Chapter 5 - Current Conditions

Introduction

The LNS watershed is located within the western Oregon Cascades Physiographic Province. Elevations range from 600 feet near the cities of Lyons and Mehama in the western portions to 5560 feet (Battle Ax), the highest point, located on the east end of the watershed. Prominent peaks and elevations include Silver King (5242), Battle Ax (5560), Beachie (5180), and Marten Buttes (5040) on the east side; Rocky Top (5014) and Mount Herob (4212) on the south side; and House Mountain (3708), Lookout Mountains (4432), Henline (4660), Nasty Rock (4663), and Whetstone (4969) on the north side of the watershed.

The LNS was stratified into 11 SWBs which are delineated on Map No. 7. SWB acreages are displayed in Table No. 16 in the Aquatic, Water Quality, and Hydrology section. Tributaries of the LNS include Battle Ax, Opal, Gold, Henline, Dry, and Elkhorn creeks in the eastern half, and Evans, Sinker, Canyon, and Kiel creeks in the western half of the watershed.

Terrestrial

Soils

Where are the major sources of sediment from erosion, landsliding, road runoff, or other management activity located? Where do they occur and where are they likely to occur? What are the processes that affect sediment from erosion, landsliding, road runoff, or other management activity? Where have they occurred, and where are they likely to occur?

Soil development is influenced by the geology, climate, vegetation, organic matter, topography, time, and disturbance such as fire, floods, and landslides. These factors working together produced the soils present in the watershed and continue to alter soil characteristics. Past glaciation in the watershed has influenced soil development, forming steep slopes and poorly sorted shallow soils prone to downslope movement in the upper elevations. Historic fires and volcanic events covering most of the watershed have also affected soil development. Loss of organic matter, vegetative cover, and soil nutrients have periodically affected productivity and soil erosion. Forest management practices and the exclusion of fire have altered soil erosion rates and soil productivity in the past 100 years. Fragile soil conditions on federal land have been identified through the Timber Productivity Capability Class (TPCC) inventory on BLM lands and the Soil Resource Inventory on Willamette NF lands. Map No. 5 shows the locations of fragile soil conditions.

Soils in the western lower elevation portion of the watershed are relatively young and somewhat poorly developed. They consist of mostly well drained clay loams over clay soils that formed in glacial till or colluvium underlain by tuffaceous igneous rock. Some soils developed in volcanic ash or have low base saturations which affect productivity. The winters are wet and mild, summers moist, and soils generally have some moisture throughout the year depending on cover. Mid-elevation soils consist of young well drained and moderately well drained loams and cobbly loams over cobbly clay loams or cobbly loams. These soils formed in glacial till, colluvium, or volcanic ash over basic tuffaceous igneous rock. Soils in the eastern upper elevation areas are also relatively young, have poor horizon development, have low base saturation, or have formed in ash. The winters are cold and wet, while summers are moist and cool. The cooler climate resulted in slower soil formation and less soil development. Soils consist of well drained and moderately well drained shallow to moderately deep cobbly or stony loams.

General soil stability in the watershed was assessed by grouping soils into classes depending on slope and age of forest cover. Three categories were used: stable, potentially unstable, and unstable. Stable soils occur on less than 60 percent slope, or on 61 to 75 percent slopes with a forest cover greater than 10 years in age. Potentially unstable soils have slopes of 60 to 75 percent and forest cover 10 years old or less, or slopes of 76 to 90 percent and a forest cover greater than 20 years old. Unstable soils have slopes greater than 90 percent, or slopes of 76 to 90 percent and forest cover less than 20 years old. Acres of soils in each stability class are listed in Table 4 by SWB. Map 6 shows slope hazard for the watershed as a whole.

Table 4. General Soil Stability by SWB (in acres).

SWB	Unstable Acres	Potentially Unstable Acres	Stable Acres
Elkhorn Creek	653	1310	6507
Cedar Creek	275	652	5041
Dry Creek	253	640	5124
Henline Mountain	230	459	2106
Evans Creek	228	179	4727
Canyon Creek	174	43	4382
Gold Creek	120	528	6087
Opal Creek	109	367	6295
Battle Axe Creek	104	268	4928
Sinker Creek	32	79	6024
Kiel Creek	31	26	9804

1996 Flood Damage Assessment

Northwest Oregon experienced extreme rainfall during February 3-9, 1996. While some mass movement is natural, heavy snowpack in the mountains combined with record high air temperatures and rainfall resulted in rapid snowmelt. This set the stage for catastrophic flooding and landslides. The impacts were highly variable across the landscape due to the range in magnitude, duration, and intensity of rainfall over northwest Oregon. This variability resulted in widely different flood flows and effects from watershed to watershed. The LNS watershed was less severely impacted than other Cascade watersheds.

An assessment of damage to BLM lands was conducted by watershed in two phases following the storm of 1996. Phase 1 was an extensive inventory of landslides, while Phase 2 focused on regional issues and was completed on only the most severely impacted watersheds, which did not include the LNS. A Phase 1 analysis was completed on 60 percent of BLM lands in the LNS watershed, and results are presented in Tables 5 and 6. The assessment found no landslides greater than 10,000 cubic feet in size; however, private and USFS lands were not inventoried. The assessment gives a general idea of the types of problems in the watersheds and areas that may benefit from restoration activities.

Table 5. 1996 Damage Assessment for Erosion Events on BLM Lands in the North Santiam Watershed Smaller Than 10,000 Cubic Feet in Size.

Affected Item	Landslides	Gullies/Surface Erosion	Channel Migration	Large Woody Debris
Stream Channel	10	0	1	0
Road Prism	7	7	0	0
Road Culvert	2	3	1	0
Facilities	0	0	0	0
Other	0	3	0	0

Table 6. Location of Landslides in the North Santiam Watershed Resulting from the 1996 Flood.

Young Harvest Units	Old Harvest Units	Road Prism	Road Culverts	Mature Forest	Non-Harvest Forests
0	4	7	0	2	0
Young Harvest Units = 0 to 15 year old harvest units Old Harvest Units = 15 to 30 year old harvest units Mature Forests = Greater than 30 years since harvest Non-Harvest Forests = No past harvest activity within the stand.					

Table 5 indicates the features that were affected by mass movement. In the LNS watershed, streams, road prisms and culverts were the features most affected by landslides, while road prisms and culverts were most affected by gullying and surface erosion. Table 6 indicates road prisms had the highest occurrence of landslides, followed by old harvest units and mature forests.

Vegetation Patterns/Seral Stage

What is the present seral stage distribution and vegetation pattern within the watershed? How does this relate to adjacent and larger ecosystems? How do current seral stages, amounts and distribution, special habitats, and vegetation patterns influence the landscape structure, functions, and processes? What are the predominate matrices, patches, and fragments? How will land use objectives and management guidelines in the ROD, the RMP, Opal Creek legislation, and on privately managed lands influence future landscape structures, functions, and processes?

Information on vegetative conditions was derived from a variety of sources. BLM Forest Operations Inventory (FOI) records (1993) were used to depict vegetative conditions on BLM lands. Vegetative condition on USFS land was obtained from the FS Database. Vegetative condition on private lands was determined from aerial photograph interpretation using 1988 and

1993 coverages from Oregon Department of Revenue forest cover maps and from the Western Oregon Digital Imagery Project (WODIP). This information was developed for the evaluation of seral stage distribution and habitat conditions across the watershed. Estimates of vegetative cover and stand conditions are expressed as existing in the summer of 1995. Harvest and other management activities conducted since then were not evaluated in this analysis.

Approximately 88 percent of the LNS watershed are conifer types consisting mostly of Douglas-fir and western hemlock. About seven percent consist of nonforest types that include roads, quarry developments, rural residential, and agricultural lands in the watershed. Meadows, rock cliff/talus, and other natural openings in the forest environment are also included as nonforest types. A relatively small percentage (5 percent) are hardwood types consisting primarily of red alder and big-leaf maple. Map 10 shows the locations of conifer, hardwood, and non-forest types in the watershed. The watershed can be stratified into three plant association groups: western hemlock, mountain hemlock, and Pacific silver fir series.

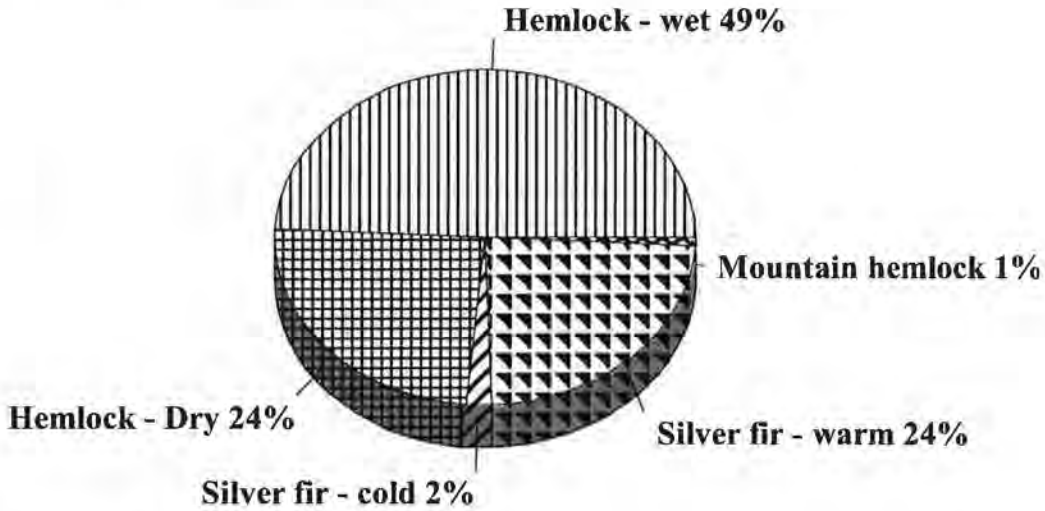

Figure 6. Plant Association Series.

Plant associations describe the potential dominant plant community (a combination of tree and shrub and/or herb layers) that would inhabit a site over time without any disturbance (Hemstrom and Logan 1986). A plant association defines a biological environment in terms of the species' composition, productivity, and response to management. Knowledge of the presence and distribution of indicator understory species further refines the biological environment, allowing us to more accurately assess site potential.

Plant associations with similar attributes have been aggregated into groups. These plant associations groups have been arranged into "sub-series" based on the broad environmental conditions in which they are found. This is a key stratification in identifying the range of structural and compositional characteristics that can be expected under natural conditions on a given site. Table 7 characterizes the relationship between series, sub-series environments, and plant associations found in this watershed.

Table 7. LNS Watershed Plant Association Series, Sub-Series, & Indicator Species.

Series	Sub-Series Environments	Understory Indicator Species in Plant Associations
Western Hemlock	Wet	dwarf Oregon grape/oxalis; Oregon oxalis; swordfern
Western Hemlock	Dry	dwarf Oregon grape; dwarf Oregon grape-salal; rhododendron-dwarf Oregon grape; rhododendron-salad; rhododendron/twinflower; vanilla leaf; dwarf Oregon grape/vanilla leaf; twinflower; rhododendron-Alaska huckleberry/dogwood bunchberry; rhododendron/beargrass
Pacific Silver Fir	Warm	vine maple/coolwort foamflower; Oregon oxalis; coolwort foamflower; rhododendron-Alaska huckleberry/dogwood bunchberry; Alaska huckleberry/dogwood bunchberry; big huckleberry/ Oregon grape; rhododendron-dwarf Oregon grape
Pacific Silver Fir	Cold	big huckleberry/beargrass; rhododendron/beargrass
Mountain Hemlock		grouse huckleberry; rhododendron; big huckleberry/beargrass; luzula

The western hemlock series is the most dominant series present in the watershed, occupying 73 percent of the landscape. The western hemlock series occur along the lower slopes and up the major riparian area of the watersheds. The silver fir series is found in the higher elevation zones, while the mountain hemlock is found on the highest ridges along the upper edges of the watershed.

In addition, mixed hardwood stands consisting mostly of big leaf maple and red alders with some Oregon white oak and Oregon ash comprise a minor component at low elevations and in riparian zones of larger order streams.

Age class distribution is an important component in describing the overall structure of the watershed as an ecosystem (Map 8). Age class distribution in the LNS has been categorized into age class bands corresponding to vegetative seral stage development. Old growth is considered 200 years and older, mature is 75 to 200 years, closed sapling is 35 to 74 years, open sapling/brush is 15 to 34 years, and grass/forb is 0 to 14 years of age. See Map 9, Seral Stage Map, and Figures 7, 8, & 9, Seral Stage Amounts by Ownership, below.

Seral Stage	Acres
Old Growth	17,302
Mature	16,667
Closed Sapling	6,943
Open Sapling/Brush	4,038
Early-Grass/Forb	1,682
Nonforest	2,734

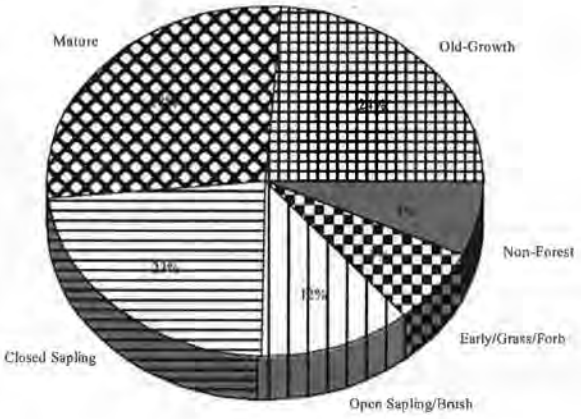

Figure 7. Seral Stage for Federal Ownership.

Seral Stage	Acres
Old Growth	69
Mature	2,573
Closed Sapling	10,310
Open Sapling/Brush	4,298
Early-Grass/Forb	3,308
Nonforest	2,233

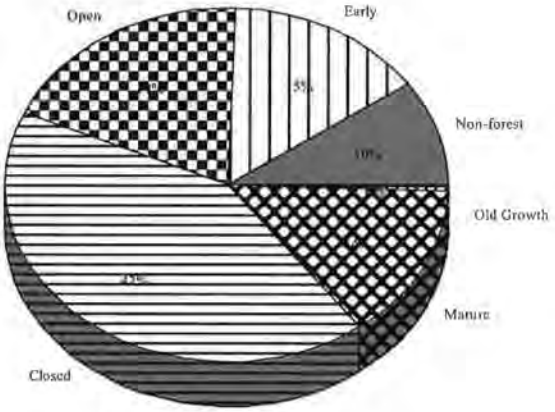

Figure 8. Seral Stage for Other Ownership.

Seral Stage	Acres
Old Growth	17,371
Mature	19,240
Closed Sapling	17,253
Open Sapling/Brush	8,336
Early-Grass/Forb	4,990
Nonforest	4,967

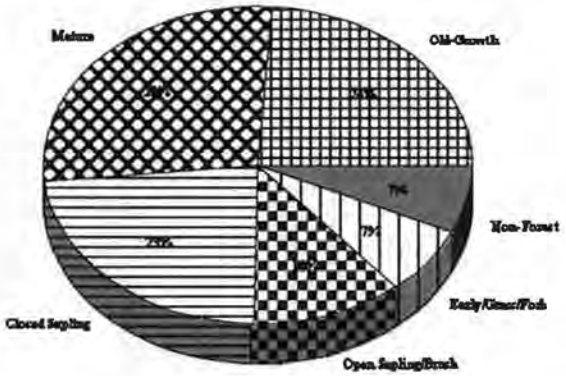

Figure 9. Seral Stages for All Lands.

The structure and pattern of vegetation or habitats within an ecosystem, such as a watershed, can be characterized in terms of patches, corridors, and a background matrix. The patterning of patches, matrix, and corridors across the landscape strongly influences the ecological characteristics, processes, and energy flows (Forman and Gordon 1986).

The term 'matrix' in landscape ecology is defined as the most connected portion of the landscape, the vegetation type that exerts the most control over landscape function (Forman and Gordon 1986, Diaz and Apostol 1992). Patches are definable vegetative types that differ in their habitat characteristics from their surroundings. Patches vary in size, shape, type, heterogeneity, and the vegetative types that surround them. The LNS exhibits considerable differences in the predominate matrix and patches, depending on location within the watershed. In the lower end, closed sapling pole stands in mid-successional stages between 30 and 70 years of age are the dominate matrix, while grass/forb, open sapling/brush, and mature forests form a patch network and secondary matrices. In the middle portion, the amount of mature forest increases and becomes the predominate matrix, while grass/forb and open sapling/brush are the dominate patches. In the upper end, mature/older forests comprise the predominate matrix. Older forests over 200 years of age are scarce in the lower half of the watershed, while forest stands in early grass/forb stages of succession are scarce in the upper end of the watershed This age class distribution follows a harvest pattern from the lower to mid elevations in the watershed over time, with the upper end remaining mostly unharvested.

Mature and older forest comprise 50 percent of the watershed. The vast majority of mature/older forests are located in the upper end of the watershed in the Battle Ax, Gold, Opal, Cedar, and Henline SWBs where they comprise the predominate matrix. Large stands of mature/older forest are found in the Elkhorn and Dry Creek SWB in the middle portion of the watershed. There is little old-growth forest in the lower half of the watershed. There are some isolated stands on BLM lands in the upper reaches of Evans Creek in the Evans Mountain CONN, and there are some stands in Kiel Creek which are approaching the old-growth condition. The largest existing patches of mature forest in the lower half of the watershed are in portions of Fawn, Fish, Salmon Creek drainages of the Evans SWB; the Big Creek CONN and the Canyon Creek drainage of the Canyon Creek SWB; and Little Sinker and Sinker Creek drainages of the Sinker SWB.

Seral stage amounts and distribution were further analyzed on federal lands and categorized by LUA. See Table 8, Seral Stage by LUA on federal lands, below. Mature/older forests comprise 69 percent of the federal ownership in the watershed. Most of the mature/older forest is in wilderness areas, SRA, WSR, DDR, and LSR. Seventy-nine percent of these LUAs are in older forest conditions compared with 24 percent in CONN and 24 percent in GFMA. Approximately 24 percent of the federal ownership in the watershed is in old-growth forests more than 200 years of age.

Table 8. Seral Stage Acreage by LUA.

Seral Stage	GFMA	%	CON N	%	SRA	%	WILD	%
Early/grass/forb	764	11%	227	5%	388	4%	135	1%
Open Sapling/brush	982	15%	761	16%	379	4%	1,243	6%
Closed Sapling	3,165	47%	858	18%	436	4%	1,950	10%
Mature	1,506	23%	2,234	47%	3,443	33%	6,858	34%
Old-Growth	51	1%	279	6%	5,353	52%	8,811	44%
Non-forest	212	3%	357	8%	353	3%	1,221	6%
Total	6,680		4,716		10,352		20,218	

Seral Stage	LSR	%	DDR	%	WSR	%	Total
Early/grass/forb	89	3%	33	5%	46	1%	1,682
Open Sapling/brush	556	17%	103	14%	14	0%	4,038
Closed Sapling	408	13%	80	11%	46	1%	6,943
Mature	797	25%	339	47%	1,490	43%	16,667
Old-Growth	1,298	41%	0		1,510	43%	17,302
Non-forest	49	2%	160	22%	382	11%	2,734
Total	3,197		715		3,488		49,366

The drainages and their associated riparian/streamside vegetation provide corridors for wildlife movement. They flow from the eastern higher elevations through the LNS to the Willamette Valley Province to the west. The higher elevation ridge top areas connecting the peaks on the southeast, east, and northeast boundaries of the watershed also serve as flow corridors. The flow of more mobile species of wildlife is from higher elevation to lower elevation in the fall/winter and to higher elevation in the spring. This corresponds to a poorly defined east/west flow across the watershed, presumably along drainages and ridgetops. Vegetation in natural corridors has been altered over time due to fire, past harvest patterns, and roads.

The proposed OCW and Scenic Recreation Area, Elkhorn WSR, Cedar Creek LSR, and the western portions of the Bull of the Woods Wilderness Area form a contiguous block in the upper (east) end of the LNS watershed. This area is connected with the Table Rock Wilderness/LSR complex to the north in the Molalla watershed and the Bull of the Woods Wilderness/LSR complex to the east in the Clackamas watershed. The area between the middle portion of the LNS watershed and the Table Rock LSR is primarily in private ownership, except for the Evans

Mountain CONN, which consists of BLM lands in the Evans SWB extending north into the Molalla River watershed. Detroit Reservoir is located 5 miles to the southeast of the watershed. Blocks of older forest designated as LSR are located to the south and east of Detroit Reservoir in the LNSR and Breitenbush drainages. Immediately to the south of the watershed is the LNSR Corridor, Mill City, and Gates. The Quartzville/Crabtree LSR in the South Santiam watershed begins 7 miles to the south of the LNSR Corridor. The Willamette Valley Physiographic Province and the cities of Mehama and Lyons are located just outside the watershed, immediately to the west. Silver Falls State Park, which contains some large blocks of older forest, lies 3 to 5 miles to the northwest. Limited connectivity between the LNS and Silver Falls State Park is provided by private lands and scattered BLM lands in Abiqua Creek.

Special Habitats

A special habitat is a habitat that has a function not provided by plant communities and successional stages (Brown et al. 1985). Special habitats are usually nonforest types such as meadows, wetlands, rock outcrops, cliffs, and talus slopes.

The predominate special habitats in the LNS are those associated with rock outcrops, cliffs, dry ridgetop meadows, and talus slopes. These features are abundant throughout the upper half of the watershed. Some of the more significant special habitats of this type are in the vicinity of Henline Mountain, Nasty Rock-Burnt Mountain, Whetstone Mountain, Battle Ax-Mount Beachie, Phantom, Rocky Top, Mount Herob, and House Mountain. In addition to rock outcrops, cliffs, dry meadows, and talus slopes, there are a limited number of small ponds and wet areas in the vicinity of these peaks. Most of these areas are relatively undisturbed because of their location and the ruggedness of the terrain.

There are a number of special habitats associated with small lakes in the LNS. The most significant lakes include Opal and Elkhorn Lakes, which have wet areas associated with them. These areas tend to have high human use due to their proximity to roads and popularity for camping and hiking.

Standing Dead and Coarse Woody Debris (CWD)

Data from inventory plots and stand exams were used to estimate the amount and condition of standing dead and down CWD across the watershed. Estimates of the amount and condition of standing dead were used to estimate existing percent of potential cavity dwelling wildlife populations. Estimates show that the LNS is between the 40 to 50 percent level; however, there is considerable variation in the amount and quality of standing dead material across the watershed. In the lower portions of the watershed, standing dead material is scarce, and estimates indicate that the habitat for cavity dwelling wildlife populations is limited. The standing dead component was found to consist mostly of smaller material in more advanced stages of decay. In the upper portion of the watershed, the existing percent of potential cavity dwelling wildlife habitat approaches 80 percent, which is highly viable.

Estimates of the amount and condition of CWD was compared to the NFP standard of 240 lineal feet per acre of hard material over 20 inches in diameter. The amount and condition of down logs follow a similar pattern to standing dead material, with the good quality material in the upper end and a lack of high quality material in the lower portions. Estimates show that there is less than 30 percent of the NFP standard in the lower portions of the watershed. In many cases, most of the

larger material is in the more advanced stages of decay.

The amount and quality of standing dead and CWD were found to be limited in the lower half of the watershed, especially larger material in the earlier stages of decay. This large, harder material will persist longer than softer material in advanced stages of decay. This material is important for nutrient capital and future habitat for cavity dwelling wildlife species.

Habitat Quality

Harvest patterns and natural disturbance in the past have created a mosaic of seral stages across the watershed. Where an older forest patch is surrounded by younger age classes, the edges of the patch exhibit environmental conditions that are different from the interior of the patch. As the amount of open area and edge increases, habitat quality declines for species associated with older forest and improves for species that are associated with edge and open areas. The amount of interior older forest in relation to the amount of total older forest habitat gives some indication of the quality of existing older forest habitat and the influence of edge effects. Edge on existing older forest was modeled to determine the amount of interior older forest and the influence of the edge effects. As a result of this analysis, it was found that 65 percent of the existing 36,500 acres of older forest is considered to be in the interior forest condition. The majority of remaining interior older forest is found in the upper half of the watershed. Extensive stands of interior forest are found in the Gold, Opal, Elkhorn, Cedar, Dry, Battle Ax, and Henline SWBs. The largest patches of interior forest in the lower half of the watershed are found in Fawn Creek (Evans SWB); Little Sinker (Sinker SWB); Big Creek and Canyon Creek (Canyon Creek SWB).

Road locations were then mapped to estimate the effect of roads on existing interior older forest habitat. This analysis indicates that much of the older forest in the lower half of the LNS is further fragmented due to edge effects created by existing roads. By contrast, there has been little fragmentation of older forest stands in the upper half of the watershed due to roads. Edge effects here are primarily due to non-forest types and some past harvesting.

Inputs from the age class analysis were used to calculate the habitat effectiveness for cover quality (Hec) using the Wisdom model (Wisdom et al.). There is an estimated 33 percent optimal cover, 18 percent thermal, and 25 percent hiding cover in the LNS. The Hec is currently at .50 which is viable for elk. Cover quality in the watershed follows a similar pattern as interior forest habitat, with the upper end in a highly viable condition. Cover quality declines toward the lower end, where the Hec is near .30, which is limiting for elk.

Roads and Transportation

How are roads influencing water quality, watershed condition, native plant communities and wildlife habitat quality, and effectiveness?

The existence of roads has obvious physical effects on the ecosystem. The land area taken up in roads does not contribute to forest habitats. Runoff from roads causes changes in water quality that affects aquatic and semi-aquatic vegetation and wildlife. The existence of roads causes edge effects and micro climatic changes that affect plant communities and wildlife. In addition, open roads and road maintenance activities cause disturbance effects resulting from increased traffic and human intrusion. Roads also facilitate the spread of noxious weeds and exotic species.

There are approximately 328 miles of road on all ownerships within the watershed. The average total road density across all ownerships in the LNS watershed is estimated at three miles per section. Road densities range from a low of less than one mile per section in the Battle Ax, Opal, Gold, and Henline SWBs, to a high of over five miles per section in the Evans and Sinker SWBs. Maps 11 & 12 (Transportation and Generalized Road Control) show the location of the roads by ownership and control.

There are several gates in the watershed which limit public access in the lower to middle portions of the watershed. Approximately two percent of the total road miles in the watershed are effectively closed. An additional 17 percent are at least seasonally closed with gates. Open (accessible) road densities across the watershed are presently estimated at 2.35 miles per section, which is considered to be moderate. However, open road densities vary widely across the watershed. Open road densities are high in the Kiel, Sinker, and Evans SWBs and low in the Battle Ax, Opal, Gold, Henline, and Elkhorn SWBs.

Inputs from the road density analysis were used to derive habitat effectiveness for open road densities (HEr) indices using the Wisdom model. The HEr index is a measure of the impact of roads on elk habitat quality. The average HEr for the entire watershed is currently at or near 0.45, which is viable for elk. The HEr is marginal to limiting in the Evans, Sinker, Kiel, and Canyon Creek SWBs.

Of the 328 total road miles in the watershed, 136 miles are on federal lands (41%). Average total road density on federal lands is estimated at 1.75 miles per section. Open (accessible) road densities on federal lands average 1.5 miles per section, which is considered to be low to moderate. The HEr for federal lands is currently at or near .6, which is viable for elk. Open road densities on federal lands are highest in the Evans and Sinker SWBs.

Special Status/Special Attention Species

What SSSA are known or suspected to occur in the watershed? How will land use objectives and management guidelines in the ROD, Salem District RMP, Willamette NFP, Opal Creek legislation, and on privately managed lands influence future habitat for these species?

Plants

There are two known populations of BLM special status plant species in the LNS watershed. Based on a literature review of the habitat requirements of the SSS known to occur in the province, a list of potential species has been identified for the LNS Watershed and its special habitats (Appendix D). This list includes Federal Endangered, Federal Threatened, Federal Proposed Threatened, and Bureau Sensitive Species.

Aster gormanii, Gorman's aster, is a Bureau Species of Concern and a candidate for federal listing as a Category 2 species (USFWS 1993). It is also a candidate for listing by the Oregon State Department of Agriculture and is considered by the Oregon Natural Heritage Data Base (1993) to be threatened throughout its range. As of 1994, 63 populations have been reported in the region, all restricted to a narrow geographic range within the western Cascades and high Cascades physiographic provinces. This range is 50 miles north to south and 30 miles east to west. This known range is characterized by steep and rugged topography, and it is unlikely that