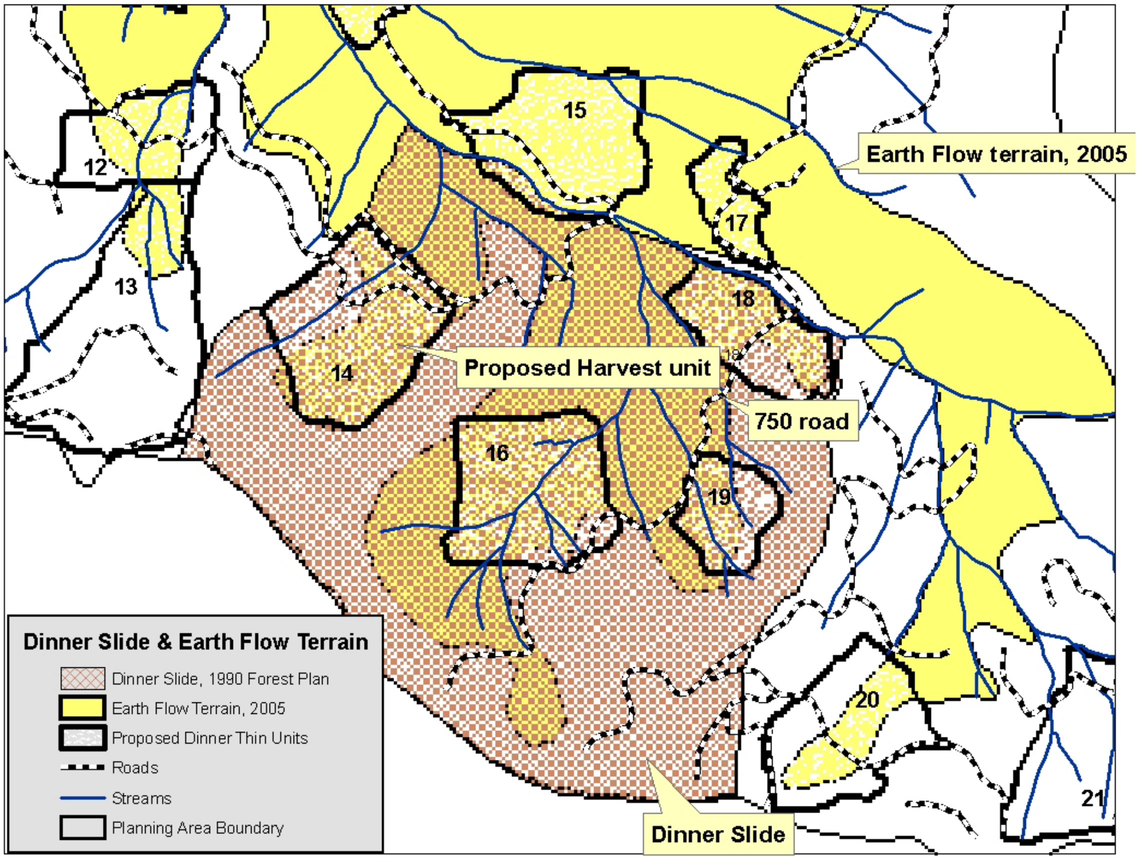

Figure 6. Location of the Dinner Slide as depicted in the 1990 LRMP overlayed with more recent earthflow mapping in the vicinity of some proposed thinning units.

Instability of features the size of the Dinner slide occurred in a wetter climate, during the last ice age and they are currently not unstable. Also, even though substantial clearcutting occurred in previous decades, DeLapp recently observed that dormant earthflow features had not re-activated with the removal of the "pumps". This is probably explained by the fact that much of the ground movement associated with active, deep-seated landslides takes place in the winter time when ground water levels are at their highest and the soil mass has attained its greatest degree of saturation. Since evapotranspiration mostly occurs during the spring and summer growing season, the problem associated with a loss of "pumps" was probably overrated.

Influence of Thinning on Evapotransiration

The degree of increased soil moisture due to timber harvest and loss of evapotranspiration is directly related to the amount of leave trees in a harvest unit (Gordon Grant, research hydrologist, Oregon State University, and Fred Swanson, USDA, research geologist from Withrow IDT notes on 6/1997). A 1997 field trip on the Umpqua National Forest to discuss the possible effects of thinning on active earthflow terrain with scientists from the Oregon State University and the USDA Forestry Sciences Lab highlighted the fact that thinning has little effect on the soil water budget. Evapotranspiration accounts for about 20% of the yearly water budget, and it is proportionately related to basal area.

As discussed in the Crawdog Environmental Assessment (USDA, Umpqua NF, 2005), the average reduction in basal area for a light thinning is around 38%. Based on a 38% reduction in basal area, the net decrease in evapotranspiration following a light thinning is projected to be only about 7.6% of the annual reduction.[15] This small decrease in water use by trees would equate to a longer period of time of soil saturation compared to unthinned areas. However, this increase occurs during the spring and summer months instead of during the winter. Since earthflows are much more likely to become active during the winter months when ground water levels are at their highest peak, the nominal moisture increase from thinning during the summer and early fall is unlikely to activate a dormant earthflow (Gordon Grant, research hydrologist, Oregon State University, pers. comm.). Moreover, as the residual leave trees extend their root systems as they grow, the leave trees would begin to utilize the excess moisture more and more each year. It is likely that the post-thinning moisture regime would incrementally return to pre-thinning conditions within about a decade.

More recently, Doug Shank, resource geologist on the Willamette National Forest, consulted on the Dinner slide based on his experience thinning earthflow terrain on the Willamette. He stated whether there is 70%, 50%, or 30% retention, he had not sen any indication that the level of retention would alter stability (6/22/05 IDT notes).

Active vs. Dormant Earthflows

Interdisciplinary findings have revealed that the earthflow terrain mapped in the Dinner planning area is dormant; the mass movement of large blocks of earth is not happening in the dormant Dinner slide area or elsewhere in the more recently mapped earthflow terrain in the Dinner planning area. Doug Shank's field review of the Dinner slide further backed-up the observations of the local interdisciplinary team that the earthflow areas are dormant. Shank made the same observation as DeLapp; even though numerous clearcuts occurred in the 1950s and 1960s with no root strength remaining and maximum loss of evapotranspiration, the clearcuts did not activate the dormant earthflow in Dinner Creek. Though Shank found very isolated blow down within the Dinner slide, he saw no renewed instability on a large scale (6/22/05 IDT notes).

In order to map active earthflow, there must be abundant field evidence of widespread slope instability that include many of the following field indicators: clumps of listing trees, raw scarps, open tension cracks, pressure ridges, and sag ponds. The NWFP cites a 400-year timeframe (evidenced by the deformation of old-growth timber) as a measure for determining "active" ground movement. These earth flow landforms have developed over tens of thousands of years and can move in a piecemeal fashion. These sites of localized slope failure (active inclusions) within the larger dormant earthflow block, can be of any size and should be mapped out as unsuitable. These unsuitable inclusions are discreet areas that have definite signs of movement.

Umpqua National Forest geologist Larry Broeker explains Layng Creek's high sedimentation rates of the 1970s as a consequence of increased peak flows that likely occurred during the period of extensive clearcutting in the 70's and 80's. Down-cutting by streams in earth flow landforms is thought to have occurred with suspected increases in peak flows. The higher peak flows locally undermined the banks of streams within earth flow landforms triggering shallow-seated debris avalanches. Affected hill slopes are still adjusting to these initial streamside failures. When a slope failure occurred it removed the support [buttressing effect] on the hill side directly above it. During the next large storm event(s) the slope directly above the initial landslide may failed and propagate further upslope; a process of incremental slope failure.
In addition to stream down cutting, the re-activation of dormant earth flows is probably related to long-term increases in precipitation levels (Swanson, 1991). Based on observations, the effects of thinning on soil moisture is likely too short lived to affect earthflow dynamics.

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[15] the 7.6% reduction in evapotranspiration was calculated as follows [0.02 x 0.38 = 0.076 x 100 = 7.6%]

Active Inclusions and Sensitive Areas

Greg Orton, Umpqua National Forest soil scientist, has carried out field reconnaissance within proposed thinning units found on the coarse-scale earthflow terrain map to refine the mapping at the scale of individual thinning units. Some small-scale areas of active instability are mapped as unsuitable due to risk of debris avalanche on steeper hillslope (inclusions) within the earthflow blocks. Sag ponds are mapped as wetlands that are ‘sensitive’ because heavy equipment used to accomplish ground-based logging could collapse underground ‘pipes’ that are transporting water. Other sensitive areas are hydrologic features such as hummocky slopes with saturated soil, and shallow subterranean stream channels. If underground pipes are collapsed, the water they transport below the surface could be forced to the surface initiating new stream downcutting.

Streams within and Adjacent to Earthflow Terrain

Streams in earthflow terrain are inherently sensitive because they readily cut down through the deep soil mass that makes up the flow. This natural tendency is substantially enhansed during peakflows, as previously discussed. It is likely that stream downcutting has tapered-off given the landscape-scale recovery of forest canopies in old clearcuts. Also, the large amount of instream wood left in channels during the 1950s and 1960s functions to slow water velocities in channels. The re-growth of riparian vegetation is helping hold surface soils in place as streambanks stabilize (adjust their angle of repose) to the effects of downcutting. Substantial levels of channel recovery has occurred; the 1996 100-year flood did not trigger any new large-scale downcutting or stream-bank avalanching. Most channels within earthflows in previously harvested areas have probably attained a new equilibrium since their initial disturbance 40-50 years ago.

Road Conditions in the Dinner Slide

Permanent roads in earthflow terrain can cause problems by rerouting water, potentially leading to both surface erosion and fluvial erosion. Since the soils are typically very deep in these landforms, substantial amounts of sedimentation can occur as a result of poorly placed or poorly designed roads in earthflow terrain. The main 1745 road, dead-end spur 1745-455, and the 1746-750 tie-through road all traverse the mapped Dinner slide. Portions of these roads were inventoried as part of the Dinner project roads analysis (USDA, Umpqua NF, 2005). All stream crossings were assessed and included in the risk assessment conducted by resource geologist, Larry Broeker. As displayed in the Roads Analysis, no high risk stream crossings exist on these roads.

Overall observations of the 750 road showed that it was in good condition with most drainage structures functioning well with no signs of gully development anywhere on the road prism. The ditch relief culverts were ample, placed on intervals that allowed adequate water dispersal with no ditch down cutting. Moreover, the outlets of the relief culverts were placed in stable areas where the water was dispersing onto gentle ground where it was infiltrating into the soil rather than scouring new channels. Though several relief culverts showed signs of advanced deterioration with some pipes plugged or rusted, at this time, road drainage continues to function well.

The nine stream crossings inventoried on the 1745 and 1745-455 spur had low risk ratings. As such, these crossings pose low risk for sediment delivery to streams. No excessive ditch scour was noted to occur on either of these roads in the vicinity of the Dinner slide.

<u>Recommendations Related to Earthflow Terrain in Layng Creek</u>

1) In dormant areas of earthflow terrain including the dinner slide, proceed with vegetation and fuel management activities using silvicultural prescriptions and logging systems that limit changes in water yield and routing processes.

2) New permanent road construction should only occur in places where the risks of diverting stream ground water flows are low. Use design techniques that effectively disperse water and that minimize the need for high levels of long-term maintenance. Temporary roads are preferred over new permanent roads. During project planning, look for opportunities to upgrade, inactivate, or decommission roads that present water routing risks and long-term maintenance problems.

3) During project planning, identify road segments in earthflow landforms that would require a higher level of inspection and maintenance, so that maintenance work can be prioritized. Road segments on steep side slopes, paralleling streams with incised inner gorges are an example where functioning ditch relief pipes are critical.

4) In identified sensitive areas, management would be prescribed that would not elevate ground water levels. Mitigate activities that would otherwise concentrate, intercept or divert water flow into unstable or potentially unstable areas by the selection of logging systems, through the silvicultural prescription, or by avoiding management activities.

5) Generally avoid ground based logging in any conditionally unsuitable (CU) areas such as areas of piping, wetlands, and areas that are influence zones to verified unstable areas. Mitigate actions by applying special harvest prescriptions, logging systems or road building techniques.

6) Streams need to be carefully defined in earthflow areas; many are interrupted with areas that go subsurface before reaching the main channel. Apply stream buffer recommendations found in the previous section of this WA iteration under Recommendations for Management in Riparian Reserves, based on site specific conditions.

SNAGS AND DOWN WOOD

Management Direction

The standards and guidelines for the matrix land allocation of the Northwest Forest Plan were designed, in part, to maintain [through time] ecological components such as down logs, snags, and large trees (ROD B-2). The Plan states that provisions for retention of snags and logs normally should be made, at least until the new stand begins to contribute coarse woody debris (ROD B-8). When the Northwest Forest Plan was implemented in 1994, the standards and guidelines for snags and down logs were “meant to provide initial guidance, but further refinement will be required for specific geographic areas” (ROD C-41). The interim guideline for down wood in the 1994 Plan was to leave 240 lineal feet of logs per acre greater than 20 inches in diameter (from the Willamette drainage north). It was further recognized that where partial harvest occurred the same basic guidelines should be applied “but they should be modified to reflect the timing of stand development cycles.” The interim guidance for snags was to provide retention within harvest units at levels sufficient to support cavity nesting bird species at 40 percent of potential population levels based on published guidelines and models. Though interim levels were published, the Northwest Forest Plan also directed the use of snag recruitment models (ROD C-46) to account for tree species, diameters, falling rates, and decay rates, in order to determine appropriate tree and snag species mixes and densities to achieve coarse wood debris (CWD) objectives. This section of the WA iteration implements the direction to further refine CWD requirements based on geographic areas.

The 1995 Layng Creek watershed analysis provided recommendations for management of snags and logs. One recommendation was to develop a process for determining levels of snags and down wood to be left in harvest units:

> *p. 128--Map ecological units to tie together information about a site using climate, soil, geology, and plant associations. Use these ecological units to develop guidelines for appropriate amounts of snags and large woody material to be left on a site. Use exams and ecology plots to refine guidelines for the number of snags and logs to be left in harvest units.*

Other recommendations in the 1995 WA specified minimum numbers of snags and logs to leave in harvest units based on plant series:

> *p.130--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.*
>
> *p.130--Retain a minimum of 4 snags per acre greater than 20" in all Douglas-fir associations.*
>
> *p. 130--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.*

Recommendations that rely on one or two specific quantities for snag or log retention on a per acre basis across a large landscape are too restrictive given the variable nature of CWD. Moreover, new methods have emerged that follow Northwest Forest Plan direction to use analytical tools (snag recruitment models etc). DecAID, the decayed wood advisor (Mellen et al, 2005), is now used to develop prescriptions for snag and down wood levels in harvest areas. This analytical process replaces the interim levels listed in the 1994 Plan and the 1995 WA recommendations regarding CWD.

In order to implement the Layng WA recommendation to use an analytical process, and in order to locally calibrate the information available in the decayed wood advisor, an inventory of snags and down wood was accomplished in Layng Creek. Inventory plots were randomly located in various landscape strata similar to the landscape areas (Figure 2). The inventory followed published methods with a total of 54 down wood transects were inventoried, and 213 snag plots, distributed among the landscape strata. As such, the results of the Layng inventory provide statistically rigorous, site-specific information on levels of CWD at both the stand-scale and across the landscape.

Levels within the natural unmanaged strata and information from DecAID help establish “reference conditions” for management purposes. The levels found within these late successional strata (both in percent ground cover and snag densities) are consistent with the findings from the western Cascades of Oregon found in DecAID (Mellen et al. 2005). The inventory and its subsequent analysis (Cox et. al., unpublished Umpqua NF report, 2005) along with published data in DecAID provide the basis for replacing the 1995 WA recommendations from page 130.

Inventory Results

Large down wood

Linear measurements of large (≥20" small end diameter) decay class 1[16] and decay class 2[17] down wood (feet/acre) tallied during the inventory are shown in Table 1 by the landscape strata. The spatial distribution of large down wood was variable, with about half of the transects in the dry and high elevation strata not having any large diameter decay class 1 and 2 down wood. The inventory in late successional stands shows that on average, the dry and high elevation late successional stands presently fall short of meeting the interim Northwest Forest Plan guidelines of 240 feet/acre (USDA 1994, ROD C-40), with the exception of the moist-site late successional stratum. Likewise, on average, the amounts of large down wood present in Layng Creek's late successional areas do not meet the 1995 WA recommendations of 300-360 feet/acre (12 or 24 pieces per acre, depending on plant association). Thus, the inventory reveals that both the Plan interim guidelines and the WA recommendations are high relative to what is present naturally in terms of lineal feet per acre in Layng Creek.

Table 2. Linear feet/acre statistics (average and 90% confidence intervals) for large (≥20" small end diameter) decay class 1 & 2 down wood in natural late successional forests of Layng Creek.

Strata	n	Percentage with no down wood	Linear feet/acre	
			average	90% CI
Dry late successional	8	50%	91	31-152
Moist late successional	8	0%	287	110-464
High elevation late successional	8	50%	104	32-177
Roadside - Dry LS	5	20%	104	50-159
Roadside - Moist LS	5	60%	42	0-84

With the adoption of DecAID, the new measure for down wood is now based on percent ground cover rather than lineal feet. Percent ground cover is a commonly used measure that best describes the abundance of down wood as it relates to wildlife use, plus it is one of the most precise and efficient means of recording amounts of down wood (Bate et al. 2002). Another important parameter that differs from the Northwest Forest Plan interim direction is the size of wood. DecAID defines coarse woody debris as everything 5 inches in diameter and greater, that is at least 5 feet long. Based on these parameters, the DecAID advisor provides ranges of CWD levels to manage within by regional habitat and structure types. The levels found in the Layng inventory with consistent with levels reported in DecAID.

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[16] Decay class 1 snags and logs as defined in this inventory have firm wood and intact bark. The down logs are supported above ground by intact branches. The snags have limbs mostly present.

[17] Decay class 2 snags and logs defined in this inventory have wood that is firm to soft, with loose and sloughing bark. The logs are sagging near the ground, and the snags have few limbs remaining and may have top breakage.

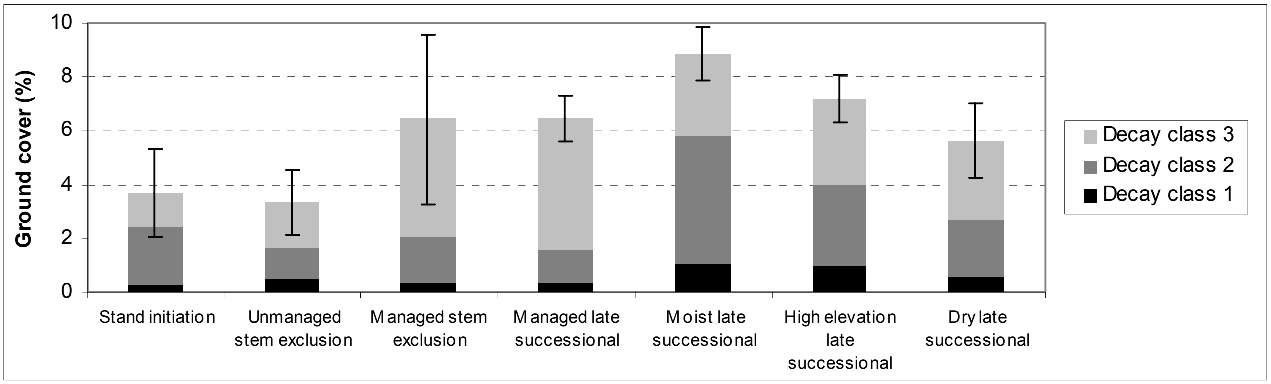

Figure 7. Average percent ground cover and 90% confidence intervals of down wood from the Layng Creek 2005 inventory.

Snags[18]

The highest density of large snags (≥20 in DBH) occurs in the natural late successional forest strata. There was no significant difference in large snag densities between the dry-site and moist-site late successional forest strata; however moist sites had slightly more decay class 1 snags. Managed plantations lacked large snags. The largest snags occurred in the moist-site late successional forest stratum, showing significantly larger diameters and taller heights than dry-site late successional forests (Table 3).

Table 3. Ninety-percent confidence intervals for average snag diameters and heights in natural late successional and stem exclusion stands in Layng Creek.

Strata	Decay class	n	DBH (inches)	Height (feet)
Dry late successional	1	89	18-22	72-90
	2	152	18-20	47-56
	3	42	23-29	19-28
Moist late successional	1	82	27-31	86-109
	2	82	23-29	65-87
	3	35	21-31	23-52
High elevation late successional	1	72	25-29	87-108
	2	59	22-26	53-69
	3	15	27-31	22-43
Unmanaged stem exclusion	1	55	14-18	63-79
	2	115	13-15	46-54
	3	72	11-13	29-37

Unmanaged stem exclusion stands had relatively high total snag densities of snags ≥10 in DBH (mean = 10.4 snags/acre), with 2.7 decay class 1 snags/acre (Figure 8).

[18] Snags were tallied if they were at least 10 inched in diameter at breast height (DBH) and at least 5 feet tall.

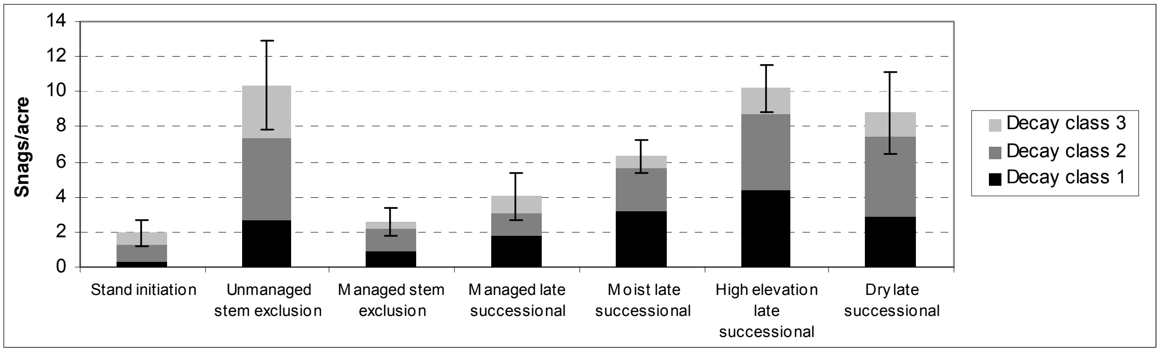

Figure 8 . Average snag densities and 90% confidence intervals for snags ≥10” DBH.

The highest density of large snags (≥20 in DBH) occurs in the natural late successional forest strata with the highest densities in the high elevations. There was no significant difference in large snag densities between the dry-site and moist-site late successional forest strata at low elevations. Managed plantations lacked large snags (Figure 9).

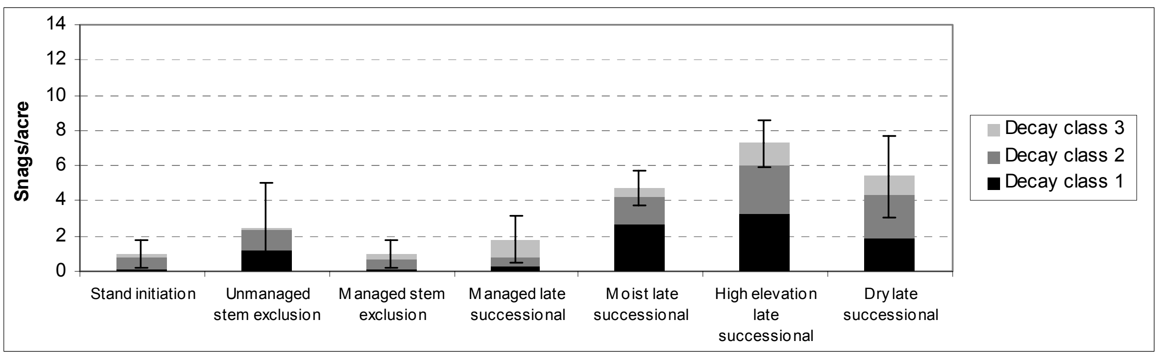

Figure 9. Average snag densities and 90% confidence intervals for snags ≥20” DBH.

Snag densities in the unmanaged stem exclusion strata in Layng Creek are consistent with the levels displayed in DecAID. As such, the inventory results function as a reference condition for establishing a range of snag densities to strive for in managed and unmanaged stem exclusion stands as they develop over the decades. Over the long run, as stem exclusion stands develop, the levels of snags would increase to levels depicted in the late successional strata, (varying with elevation and moisture regime) depending on the management they receive in the future.

Recommendations for Management of Snags and Down Wood

The following recommendations replace the snag and CWD recommendations on page 130 of the 1995 Layng Creek Watershed Analysis:

1) CWD strata developed for this inventory should be used in place of plant associations to guide management of CWD at the landscape scale. Plant associations would continue to be used at the stand scale to define successional pathways for individual stands within the landscape areas.

2) CWD inventory from the natural (unmanaged) strata and data from DecAID should be used to provide reference data for appropriate levels of CWD.

3) Stand development and CWD dynamics models, such as the Forest Vegetation Simulator and Fire and Fuels Extension (FVS-FFE) should be used to ensure timber harvest units retain

appropriate levels of CWD into the future as appropriate (e.g., one to two management rotations, etc.).

4) Retention of green trees for CWD creation should occur only if modeling indicates a need to achieve desired future conditions. Levels of retention will be variable and should be based on what is required to achieve the desired future condition, guided by the information from the inventory and DecAID (Mellen et al. 2005) and desired landscape conditions. Overall desired conditions should be defined by a desired distribution of forest structures and associated CWD potentials.

5) The preferred method of snag creation would be through the use of fire (e.g., during fuels treatments). Other methods that include the use of inoculants, tree topping, and retention of trees damaged during harvest, etc. should also be considered.

6) Future wildfires will likely be the source of future patches of high snag densities. When these events occur, the use of landscape distribution data for snags is recommended to determine appropriate amounts to leave within the landscape.

INVASIVE PLANTS

Since the publication of the 1995 Layng Creek WA, the Forest Service has placed more emphasis on invasive plants. In Layng Creek, the following management goals are based on ecological principles:

- Prevent creating conditions that favor invasive plants and maintain or encourage conditions that are resistant to colonization.
- Treat invasive plants while managing for desired vegetation.

False-brome is an invasive grass that has been expanding rapidly in the Pacific Northwest. In Oregon infestations can dominate understory and open habitats in the Willamette Valley, Coast Range, and Cascade Range from 200-3,500 feet in elevation. On the Umpqua National Forest it is only known from two core populations on the Cottage Grove Ranger District. Both populations are within the Layng Creek Watershed. A newly discovered population in Layng Creek was found at the headwaters of Junetta Creek on the slopes of Mount June. The other population is located less than 1,000 feet from Layng Creek off Forest Road 1721. This population has been expanding even with implementation of mechanical control efforts.

Populations of false-brome are known to occur in a variety of habitats including shaded understory, road edges, animal trails, open meadows, and forest edges. False-brome can successfully dominate, at the expense of native plants, infested habitats. It may alter fire regimes by increasing thatch build-up and changing plant communities from forb- to grass-dominated ecosystems.

Recommendations For The Management Of Invasive Plants

1) The highest priority for treatment in the watershed will be for new aggressive species such as false-brome (*Brachypodium sylvaticum*), with potential for significant ecological impact including but not limited to noxious weeds. Currently the best control methods for false-brome infestations involve the use of herbicide (e.g., glyphosate). Mowing and burning alone have not been successful. There has been some success with mowing, mulching, and then planting native seed. New invasive plant standards (USDA, Forest Service, 2005), added to the Forest Plan for implementation starting March 1, 2006, apply to invasive species management for the

watershed, forest, and region. The standards that directly apply to the use of herbicides include 15, 16, 18, 19, 20, 21, 22, and 23.

2) As outlined in the Layng Creek Municipal Watershed Management Plan, Vol. 1 (USDA, Forest Service, 1989) the forest would inform the City of Cottage Grove as to any proposed use of herbicides. Only herbicides acceptable to the City of Cottage Grove would be used in the watershed.

3) Other high priority treatment areas in Layng Creek will possibly include new infestations of invasive plants, high traffic locations, and sensitive areas such as roadless areas.

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