Lookout Point Watershed Analysis Update

August, 2012

Introduction

The Lookout Point Watershed Analysis was prepared by personnel of the old Lowell Ranger District in 1997, so this analysis is now about 15 years old. In that time considerable new information has come to light and some conditions have changed. Additionally, the original WA contained some misinformation, or the watershed conditions are better understood now. There is also a new land management project proposed in this watershed (the Outlook Landscape Diversity Project) the analysis of which would be facilitated by this watershed update. In addition to updating current conditions, this reanalysis updates the list of recommendations. Specific conditions or occurrences creating the need for this update include:

- vegetation growth which has changed the conditions of the 28% of the watershed consisting of young stands created by past regeneration harvest,
- a better understanding of the fire history of the area,
- the presence of a new invasive plant species, false brome,
- reintroduction of Chinook salmon and bull trout into upstream watersheds,
- construction of additional infrastructure elements such as cell phone towers and fiber optic lines, and
- continuing deterioration of road conditions.

The 1997 "Lookout Pont Watershed Analysis Area" document covered only the 49,638 acres of federally owned lands within the 100,000+ acre Lookout Point Reservoir Fifth Field watershed, which is one of nine within the Fourth-Field Middle Fork of the Willamette River watershed. This update will also address only the National Forest portion of this watershed. Some 60,000 acres of BLM and privately owned lands occur in the lower portions of the full 5th Field watershed, which include the Lookout Point dam and the lower half of the associated reservoir, the Dexter dam and reservoir, the Lost Creek drainage, and the communities of Dexter and Lowell. The Federally owned portion of the Lookout Point watershed includes the upper half of Lookout Point Reservoir, a state highway and Union Pacific Rail Road right-of way, a Bonneville Power Administration power line corridor, the Middle Fork Ranger Station, and a total of almost 1000 acres of private land in about 12 separate parcels. Several of these parcels contain private residences, but most contain industrial forest lands.

The original watershed analyses were done to comply with a requirement of the Northwest Forest Plan (UDA/USDI, 1994, pages B-20 and C-3). That requirement was based upon perceptions that 1) there was generally a poor understanding of watershed conditions and

functions, and 2) there were watershed-specific criteria on which to base a determination of appropriate no treatment riparian buffer widths. All watershed analyses used a set format presented in a document titled Ecosystem Analysis at the Watershed Scale (USDA/USDI, 1995). This update will roughly follow that format; the WA contains five chapters titled respectively I. Characterization (a general description of the watershed), II. Issues and Key Questions (uses and values of the watershed and those elements most relevant to management questions); III. Reference and Current Conditions (reference refers to conditions of the watershed before habitation and management began); IV. Interpretation (a synthesis of the previous information); and V. Recommendations (actions that could move the watershed towards reference conditions or management objectives).

The following individual specialists participated in this update:

- Doug Larson, fisheries biologist
- John Dixon, hydrologist
- Molly Juillerat, botanist
- Dick Davis, wildlife biologist
- Tim Bailey, forester
- Alie Richards, fuels technician
- Jose Mercado, assistant fuels management officer
- Zeke Langum, road engineer
- Terry Godin, archaeologist; cultural reousrces
- Karl Dietzler recreation planner

Each of these individuals has prepared a short report on the changes related to their resource, except for Cultural Resources, for which the 1997 WA did not require updating. These reports follow the same general format used in the original watershed analysis. These reports are attached below, in the order shown. Additional recommendations resulting from this update follow the specialist reports. The recommendations also include a new Appendix that presents the rationale for the need to thin young management created stands within riparian reserves.

A. Forest Vegetation and Fire History

B. Wildlife

C. Recreation

D. Hydrology

E. Botany

F. Roads

G. Fisheries

H. Fuels

I. Recommendations

Lookout Point Watershed Analysis Update –

Middle Fork Ranger District
Willamette National Forest

Forest Resources Report

prepared by Tim Bailey - Forester
February, 2012

Introduction

This report covers the forest vegetation aspects of this Watershed Analysis (WA) update, primarily relating to growth and conditions of the approximately 14,000 acres of managed second-growth stands created by past even-aged harvest, and the fire history of the area. As expected, the young stands have grown considerably in the 15 years since the 1997 WA was completed. Conditions in the 33,000 acres of mature and old-growth stands have not appreciably changed in the last 15 years, but a clearer understanding of the history of these stands has developed. The conditions discussed below are based upon an extensive field reconnaissance of the area during the summer of 2011. Non-forest vegetation conditions are addressed in the Botany Report.

There is some overlap between this report and the Fuels report relating to fire history, fire regime, and fire regime condition class. Since the fire regime this landscape has been subjected to has had a profound influence on the conditions of forest vegetation, it is addressed here.

Vegetative Reference Conditions

The 1997 Lookout Point Watershed Area Analysis (WA; USDA, 1997) used the year 1900 to characterize reference conditions. It is unclear why that time was chosen, as by 1900 settlement in and around this area was well on its way, and any effects Native American cultural practices may have had on this landscape had been absent for at least 50 years, and probably longer than that. The WA said (page 44) that in 1900 nearly half the watershed was occupied by stands in the understory re-initiation phase (81 to 200 years of age), and only seven percent of the area contained old-growth stands (greater than 200 years in age). This cannot have been the case since about half the area is now occupied by stands in the understory re-initiation stage. This extensive area of now 95 to 120 year old trees would have been from several to less than 20 years old in 1900, and would have been in the stand initiation stage of forest development. The 1997 WA also said there were about 3,300 acres of late-successional or old-growth stands (forests greater than 200 year in age) in 1900. However, the area now contains about 7,300 acres

(15%) of old-growth stands; these stands are all old enough now that they would have been considered old-growth in 1900, and a considerable percentage of the 14,000 acres of current plantation area contained old-growth forests in 1900. It should also be noted that the 1997 WA used a different convention for describing seral stages than used in this update; it used the more silvicultural characterization of stand initiation, stem exclusion, understory reinitiation, and late-successional/old-growth. This analysis uses a seral stage characterization (see table below) roughly based on that used in USDA, et. al., 2005 ; early seral, mid-seral, late-seral, and old-growth, that better facilitates determination of fire regime history and wildlife habitat values and characteristics.

However inappropriate the year 1900 may be for characterizing reference conditions of this watershed, it would be very difficult, given the fire history of the area discussed below, to say what reference conditions were much before 1900 since the last large fire event erased much of the obvious indications of previous forest seral stage distribution, and any indications or physical signs of historic fire occurrence specific enough to facilitate determination of when exactly fires previous to the 1900 era occurred. It is likely that 150 or 200 years ago most of this area was occupied by stands greater than 200 years of age, but it is very difficult to determine the areal extent of such stands.

Much of the 28 percent of the area which has been harvested in the last 50 years was occupied by old-growth forest prior to harvest, as evidenced by the large remaining stumps and large down logs that remain in these young stands. During the first several decades of this harvest history, forest harvest activities were largely focused on old-growth stands because they contained the highest volume and quality of lumber, and there was also an impression that old-growth stands were declining in growth and volume quality due to decadence.

Reference and Current Seral-Stage Distribution

Time Period	**Non-Forest: Altered**	**Non-Forest Vegetation**	**Early Seral**	**Mid-Seral**	**Late Seral**	**Old - Growth**	**Total Watershed**
Reference Conditions – 1900 - acres	500	718	25,000	920	2,000	20,500	
percent	(1)1%	1 %	50%	2%	4%	42%	
Current Conditions – acres	2,484	718	2,240	11,571	25,343	7,282	
percent	5%	1.4%	4.5%	23%	51.1%	14.6%	49,638

(1) Likely some agricultural fields developed in the Middle Fork Of the Willamette River bottom

Non-forest – altered = features that either are not vegetated or contain vegetation atypical of natural, native conditions, such as the reservoir surface, Highway 58, and the railroad and power line right's-of-way;

Non-forest vegetation = meadows, marshes, rock outcrops, talus slopes, brush fields;

Early-seral = forests less than 20 years old without a closed canopy - stand initiation stage;

Mid-seral = forests from 20 to 80 years of age - stem exclusion stage

Late-seral = forests from 80 to 200 years of age - understory re-initiation stage;

Old-growth = forests greater than 200 years of age, typically with complex structure (high amount so dead wood, deep crowns, multiple canopies).

As more fully discussed below, most of the early-seral forests are very close to canopy closure and will be transiting to mid-seral conditions within the next 5 or 10 years.

Second-Growth Plantation Current Conditions

The watershed contains about 14,000 acres (28%) of young managed stands from 10 to 50 years of age. With a very few exceptions, these stands were artificially regenerated after clearcutting. The 1997 WA posed Key Questions concerning how much land is available for timber harvest in Matrix and LSR lands (Vegetation Issue questions #1 and 5, pages 19 and 20). The answers included mature stands in Matrix lands. Since all such stands in this area are 100 years of age or older, and there currently is an unofficial prohibition of harvest in stands greater than 80 years of age (due in part to the suspected presence of red tree voles in stands exceeding that age), this analysis update will address only plantation stands in regard to available acreage for harvest.

The 1997 WA identified a total of about 1,700 acres of commercially sized plantations that need to be thinned in all land allocations. Recent field reconnaissance for the up-coming Outlook Landscape Diversity project indicates this acreage has increased by a factor of three; there are now about 5,200 acres of plantations that could benefit from commercial thinning (see the Outlook Silvicultural Prescription for a discussion of the purpose and need for commercial thinning). These stands are scattered more or less evenly across the watershed area, with the exception of the unroaded areas in the vicinity of Hardesty Mountain and Sawtooth Rock. About 70 percent of these acres occur within the Late-Successional Reserve, which includes all lands south of Highway 58 and some north of the river in the lower portions of the Burnt Bridge Creek drainage. Thinning of these 5,200 acres will be included in the NEPA analysis and decision that will ultimately result from the Outlook project.

The increase in thinnable acreage is a direct result of continued tree growth on these generally very productive forest sites. This growth has also resulted in a similar decline in early-

successional forest acreage, since virtually no regeneration harvest has occurred in this area over the last ten years, and little on the last 15 years. At this time the area contains only about 2,200 acres of early-seral stands, less than one tenth the acreage 100 years ago. All early-seral stands were created by past regeneration harvest, since there have been no wildfires of any significant acreage in the last 50 years. This early-successional acreage is only a fifth of the amount reported in the 1997 WA. The continued growth which has occurred in young stands has major implications for the quality of big game habitat in the area, which is addressed fully in the Wildlife Report. Furthermore, most of this acreage will transit to mid-seral (closed canopy) conditions within the next 5 to 10 years, since there has been essentially no regeneration harvest, wildfires, or any other stand regeneration event since the 1997 WA was completed.

The 1997 WA does not contain any specific information on reference and current conditions of snags and large wood in second-growth stands. Many of those stands, particularly those greater than 30 years old, contain moderate to large amounts of large down woody material as a result of low log merchantability standards at the time of harvest. Younger plantations may have very low levels of large wood due to more recent contract requirements for unmerchantable material to be removed to landings. Most of the young stands older than 20 years contain moderate to large amounts of small diameter down wood (generally no larger than 6 inches in diameter) as they are currently in the stem exclusion stage due to inter-tree competition.

Fire Stand Current Conditions

The fire stands discussed here are those formed after the extensive fire events around 1890 discussed below, and generally reflect the late-seral conditions in the table above. The 1997 WA mentions (on page 65), almost in passing, that snags and large down wood levels in natural stands are “suspected” to be low due to a combination of fire history and salvage operations. There is little on-the-ground evidence and no records that indicate mature stands in this area experienced extensive and/or especially intensive salvage activity, though several hundred acres of stands of this age were thinned about 25 years ago. Many, if not most, of these 95 to 120 year old stands contain low to nearly non-existent amounts of large down wood due to the fire history described below. In many cases these levels are considerably lower than those found in the managed plantations.

Reference conditions for large down wood in late-seral stands is difficult to characterize since the amount of that seral class in 1900 is thought to have been small, and since the fire history in this area has resulted in removal of evidence of the conditions of such stands over 100 years ago. The selection of the 1900 reference time is also problematic in relation to the large wood conditions of these stands, which would nearly all be in the early-seral stage condition in 1900. Depending upon the exact timing of the second fires discussed below, these young stands may have had very large amounts of snags and large wood, or very little if the second fires had consumed that material before 1900.

Fire History

Another vegetation-related Key Question (Vegetation Issue, question #2, page 19) posed in the 1997 WA related to historic fire occurrence and whether this type of disturbance should be reinitiated. While the 1997 WA says a "significant amount of stand replacement fire occurred in the late 1800s to early 1900s" in this area, (page 65), it concluded (page 102) that "approximately 75% of the watershed….. were [sic] open woodlands and prairies prior to European settlement", and "Vegetation was a savanna-like association of oak woodlands…. and grasses", implying a frequent, low intensity historic fire regime. No evidence of such forest conditions resulting from frequent, low intensity fire was noted during the field reconnaissance in 2011. However, there were extensive stand replacement fires around the turn of the 20th century; nearly half the forested area of this watershed is occupied by even-aged stands about 100 years old, resulting from the last wildfire events. None of these 100+ year old stands have been observed to contain legacy trees or structure indicative of open woodland conditions.

The 1997 perception of a frequent fire regime was apparently influenced by the extensive occurrence of historic fires between 1930 and 1950. Most of these fires were human-caused, resulting primarily from railroad use and maintenance. None of these fires were very large; most burned between the river or Reservoir and Highway 58. Since that period of time, technology has greatly reduced the occurrence of railroad related fires (personal conversation with Randy Green, Middle Fork District Assistant Fire Management Officer and participant in preparation of the 1997 WA). The 1997 WA did not answer the question of whether frequent fire should be reinitiated in this area. The following narrative explains why I believe this characterization of the fire history in this area is inaccurate, and will answer the question of the need to reintroduce frequent fire in the negative.

The Lookout Point landscape has experienced considerable and complex fire activity over the last 150 years, at least in terms of the area affected by the last fire events. It appears that multiple, relatively severe fires (in terms of vegetation mortality) burned across this landscape from approximately 150 to 95 years ago, resulting in a bit less than 50 percent of the watershed being occupied by more or less even-aged and uniform forests ranging in age from 90 to 130 years. I infer these historic fires from the age of the stands which regenerated after the fires, and secondarily from charred wood remnants on old tree stubs and the forest floor, and in some cases old scars on still living trees. Stand replacement fire, that which kills most or all the trees existing before a given fire event, is relatively easy to map using crown characteristics (generally texture and color) indicative of younger, dense, and even-aged stands. When such fires burn, they certainly also involve some amount of ground fire or underburning outside of stand replacement burning that kills few to no overstory trees in areas not affected by severe fire. After some time passes, the extent of such ground fire is exceedingly difficult to quantify or map. This discussion in large part addresses only the stand replacement component of this fire regime, at least in quantitative terms, since only that component of the historic fire regime can be easily and accurately quantified through mapping.

Assuming that most of the harvest occurring in the last 50 years (some 14,000 acres, or 28 percent of the project area) was concentrated in old-growth stands, the remainder of the area was composed of late-successional or old-growth stands that typically survived the successive fire events, or in rare cases escaped the fires altogether. This assumption is supported by the fact that until the late 1980s harvest generally did not occur in stands less than 100 year old in order to let these younger stands grow and accumulate more volume. Harvest at that time was focused on old-growth forests due the perception that it was decadent and needed to be converted to a younger, more thrifty forest. The size of stumps in most of the younger plantations also supports the assumption that most of the young stand acreage was old-growth prior to harvest. Old-growth stands remaining in this area generally survived the last fires due to their topographic position, either in the lower portions of deeply incised drainages, on mid-slope benches, or on northern slopes in the heads of drainages.

Acreages of mature fire stands and old-growth should be considered to be very approximate, as the boundary between old-growth and mature stands is in many cases not especially distinct, and considerable, somewhat arbitrary judgment was used in drawing stand boundaries. Between pure old-growth stands along drainages and pure second-growth stands near ridge tops, a band of mixed aged forest occur. These stands contain at least two age classes resulting from a mid-slope band of partial mortality from the last fire. There are also scattered patches of forest around 200 year of age, those just beginning to acquire typical old-growth forest characteristics. These stands apparently survived the fire events 100 years ago, though they certainly underburned with some degree of overstory mortality. These stands were about 100 years old when the last set of stand replacement fires occurred in this area. Stands of that age can survive wildfire due to lower fuel loading, on topography that moderates fire behavior, or due to weather conditions or the timing of the fire event.

Double Burning

Many, if not most, of the generally 100 year old fire stands appear to have burned at least twice in relatively rapid succession between 1860 and 1915, based upon the lack of structure (in terms of large snags or down wood) from the previous stand. This “double burning” phenomenon is known to occur (USDA, 1995; Agee, 1990) and in fact appears to be quite common in southern portions of the Willamette National Forest; there are numerous, large stands from 90 to 150 years old throughout this Ranger District that exhibit a similar lack of structure from the previous stand. This fire occurrence resulted in creation of 100 year old stands with little to no dead wood structure on up to 50 percent of the Lookout Point watershed within the Forest boundary. Large diameter down tree stems are known to persist as obvious structural features for several centuries or longer (Maser, et al., 1984), unless they are consumed by fire.

The occurrence of relatively large remnant tree stubs (none associated with a down stem and nearly all containing some amount of charred wood) indicate that most of these stands were occupied by older forests prior to the last fire events. It is difficult to determine the full extent of

this multiple fire occurrence since such structures cannot be seen with aerial photography and to accurately map such cryptic structural characteristics would requires years of ground-based reconnaissance on densely vegetated and often very steep slopes. But in fact only a handful of 100 year old stands have been found which appear to have burnt only once in the last 150 years, despite extensive reconnaissance. These stands do contain abundant obvious snags and large down wood from the stems of large trees that would be expected to occur within stands resulting from only one stand replacement fire event.

Some have expressed doubt or disbelief that stand replacement fires can burn back to back, so-to-speak. Some believe that there would not be adequate fuel to carry the second fire; or that standing snags are not especially flammable. A stand replacement fire in the Douglas-fir ecosystem on the west slope of the Cascade Mountains creates a huge fuel loading; little of the forest aside from the dead ground fuels and sometimes the tree foliage is consumed during the first fire. While fire does not carry in a forest of standing dead trees immediately after the event due to the lack of fine fuels, course fuels such as snags can burn once they begin to deteriorate, if ignited, but they generally do not provide for fire spread. A new forest developing under the snags generates abundant fine fuels, especially so if the natural, and very flammable, conifer regeneration is abundant. This creates a fine fuel bed that is added to as the tops of the dead trees deteriorate and fall to the ground. These second fires were carried by the dense young stands of conifers, and typically occur from 10 to 25 years after the first fire that resulted in the initial regeneration.

There are few vegetation types more flammable when conditions are dry than a dense stand of young conifers with a considerable amount of dead branches and tree tops on the ground and abundant deteriorated snags. If a fire starts in such a fuel mixture (dense young conifers under 60 to 100 tons of standing and down, somewhat deteriorated dry wood), it is likely to burn with an intensity that would not be seen in an older stand with less fuel and more shaded fuels. The dense young conifers provide for rapid fire spread, and the large amount of dead and deteriorated large wood provides for an intense and long duration fire that can consume most dead wood on such sites.

The 100 year old fire stands resulting from repeated fire events over a relatively short period of time tend to be even-aged and relatively uniform, but they are generally not as dense as the stands that developed after only one fire, since there would likely be fewer seed trees existing after the second fires; less available seed results in a somewhat more sparse second regeneration. Some of these fire stands do contain two slightly different age classes since they can contain some to a few trees that regenerated after the first fire but survived the second fire. The older cohort is typically only 10 to 30 years older than trees which regenerated after the second fire, but they tend to be considerably larger since they grew free of competition for a considerable period of time after the second fire. Such two-aged stands are typically found on terrain features such as benches or generally gently sloped ground that may have moderated fire behavior enough to allow some young trees to survive the second fire.

Fire Regime

Fire regime is not a stand or slope concept; it is typically applied to a larger landscape such as the Lookout Point watershed, or larger. An individual stand or slope may miss being affected by any given large, landscape-scale fire event, or it can be affected by multiple smaller fires while the rest of the landscape is unaffected. The fire regime concept refers to the average frequency or interval, and the severity (or lack thereof) with which natural fires have occurred on a landscape. Given the large area covered by the last major fire event in this area, it is difficult to make conclusions about what the average natural fire regime might be. These last fires have to a large extent removed or obscured any natural records of previous fires. The overall distribution of age classes appears to have been established by just two major fire episodes; one about 100 years ago and another event about 300 plus years ago – the one that regenerated the stands that grew to become the old-growth stands remaining in this area.

It would be easy to conclude, especially if the effectiveness of the last 90 years of fire suppression is discounted, that the natural fire regime is one of high severity but low frequency (fire regime IV B or C; USDA, et. al., 2005). I believe a low frequency stand replacement fire regime was likely the one occurring in this area for at least the last several centuries, given the fact that most of the natural stands which have developed since the last fire event contain stubs of relatively large trees from the previous stands, indicating that those stands had more or less an old-growth stature. This implies a long enough interval passed between stand replacement events to regenerate old-growth forests.

The conclusion of an infrequent fire regime may appear to be at odds with the two to several successive fires over the relatively short period of time described above. I still characterize the double burn scenario as permutation of an infrequent fire regime since, in the span of time relating to a forest's potential maximum age, those two or more fires burn over a relatively short period of time, and they are related in the sense that the first fire set the stage for the second. If such clustering of fires occurs repeatedly across a large watershed, as is evidenced by a similar stand structure occurring across this large District, and there are long intervals between these clustered fires, the cluster over a short period of time can be thought of as a single event in the scope of how forests develop on the landscape.

Again, this discussion primarily addresses stand replacement fire history; the old-growth stands in this area, both those killed by the last fire events and those which survived, could have experienced periodic, or even frequent ground fires, the obvious evidence of which disappeared due to the effects of the last fire or the growth of understory vegetaiton. A frequent ground fire regime could very well have operated on the south facing slopes north of the river/reservoir, but such a regime becomes less likely on the northerly slopes given their relatively lush nature. Certainly much or most of the remaining old-growth in this planning area experienced non-stand replacement fire during the last events, so there was a low severity ground fire component to this regime.

However frequent ground fires may have been on this landscape, they do not appear to have had much influence on overstory tree density, implying they were on the low end of the mixed severity scale. Therefore it would be most accurate to characterize the natural fire regime in this area as mixed severity with a fire return interval somewhere in the neighborhood of 100 years (fire regime III B or C USDA, et. a., 2005), since there have not been any large, stand replacement events (the type where suppression is not very effective) for at least the last 100 years. As such, there is probably no need at this time to reintroduce stand replacement fire into this area, but there may well be a need to reinstate a ground fire regime. While there is now and there will be an increasing need for early-successional habitats in this area to provide for the full range of vegetative diversity and wildlife habitat, the sue of prescried fire to achieve that potential need is problematic. Stand replacement fire can be uncontrollable and to a large extent unpredictable. It would be very difficult, if not impossible, to use such a powerful but imprecise tool to create early-successional habitat without risking creating much more than desired, or the loss of equally valuable old-growth habitat.

Fire suppression has been occurring to one extent or another in this area since the early 20th century, but may not have been particularly effective or aggressive early on. The 1997 WA said (page 103) that by 1900 (the reference conditions date used) fire suppression had been in effect for 60 years. This is not at all the case; the settlement of Oregon had hardly begun in 1840, and what settlement had begun was focused in the lower Willamette Valley, some tens of miles or more from this watershed. Early settlement activities tend to involve the use of fire to clear land more than its suppression. Fire suppression policies or infrastructure did not exist in the mid nineteenth century; the National Forest System was not created until 1905, and there was no concerted fire suppression policy on National Forest lands until after the huge landscape fires of 1910 in northern Idaho and Montana. Concerted, organized fire suppression organizations and efforts did not begin until sometime after that.

Has fire suppression been effective enough to have modified or prevented the historic occurrence of fire in this area in the last 90 years? However one views the effectiveness of fire suppression, it is generally true that suppression efforts are more successful in limiting the amount of ground or understory fire than they are for limiting the extent of stand replacement fire once it starts. Once fires burn severely enough to generate enough heat to kill or consume the canopy of a forest of very tall trees, suppression efforts are usually not very effective, nor is it even safe to attempt effective fire suppression activities with such extreme fire behavior. Suppression of low severity ground fire is much less difficult and more likely to be successful. It is also quite likely that suppression of small ground fires prevented fires from developing into stand replacement events at a later date, something that was probably fairly common before fire suppression began.

The Fire Regime Condition Class is a measure of whether or how much the current fire regime has departed from the natural or historic fire regime (USDA, et. al., 2005). A Condition Class of 1 means the fire regime is within or near the historic range, resulting in a low risk of losing key ecosystem components from uncharacteristic fire behavior. A Condition Class of 3 indicates the

fire regime has departed from the historic frequency by multiple return intervals, resulting in dramatic changes in potential fire size, intensity and severity due to a build-up of fuels. Wildfire in this situation can entail a high risk of losing key ecosystem components; for example old-growth trees. This buildup of forest fuels would have been reduced if periodic ground fires had occurred. Since the stand replacement fire regime in this area is one of medium frequency, it's condition class is now a 1, but to the extent that the low intensity component of the mixed severity regime may have been attenuated, this area could be trending toward a Condition Class of 2, resulting in a moderate risk of losing key ecosystem components during the next fire event.

Without more information and a better understanding of the historic underburning regime, it is not possible to say whether the current fire regime has departed markedly from the historic regime; unfortunately such information no longer exists. In terms of the last landscape-scale event some 100 plus years ago, it is quite doubtful that was a departure from the natural fire regime at that time since it happened before fire suppression commenced. It can be confidently assumed that such an extent of stand replacement fire in this landscape is within the range of the natural fire regime.

There is some lore regarding Native American occupation in this area, and their use of fire. The area does contain some considerable evidence of past Native American use, but most of that is concentrated along the river bottom, most of which now exists at the bottom of Lookout Point Reservoir. Evidence and historic accounts of frequent, low intensity fire associated with Native American presence occurs in other portions of the Middle Fork District, and it very well could be that this area saw such use pre-historically, but from what I have seen of the structure and ages of the upland vegetation in this area, the effects of fire use by Native Americans in this specific landscape, if it occurred at all, was likely confined to the valley bottom where most settlements appeared to have been located.

This fire history based on stand age and structure necessarily covers only the last 200 years or so. Little can really be inferred from physical evidence as to how long this regime has persisted on this landscape. Subtle indications of past fire occurrence such as charcoal deposition in lake or bog sediments can tell if and when fires burned in the general vicinity of a landscape, but they cannot tell very much of how extensive those fires may have been, or the patterns they created on the landscape. There only two such studies that have been conducted with-in 100 miles of this area (Sea and Whitlock, 1994; and Walsh, et. al., 2010). It is certainly possible that the fire regime in this area varied as the climate varied. Certainly at the height of the last glaciation, the vegetation and the resultant fire history of this area was very different than now. It is possible that more recent climate fluctuations such as the Medieval Warming period (AD 800-1100), or the Little Ice Age (AD 1300-1650) had a accelerating or depressant effect on fire occurrence and behavior in this area.

Characterization of a fire regime from only the last 200 years of known activity certainly has a degree of uncertainty in terms of using that snapshot in time to characterize an overall fire

regime that may have been operating on the landscape for up to several millennia. It cannot be said with any certainty whether the phenomenon of repeated fires or reburns described above is a common occurrence in this area, though such a fire regime that results in fairly uniform mature stands with low levels of large wood from the previous stands has been seen in a number of landscape-scale drainages on this Ranger District up stream of the Lookout Pont watershed (for example, Devils Canyon Creek and Hemlock Creek area, Cayuse Creek/Fisher Creek, Chucksney Mountain, and Dartmouth Creek in the North Fork watershed; the entire south facing slope of the Salt Creek Watershed; the Eagle Butte Creek area of the Salmon Creek Watershed; the south slopes of the Larson Creek drainage in the Hill's Creek Reservoir watershed; and the Pioneer Gulch/Emigrant Creek areas of the Upper Middle Fork watershed).

It should also be noted that there may be long-term cycles or occurrences that would not be at all apparent from a relatively short exposure snapshot of stand ages and evidences of fire occurrence. While there are occasional individual trees or small groups of older trees, most if not all the relatively even-aged and contiguous old-growth forest stands in the southern end of the Willamette National Forest are no older than about 450 years. This implies a very large, regional fire or series of fires that affected vast amount of forest lands some 500 years ago, and such observations cover a large part of the western Cascades (as Franklin in Spies and Duncan, 2009, page 251, also implies). If fire occurrence patterns include millennia scale variations, it is essentially impossible to fully and accurately characterize the full extent of fire history in given area since there is no evidence remaining of fire occurrence and extent on this landscape past about 400 years ago. Given the potential for future climate change, fire regimes occurring 500 or 1000 years ago may be of no particular relevance to today's functioning of the forest.

Fire Regime Reference and Current Conditions

As discussed above, the current fire regime of a relatively infrequent, mixed severity fire, as best we can say with the scant information available, has not likely changed in the last 100 or 200 years, aside from the likelihood that the underburning component of this regime has essentially been eliminated during the last 60-80 years.

Literature Cited

Agee, J.K., 1990. The historic role of fire in Pacific Northwest Forests. In Natural and Prescribed Fire in the Pacific Northwest. Walstad, J.D., Radosovich, S.R., and Sanberg, D.V. (eds.) Oregon State University Press, Corvallis, Oregon.

Maser, C., J. M. Trappe, S. P. Cline, K. Cromak, Jr., H. Blaschke, J. R. Sedell, and F. J. Swanson, 1984. The Seen and Unseen World of the Fallen Tree. Pacific Northwest Forest and Range Experimental Station, UDA Forest Service General Technical Report PNW-164, March, 1984.

Sea, D,S., and C. Whitlock. Postglacial Vegetation and Climate of the Cascade Range, Central Oregon. Quaternary Research 43, pgs. 370-381. December, 1994.

Spies, Thomas A., and S. L. Duncan, 2009. Old Growth in a New World – A Pacific Northwest Icon Reexamined. Island Press, Washington, D.C., 2009.

USDA/USDI, 1994. Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. USDA Forest Service and the USDI Bureau of Land Management. April, 1994.

USDA/USDI, 1995. Ecosystem Analysis at the Watershed Scale, Version 2.1 (The Revised Federal Guide for Watershed Analysis), Review Draft. United States Department of Agriculture and United States Department of Interior, Portland, Oregon, March 24, 1995.

USDA, 1997. Lookout Point Watershed Analysis Area, Lowell Ranger District, Willamette National Forest. September, 1997

USDA, USDI, USGS, and TNC, 2005. Interagency Fire Regime Condition Class Guidebook, Version 1.2. USDA Forest Service, UDAI Bureau of Land Management, USDI Fish and Wildlife Service, USDI National Park Service, US Geographical Service, and The Nature Conservancy http://ccc.frcc.gov/docs/1.2.2.2/Complete_Guidebook_V1.2pdf. May, 2005.

Walsh, M. K., C. A. Perl, C. Whitlock, P. J. Bartlein, and M.A. Worona, 2010. An 11,000-year-long record of fire and vegetation history at Beaver Lake, Oregon, central Willamette Valley. Quaternary Science Reviews 20, pgs. 1093-1106, January, 2010.

Lookout Point Reservoir Watershed Analysis 2012 Update: Wildlife Habitat/Species Section:

Prepared by Richard F Davis / Middle Fork Ranger District Wildlife Biologist
GIS analysis and mapping by Cheron Ferland / Middle Fork Ranger District Assistant Wildlife Biologist
August 2012

Introduction

This Lookout Point Reservoir Watershed Analysis update is based on a combination of habitat modeling, GIS mapping/analysis, aerial photo interpretation, field reconnaissance/ground truthing, and new species/site-specific information. Terrestrial habitats and species associated with the following categories are addressed in this update: Threatened, Endangered, and Sensitive (TES) species – northern spotted owl and USFS Region 6 sensitive species; Deer/Elk (Big Game) Habitat; Dead Wood (Snag and Down Wood Habitat); Management Indicator Species (MIS); and Survey and Manage species (S&M).

TES Species

Northern Spotted Owl

The northern spotted owl (NSO) is currently managed under a recovery plan revised in 2011 (USFWS 2011c). The Revised Recovery Plan builds extensively on the 1992 Draft Recovery Plan for the Northern Spotted Owl, the 1994 Northwest Forest Plan, and the 2008 Recovery Plan for the Northern Spotted Owl. This Lookout Point Reservoir Watershed Analysis update provides a revised assessment of NSO and their habitat within the watershed. The update is based on current approaches to identifying nest sites and surrounding habitat. The following definitions are used to classify NSO habitat in relation to structural characteristics, as well as site-specific spatial characteristics.

> ***Suitable habitat*:** Consists of forested stands used by spotted owls for nesting, roosting and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60-90%); a multi-layered, multi-species canopy with large overstory trees (with dbh of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly. This habitat is described as *nesting and roosting habitat* in the revised northern spotted owl recovery plan (USFWS 2011c, p. A-10).
>
> Foraging habitat generally has attributes similar to those of nesting and roosting habitat, but such habitat may not always support successfully nesting pairs (USFWS 2011c, p. A-10). Together, these comprise suitable habitat in this document.
>
> ***Dispersal habitat***: At a minimum, dispersal habitat consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USFWS 2011c, p. A-10). It is comprised of conifer and mixed mature conifer-hardwood habitats with a canopy cover greater than or equal to 40 percent and conifer trees greater than or equal to 11 inches average diameter at breast height (dbh) with open space beneath the canopy to allow spotted owls to fly. Generally, spotted owls use younger stands to move between blocks of suitable habitat, roost, forage and survive until they can establish a nest territory. Juvenile owls also use dispersal habitat to

move from natal areas. Dispersal habitat thus includes habitat that will provide some roosting and foraging opportunities during the colonization phase of dispersal, but not at a scale that would support nesting pairs (in which case it would be classified as suitable habitat).

Suitable habitat can also function as dispersal habitat as it supports both territorial and dispersing spotted owls. However, in this document, dispersal habitat generally refers to stands that are 40-79 years old.

Unsuitable habitat: Refers to land which may or may not be capable of growing NSO habitat, and does not currently function as either suitable or dispersal habitat.

Known Owl Site: A site that was or is occupied by a pair or resident single as defined by the survey protocol (1990-2011). The specific site location is determined by the unit biologist based on the best and/or most recent information. A known site may be determined to be inactive only in accordance with the current survey protocol (USFWS 2011b).

Predicted Owl Site: An area able to support resident spotted owls (i.e. a potential breeding pair) as determined by the USDI et al. (2008) northern spotted owl occupancy template. This is used for determining effects to spotted owls where survey data are insufficient.

Nest Patch (or Stand): 300 meters (radius circle) around a known or predicted owl site, where a spotted owl would be likely to select a nest tree. This is based on habitat usage of spotted owls within the Central Cascades Study Area, located on the Willamette National Forest.

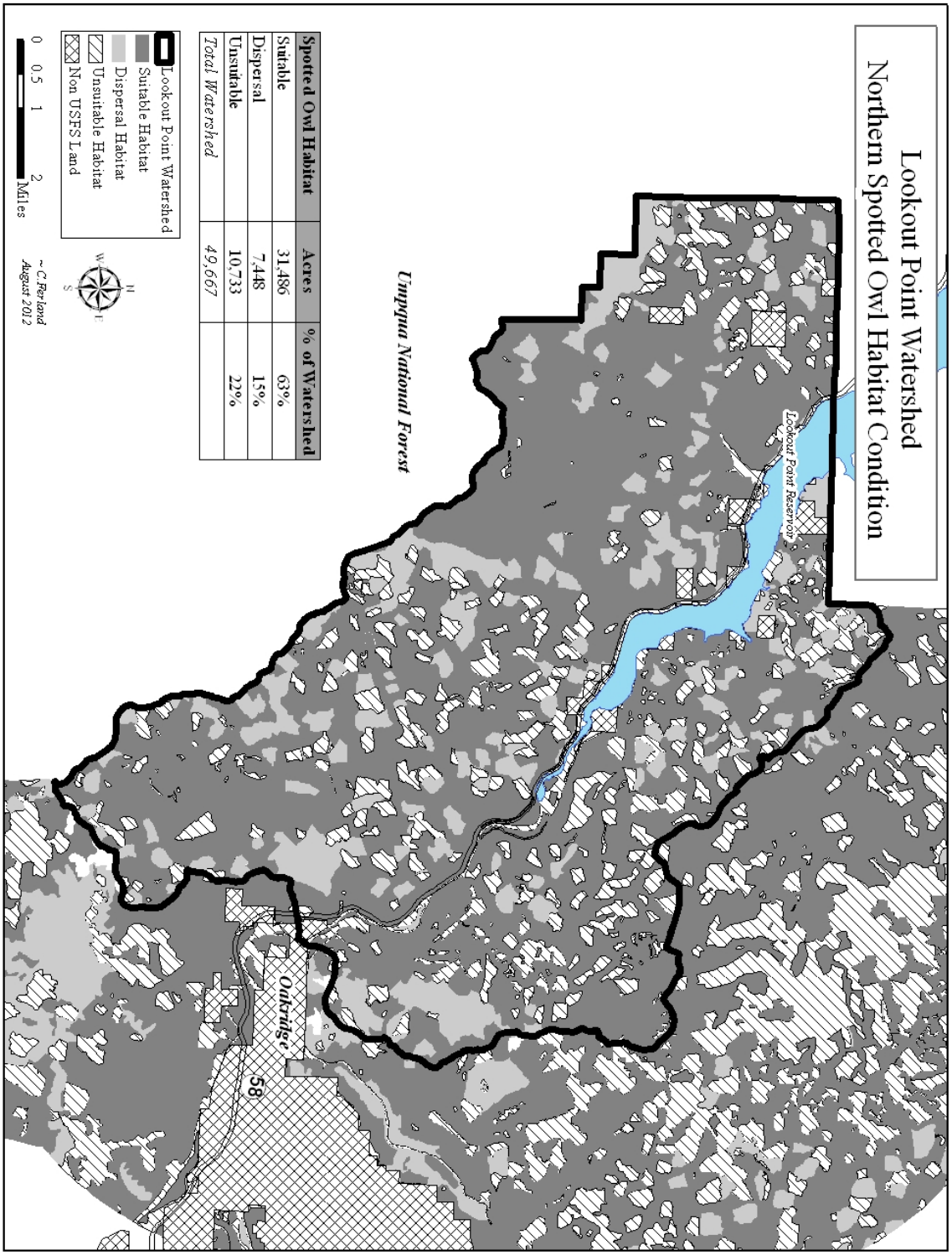
***Core Area*:** 0.5 mile (radius circle) around a known or predicted owl site, which delineates the area most heavily used during the nesting season for nesting, foraging and rearing young. Bingham & Noon (1997) defined the core area as that portion of a northern spotted owl home range that received disproportionately high use for nesting, roosting and access to prey; they suggested that 60-70% of owl reproducing season activity occurred in about 20% of the home range. Although Courtney et al. (2004:5-5) observed that core area sizes varied greatly among owls, it has been determined that Bingham & Noon (1997), Wagner & Anthony (1999), Franklin et al. (2000) and Irwin et al. (2004) collectively suggested a core area of about 500 acres.

***Home Range*:** An estimated area for habitat use of a spotted owl pair. For the Oregon Cascades, this estimate is 1.2 miles (radius circle) around a known or predicted owl site (Thomas et al. 1990, USDI et al. 2008) and is also referred to as the Provincial Home Range in this document, since other provinces have different estimates for home ranges (USDI et al. 2008).

The current condition for NSO habitat within the watershed is displayed in Figure 1. The 1997 watershed analysis recognized that NSO habitat mapping did "not accurately represent field conditions" (page 113). It did however state that suitable NSO habitat represented about 56% of the watershed. The approach taken in 1997 to address dispersal habitat is no longer applied, and recommendations made related to that are no longer warranted. Mapped NSO habitat was revised for this update. The update reveals an ingrowth of dispersal and suitable habitat as stands throughout the watershed have developed over the past 15 years while timber harvest that removed NSO habitat essentially came to a halt. Suitable habitat currently represents about 63% of

the watershed, with dispersal at 15% and unsuitable at 22%. About five percent of the unsuitable is composed of land not capable of developing into NSO habitat, and consists of features such as reservoir surface, highway, railroad, and power line right-of-ways.

Figure 1. Current condition of NSO habitat within Lookout Point Reservoir Watershed.



Spotted Owl Habitat	Acres	% of Watershed
Suitable	31,486	63%
Dispersal	7,448	15%
Unsuitable	10,733	22%
Total Watershed	*49,667*	

The 1997 analysis addressed 22 NSO sites across the watershed, with 7 sites in matrix and 15 in LSR allocation. This update is based on 2011 NSO site data which includes 21 sites within the watershed (7 matrix, 14 LSR). Habitat condition within territorial home ranges for each of the NSO sites is characterized in Table 1. Dispersal habitat is almost exclusively a result of forest stands recovering after harvest activity. Unsuitable habitat is largely a result of previous harvest activity in addition to private lands, infrastructure, and a minor amount of natural meadows. Future activities that affect NSO habitat should avoid adverse effects to NSO habitat within established nest patches.

Table 1. Current habitat conditions related to known or predicted northern spotted owl (NSO) nest sites within the Lookout Point Reservoir Watershed.

NSO Site #	Nest Patch				Core Area				Home Range			
	300m radius / 70 acres				0.5 mi radius / 503 acres				1.2 mi radius / 2,895 acres			
	Unsuitable	Dispersal	Suitable	% Suitable	Unsuitable	Dispersal	Suitable	% Suitable	Unsuitable	Dispersal	Suitable	% Suitable
220	0	23	46	66%	28	179	296	59%	425	540	1860	64%
1010	4	0	66	94%	65	33	405	81%	686	410	1799	62%
1025	14	0	56	80%	121	33	349	69%	710	533	1652	57%
1034	0	21	49	69%	2	87	414	82%	9	284	1717	85%
1035	14	0	56	79%	109	108	286	57%	543	795	1496	53%
1040	0	7	62	89%	74	146	283	56%	517	606	1772	61%
1041	0	0	70	100%	56	5	442	88%	218	253	1707	78%
1042	2	0	68	97%	48	21	434	86%	327	273	1987	77%
1325	0	0	70	100%	20	109	373	74%	471	427	1956	68%
2872	23	1	46	66%	89	83	332	66%	970	381	1415	49%
2873	17	0	53	76%	180	0	323	64%	964	258	1539	53%
2876	0	5	65	93%	5	72	425	85%	274	225	2381	82%
2880	4	0	66	94%	36	220	248	49%	334	935	1626	56%
2893	0	1	68	98%	40	124	338	67%	543	475	1877	65%
3058	0	0	69	99%	72	77	350	70%	536	564	1720	59%
3549	7	5	58	82%	43	47	390	77%	765	491	1544	53%
3943	0	0	70	100%	0	92	411	82%	159	528	1490	68%
3944	1	0	69	99%	60	100	343	68%	543	753	1573	54%
4083	1	0	69	99%	71	54	378	75%	451	655	1789	62%
4391	18	0	52	75%	122	3	377	75%	892	111	1892	65%
4542	0	2	68	97%	32	56	414	82%	298	166	2206	76%

There are a limited number of non-USFS acres in two core areas and nine home ranges that are considered "unsuitable" for analysis purpose. Percent suitable for five home ranges that extend beyond Willamette NF boundary is based on Willamette acreage for this analysis update. Shaded cells represent core or home range conditions which currently fall below 50% or 40% suitable thresholds which represent "fitness thresholds" within core areas and home ranges respectively. Suitable habitat conditons below these thresholds warrants concern for owl pairs to maintain reproductive productivity.

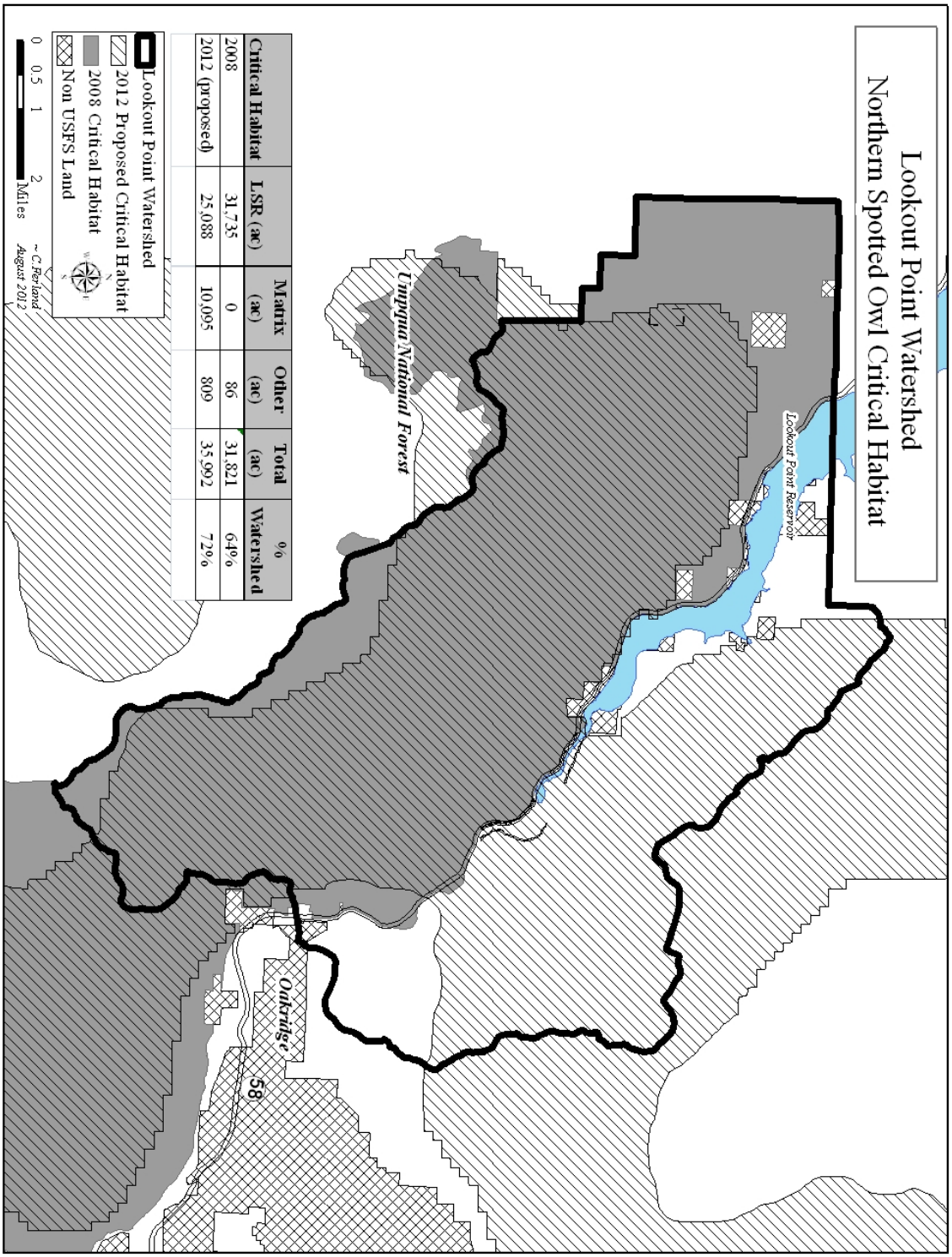
Northern Spotted Owl Critical Habitat

Legal Status: on January 15, 1992, the US Fish and Wildlife Service designated critical habitat for the spotted owl on 6,887,000 acres. On June 12, 2007, the Service issued a proposal to revise the existing designation of critical habitat for the spotted owl (USFWS 2007d). On August 13, 2008 the Service re-designated critical habitat for the spotted owl on approximately 5,312,300 acres of Federal lands in California, Oregon, and Washington (USFWS 2008b). On March 8, 2012, in compliance with an order from a US District Court, the US Fish and Wildlife Service announced a science-based revised critical habitat proposal for the northern spotted owl. This proposal has undergone a public review process to determine what forest lands should be designated as critical habitat in the final rule which is expected to be published in November 2012.

The 1997 analysis addressed NSO critical habitat (page 81; Map 26) under the 1992 designation. Current (2008) critical habitat covers more of the watershed (64% / 31,821 acres) than the 1992 version (62% / 30,431 acres).

Under 2012 proposed critical habitat the amount of the watershed under designation would increase to 72% (35,992 acres) and would include a significant portion of the watershed under Matrix allocation (10,095 acres). Figure 2. displays current and proposed NSO critical habitat relative to the watershed.

Figure 2. Current and proposed NSO critical habitat within the Lookout Point Reservoir Watershed.



USFS Region 6 Sensitive Species

This section provides updated information for sensitive terrestrial fauna listed in the 2011 Region 6 Regional Forester's Sensitive Species List with documented or suspected occurrences on the Willamette National Forest. Table 2 summarizes habitat requirements and known or suspected occurrence in the Lookout Point Reservoir watershed for each listed species. The bald eagle and peregrine falcon were listed as threatened and endangered respectively under the Federal Endangered Species Act (ESA) when the 1997 watershed analysis was written. Bald eagles were delisted under ESA in 2007 and peregrine falcons were delisted in 1999, and these two species will be listed as sensitive throughout their respective mandatory delisted monitoring timeframes. Four of the 25 current sensitive species are also candidate species for listing under the Federal ESA, and are indicated as such in Table 2.

Table 2. Summary of Ecological Requirements for Animal Species on the Regional Forester's Sensitive Species List (December 2011) for species with documented or suspected occurrence on the Willamette National Forest – including specific occurrence knowledge for Lookout Point Reservoir Watershed.

Species	Habitat
Bald Eagle *Haliaeetus leucocephalus* *Status: Sensitive* *ESA delisted 2007*	Bald eagles use scattered old-growth conifer trees in proximity to open water near rivers, lakes, and reservoirs with plentiful prey. They feed primarily on fish, but will also eat waterfowl and carrion. On the Middle Fork R.D., they currently nest along and between Hills Creek and Lookout Point Reservoirs, as well as at three known locations near lakes in the High Cascades. **Occurrence:** confirmed nest sites (3) south of reservoir
American Peregrine Falcon *Falco peregrinus anatum* *Status: Sensitive* *ESA delisted 1999*	Preferred nesting sites for peregrines are sheer cliffs 75 ft. or more in height having horizontal ledges or small caves. Foraging is associated with a variety of open and forested habitats however is most closely associated with riparian settings. Numerous potential nest sites and occupied territories occur on the Middle Fork R.D. **Occurrence:** confirmed sightings, nesting unconfirmed but suspected
Bufflehead *Bucephala albeola* *Status: Sensitive*	Buffleheads summer on wooded lakes and rivers and winter on lakes and coastal waters. Nesting normally occurs near lakes in tree cavities 5-50 feet high. They are a diving duck that eats small mollusks, fish, snails, crustaceans, and aquatic insects. Winter sightings are common along reservoirs. Sightings during the breeding season are not uncommon at some Middle Fork R.D. locations such as Gold Lake, and nesting activity is suspected at sites associated with numerous high elevation lakes. **Occurrence:** suspected transient
Harlequin Duck *Histrionicus histrionicus* *Status: Sensitive*	During nesting (April-June), adults require fast-flowing water with midstream loafing sites nearby, dense shrub or timber/shrub mosaic vegetation on the bank, and an absence of human disturbance. Harlequins nest on the ground under shelter of vegetation, rocks, or large woody debris in close proximity to water. Broods prefer low gradient streams with adequate macroinvertebrate abundance. Breeding and foraging is known to occur along portions of the North and Middle Forks Willamette River, as well as Salmon, Salt, Fall, Little Fall Creek, and Hills Creeks on the Middle Fork R.D although sightings have become very rare in the past 10 years. **Occurrence:** two observations, 1990's - suspected transient

Yellow Rail *Coturnicops noveboracensis* *Status: Sensitive*	Feeds in shallow water, eating snails, insects, and some seeds and grasses. Summers on wet meadows and marshes. Winters on grasslands, fields, coastal marshes. No documented occurrence on Middle Fork R.D. **Occurrence:** unlikely – not suspected
Northern Waterthrush *Seirus noveboracensis* *Status: Sensitive*	There are a limited number of sightings or vocal detections of northern waterthrush on the Middle Fork R.D. The species' distribution in Oregon is very limited. Typical habitat for the Northern Waterthrush is riparian thickets in forests near rapidly flowing water. On occasion it will use dense vegetation at the edges of lakes. They nest on the ground or in a hole in a stream bank. Their diet is mostly aquatic and terrestrial insects, spiders, mollusks, small fishes, and snails. Waterthrushes winter primarily in Mexico, Central America, and northern South America. **Occurrence:** unlikely – not suspected
Black Swift *Cypseloides niger* *Status: Sensitive*	Black swifts are found near wet cliffs in mountainous regions. They feed on-the-wing eating flying insects. They nest in small colonies on ledges or mountain crevices associated with waterfalls. There are historical summer records in the Santiam Pass area, Linn County, which suggests breeding in that area. Salt Creek Falls is the only documented nest site on the Middle Fork R.D. **Occurrence:** unlikely – not suspected
Purple Martin *Progne subis* *Status: Sensitive*	There are no records of purple martin on the Middle Fork R.D. Purple martins nest in tree cavities, crevices in rocks, and artificial cavities located near open habitats such as savannah forestlands and meadows for foraging. They are often also associated with open water. They nest both singly and in colonies. Martins eat mainly flying insects and lepidopterans. **Occurrence:** unconfirmed – low potential
Lewis' Woodpecker *Melanerpes lewis* *Status: Sensitive*	There are limited records of Lewis' woodpecker on the Middle Fork R.D. These involve observations occurring outside the breeding season and are most likely associated with dispersing or migrating individuals. This woodpecker is associated with open forests, often at lower elevations. It nests in Oregon in white oak woodlands, ponderosa pine woodlands, mixed oak-pine woodlands, and cottonwood riparian woodlands. Lewis' woodpecker are weak primary cavity nesters and most often secondary cavity nesters. In spring and summer, they eat mostly insects and spiders. In the fall, their diet turns to acorns and berries. They cache acorns under bark and in crevices of trees. **Occurrence:** unlikely – not suspected
White-headed Woodpecker *Picoides albolarvatus* *Status: Sensitive*	There are occasional reports of white-headed woodpeckers on the Middle Fork R.D., mostly at high elevations adjacent to the Pacific Crest and east-side forests where it is more typically found. The species is mainly associated with ponderosa pine or ponderosa pine-mixed-conifer forests. Sightings on the Middle Fork R.D. have occurred in mixed-conifer habitat with lodgepole pine, western white pine, and Engelmann spruce components. It requires large trees for foraging and snags for nesting. Its diet varies seasonally. In spring and summer it easts mostly insects, but in winter and early spring it mainly feeds on seeds of ponderosa pine. **Occurrence:** unlikely – not suspected

North American Wolverine *Gulo gulo luscus* *Status: Sensitive* *Federal Candidate*	Found primarily in wilderness or remote country where human activity is limited. High elevation areas appear to be preferred in summer. In winter wolverines may move to lower elevations which are snowbound and/or have very limited human activity. They are capable of foraging widely (30-40 km) on a daily basis. Heavy use of openings with good winter populations of big game - a principal source of carrion which makes up much of the wolverine's diet. They also feed on marmots, snowshoe hares, various rodents, insects, insect larvae, eggs, and berries. Between 1965 and 1999, 33 sightings or evidence of wolverine were reported on or adjacent to the Forest boundary – including on the Middle Fork R.D. These sightings are generally classified as unconfirmed by researchers. The likelihood that the species is still present in this portion of its historic range has been **Occurrence:** unconfirmed - unlikely – not suspected
Fisher *Martes pennanti (West Coast)* *Status: Sensitive* *Federal Candidate*	Fisher are considered a riparian associate but are found in a wide variety of densely forested habitats at low to mid-elevations. Their diet consists of small and medium-sized forest mammals (porcupines, snowshoe hares, tree squirrels, mice, and voles most common). They also eat carrion, and will seasonally eat birds, bird eggs, amphibians, fish, and insects. They use ground burrows, tree cavities, witches brooms or other clumped growth, or occasionally bird or small mammal nests as resting sites. Tree cavities are used by most maternal females with young and ground burrows are used mostly in winter. Data suggests they do better in areas with minimized fragmentation of old growth, second-growth, and riparian habitat, and in areas with abundant down and standing dead woody material important. Between 1979 and 1999, nine fisher sightings were reported on the Middle Fork R.D. These sightings are generally classified as unconfirmed by researchers. The likelihood that the species is still present in this portion of its historic range has been questioned, and is considered to be low. However fisher presence was confirmed based on one survey detection within the past decade on the Diamond Lake RD/Umpqua NF immediately south of the Willamette NF. **Occurrence:** unconfirmed - unlikely
Fringed Myotis *Myotis thysanodes* *Status: Sensitive*	Fringed myotis is considered a riparian associate related to mixed-conifer forests having relatively dry moisture regimes. They have been documented using buildings plus rock crevice, cave, and live tree/snag habitat. Very little is known about wintering habits. They forage on moths, leafhoppers, lacewings, daddy-longlegs, crickets, flies, true bugs, and spiders. Since 1983, there have been at least 34 documented occurences on the Middle Fork R.D. **Occurrence:** suspected
Townsend's Big-eared Bat *Corynorhinus townsendii* *Status: Sensitive*	Within the western U.S. Townsend's big-eared bats have been reported in a variety of habitat types ranging from sea level to 10,000'. Habitat associations include: coniferous forests, mixed mesophytic forests, deserts, native prairies, riparian communities, active agricultural areas, and coastal habitat types. Throughout their range, distribution is strongly correlated with the availability of caves and cave-like roosting habitat, including abandoned mines. It has also been reported to utilize buildings, bridges, rock crevices, and hollow trees as roost sites. Summer maternity colonies range from a few individuals to several hundred individuals. They are moth specialists with over 90% of their diet composed of lepidopterans. Only one site known to support a maternity colony has been documented on the Willamette National Forest. That site is on the Middle Fork R.D. within an abandoned structure. Single individuals have also been documented at at least 12 other sites on the district. **Occurrence:** confirmed - limited

Pallid Bat *Antrozous pallidus* *Status: Sensitive*	Pallid bats are usually associated with desert areas in Oregen, however they do occur in the drier interior valleys of west and southwestern Oregon. Occurrence has been documented in brushy/rocky terrain along the edges of conifer, deciduous, and open farmland habitat. They would most likely occur at low elevations adjacent to the Willamette Valley (Lowell area). They are gregarious - living in colonies of 12-100 individuals. They day roost primarily in trees and rock crevices. Night roosts have been found in abandoned mines, rock overhangs/crevices, and deserted buildings. Little is known about their winter hibernacula. They are insectivorous feeders. There has been no documentation of this species on the Willamette National Forest. Incidental locations have occurred historically west of Eugene. **Occurrence:** suspected - limited
Foothill Yellow-legged Frog *Rana boylii* *Status: Sensitive*	Foothill yellow-legged frogs live in sections of low-gradient streams with exposed bedrock or rock and gravel substrates. They attach their eggs to the bottom of quiet scour-pools or riffles in gentle-gradient streams, often where there is only slight flow from the main river. Hatchlings cling to egg masses initially and then to rocks. Known locations are largely associated with sightings on private land adjacent to the Sweet Home R.D. There is suspected occurrence on the Middle Fork R.D. in Fall Creek watershed. **Occurrence:** two observations, early 1990's – limited potential
Oregon Spotted Frog *Rana pretiosa* *Status: Sensitive* *Federal Candidate*	Oregon spotted frogs favor lakes and slow moving streams associated with a permanent water source having a soft and muddy bottom. They are a marsh specialist with strong preference for warmer waters; more aquatic than other ranids. They are often found in water or on the water's edge floating on the surface or resting on aquatic vegetation. Their diet is invertebrates caught above and below the surface. They are early breeders: egg massess are typically deposited on top of one another in a communal fashion, not attached to vegetation, and deposited in warmer shallow water, making them suseptible to mortality due to freezing or drying. One documented population on the Middle Fork R.D. occurs in the Gold Lake Bog Research Natural Area. **Occurrence:** unlikely – not suspected
Pacific Pond Turtle *Actinemys marmorata* *Status: Sensitive*	Pond turtles inhabit marshes, sloughs, moderately deep ponds, and slow moving portions of creeks and rivers. They have been observed in altered habitats including reservoirs, abandoned gravel pits, stock ponds, and sewage treatment plants. They occur from sea level to about 6,000'. They require basking sites, such as partially submerged logs, vegetation mats, rocks and mud banks, and may even climb a short way onto tree branches that dip into the water. They use uplands for egg laying, overwintering, and dispersal. They may move up to 1,500' and possibly more for overwintering where they burrow into leaf litter or soil. Nest areas are often adjacent to water but have been found as far away as 1,500'. Most nesting areas are characterized by sparse vegetation, usually short grasses or forbs. Known populations occur along and between Lookout Point and Hills Creek Reservoirs on the Middle Fork Willamette River, as well as locations in the watershed above Hills Creek Reservoir on Middle Fork R.D. and one adult turtle has been spotted on Kwis Kwis Road within the Salt Creek Watershed (2008&2009). **Occurrence:** confirmed – known population
Mardon Skipper *Polites mardon* *Status: Sensitive* *Federal Candidate*	Mardon skipper are currently known to exist at seven, small, geographically disjunct areas in Washington, Oregon, and California. In the southern Washington Cascades, the Mardon skipper is found in open, fescue grasslands within Ponderosa pine savanna/woodland habitat at elevations ranging from 1900' to 5100'. South Cascade sites vary in size from small, ½ acre or less meadows, to large grassland complexes, and site conditions range from dry, open ridgetops, to areas associated with wetlands or riparian habitats. Within these environments a variety of nectar source plants are important. The short, open stature of native fescue bunchgrass stands allows mardon skippers to access nectar and oviposition plants. There are no known populations of this species on the Willamette NF. **Occurrence:** unlikely – not suspected

Johnson's Hairstreak *Callophrys johnsoni* *Status: Sensitive*	Johnson's hairstreak are but documented on the Willamette National Forest. The current overall range is uncertain. It is considered to be very localized and scarce with few "big" years. This butterfly depends on coniferous forests that contain mistletoes of the genus *Arceuthobium*. The mistletoe occurs mainly on western hemlock and occasionally true firs. Peak conditions for this butterfly exist in old-growth and late-succesional forests. Younger forests that contain dwarf mistletoe may also have the potential to support populations. Elevation ranges from sea level to 6,000 feet. Species typically spend much of their time in the forest canopy. No Hairstreak have been documented on the Middle Fork R.D. but there is one detection close to the district boundary on Chucksney Mountain. **Occurrence:** unconfirmed – low potential
Crater Lake Tightcoil *Pristiloma arcticum crateris* *Status: Sensitive*	Crater Lake Tightcoil may be found sparsely distributed throughout the Oregon Cascades above 2000' elevation associated with perennially wet environments in mature conifer forests and meadows among vegetation or under rocks and woody debris. Suitable habitat is limited to within 33' (10 meters) of perennially wet environments generally in areas under snow for extended periods during winter. There are no documented sites on the Willamette National Forest. **Occurrence:** unconfirmed - unlikely
Cascades Axetail Slug *Carinacauda stormi* *Status: Sensitive*	The Cascades Axetail Slug preferred habitat is forested stands dominated by Douglas-fir, with a vine maple, sword fern and Oregon grape understory. The species appears to prefer moist, Douglas-fir needle duff as a key habitat component. This species recently underwent re-classification and what were previously thought to be *Gliabates oregonius* specimens collected since 2006, are now documented as a new species – *Carinacauda stormi* (Cascades Axetail) (LEONARD et al, 2011). In 2011, *Gliabates oregonius* was removed from the R6 Regional Foresters Sensitive Species list and *C.stormi* was added. **Occurrence:** unconfirmed
Evening Fieldslug *Deroceras hesperium* *Status: Sensitive*	There are no records of evening fieldslug on the Middle Fork R.D. Within Oregon, scattered sites have been documented for this species in several provinces, including both sides of the Cascades from Hood River to Klamath River basin. The majority of documented sites occur on the eastern slope of the Cascades. This species has year-round high moisture requirements, with suitable habitat limited to moist surface vegetation and cover within 100' (30 meters) of perennial wetlands, springs, seeps, and low gradient streams. The species is among the least known slugs in the western United States. **Occurrence:** unconfirmed – suspected limited potential
Western Bumblebee *Bombus occidentalis*	The Western bumblebee has not been documented no the Willamette National Forest. This bee was once common in the Western U.S. but has suffered drastic declines since 1998. Bumblebee colonies are annual. In the late winter or early spring the queen emerges from hibernation and then selects a nest site, which is often a pre-existing hole, such as an abandoned rodent hole. Bumblebees will visit a range of different plant species and are important generalist pollinators of a wide variety of flowering plants and crops. **Occurrence:** unconfirmed
California Shield-backed Bug *Vanduzeeina borealis californica*	The California shield-backed bug is only known to occur in California and Oregon. This 3/4 –inch long bug has only been documented at one location on the Willamette N.F. – on the H.J. Andrews Experimental Forest. It's a tall grass prairie specialist that inhabits medium to high elevation (e.g. 3,000') natural balds and meadows. **Occurrence:** unconfirmed - unlikely

Deer/Elk (Big Game) Habitat

The 1997 watershed analysis evaluated the condition of Big Game Emphasis Areas (BGEAs) using habitat effectiveness index (HEI) modeling based on Wisdom et al (1986) as directed by the Willamette Forest Plan. Table 3 reflects results of 1997 model output where it was only applied to BGEAs outside Late Successional Reserve (LSR) allocation. The LSR portion was omitted based on the rationale that areas under that allocation are "where habitat objectives are focused on development of late-successional forest habitat and not on management of habitat for big game." HEI analysis was not conducted as a part of this update. A projected downward trend in local HEI due to the loss of forage habitat as it is converted to cover habitat based on effects from shifts in management practices under the Northwest Forest Plan (USDA, USDI 1994) has been widely recognized (ODFW 2003, Cook 2002).

Recent HEI modeling associated with project planning across the Middle Fork District have confirmed significant declines in forage index values – which translated into substantial decline in overall quality index when compared to watershed analysis values from the mid 1990's. Forage and Overall Index values indicated in Table 3 are certain to have followed similar declines, and would currently be well below Forest Plan Standards.

Table 3. Deer/elk habitat 1997 modeling results based on 1990 Forest Plan Standard and Guidelines.

BGEA Name / emphasis level	HEI Modeling Results from 1997 Watershed Analysis				
	Individual Indices				Overall Index
	HEs	HEr	HEc	HEf	HEI
Rhodes-School / High	0.87	0.34	0.60	0.39	0.51
Tire / High	0.77	0.54	0.69	0.50	0.62
White-Dell / High	*	*	*	*	*
Duval / Mod	*	*	*	*	*
East Goodman / Mod	*	*	*	*	*
West Goodman / Mod	*	*	*	*	*
East Deception / Low	*	*	*	*	*
Schweitzer / Low	*	*	*	*	*
Willamette NF Land Management Plan S&G Minimum Objective Level:					
High Level BGEA Individual Index: >0.5 Overall Index: >0.6					
Moderate Level BGEA Individual Index: >0.4 Overall Index: >0.5					
Low Level BGEA Individual Index: >0.2 Overall Index: increase if any variable < 0.2					
Index Definitions: HEs = size and spacing HEr = open road density HEc = cover quality					
HEf = forage quality HEI = overall habitat quality					
* 1997 Analysis was not completed for these BGEAs located within LSR land allocation.					
Shaded Cell = Index Below Forest Plan Standard					

As a result of the shift in management practices under the Northwest Forest Plan, HEI modeling is no longer considered "best science" as a way to evaluate and manage habitat for deer and elk. New modeling methods have been developed to evaluate habitat quality and use for elk in the west Cascades of Oregon and Washington. Although specifically based on elk utilization studies, modeling is considered to represent trends in the ecological relationship between deer and habitat also. It is expected that the new modeling method will be applied to project planning and referenced during effects analysis related to management affecting habitat for deer and elk.

There are two components to "Westside Modeling" – the Nutrition Model and the Habitat Use Model. Each of these components is addressed in this update. The Nutrition Model relies on the following covariates to arrive at an output that predicts forage nutrition value: % canopy cover, proportion of hardwoods, existing vegetation type, potential vegetation zone.

The product of Nutrition Model output is displayed as dietary digestible energy (DDE) which is categorized under six classes of intermediate forage quality available in summer range habitat for elk as shown below:

Class	Description	Mean DDE
1	Poor	<2.40
2	Low-Marginal	≥2.40 to <2.575
3	High-Marginal	≥2.575 to <2.75
4	Low-Good	≥2.75 to <2.825
5	High-Good	≥2.825 to <2.90
6	Excellent	≥2.90
9	No Data	N/A

DDE values represent Kcal/g of forage where data show 2.9 Kcal/g represent conditions under which elk cow/calf/yearling performance (breeding date, pregnancy rate, winter survival) is optimized. A DDE value of 2.7 Kcal/g can be considered to represent a maintenance level threshold with respect to elk nutrition and performance (Cook et al. 2005; Cook 2011).

The product of Habitat Use Model output is based on four covariates (DDE, slope, distance to cover-forage edge, and distance to open public road) and displayed as predicted level of elk use, categorized as quartiles which represent four resource selection values that are unit-less (Cook 2011). The higher the value the more predicted elk use. A resource selection value of 9 indicates 'No Data'.

Figure 3 displays model output that represents current DDE condition for BGEAs within the Lookout Point Reservoir watershed. Table 4 displays current DDE condition sorted by individual BGEAs. Table 5 displays current DDE condition for BGEAs sorted by individual DDE Class.

Figure 4 displays model output that represents current Predicted Use for BGEAs within the Lookout Point Reservoir watershed. Table 6 displays predicted use within individual BGEAs. Table 7 displays overall predicted use sorted by quartile for BGEAs within the watershed.

Figure 3. Current DDE condition based on habitat modeling for BGEAs within the Lookout Point Reservoir Watershed.

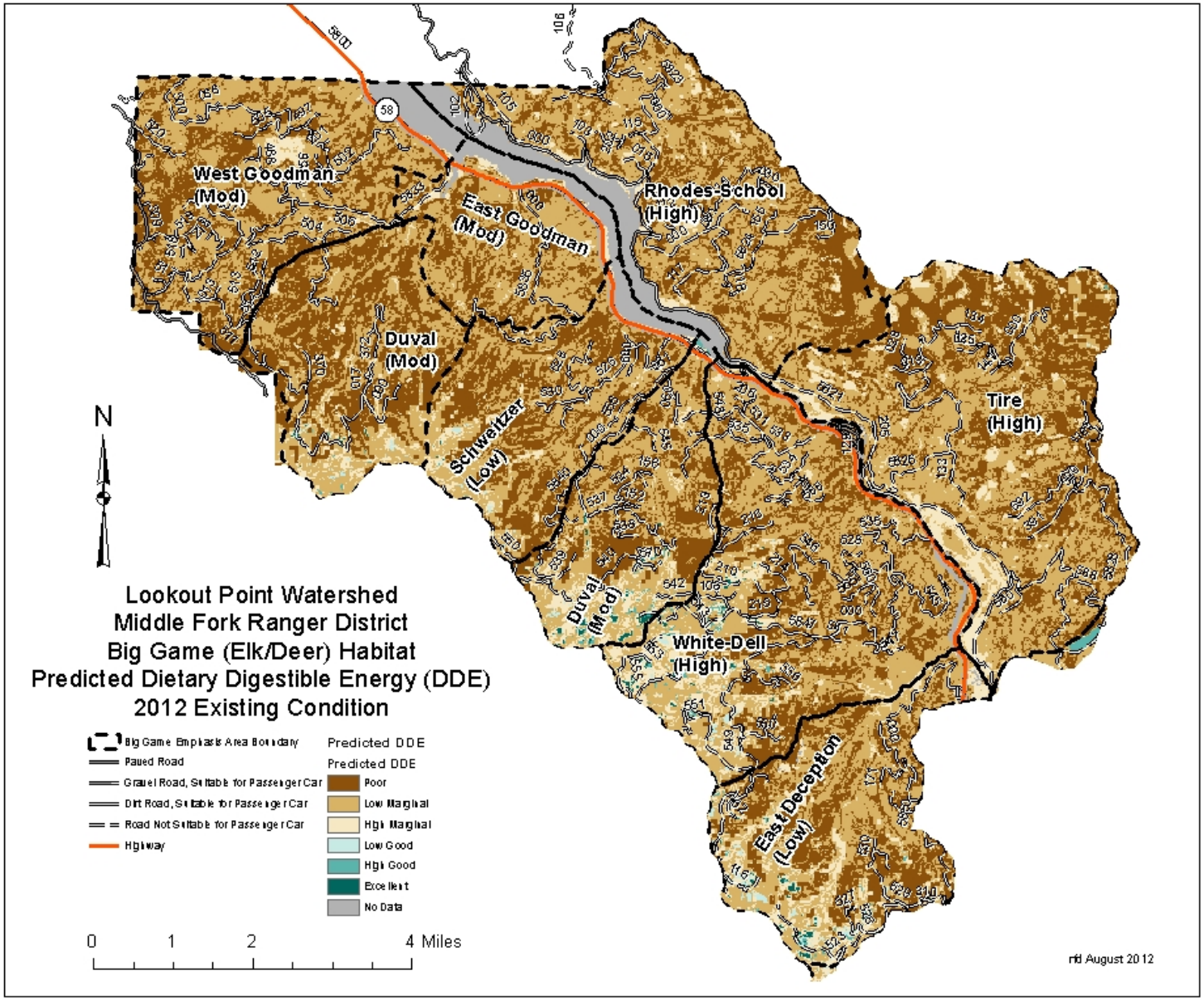


Table 4. Current predicted DDE classes for BGEAs within the Lookout Point Reservoir Watershed.

BGEA Name	Emphasis Level	DDE Class	FREQUENCY	DDE Class Acres	% of LP Watershed
Duval	Mod	1	69	3,205	6
Duval	Mod	2	137	3,577	7
Duval	Mod	3	78	670	1
Duval	Mod	4	14	45	0
Duval	Mod	5	18	45	0
Duval	Mod	6	11	50	0
Duval	Mod	9	1	34	0
			BGEA Acre Total	**7,627**	**15**
East Deception	Low	1	68	1,699	3
East Deception	Low	2	134	2,229	5
East Deception	Low	3	84	650	1
East Deception	Low	4	17	74	0
East Deception	Low	5	16	34	0
East Deception	Low	6	13	32	0
East Deception	Low	9	1	61	0
			BGEA Acre Total	**4,778**	**10**
East Goodman	Mod	1	46	911	2
East Goodman	Mod	2	72	1,474	3
East Goodman	Mod	3	16	102	0
East Goodman	Mod	9	1	448	1
			BGEA Acre Total	**2,935**	**6**
Rhodes-School	High	1	61	2,467	5
Rhodes-School	High	2	105	3,731	8
Rhodes-School	High	3	22	298	1
Rhodes-School	High	9	1	751	2
			BGEA Acre Total	**7,246**	**15**
Schweitzer	Low	1	63	1,746	4
Schweitzer	Low	2	120	1,940	4
Schweitzer	Low	3	59	214	0
Schweitzer	Low	4	3	14	0
Schweitzer	Low	5	4	1	0
Schweitzer	Low	6	2	3	0
Schweitzer	Low	9	1	245	0
			BGEA Acre Total	**4,163**	**8**
Tire	High	1	69	3,373	7
Tire	High	2	128	4,423	9
Tire	High	3	51	779	2
Tire	High	4	1	2	0
Tire	High	5	2	1	0
Tire	High	6	3	1	0
Tire	High	9	1	73	0
			BGEA Acre Total	**8,653**	**18**
West Goodman	Mod	1	60	2,270	5
West Goodman	Mod	2	92	3,134	6
West Goodman	Mod	3	17	144	0
West Goodman	Mod	9	1	355	1
			BGEA Acre Total	**5,904**	**12**
White-Dell	High	1	67	2,472	5
White-Dell	High	2	140	4,381	9
White-Dell	High	3	78	823	2
White-Dell	High	4	15	41	0
White-Dell	High	5	14	60	0
White-Dell	High	6	10	41	0
White-Dell	High	9	1	262	1
			BGEA Acre Total	**8,080**	**16**
			Total All BGEA Acres	**49,386**	**100**

Table 5. Current predicted DDE levels for Lookout Point Reservoir Watershed sorted by forage classes.

BGEA Name	Emphasis Level	DDE Class	DDE Class Acres	% of LP Watershed
Duval	Mod	1	3,205	6
East Deception	Low	1	1,699	3
East Goodman	Mod	1	911	2
Rhodes-School	High	1	2,467	5
Schweitzer	Low	1	1,746	4
Tire	High	1	3,373	7
West Goodman	Mod	1	2,270	5
White-Dell	High	1	2,472	5
DDE Class 1 (Poor) Acre Total			**18,143**	**37**
Duval	Mod	2	3,577	7
East Deception	Low	2	2,229	5
East Goodman	Mod	2	1,474	3
Rhodes-School	High	2	3,731	8
Schweitzer	Low	2	1,940	4
Tire	High	2	4,423	9
West Goodman	Mod	2	3,134	6
White-Dell	High	2	4,381	9
DDE Class 2 (Low Marginal) Acre Total			**24,889**	**50**
Duval	Mod	3	670	1
East Deception	Low	3	650	1
East Goodman	Mod	3	102	0
Rhodes-School	High	3	298	1
Schweitzer	Low	3	214	0
Tire	High	3	779	2
West Goodman	Mod	3	144	0
White-Dell	High	3	823	2
DDE Class 3 (High Marginal) Acre Total			**3,678**	**7**
Duval	Mod	4	45	0
East Deception	Low	4	74	0
Schweitzer	Low	4	14	0
Tire	High	4	2	0
White-Dell	High	4	41	0
DDE Class 4 (Low Good) Acre Total			**176**	**0**
Duval	Mod	5	45	0
East Deception	Low	5	34	0
Schweitzer	Low	5	1	0
Tire	High	5	1	0
White-Dell	High	5	60	0
DDE Class 5 (High Good) Acre Total			**142**	**0**
Duval	Mod	6	50	0
East Deception	Low	6	32	0
Schweitzer	Low	6	3	0
Tire	High	6	1	0
White-Dell	High	6	41	0
DDE Class 6 (Excellent) Acre Total			**128**	**0**
Duval	Mod	9	34	0
East Deception	Low	9	61	0
East Goodman	Mod	9	448	1
Rhodes-School	High	9	751	2
Schweitzer	Low	9	245	0
Tire	High	9	73	0
West Goodman	Mod	9	355	1
White-Dell	High	9	262	1
DDE Class 9 (No Data) Acre Total			**2,229**	**5**
	Total BGEA Acres		**49,386**	**100**

Figure 4. Current predicted use condition based on habitat modeling for BGEAs within the Lookout Point Reservoir Watershed.

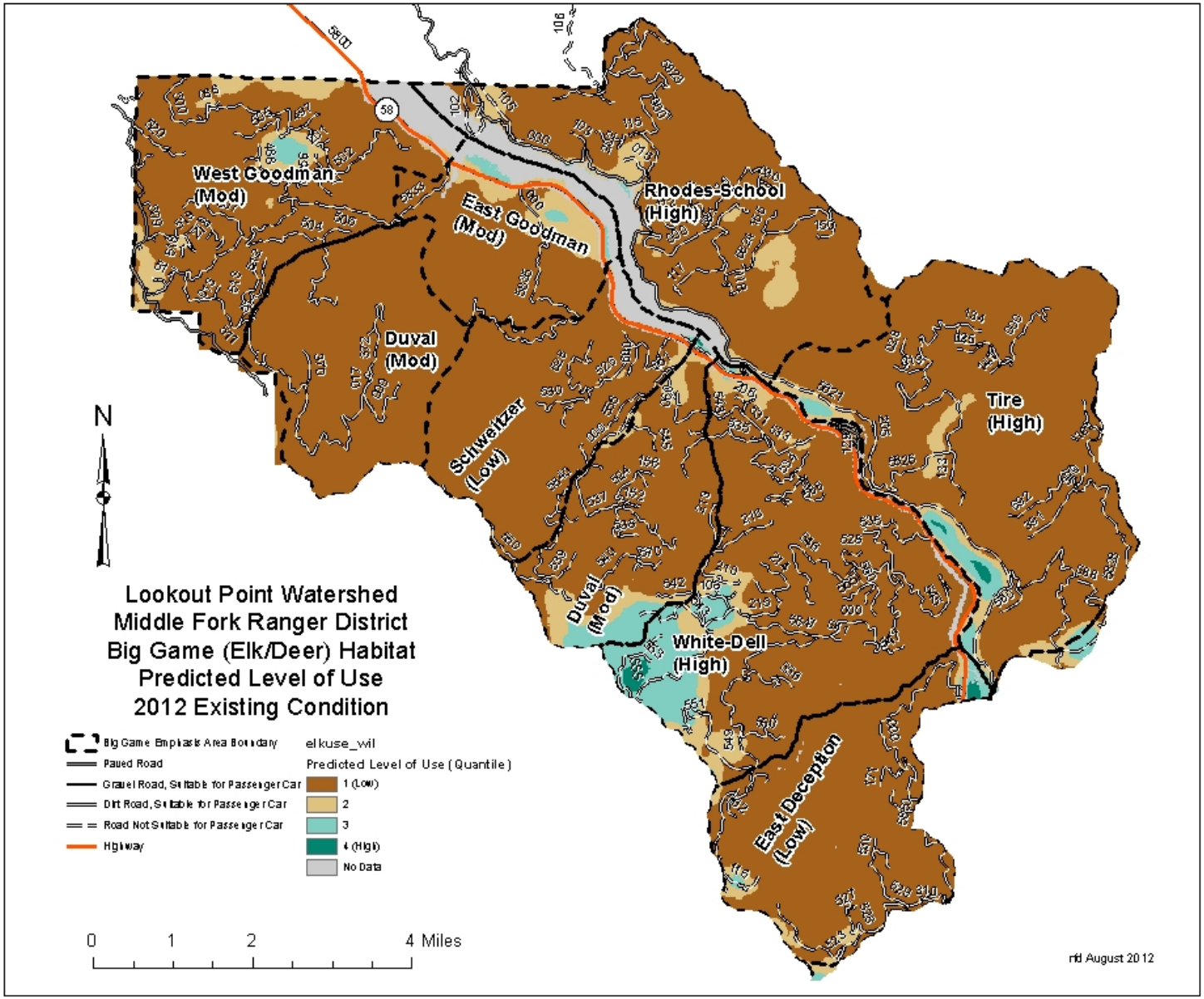


Table 6. Current predicted habitat use quantiles for BGEAs within Lookout Point Reservoir Watershed.

BGEA Name	Emphasis Level	Use Quantile	SUM_Acres	% of LP Watershed
Duval	Mod	1	6,930	14
Duval	Mod	2	411	1
Duval	Mod	3	248	1
Duval	Mod	4	3	0
Duval	Mod	9	34	0
		BGEA Acre Total	**7,627**	**15**
East Deception	Low	1	4,452	9
East Deception	Low	2	192	0
East Deception	Low	3	53	0
East Deception	Low	4	21	0
East Deception	Low	9	61	0
		BGEA Acre Total	**4,778**	**10**
East Goodman	Mod	1	1,997	4
East Goodman	Mod	2	403	1
East Goodman	Mod	3	88	0
East Goodman	Mod	9	448	1
		BGEA Acre Total	**2,935**	**6**
Rhodes-School	High	1	5,897	12
Rhodes-School	High	2	588	1
Rhodes-School	High	3	11	0
Rhodes-School	High	9	751	2
		BGEA Acre Total	**7,246**	**15**
Schweitzer	Low	1	3,839	8
Schweitzer	Low	2	72	0
Schweitzer	Low	3	6	0
Schweitzer	Low	4	0	0
Schweitzer	Low	9	245	0
		BGEA Acre Total	**4,163**	**8**
Tire	High	1	7,805	16
Tire	High	2	484	1
Tire	High	3	260	1
Tire	High	4	30	0
Tire	High	9	73	0
		BGEA Acre Total	**8,653**	**18**
West Goodman	Mod	1	4,883	10
West Goodman	Mod	2	587	1
West Goodman	Mod	3	79	0
West Goodman	Mod	9	355	1
		BGEA Acre Total	**5,904**	**12**
White-Dell	High	1	6,193	13
White-Dell	High	2	749	2
White-Dell	High	3	803	2
White-Dell	High	4	73	0
White-Dell	High	9	262	1
		BGEA Acre Total	**8,080**	**16**
	Total All BGEA Acres		**49,386**	**100**

Table 7. Current predicted habitat use for Lookout Point Reservoir Watershed sorted by quantile.

BGEA Name	Emphasis Level	Use Quantile	SUM_Acres	% of LP Watershed
Duval	Mod	1	6,930	14
East Deception	Low	1	4,452	9
East Goodman	Mod	1	1,997	4
Rhodes-School	High	1	5,897	12
Schweitzer	Low	1	3,839	8
Tire	High	1	7,805	16
West Goodman	Mod	1	4,883	10
White-Dell	High	1	6,193	13
Use Quantile 1 (Low) Acre Total			**41,995**	**85**
Duval	Mod	2	411	1
East Deception	Low	2	192	0
East Goodman	Mod	2	403	1
Rhodes-School	High	2	588	1
Schweitzer	Low	2	72	0
Tire	High	2	484	1
West Goodman	Mod	2	587	1
White-Dell	High	2	749	2
Use Quantile 2 Acre Total			**3,486**	**7**
Duval	Mod	3	248	1
East Deception	Low	3	53	0
East Goodman	Mod	3	88	0
Rhodes-School	High	3	11	0
Schweitzer	Low	3	6	0
Tire	High	3	260	1
West Goodman	Mod	3	79	0
White-Dell	High	3	803	2
Use Quantile 3 Acre Total			**1,549**	**3**
Duval	Mod	4	3	0
East Deception	Low	4	21	0
Schweitzer	Low	4	0	0
Tire	High	4	30	0
White-Dell	High	4	73	0
Use Quantile 4 (High) Acre Total			**127**	**0**
Duval	Mod	9	34	0
East Deception	Low	9	61	0
East Goodman	Mod	9	448	1
Rhodes-School	High	9	751	2
Schweitzer	Low	9	245	0
Tire	High	9	73	0
West Goodman	Mod	9	355	1
White-Dell	High	9	262	1
Use Quantile 9 (No Data) Acre Total			**2,229**	**5**
	Total BGEA Quantile Acres		**49,386**	**100**

Data displayed in the DDE and predicted use tables reveals a number of characteristics about deer/elk habitat within the watershed. Habitat management under current Forest Plan Standards for deer/elk within the Lookout Point Reservoir watershed treats 49% of the area as high, 33% as moderate, and 18% as low emphasis. New Westside Modeling suggests 87% of the watershed provides poor to low-marginal nutritional forage measured as DDE, and that nutritional forage quality is below maintenance levels for elk across about 94% of the watershed. New modeling also suggests that predicted habitat use is considered low across about 85% of the watershed. Based on current BGEA emphasis levels, predicted use falls within the lowest quartile for each group of emphasis levels as follows: High = 83% low, Moderate = 84% low, Low = 93% low. A recommendation is made to use new Westside Modeling to identify opportunities and implement treatments within the watershed that increase DDE and predicted use values, and result in the most strategic improvement in forage habitat for deer and elk where possible.

One component of current Forest Plan Standards pertaining to deer/elk habitat management that can be associated with new habitat use modeling is the amount of BGEAs exposed to motorized vehicle activity. Table 8 displays current condition of BGEAs within Lookout Point Reservoir watershed with respect to potential motorized vehicle activity. The current condition is referenced against road density standards (HEr) and indicates the reduction in mileage required to meet S&Gs. There is a general correlation between the location and extent of closure displayed in Table 8 and similar closures recommended in the 1997 watershed analysis (page 132 Table 37). Opportunities to close extraneous roads in these areas should continue to be identified and implemented.

Table 8. Relationship between current motorized vehicle use and Forest Plan Standards applied to Big Game Emphasis Areas (BGEA).

BGEA Name	Emphasis Level	BGEA Acres	Current Sum Open Miles*	Motorized Road & Trail Density	Minimum Density (mi/mi^2) Needed to Meet Forest Plan S&G	Miles to Close to Meet S&G	Current % above S&G
Rhodes-School	High	7,247	31.1	2.75	<1.95	9.0	41
Tire	High	8,651	33.3	2.46	<1.95	6.9	26
White-Dell	High	8,083	50.9	4.03	<1.95	26.3	107
Duval-combined	Mod	7,628	32.3	2.71	<2.9		
East Goodman	Mod	2,936	7.3	1.60	<2.9		
West Goodman	Mod	5,901	30.1	3.26	<2.9	3.4	13
East Deception	Low	4,779	17.7	2.37	<4.8		
Schweitzer	Low	4,168	16.0	2.46	<4.8		
Column Total		**49,392**	**218.7**	**2.83**		**45.6**	

* Information is based on 2012 data analysis which used MVUM open roads and motorized trails, and included roads seasonally open during calving/fauning period.

Dead Wood (Snag and Down Wood) Habitat

Background

Standards and Guidelines (S&Gs) for managing snag and down wood (coarse woody debris – CWD) habitat are provided by the Willamette Forest Plan as amended by the ROD. Consideration of dead wood levels is based on whichever Forest Plan or ROD S&G is more restrictive or provides greater benefits to late-successional forest

related species. S&Gs pertaining to CWD levels are directed at retention and recruitment associated with regeneration harvest, while recognizing opportunities to apply the same basic guidelines, but modified to reflect stand potential associated with other harvest prescriptions. The general standard for CWD applied to projects if proposing traditional regeneration harvest would be to leave 240 linear feet of logs/acre which are ≥ 20" diameter and ≥ 20' in length.

Under the Willamette Forest Plan as amended by the ROD, snag habitat shall be managed at levels within harvest units capable of providing for at least 40% or greater potential populations of cavity-nesting species. The 40% level is influenced by vegetation zones and is identified as ≥ 1.5 snags/acre for the western hemlock zone, and ≥ 1.7 snags/acre for the true fir zone. Current science has tested the validity of the potential population approach to species management, yet it remains the basis for S&Gs involving snag management. Strong support for identifying more appropriate amounts of snag and down wood habitat is being given to new approaches in addressing these habitat components. One such approach devoted to identifying appropriate levels of snag and down wood in selected habitat types is DecAID - the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon (Mellen-McLean et al. 2012). DecAID has been created to help managers decide how much dead wood to provide for this part of a species habitat needs, and is designed to apply to salvage as well as green tree projects.

The benefit of DecAID applied to projects involving removal (harvest) of green trees is in evaluating affected habitat types during the planning process to determine if current dead wood levels are consistent with reference conditions, and to aid in identifying dead wood management goals for projects that affect dead wood habitat throughout dominant habitat types. Dead wood amounts in DecAID are addressed in terms of tolerance levels which reflect what percent of a wildlife population is afforded use by particular sizes or amounts of snags and down wood. However, even in simplest terms, DecAID tolerance levels for an appropriate wildlife habitat type in a specific size class and structural condition cannot be used as a surrogate to estimate dead wood levels to support a given population potential (Mellen-McLean pers com). They simply suggest the likelihood that adequate dead wood habitat is being provided.

DecAID may be used to evaluate snag and down wood habitat on a landscape by comparing current and reference conditions, and against a variety of ranges to accommodate species needs in certain habitat types. Dead wood habitat levels are best monitored and managed at a landscape level such as a watershed or portion thereof. The Lookout Point Reservoir Watershed exceeds an appropriate minimum sized area of similar habitat to consider when evaluating current and future levels of dead wood. When comparing snag and down wood levels, it is important to consider values for an affected habitat type that are from stands in a size class and structural condition similar to those where treatments are proposed. Another way that dead wood levels are being considered relative to DecAID values is to estimate reference and current snag and down wood levels at a watershed scale across an entire habitat type without specific consideration of size class and structural condition where treatments are proposed. This provides a broad landscape perspective on current and reference conditions for a habitat type. However, including a full range of size and structural stage data when considering current dead wood levels for affected habitat results in utilizing data that is less specific to a smaller project area. The following sections provide information on snag and down wood levels for the overall watershed (broad scale).

Analysis

Analysis of Dead Wood in Lookout Point Reservoir Middle Fork of Willamette (LPR-MFW) Watershed is based on 2012 application of existing data (Doerr pers com). LPR-MFW Watershed (5th field watershed 1709000107) totals about 101,918 acres including non-federal lands. Forest Service acres total about 49,000 acres with

- 71% (34,850 acres) in Westside Lowland Conifer/Hardwood Forest-Oregon Cascades habitat,
- 8% (3,700 acres) in Montane Mixed Conifer Forest habitat, and
- 21% (10,385 acres) in Westside Oak and Dry Douglas Fir Forest and Woodland habitat.

Data presented below represent Forest Service lands only, and display estimated current percent of the watershed for each wildlife habitat type (WHT) in different snag and downed wood densities based on Gradient Nearest Neighbor (GNN) analysis of forest inventory plot data (LEMMA 2009) for the watershed. A historic reference condition is also developed using snag and downed wood abundance derived from plot data in unmanaged stands throughout the habitat type and an assumed fire regime interval for the watershed that estimates the average amount of the habitat in different successional stages. This information is calculated for both total snags (≥ 10" dbh) and downed logs (≥ 5" diameter) and for large (≥ 20" diameter) logs and large (≥ 20" dbh) snags. Snag data are given as snags/acre and downed wood data are given as % cover. Predictions generated by methods such as GNN for vegetation conditions are appropriate for regional-scale analyses but are recognized as insufficiently accurate for most site-level application (LEMMA 2009). Including a broad range of size and structural stage data when considering current dead wood levels for affected habitat results in utilizing data that is less specific to the project area. Dead wood values based on a variety of sources such as fire history, stand inventories, fuel plot sampling, and estimates based on field reconnaissance that are more specific to project planning may be used in future analyses to supplement this analysis based exclusively on GNN data.

Snags:

For FS Lowland Conifer/Hardwood Forests habitat in the LPR-MFW Watershed, the estimated median number of large snags (>19.9" dbh) is 1.5/acre compared to an estimated historic median reference condition of 5/acre for the Westside Lowland Conifer/Hardwood Forests of the Oregon Cascades (Figure 5).

For FS Lowland Conifer/Hardwood Forests in the LPR-MFW Watershed, the estimated median number of snags (>9.9" dbh) is 5/acre compared to an estimated historic median reference condition of 12/acre for the Westside Lowland Conifer/Hardwood Forests of the Oregon Cascades (Figure 8).

For FS Montane Mixed Conifer Forest habitat in the LPR-MFW Watershed, the estimated median number of large snags (>19.9" dbh) is 2/acre compared to an estimated historic median reference condition of 5.5/acre (Figure 6).

For FS Montane Mixed Conifer Forests in the LPR-MFW Watershed, the estimated median number of snags (>9.9" dbh) is 7/acre compared to an estimated historic median reference condition of 13/acre (Figure 9).

For FS Westside Oak and Dry Douglas Fir Forest and Woodland habitat in the LPR-MFW Watershed, the estimated median number of large snags (>19.9” dbh) is 0 acre compared to an estimated historic median reference condition of 1.5/acre (Figure 7).

For FS Westside Oak and Dry Douglas Fir Forest and Woodland habitat in the LPR-MFW Watershed, the estimated median number of snags (>9.9” dbh) is 2 acre compared to an estimated historic median reference condition of 4/acre.

Figure 5. Comparison of Current Large (>19.9" DBH) Snag Densities in Westside Oregon Cascade Lowland Conifer/Hardwood Forests in the Lookout Point Reservoir - Middle Fork of Willamette Watershed to Reference Conditions

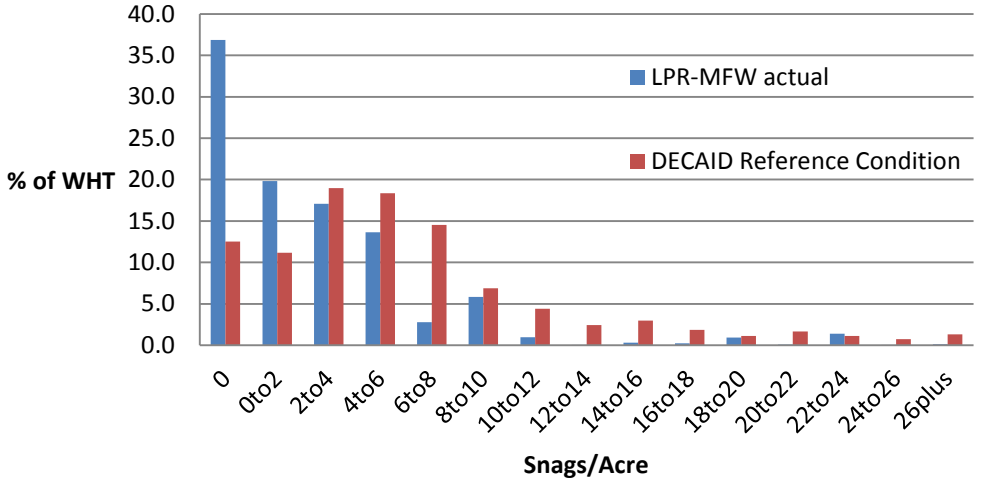


Figure 6. Comparison of Current Large (>19.9" DBH) Snag Densities in Montane Mixed Conifer Forests in the Lookout Point Reservoir-Middle Fork of Willamette Watershed to Reference Conditions

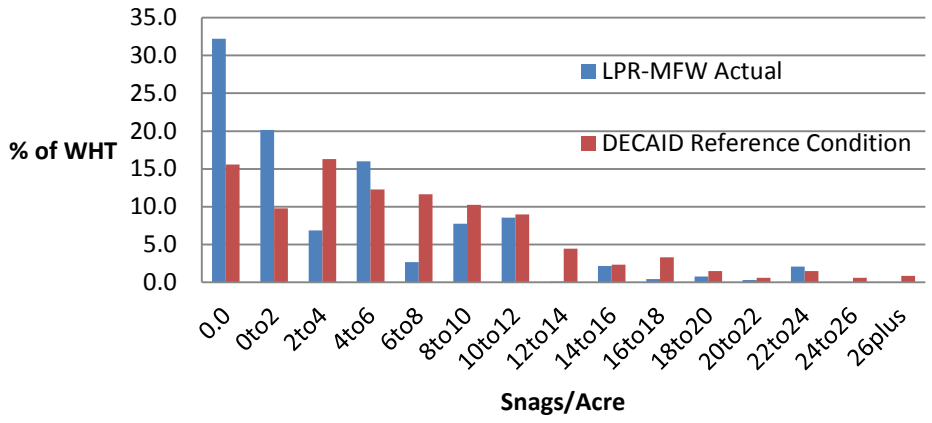


Figure 7. Comparison of Current Large (>19.9" DBH) Snag Densities in Westside Oak/Dry Douglas Fir Forests and Woodlands in the Lookout Point Reservoir-Middle Fork of Willamette Watershed to Reference Conditions

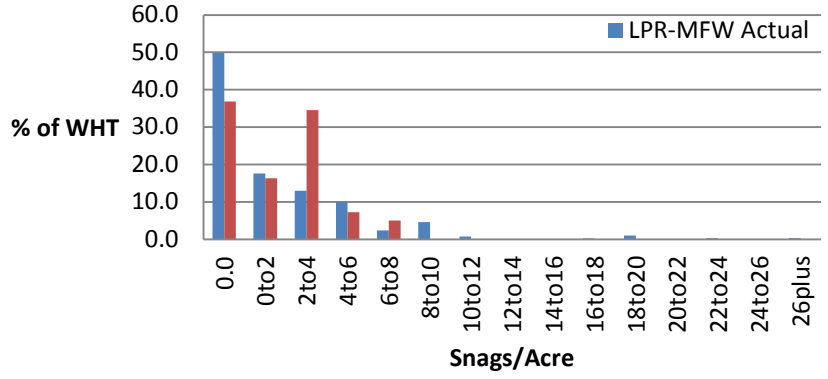


Figure 8. Comparison of Current (>9.9" DBH) Snag Densities in Westside Oregon Cascade Lowland Conifer/Hardwood Forests in the Lookout Point Reservoir-Middle Fork of Willamette Watershed to Reference Conditions

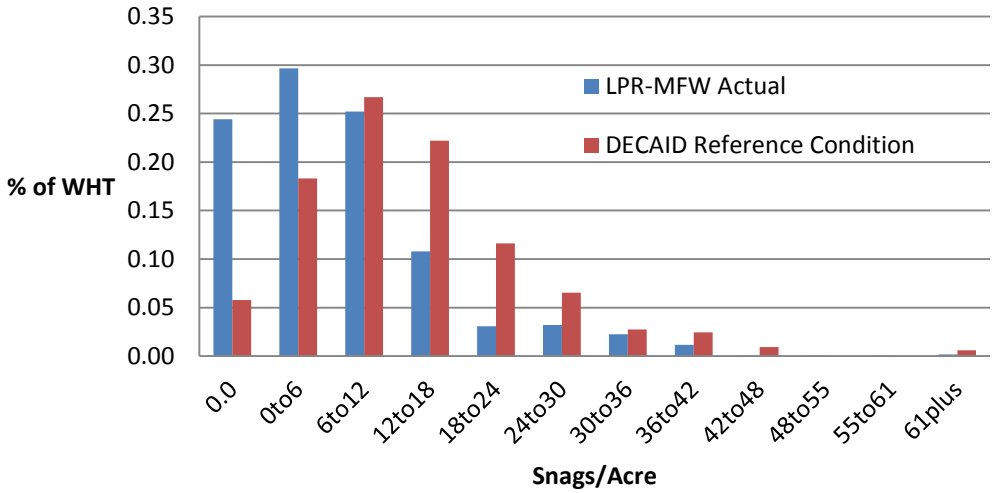
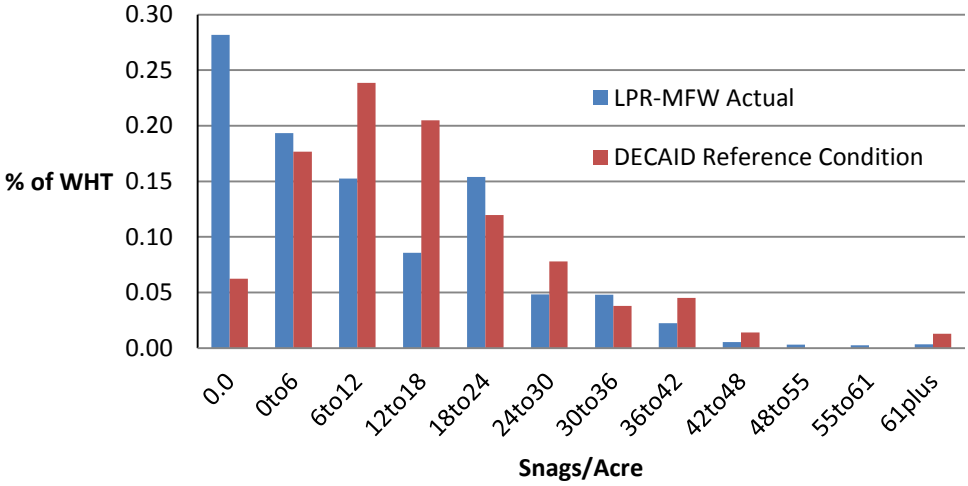


Figure 9. Comparison of Current (>9.9" DBH) Snag Densities in Montane Mixed Conifer Forests in the Lookout Point Reservoir-Middle Fork Willamette Watershed to Reference Conditions



Wildlife Relationship on Snag and Downed Log Abundance:

DECAID provides a compilation of studies showing relationships of snag and downed wood abundance to wildlife occupancy of the site for a variety of wildlife species. These are expressed as tolerance levels. For example, the 50% tolerance level for large snags for nesting pileated woodpeckers is 7/acre for Westside Lowland Conifer/Hardwood Forests of the Oregon Cascades. This number indicates that half of pileated woodpeckers studied in this wildlife habitat would be expected to nest at sites with 7 or fewer large (>19.9" dbh) snags/acre. Many factors influence the population density and habitat selection of species that are associated with dead wood abundance. In general though, the greater the abundance of snags and downed wood and the larger the snags and downed logs, the better the habitat conditions for the "dead wood dependent" species, and standards and guidelines for retaining snags and downed wood were developed around these relationships. DECAID does not provide wildlife tolerance data for Westside Oak and Dry Douglas Fir Forest and Woodland Habitat.

Snags densities above the 50% tolerance level were used to estimate the amount of above average habitat for the species, while the amount of habitat meeting the 30−50% tolerance interval were used to represent the amount of "moderate quality" dead wood habitat. The ≥80% tolerance range represents the highest quality dead wood habitat for the species.

Species-specific information in DecAID was reviewed for species found in the project watershed with snag and downed wood relationship studies comparable to the forest inventory plot data. From these studies, TES species, MIS species, and key prey species of northern spotted owl were selected. Then tolerance levels for these species were compared to estimated current and historic snag and downed wood abundance. DecAID provided tolerance levels for the following species:

1) Westside Lowland Conifer/Hardwood Forests of the Oregon Cascades:
    a) pileated woodpeckers-MIS (large snag density at nesting and foraging sites, large log cover *at foraging sites) and
    b) northern flying squirrel-important prey for NSO (total snag densities and total log cover** in occupied habitat)
2) Montane Mixed Conifer Forests-(available wildlife use data is limited for species that normally occur in this habitat in the watershed):
    a) Marten-MIS (large and total snag density and total log cover** at occupied sites).

**DECAID shows information for % total log cover >19.9 cm diameter compared to >19.9" diameter in the inventoried plot data.*

***DECAID shows information for % total log cover >3.9" diameter compared to >4.9" diameter in the inventoried plot data. Only the 50% tolerance level is given in DECAID for % total log cover for marten.*

Table 9. Estimated % of FS Forest Habitat Type (WHT) Meeting Snag Density Tolerance Levels for Key Wildlife Species, Current Condition vs. DECAID Historic Reference Condition, LPR-MFW Watershed

Habitat and Wildlife Species Use	Dead Wood Feature	Wildlife Tolerance Level	% of Habitat Meeting T. L.	
			Current Condition	DECAID Historic Reference
Westside Lowland Conifer/Hardwoods, Oregon Cascades				
Pileated Woodpecker				
Nesting Sites	Snags>19.9”dbh	≥30% T. L.	22%	51%
	Snags>19.9”dbh	≥50% T. L.	11%	32%
	Snags>19.9”dbh	≥80% T. L.	4%	17%
Foraging Sites	Snags>19.9”dbh	≥30% T. L.	10%	27%
	Snags>19.9”dbh	≥50% T. L.	3%	13%
	Snags>19.9”dbh	≥80% T. L.	2%	6%
Northern Flying Squirrel				
Occupied stand	Snags>9.9”dbh	≥30% T. L.	55%	81%
	Snags>9.9”dbh	≥50% T. L.	28%	57%
	Snags>9.9”dbh	≥80% T. L.	10%	25%
Montane Mixed Conifer				
Marten				
Occupied site	Snags>19.9”dbh	≥30% T. L.	42%	61%
	Snags>19.9”dbh	≥50% T. L.	41%	58%
	Snags>19.9”dbh	≥80% T. L.	37%	55%
Occupied site	Snags>9.9”dbh	≥30% T. L.	40%	56%
	Snags>9.9”dbh	≥50% T. L.	36%	49%
	Snags>9.9”dbh	≥80% T. L.	1%	3%

The large snag analysis suggests that currently the LPR-MFW watershed is below historical levels for large snags in Westside Lowland Conifer/Hardwood habitat and providing less nesting and foraging habitat for pileated woodpeckers than was provided in the estimated historic condition (Table 9). An estimated 11% of this habitat meets or exceeds large (>19.9” dbh) snag densities at the 50% tolerance level for pileated woodpecker nesting sites compared to 32% of the estimated historic habitat. An estimated 3% of the habitat meets or exceeds large snag densities at that tolerance level for pileated woodpecker foraging sites compared to 13% of the estimated historic habitat. DecAID inventory data for pileated woodpecker habitat use are from the Oregon Coast Range and Olympic Peninsula where snags are known to be larger and more common than in the Oregon western Cascades. Tolerance level data in this table should be viewed as reflecting a general trend rather than absolute values.

The total snag analysis also shows that currently the LPR-MFW watershed is below historical levels for snags in Westside Lowland Conifer/Hardwood habitat and providing less snag habitat for northern flying squirrels than was provided in the estimated historic condition (Table 9). An estimated 28% of this habitat meets or exceeds

total (>9.9" dbh) snag densities at the 50% tolerance level for occupied northern flying squirrel sites compared to 57% of the estimated historic habitat.

Currently the LPR-MFW watershed is below historical levels for large snags in montane mixed conifer habitat and providing less large snag habitat for marten than was provided in the estimated historic condition. An estimated 41% of this habitat meets or exceeds large (>19.9" dbh) snag densities at the 50% tolerance level for occupied marten sites compared to 58% of the estimated historic habitat (Figure 6 and Table 9).

The total snag analysis indicates that currently the LPR-MFW watershed is below historical levels for snags in montane mixed conifer habitat and providing less small snag habitat for marten than was provided in the estimated historic condition (Figure 9 and Table 9). An estimated 36% of this habitat meets or exceeds total (>9.9" dbh) snag densities at the 50% tolerance level for occupied marten sites compared to 49% of the estimated historic habitat.

Downed Logs:

For Lowland Conifer/Hardwood Forests in the LPR-MFW Watershed, the estimated median % cover of large logs (>19.9" diameter) is 1.5% compared to an estimated historic median reference condition of 1.5% for the Westside Lowland Conifer/Hardwood Forests of the Oregon Cascades (Figure 10).

For Lowland Conifer/Hardwood Forests in the LPR-MFW Watershed, the estimated median % cover of downed logs (>4.9" diameter) is 4% compared to an estimated historic median reference condition of 5% for the Westside Lowland Conifer/Hardwood Forests of the Oregon Cascades (Figure 12).

For Montane Mixed Conifer Forests in the LPR-MFW Watershed, the estimated median % cover of large logs (>19.9" diameter) is 1.5% compared to an estimated historic median reference condition of 0.5% (Figure 11).

For Montane Mixed Conifer Forests in the LPR-MFW Watershed, the estimated median % cover of downed logs (>4.9" diameter) is 4% compared to an estimated historic median reference condition of 3.5% (Figure 13).

For FS Westside Oak and Dry Douglas Fir Forest and Woodland habitat in the LPR-MFW Watershed, the estimated median % cover of downed logs (>4.9" diameter) is 3% compared to an estimated historic median reference condition of 1% (Figure 14)

Figure 10. Comparison of Current % Cover of Large (>19.9" DBH) Downed Logs in Westside Oregon Cascade Lowland Conifer/Hardwood Forests in the Lookout Point Reservoir-Middle Fork Willamette Watershed to Reference Conditions

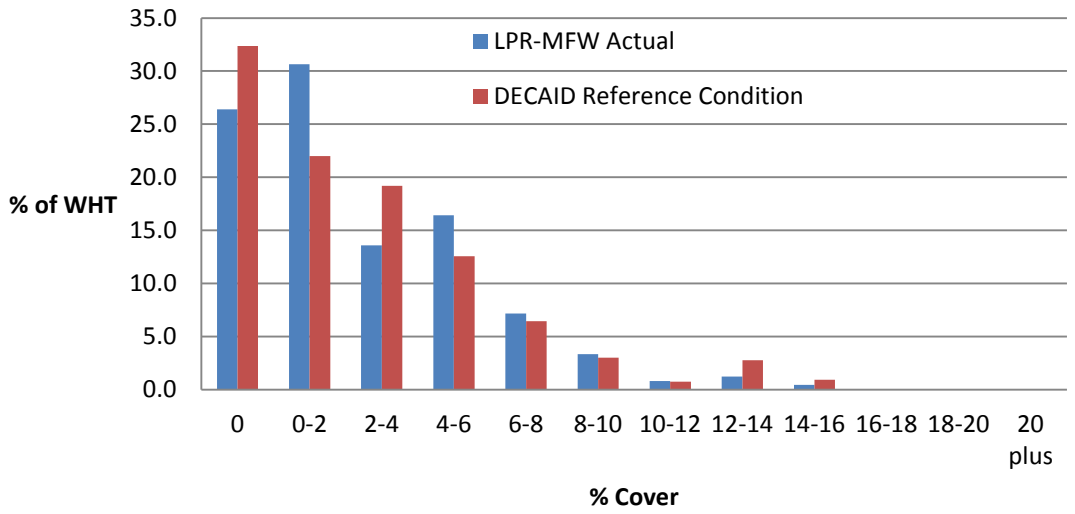


Figure 11. Comparison of Current % Cover of Large (>19.9" DBH) Downed Logs in Montane Mixed Conifer Forests in the Lookout Point Reservoir-Middle Fork Willamette Watershed to Reference Conditions

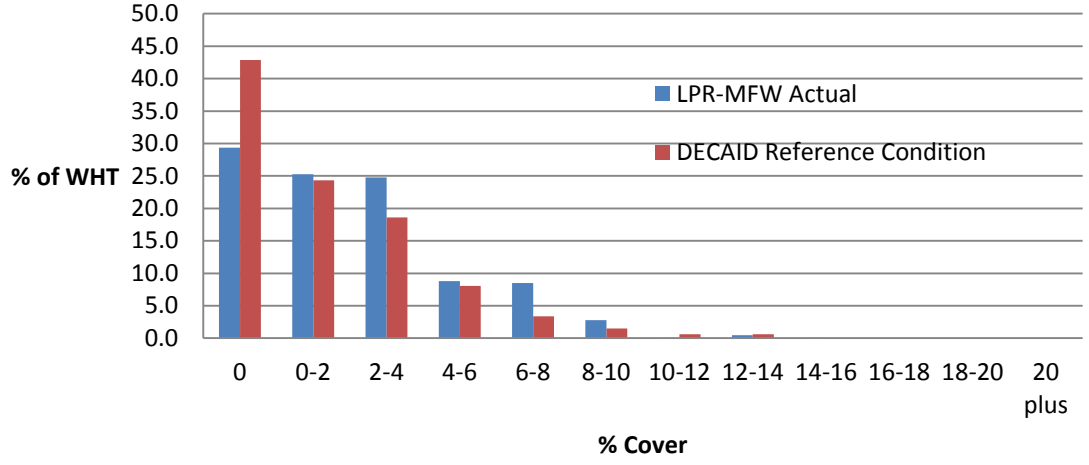


Figure 12. Comparison of Current % Cover of Total (>4.9" DBH) Downed Logs in Westside Oregon Cascade Lowland Conifer/Hardwood Forests in the Lookout Point Reservoir-Middle Fork Willamette Watershed to Reference Conditions

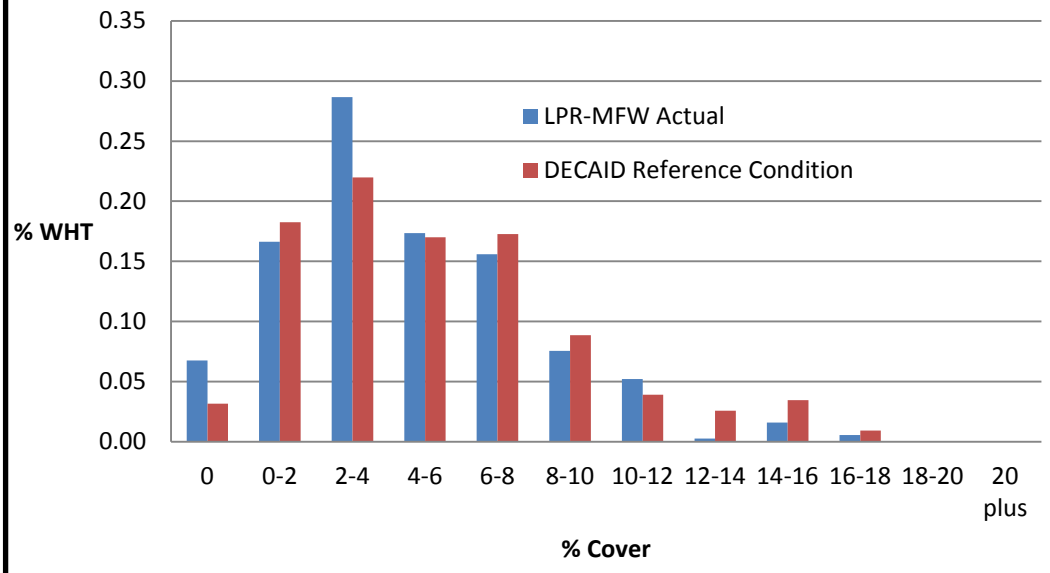


Figure 13. Comparison of Current % Cover of Total (>4.9" DBH) Downed Logs in Montane Mixed Conifer Forests in the Lookout Point Reservoir-Middle Fork Willamette Watershed to Reference Conditions

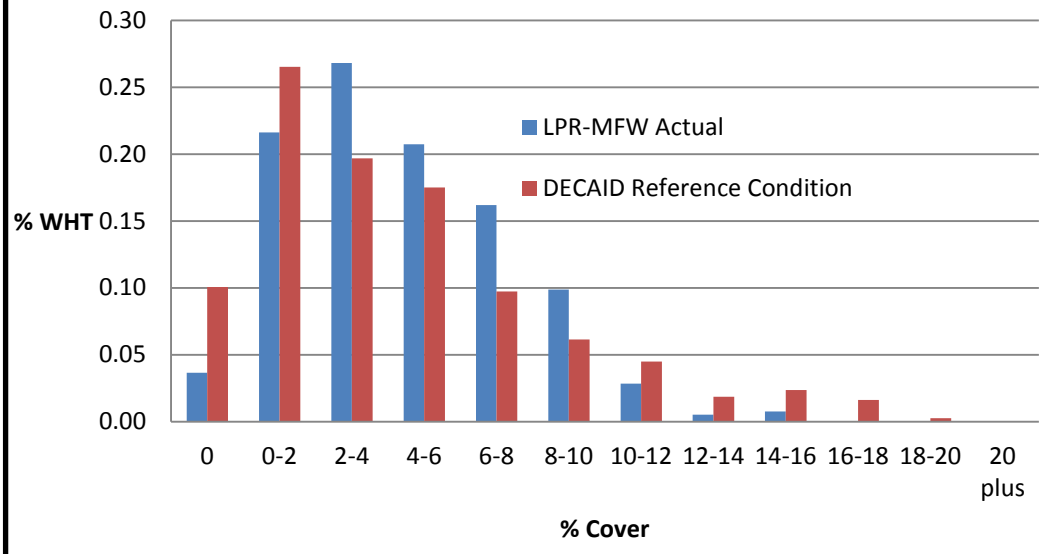


Figure 14. Comparison of Current % Cover of Total (>4.9" DBH) Downed Logs in Westside Oak and Dry Douglas Fir Forest and Woodland Habitat in the Lookout Point Reservoir-Middle Fork Willamette Watershed to Reference Conditions

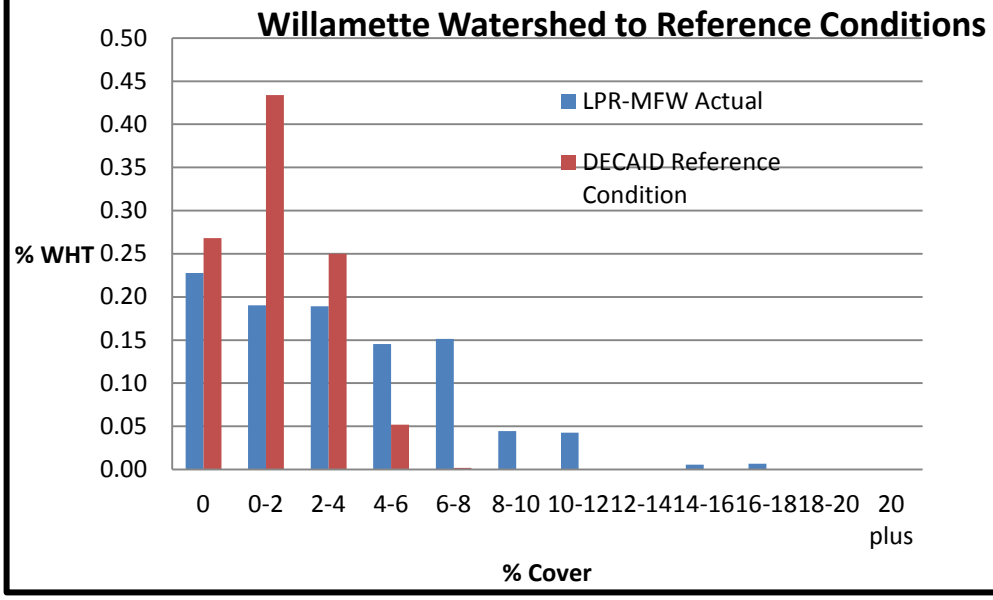


Table 10. % of Forest Habitat Meeting Downed Log Cover Tolerance Levels for Key Wildlife Species, Current Condition vs. DECAID Estimated Historic Reference Condition, LPR-MFW Watershed				
Habitat and Wildlife Species Use	Dead Wood Feature	Wildlife Tolerance Level	% of Habitat Meeting T. L.	
			Current Condition	DECAID Historic Reference
Westside Lowland Conifer/Hardwoods, Oregon Cascades				
Pileated Woodpecker				
Foraging Sites	Logs>19.9”diameter*	≥30% T. L.	>44%*	>47%*
	Logs>19.9”diameter*	≥50% T. L.	>33%*	>32%*
	Logs>19.9”diameter*	≥80% T. L.	>15%*	>16%*
Northern Flying Squirrel				
Occupied stand	Logs>4.9”diameter**	≥30% T. L.	68%	72%
	Logs>4.9”diameter**	≥50% T. L.	27%	36%
	Logs>19.9”diameter*	≥80% T. L.	>2%*	>10%*
Montane Mixed Conifer				
Marten				
Occupied site	Logs>4.9”diameter**	≥50% T. L.	10%	16%
**DECAID shows information for % total log cover >19.9 cm diameter compared to >19.9” diameter in the*				

inventoried plot data. Thus the % of habitat in the above the tolerance limit is substantially underestimated, but is shown to compare the relative difference between the current and historic condition.
***DECAID shows information for % total log cover >3.9" diameter compared to >4.9" diameter in the inventoried plot data. Thus the % of habitat in the above the tolerance limit is somewhat underestimated. Only the 50% tolerance level is given in DECAID for % total log cover for marten.*

The downed log analysis suggests that currently the LPR-MFW watershed is at historic levels for large downed log cover in Westside Lowland Conifer/Hardwood habitat (Figure 10) and is providing similar large downed log foraging habitat for pileated woodpeckers than was provided in the estimated historic condition (Table 10). Currently an estimated 33% of this habitat meets or exceeds large log cover at the 50% tolerance level for pileated woodpecker foraging sites compared to 32% of the estimated historic habitat.

The downed log analysis indicates that currently the LPR-MFW watershed is somewhat below (4% versus 5%) historical levels for total downed log cover in Westside Lowland Conifer/Hardwood habitat. Given the above discussion this implies that the lack of log cover is in the smaller log diameters (<20" diameter). Current total downed log habitat for northern flying squirrels is below historic conditions at the 50% tolerance level (Table 10). Currently an estimated 27% of the Westside Lowland Conifer/Hardwood habitat meets or exceeds total downed log cover at the 50% tolerance level for northern flying squirrels habitat compared to 36% of the estimated historic habitat.

The downed log analysis suggests that currently the LPR-MFW watershed is well above historical levels for large downed log cover in montane mixed conifer habitat and also somewhat above historical levels for total downed log cover in this habitat type. However, the data suggest that currently there is less downed wood habitat for marten than occurred historically because there is a lower percentage of the area with high levels of downed logs (>8% cover). Currently an estimated 10% of this habitat meets or exceeds total log cover at the 50% tolerance level for occupied marten sites compared to 16% of the estimated historic habitat.

The downed log analysis suggests that currently the LPR-MFW watershed is well above (3% versus 1%) historical levels for total downed log cover in Westside Oak and Dry Douglas Fir Forest and Woodland habitat.

MIS

The Willamette Forest Plan has identified a number of terrestrial wildlife species with habitat needs that are representative of other wildlife species with similar habitat requirements for survival and reproduction. These management indicator species (MIS) include spotted owl, bald eagle, peregrine falcon, cavity excavators, pileated woodpecker, deer, elk, and marten. As indicated in Table 11, most of these species are either known to occur or have potential to occur in or near the Lookout Point Reservoir Watershed. Activity associated with proposed management actions is expected to be consistent with, or exceed Willamette Forest Plan Standards and Guidelines as they pertain to MIS management (USDA 1990).

Table 11. Willamette National Forest Management Indicator Species (MIS) and their relationship with the Lookout Point Reservoir Watershed.

MIS	Key Habitat Feature [a]	Habitat Present in Analysis Area?	Species Present in Analysis Area? [b]
Northern Spotted Owl	Old-growth and mature conifers	Yes	Documented
Pileated Woodpecker	Old-growth and mature conifers	Yes	Documented
American Marten	Old-growth and mature conifers	Yes	Documented
Northern Bald Eagle	Old-growth conifers near large bodies of water	Yes	Documented
American Peregrine Falcon	Cliff nesting habitat near abundant prey	Yes	Occasional
Black-tailed Deer	Winter Range	Yes	Documented
Roosevelt Elk	Winter Range	Yes	Documented
Primary Cavity Excavators:	Dead and decaying trees	See below	
	Red-breasted nuthatch	Yes	Documented
	Northern flicker	Yes	Documented
	Hairy woodpecker	Yes	Documented
	Downy woodpecker	Yes	Documented
	Red-breasted sapsucker	Yes	Documented
	Lewis' woodpecker	No	Not Likely
	Black-backed woodpecker	No	Not Likely
	Northern three-toed woodpecker	No	Not Likely

[a] As identified in the 1990 Willamette National Forest Land and Resource Management Plan (FEIS III – 68-83)
[b] Documented defined as a resident population based on known survey, monitoring, or incidental observation data.

Activity associated with proposed management actions is expected to be consistent with, or exceed Willamette Forest Plan Standards and Guidelines as they pertain to MIS management (USDA 1990).

Survey & Manage

Projects that are within the range of the northern spotted owl are subject to the survey and management standards and guidelines in the 2001 ROD, as modified by the 2011 Settlement Agreement. On December 17, 2009, the U.S. District Court for the Western District of Washington issued an order in *Conservation Northwest, et al. v. Sherman, et al.*, No. 08-1067-JCC (W.D. Wash.), granting Plaintiff's motion for partial summary judgment and finding NEPA violations in the *Final Supplemental to the 2004 Supplemental Environmental Impact Statement to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines* (USDA and USDI, June 2007). In response, parties entered into settlement negotiations in April 2010, and the Court filed approval of the resulting Settlement Agreement on July 6, 2011.

Activity associated with proposed management actions is expected to be consistent with the Willamette National Forest Land and Resource Management Plan as amended by the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines* (2001 ROD), as modified by the 2011 Settlement Agreement in litigation over Survey and Manage Mitigation Measure in *Conservation Northwest v. Sherman*, *Conservation Northwest, et al. v. Sherman, et al.*, Case No. 08-1067-JCC (W.D. Wash., July 6, 2011).

The 2011 Settlement Agreement makes four modifications to the 2001 ROD: (A) acknowledges existing exemption categories (2006 Pechman Exemptions); (B) updates the 2001 Survey and Manage species list; (C) establishes a transition period for application of the species list; and (D) establishes new exemption categories (2011 Exemptions).

The 2011 Settlement Agreement states:
"For projects with signed Records of Decision, Decision Notices, or Decision Memoranda from December 17,2009, through September 30, 2012, the Agencies will use either of the following Survey and Manage species lists:

a. The list of Survey and Manage species in the 2001 ROD (Table 1-1, Standards and Guidelines, pages 41-51).
b. The list of Survey and Manage species and associated species mitigation, Attachment 1 to the Settlement Agreement."

Future project reviews associated with management activity within the Lookout Point Reservoir Watershed will rely on the list attached to the Settlement Agreement.

The Willamette National Forest compiled the species in Table 12 (below) from the 2011 Settlement Agreement Attachment 1. The list includes those vertebrate and invertebrate species with pre-disturbance survey requirements (Category A, B, or C species), who's known or suspected range includes the Willamette National Forest according to:

- Survey Protocol for the Great Gray Owl within the Range of the Northwest Forest Plan – Version 3.0 (2004).
- Survey Protocol for the Red Tree Vole *Arborimus longicaudus* of the Northwest Forest Plan – Version 2.1 (2002).
- Survey Protocol for Survey and Manage Terrestrial Mollusk Species from the Northwest Forest Plan – Version 3.0 (2003).

This list also includes any Category D, E, or F species with known sites located within the Lookout Point Reservoir Watershed. All habitat management projects will address Survey and Manage requirements, and if activities meet survey triggers a compliance statement that includes Table 12 will be included in the project file.

Table 12. Survey & Manage Terrestrial Wildlife Species within the Lookout Point Reservoir Watershed.

Species	S&M Category	Survey Triggers			Survey Results			Site Management
		Within Range of the Species?	Project Area Contains Suitable habitat?	Project May Negatively Affect Species Habitat?	Surveys Required?	Survey Date (mo/year)	Sites Known or Found?	
Vertebrates								
Great Gray Owl (*Strix nebulosa*)	C	Yes						
Red Tree Vole (*Arborimus longicaudus*)	C	Yes						
Mollusks								
Evening Fieldslug (*Deroceras hesperium*)	B	Yes						

Crater Lake Tightcoil (*Pristiloma arcticum crateris*)	A	1						

1 The range for *Pristiloma arcticum crateris* lies above 2,000 feet elevation. Project review needs to consider elevation relative to addressing this survey trigger for the species.

Note that there are no known sites for Category F species *Megomphix hemphilli* (Oregon megomphix) within the watershed that would require management under the 2001 ROD requirements.

Although there are documented observations/detections of great gray owls within the Lookout Point Reservoir Watershed, no nest sites have been documented. Projects will evaluate survey requirements based on current protocol.

Red tree voles are known to occur within the watershed. The Lookout Point Reservoir Watershed is exempt from pre-disturbance surveys for this species as a result of the Programmatic Non-high Priority Site Status Pilot Study. The non-high priority site designation applies to the matrix portion of the watershed only. Projects that meet the survey triggers and are not under matrix allocation would still require pre-disturbance surveys.

Habitat for each mollusk species occurs to a limited extent within the watershed. Projects will evaluate survey requirements based on current protocol.

Literature Cited

Bingham, B.B, and B.R. Noon. 1997. Mitigation of habitat "take": application to habitat conservation planning. Cons. Biology. 11(1): 127-139

Cook, J.G. 2002. Nutrition and Food. Chapter 5, pp. 259-350. *in*: Toweill, D.E. and J.W. Thomas, editors. North American Elk: Ecology and Management. Smithsonian Institution Press. 2002.

Cook, J.G., Bruce K. Johnson, Rachel C. Cook, Robert A. Riggs, Tim DelCurto, Larry D. Bryant, and Larry L. Irwin. 2005. Nutrition and Parturition Date Effects on Elk: Potential Implications for Research and Management. Pages 113-126 in Wisdom, M. J., technical editor, The Starkey Project: a synthesis of long-term studies of elk and mule deer. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resources Conference, Alliance Communications Group, Lawrence, Kansas, USA.

Cook, J.G. 2011. Elk Habitat Selection in Western Oregon and Washington: Final Models and Management Applications. Presentation. April 5-6, 2011. Portland, Oregon.

Doerr, Joe. 2012. Personal Communication. Forest Wildlife Biologist, Willamette National Forest, USDA Forest Service. July 20, 2012.

Franklin, A.B., D.R. Anderson, R.J. Guiérrez & K.P. Burnham. 2000. Climate, habitat quality, and fitness in northern spotted owl populations in northwestern California. *Ecological Monographs* 70(4):539-590.

Irwin, L.L., D. Rock and S. Rock. 2004. Adaptive management monitoring of spotted owls, 2004 annual progress report. National Council for Air and Stream Improvement, Inc. Vancouver, Washington. 47 pp.

LEMMA: Landscape Ecology, Modeling, Mapping and Analysis. 2009. <http://www.fsl.orst.edu/lemma/> Accessed December 10, 2009.

Mellen-McLean, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Susan A. Livingston, Elizabeth A. Willhite, Bruce B. Hostetler, Catherine Ogden, and Tina Dreisbach. 2012. DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 2.20. USDA Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland,
Oregon. http://www.fs.fed.us/r6/nr/wildlife/decaid/index.shtml

Oregon Department of Fish and Wildlife. 2003. Oregon's elk management plan: February 2003. Oregon Department of Fish and Wildlife, P.O. Box 59, 2501 S.W. First Avenue, Portland, Oregon 97201.

Thomas, J.W., E.D. Forsman, J.B. Lint, E.C. Meslow, B.R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl. Report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. Unpublished interagency document. 458 pages.

USDA Forest Service, USDI Bureau of Land Management. 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, USDA Forest Service and USDI Bureau of Land Management, 1994.

USDI Fish and Wildlife Service, USDI Bureau of Land Management and USDA Forest Service. 2008. Methodology for estimating the number of northern spotted owls affected by proposed federal actions. Version 2.0. Oregon Fish and Wildlife Office, Fish and Wildlife Service, Portland, OR.

USFWS (U.S. Fish and Wildlife Service). 2007d. Proposed Revised Designation of Critical Habitat for the Northern Spotted Owl (*Strix occidentalis caurina*); Proposed Rule. Fed. Reg. Vol. 72. 112:32450-32516. June 2007.

USFWS (U.S. Fish and Wildlife Service). 2008b. Revised Designation of Critical Habitat for the Northern Spotted Owl (*Strix occidentalis caurina*); Final Rule. Fed. Reg. Vol. 73. 157:47326-47522. August 13, 2008.

USFWS (U.S. Fish and Wildlife Service). 2011b. 2011 Protocol for Surveying Proposed Management Activities that may impact Northern Spotted Owls. February 3, 2011. USFWS, Portland, OR.

USFWS (U.S. Fish and Wildlife Service). 2011c. Revised Recovery Plan for the Northern Spotted Owl (Strix occidentalis caurina). USFWS, Portland, Oregon. xvi+258 pp.

Wagner, F. F., R. G. Anthony. 1999. Reanalysis of northern spotted owl habitat use on the Miller Mountain study area. final report for step 1: Identification and evaluation of northern spotted owl habitat in managed forests. Oregon Cooperative Fish and Wildlife Unit, Oregon State University, Corvallis, OR.

Wisdom, M., L.R. Bright, C.G. Carey, W.W. Hines, R.J. Pedersen, D.A. Smithey, J.W. Thomas, and G.W. Witmer. 1986. A model to evaluate elk habitat in western Oregon. USDA Forest Service, Pacific Northwest Region Report R6-F&WL-216-1986. March 1986.

Lookout Point Watershed Analysis

Recreation Resources Report Update

Middle Fork Ranger District
Willamette National Forest

Mossy Maples Forest Camp: *Once located along the old Highway 58 right-of-way, now under the Lookout Point Reservoir high water mark. Black Canyon Campground replaced Mossy Maple and River's Edge Forest Camps. Courtesy of Willamette National Forest Heritage Archives.*

Karl Dietzler
Recreation Planner
Middle Fork Ranger District
Willamette National Forest
August 16, 2012

Introduction

This report updates the recreation resources discussed in the Lookout Point Watershed Analysis (LPWA) Area report, completed in September, 1997. Overall, there has been little physical change within the watershed analysis (WA) area, in terms of the types or number of resources (see Figure 1 for the GIS map indicating key recreation resources at the end of this report). General use patterns have remained similar: anglers and developed/dispersed campers concentrate along the reservoir/Middle Fork Willamette River, and hikers, equestrians, and off-road cyclists traverse trails up to the high ridges along the Winberry Divide, or to the high country of Eagles Rest, Hardesty, Patterson, or Tire Mountains. Hunters drive forest roads to access locations up near the ridgelines. It is a safe assumption that general recreational use levels have increased since the 1997 LPWA, especially with the off-road cycling user group; however, there are no Forest Service recorded use numbers, save for special-use permitted events and guides. Not having similar data, the 1997 LPWA recreation resource section relied on the 1994 Oregon State Comprehensive Outdoor Recreation Plan in order to make broad inferences regarding the current and future condition of recreational trends. These inferences are general in nature, and do not provide a specific picture of recreational use trends within the watershed area. At present, the 49,126-acre analysis area supports two active developed campgrounds with boat ramps, one campground removed from public use, one wildlife interpretive area, one recorded and numerous dispersed campsites, two historic trail shelters, 48.2 miles of trails, and special-use permittees. For the latter, recreation special uses comprise outfitters and guides, events, and educational programs, and land uses comprise railroad, communications, and power company rights-of-way, state entities, and communication towers. The attached map at the end of the document depicts an overview of the WA area.

1997 & 2012 Recreation Condition Comparison

Physical Resources

Developed Recreation Sites

Hampton, Black Canyon, and Shady Dell Campgrounds exist within the riparian reserves of the WA. Hampton is a small, five-site area used primarily for its boat launch, with a gate installed in 1993 to prevent illegal winter dumping. Black Canyon, constructed to replace the Mossy Maple and River's Edge Forest Camps inundated by the reservoir, has 72 sites and offered year-round boat ramp access beginning in 1992 for the winter fishing season. In 1993, special-use outfitter guides began using the Black Canyon boat ramp as a take-out point. There are no accurate use figures for Hampton and Black Canyon Campgrounds.

The Shady Dell campground, listed as having nine sites, was then listed as managed as a reservation group site only. It is now a campground removed from public use, but utilized for Forest Service partner groups, such as the Northwest Youth Corps, or occasional special-use permitted groups, such as the Oregon Army National Guard.

Additionally, a joint U.S. Army Corps of Engineers (USACOE) and U.S. Forest Service (USFS) planning project proposed two additional campgrounds: Lakeview, proposed at the Forest Boundary off of Forest Road 5824, and another at Goodman Creek. These campgrounds, part of a joint COE and FS planning project for the LO Point Reservoir, never materialized.

The Buckhead Wildlife Interpretive Area, in existence but not mentioned in the 1997 WA, hosts a small loop trail with interpretive signs, toilet, and picnic area for day-use passive wildlife observation opportunities.

Dispersed Campsites

One dispersed campsite was mentioned for the WA in 1997; however, its location was not identified. In the 2012 Geographic Information Systems database, one dispersed campground is depicted along the Hardesty Mountain trail and it is located along the trail in T20S, R1E, Section 10. Another known dispersed camp is located along the North Shore Road, and its location needs to be entered into the GIS database. Yet another dispersed site, located on a Bureau of Land Management (BLM) inholding, is based out of a gravel pit in the planning area (where) south of the Lookout Point Reservoir has evidence of heavy use.

Trails, Trailheads, and Trail Shelters

There are 48.2 miles of trails in the watershed. Nineteen trails were identified in the 1997 WA, with 85% accessed from Highway 58. There are fifteen planning area trails (or portions) current within the WA boundary for 2012:

Alpine Ridge - Salmon Creek Trail Area

- Alpine Trail #3450
- Buckhead Trail #3474

Hardesty Trail Area

- Black Canyon Trail #3486
- Deception Butte Trail #3466
- Eagles Rest Trail #3461
- Eula Ridge Trail #3463
- Goodman Creek Trail #3461.1
- Hardesty Trail #3469
- Lawler Trail #3473
- Lone Wolf/Patterson Mountain Trail #3470
- Lost Creek Trail #3462
- South Willamette Trail #3465

Winberry Trail Area

- Cloverpatch Trail #3457
- Tire Mountain Trail #3485
- Winberry Divide Trail #3476

Only the Goodman Creek Trail lies within the riparian reserve. Approximately 1/3 of the trails were classified as historic way trails, utilized by Forest Service personnel on pack animals to access the high peaks. Then-current trail projects were the completion of three miles of the old Boundary Trail (now the Eugene to Crest) and reconstruction of the Lawler Trail. The reference

to the Lawler Trail reconstruction may have indicated the construction of the extension to the trail down to the Eula Ridge Trail area. The date for this project is unknown. Additionally, the Buckhead Wildlife Interpretive Area trail and Black Canyon Interpretive trail were not specifically mentioned.

Currently, the Hardesty Trailhead is currently being improved with formalized parking, a toilet, and a day-use picnic facility; project completion is expected at the end of Fiscal Year (FY) 2012.

Ash Swale and Lone Wolf Shelters are situated along the Goodman Creek and Lawler Trails, respectively. These historic shelters, constructed by the Civilian Conservation Corps during the 1930s, were utilized as overnight locations for Forest Service employees accessing the higher peaks portion of this area. Having the shelters eliminated the use of packing heavy canvas tents. Both shelters have been completely reconstructed. Use figures for each shelter are unknown.

Off Highway Vehicle (OHV) Use

In the years leading up to the 1997 report, OHV use occurred in the reservoir after draw-down. The USACOE reported low to moderate levels of unauthorized OHV use, and was planning to designate an OHV use area in Section 18, near Armet Creek. This USACOE development has never materialized, and the area was formally closed to OHV use during the late 1990s.

Travel Routes and General Recreation/Land-Use Patterns

The LPWA indicated that main travel routes were Oregon State Highway 58 and Forest Road 5821, also known as the North Shore Road. This has not changed.

General recreation patterns (preferences and demand) were determined in the 1997 LPWA by referring to 1994 State of Oregon Statewide Comprehensive Outdoor Recreation Plan (SCORP) data regarding recreational activities. While having SCORP data is useful for understanding overall statewide recreation trends, specific outcomes could not be correlated to the WA planning area, as there are no specific Forest Service recreation use numbers for hikers, off-road cyclists, and developed/dispersed campers.

1997 land-use patterns included a gasoline-filling station near the Hampton Campground, scattered rural residences situated in private land in-holdings along Highway 58, and a small trailer park near the Middle Fork Ranger station. Overall, these land-use patterns have not changed for 2012.

Special Uses

Recreation Special Uses

For recreation, Special Uses guides and events have increased from 1997. The following is the recreation special uses list for 2011:

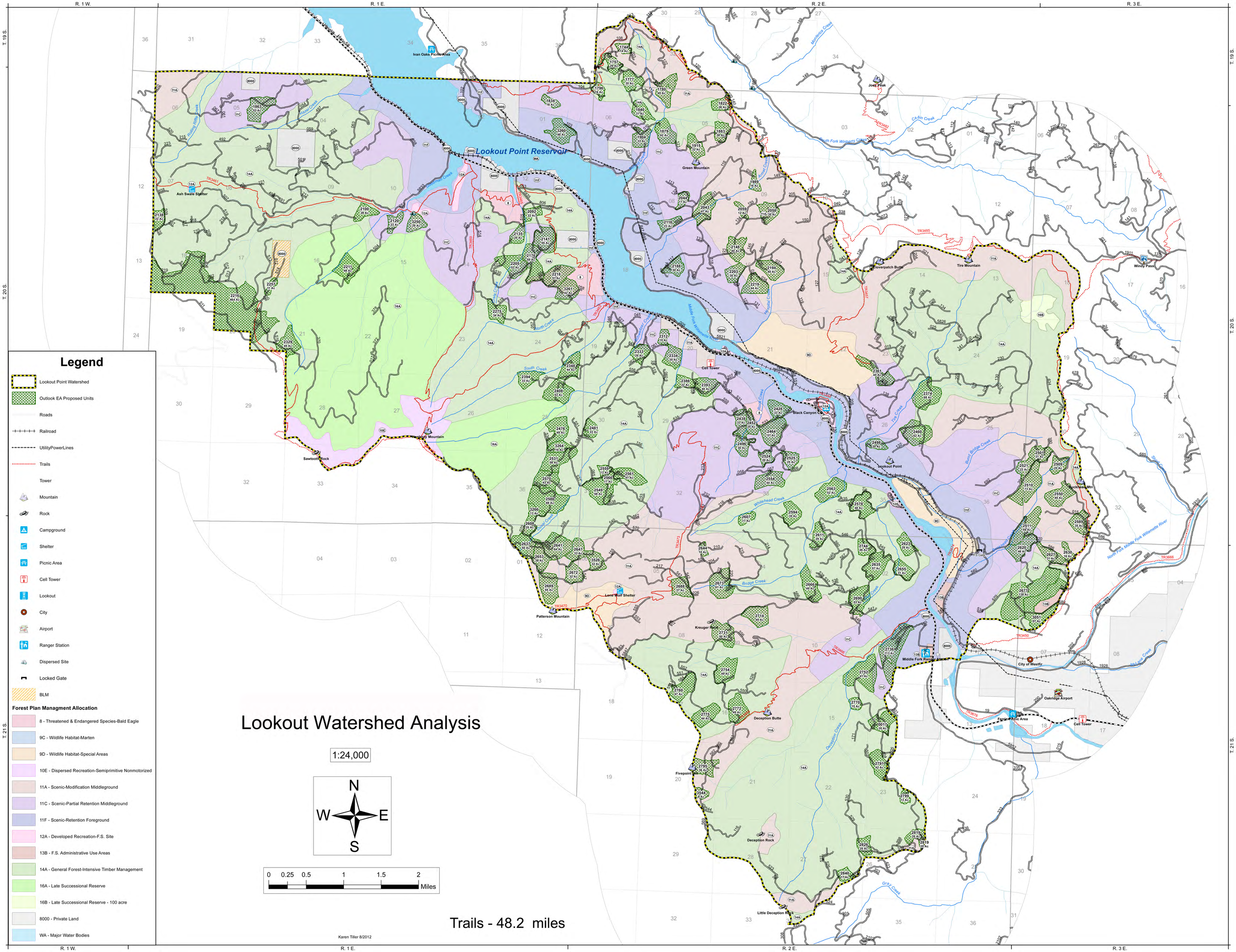
River Guides:	15 guides, 71 trips, 153 clients 2 new river guide requests for 2012
Land-Based Guides:	City of Eugene Riverhouse Oregon Adventures Pacific Tree Climbing Institute River Road Parks and Recreation University of Oregon Dept. of Recreation and Physical Education
Recreation Events:	Mountain Bike Oregon (two events, July & August) Hardesty Hardcore Run Cream Puff Mountain Bicycle Race Oakridge Super D (use suspended for 2012)

Land-Use Special Use Permits

Linear Rights-of-Way	Highway 58 Corridor:	Lane Electric Co-op CenturyLink/Qwest phone lines/ Level III Fiberoptics 360networks Fiberoptics Bonneville Power Administration Union Pacific Railroad
General Land Uses:	Oregon Dept. of Fish & Wildlife (ODFW) fish monitoring trap, Deception Creek, Westfir. Buckhead Mountain Communications Tower, Verizon Wireless	
Other (Non-Permit) Land Uses:	Bureau of Land Management inholdings Private inholdings	

Literature Cited

USDA, 1997. Lookout Point Watershed Analysis Area, Lowell Ranger District, Willamette National Forest.


R. 1 W.
R. 1 E.
R. 2 E.
R. 3 E.
T. 19 S.
T. 20 S.
T. 21 S.
Lookout Point Reservoir
Ivan Oaks Picnic Area
Joes Peak
Green Mountain
Ash Swale Shelter
Moverpatch Butte
Tire Mountain
Windy Pass
Cell Tower
Black Canyon
Lookout Point
Hungry Mountain
Sawtooth Rock
Blackhead Mtn
Lone Wolf Shelter
Patterson Mountain
Kreuger Rock
Middle Fork Ranger Station
City of Westfir
Oakridge Airport
Fergus Picnic Area
Deception Butte
Deception Rock
Fivepoint
Little Deception Rk
Cabin Creek
South Fork Winberry Creek
Martinka Creek
Middle Fork Willamette River
North Fork Middle Fork Willamette River
Blunt Bridge Creek
Whitehead Creek
Bridge Creek
Deception Creek
Gray Creek
Moss Creek
Dorbrough Creek
Salt Creek
Rock Creek
Tire Creek
Hazel Creek
Riding Pole Creek
Hardy Creek
North Creek
South Creek
TR3461
TR3460
TR3485
TR3407
TR3470
TR3472
TR3456
TR3666
TR3676
Legend
Lookout Point Watershed
Outlook EA Proposed Units
Roads
Railroad
UtilityPowerLines
Trails
Tower
Mountain
Rock
Campground
Shelter
Picnic Area
Cell Tower
Lookout
City
Airport
Ranger Station
Dispersed Site
Locked Gate
BLM
Forest Plan Managment Allocation
8 - Threatened & Endangered Species-Bald Eagle
9C - Wildlife Habitat-Marten
9D - Wildlife Habitat-Special Areas
10E - Dispersed Recreation-Semiprimitive Nonmotorized
11A - Scenic-Modification Middleground
11C - Scenic-Partial Retention Middleground
11F - Scenic-Retention Foreground
12A - Developed Recreation-F.S. Site
13B - F.S. Administrative Use Areas
14A - General Forest-Intensive Timber Management
16A - Late Successional Reserve
16B - Late Successional Reserve - 100 acre
8000 - Private Land
WA - Major Water Bodies
Lookout Watershed Analysis
1:24,000
N
W
E
S
0 0.25 0.5 1 1.5 2 Miles
Trails - 48.2 miles
Karen Tiller 8/2012

Lookout Point Watershed Analysis Area – Soil / Watershed Analysis Update

John Dixon 08.29.2012

National Watershed Condition Framework

The National watershed Condition Framework classified watershed condition for all 6th level watersheds and was completed in 2011 across the Willamette National Forest. This effort used existing data layers, local knowledge and professional judgment. Twelve watershed condition indicators were used to determine the overall watershed condition and ultimately a Watershed Condition Class (WCC) (Figure 1). A watershed having a WCC ranking of 1 is "Properly Functioning", while a ranking of 2 is "Functioning at Risk" and a ranking of 3 is "Not Properly Functioning". Through targeted restoration of specific resources in these watershed the WCC can be uplifted from "Not Properly Functioning" to "Functioning at Risk" and from "Functioning at Risk" to "Properly Functioning". Targeted restoration efforts are identified in Watershed Action Plans (WAP) for selected priority focus 6th level watersheds.

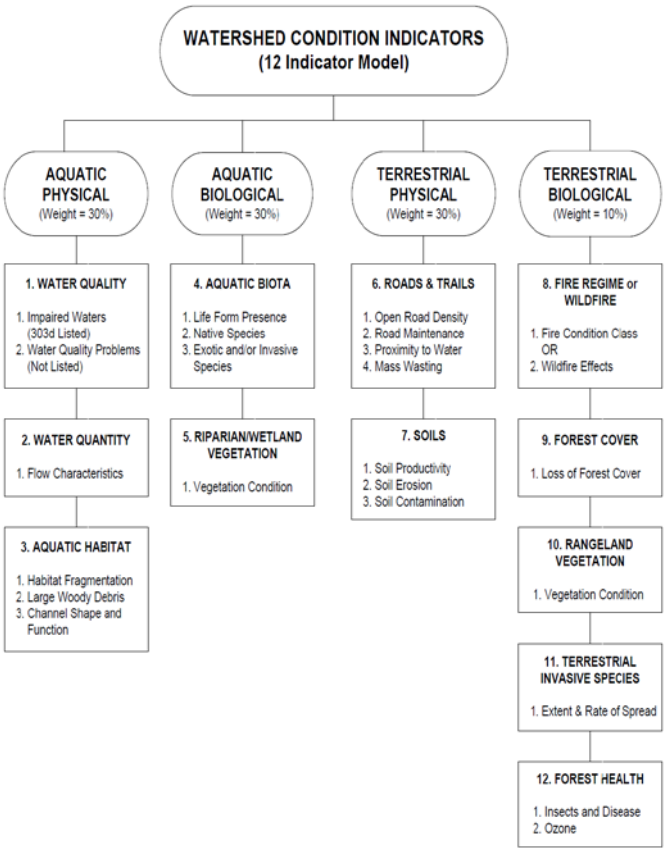


Figure 1. Watershed Condition Indicators

The Lookout Point HUC 5th field is predominantly comprised of two 6th level watersheds; Deception Creek and Dexter Reservoir. The Watershed Condition Framework rated these watersheds as "Functioning at Risk". The following tables (1-6) display general watershed characteristics and rankings of the 12 watershed condition indicators.

Table 1. Lookout Point 6th Level Watershed Characteristics

HUC 6th Level NAME	HUC Number	WATERSHED TOTAL ACRES	USFS ACRES	NON USFS ACRES	% USFS	% Non USFS
Deception Creek	170900010701	19914	19761	153	99	1
Dexter Reservoir	170900010703	47778	27495	20283	58	42

Table 2. Lookout Point 6th Level Watershed Aquatic Physical Watershed Condition Indicators

	AQUATIC PHYSICAL								
	1. Water Quality			2. Water Quantity	3. Aquatic Habitat				AQUATIC PHYSICAL TOTAL
HUC 6th Level NAME	1. Impaired Waters	2. Water Quality Problems	Water Quality Total	1. Flow	1. Habitat Frag.	2. LWD	3. Channel	Aquatic Habitat Total	
Deception Creek	2.0	2.0	2.0	2.0	2.0	2.0	3.0	2.3	2.1
Dexter Reservoir	2.0	2.0	2.0	3.0	2.0	3.0	2.0	2.3	2.4

Table 3. Lookout Point 6th Level Watershed Aquatic Biological Watershed Condition Indicators

	AQUATIC BIOLOGICAL					
	4. Aquatic Biota				5. Riparian/Wetland Veg	AQUATIC BIOLOGICAL TOTAL
HUC 6th Level NAME	1. Life Form	2. Native Species	3. Exotic /Invasive	Aquatic Biota Total	1. Veg Condition/ R6 Indicator	
Deception Creek	3.0	2.0	1.0	2.0	1.0	1.50
Dexter Reservoir	3.0	2.0	3.0	2.7	1.0	1.83

Table 4. Lookout Point 6th Level Watershed Terrestrial Physical Watershed Condition Indicators

	TERRESTRIAL PHYSICAL										
	6. Roads and Trails (Provide one indicator score--under "Roads Trails Total" or "R6 Roads Indicator" Enter "0" for indicator column not used.)						7. Soils				TERRESTRIAL PHYSICAL TOTAL
HUC 6th Level NAME	1. Open Road Density	2. Road Maint.	3. Prox to Water	4. Mass Wasting	Roads Trails Total	R6 Roads Indicator	1. Soil Product	2. Soil Erosion	3. Soil Contam	Soil Total	
Deception Creek	2.0	2.0	3.0	3.0	2.5		1.0	1.0	1.0	1.0	1.8
Dexter Reservoir	3.0	3.0	3.0	3.0	3.0		1.0	1.0	1.0	1.0	2.0

Table 5. Lookout Point 6th Level Watershed Terrestrial Biological Watershed Condition Indicators

	TERRESTRIAL BIOLOGICAL										
	8. Fire Regime or Wildfire			9. Forest Cover	10. Rangeland Vegetation		11. Terrestrial Invasives	12. Forest Health			TERRESTRIAL BIOLOGICAL TOTAL
HUC 6th Level NAME	1. Fire Condition Class	2. Wild fire	Fire Total	1. Loss Forest Cover	1. Veg Condition	Forest or Range	1. Extent Rate Spread	1. Insects Disease	2. Ozone	Forest Health Total	
Deception Creek	2.0		2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.3
Dexter Reservoir	2.0		2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.3

Table 6. Lookout Point 6th Level Watershed Overall Watershed Condition Rating

HUC 6th Level NAME	OVERALL WATERSHED CONDITION RATING
Deception Creek	2.0
Dexter Reservoir	2.0

Hydrologic Recovery – Current Aggregate Recovery Percentage Ratings

Traditionally, projects involving timber harvest on the Willamette National Forest are analyzed for their cumulative impact on the quantity and timing of peak flows and water yields using an accounting methodology known as Aggregate Recovery Percentage or ARP, as specified by the Forest Plan. The ARP model compares the amount of an analysis area within the transient snow zone that is recovered against a threshold value (Midpoint) that was calibrated for the area during development of the Forest Plan. The midpoint values were developed based on the soil, geology, vegetation, climate, and stream channel conditions of each sub-watershed, and are intended to represent a minimum safe level of vegetative recovery in the sub-watersheds to prevent significant alteration of peak flow regimes as a result of management activities. This mid-point value is used as a threshold of concern; when current conditions or planned conditions drop below the mid-point value, there is the potential for an increase in peak flows which may result in channel scour or streambank erosion. Recovery generally occurs when stand diameters average 8” dbh and crown closures exceed 70%. The transient snow zone is generally considered to include those areas of the forest between the elevations of 1,500 and 4,500 feet. The analysis is based on data extracted from the Forest’s VEGIS database, which includes information about all past harvest activities in the sub-watershed.

Current ARP calculations for the sub-watersheds within the Lookout Point Watershed Analyses Area are all well above Mid-Point ARP values. The values presented in Table 7 include the effects of past harvests within the sub-watersheds. The last know active timber sales in the area date back to approximately 1997.

Table 7. Current Aggregate Recovery Percentage and Mid-Point Aggregate Recovery Percentage

Sub-watershed	Current Hydrologic Recovery	Mid-Point ARP*
Burnt-Buckhead	93	75
Cain-Armet	90	70
Crale	95	70
Duval	94	75
East Deception	93	80
Hospital-Carpet	87	70
Lower Goodman	96	70
Middle Deception	94	75
North-South	98	75
North Shore Tributaries	95	70
Rhodes-School	89	70
Rock	91	70
Rolling-Fern	88	70
Schweitzer	97	75
Tire	86	70
West Deception	96	70
West Goodman	88	70
White-Dell	90	75

* Mid-Point ARP values based on weighted average mid-point values of Planning Sub-drainages identified in Appendix E of the Willamette National Forest Land and Resource Management Plan

Transportation

Roads have three primary effects on water: they intercept rainfall directly on the road surface and road cutbanks and intercept subsurface water moving down the hillslope; they concentrate flow, either on the surface or in an adjacent ditch or channel; and they divert or reroute water from flow paths that it would take were the road not present.

The construction and use of roads can be a significant source of sediment in forested basins (Swanson and Dyrness 1975, Reid and Dunne 1984). Roads and particularly road-stream crossings, where the road system and stream system intersect, present risks to water quality and to aquatic and riparian habitats. Sediments from road failures at stream crossings are deposited directly into stream habitats and can have both local and downstream effects. These include alterations of the channel pattern or morphology, increased bank erosion and changes in channel width, substrate composition, stability of slopes adjacent to the channels, and riparian vegetation. All of these changes result in important biological consequences that can affect the entire stream Ecosystem (USDA, 2000).

Roads modify natural drainage patterns and can increase hillslope erosion and downstream sedimentation. Often times improperly designed or maintained road ditch lines and road fills will input significant amounts of fine sediment into the stream system. Undersized and/or improperly maintained culverts have a greater risk of failure than properly sized and maintained culverts (Robison, E.G., A. Mirati, and M. Allen 1999).

Lookout Point WAA has a total of 268 miles of road, of which approximately 250 miles are under USDA Forest Service ownership. Road ownership also includes; Lane County, Oregon Department of Transportation (ODOT), Private, Bureau of Land Management, and City. Table 7 displays the existing condition of roads within the Lookout Point WA by operating maintenance level and ownership. Over 70 percent of the roads within the WAA are at Operating Maintenance Level 2. As noted in the 1997 Lookout Point WA, this is of concern since these roads do not receive adequate maintenance that can result in an increase of fine sediments into stream channels.

Table 7. Existing Operation Levels and Ownership of Roads Within the Lookout Point WA

OPERATING MAINTENANCE LEVEL	MILES
1 - BASIC CUSTODIAL CARE (CLOSED)	
BLM	0.13
Collector	0.01
Local	26.42
TOTAL	**26.56**
2 - HIGH CLEARNACE VEHICLES	
Arterial	0.07
BLM	0.65
Collector	56.25
Local	150.69
Umpqua	1.41
TOTAL	**207.66**
3 - SUITABLE FOR PASSENGER CARS	
Arterial	0.12
BLM	0.40
Campground	1.05
Collector	11.34
Local	4.80
TOTAL	**17.71**
4 - MODERATE DEGREE OF USER COMFORT	
BLM	0.04
Local	2.69
Private	0.53
TOTAL	**3.26**
5 - HIGH DEGREE OF USER COMFORT	
City	0.47
State	12.42
TOTAL	**12.89**

Middle Fork Ranger District, Roads Analysis Report, 2004

The primary intention of the Roads Analysis Report was to assess the problems and risks of roads in a watershed and set priorities for incorporation into project level NEPA work. The goal was to complete a roads analysis for the Middle Fork Ranger District that specified which roads to retain, which roads to close, and establish the appropriate level of maintenance. The objective was to balance funding levels available for road maintenance with needs for access in a manner that minimized road related effects to resources.

There are four primary interests that guided the analysis of each road segment; these included potential affects to terrestrial and aquatic resources and values for public and administrative uses. Potential affects and values are assigned ratings; high, moderate, and low.

Using an automated spatial analysis process, each road segment was evaluated for its potential affects to the primary interests. When the ranking to close the road was equal to the ranking to keep it open the automated system highlighted the need for an interdisciplinary discussion. This discussion and a landscape look at the individual road segment resulted in a consensus recommendation for the road. Once all recommendations were finalized, a visual landscape assessment of the road system was made to ensure that road recommendations were viable and complied with pertinent policy and direction.

The Road Analysis Report identified approximately 130 miles of road to close and 121 miles of road to retain as open that are under USDA Forest Service ownership within the Lookout Point WAA (figure 2). Of these 130 miles of road to close, there are currently 26 miles of level 1 road – Basic custodial care (closed). As a result, open road density by 6th level watershed would be reduced greatly if the Roads Analysis road closure direction was to be implemented (Table 8).

Figure 2. Roads Analysis Report Recommended to be Closed or to Remain Open within the Lookout Point WA

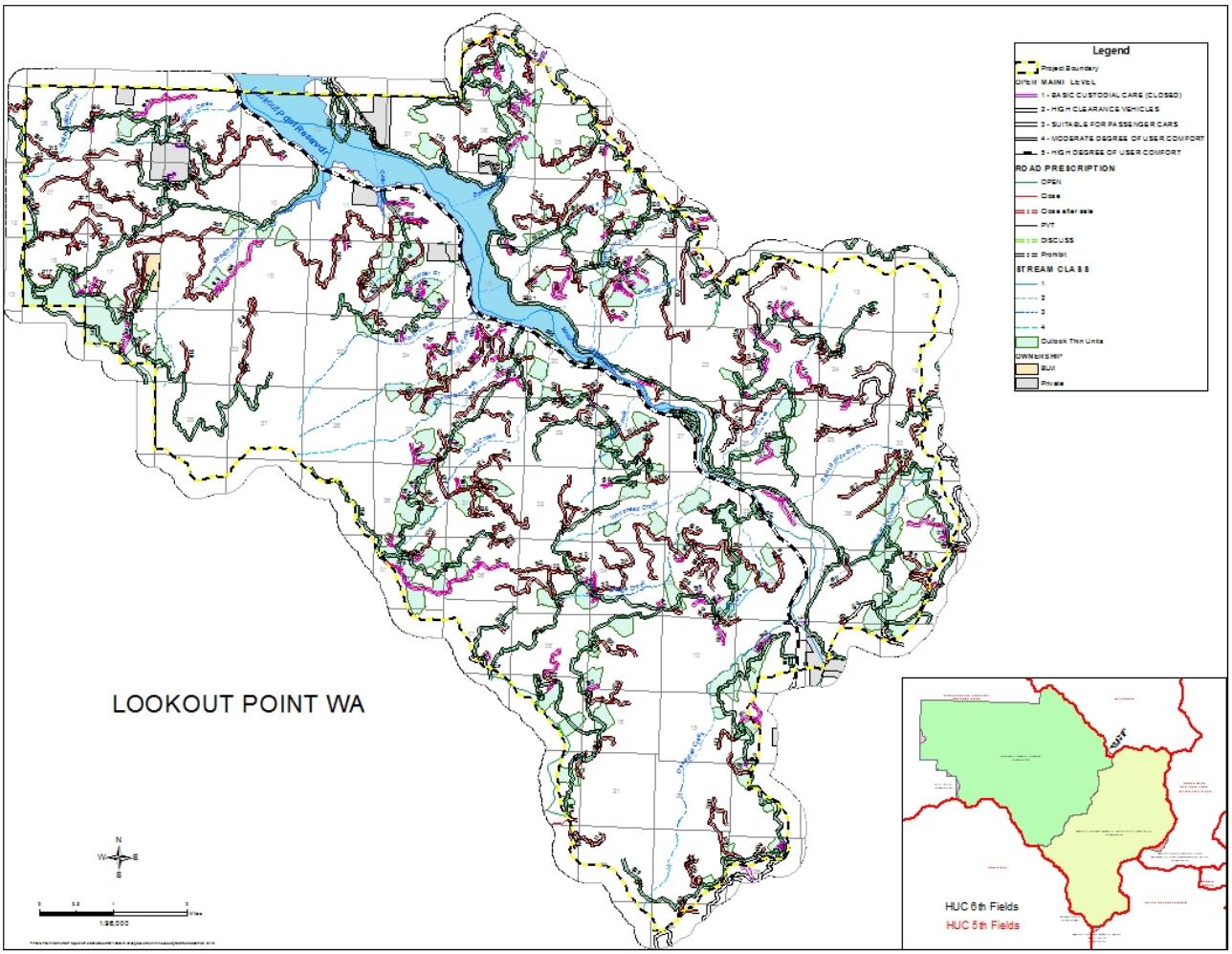


Table 8. Existing and Potential Open Road Density based on the Roads Analysis Direction for Miles of FS Road to be Closed

HUC 6th Level Watershed Name	Watershed Area and Miles of Road by Ownership		Open Road Density Mi/Mi Sq
Dexter Reservoir	Area (acres)	29539	
	Area (mi. sq.)	46	
	Miles of Roads - All Owners	165	3.6
	Miles of Road - FS	152	
	Miles of FS Road to be Closed	84	1.7
Deception Creek	Area (acres)	19670	
	Area (mi. sq.)	31	
	Miles of Roads - All Owners	109	3.5
	Miles of Road - FS	102	
	Miles of FS Road to be Closed	50	1.9

Roads Analysis Report – High Aquatic Risk Roads

The Road Analysis Report assigned aquatic risk ratings to all road segments (USDA, 2004). The rating assesses potential impacts to critical habitat areas for fish, road-stream crossings, road surface types, risk of debris failure, risk or land flow and steepness of side slopes. These elements are a reflection of the potential for the road system to modify the surface and subsurface hydrology that can increase sedimentation to aquatic habitats. There are approximately 250 miles of Forest Service system roads on Forest Service lands within the Lookout Point WAA that were evaluated for aquatic risk. There are approximately 39 miles of roads that have a high risk, 75 miles of road that have a moderate risk, and 21 miles of road that have a low aquatic risk rating.

Many of these roads have stream culverts, drainage structures, and ditches that have a risk of failure during high runoff events. In addition, there are many miles of roads in the watershed that have not been maintained or repaired to desired standards. If roads are not maintained or closed in the near future, there is an increased risk for detrimental effects to water quality and aquatic resources. Failure of these drainage systems could result in chronic sediment source areas for streams or catastrophic failure leading to mass wasting events delivering large quantities of sediment to streams. In either case, these failures would have a detrimental affect on water quality and in-stream habitat for aquatic organisms.

Road closure and treatments to store or decommission roads in a hydrologically stabilized condition would be accomplished using a variety of methods that could include culvert and fill removal, lowering fill heights over culverts, side cast pull back, road sub-soiling, waterbar installation, and ditch cleaning. Road entrances would be closed using a variety of methods such as earthen berm construction, boulder array placement, and gate installation.

John Dixon

District Soil Scientist / Hydrologist

References Cited

Robison, E.G., A. Mirati, and M. Allen. 1999. Oregon road/stream crossing restoration guide. Advanced Fish Passage Training Version. Oregon Dept. of Forestry, Salem, OR.

Swanson, F. J., and C. T. Dyrness. 1975. Impact of clear-cutting and road construction on soil erosion by landslides in the western Cascade Range, Oregon. Geology 3:393-396.

USDA, Forest Service. 2000. Forest Roads: A Synthesis of Scientific Information. United States Department of Agriculture Forest Service. 117p.

USDA, Forest Service. 2004. Middle Fork Road Analysis Report. Middle Fork Ranger District. Westfir, OR 97452

Reid, L. M., and T. Dunne. 1984. Sediment production from forest road surfaces. Water Resources Research 20 (11):1753-1761.

Lookout Point Watershed Analysis Botanical Update August 2012

Introduction

This report covers the botanical resources aspects (Rare and Invasive plant species and Special Habitats) of the Lookout Point Watershed Analysis update. Sensitive and Survey and Manage plant lists have gone through several changes in the last 15 years. The biggest change in the watershed is the invasion and establishment of false brome an invasive plant species. The invasive species list has also changed as new invaders become known and or established in the area. We completed the Buckhead Weed Management Plan as recommended in the previous Watershed Analysis. We have documented more special habitat types during timber sale surveys. More information about this watershed will be available in the winter of 2013 after the Outlook Planning Area surveys are completed and the results are written up in the Botanical Report.

Sensitive, Rare and Survey and Manage Plants

Current Condition

Whitebark pine is the only plant on the Willamette that is a candidate species on the Threatened and Endangered Species list. There are no whitebark pine in the analysis area. Botanical species in the analysis area include; Sensitive and Strategic, Review, Watch and Concern and Survey and Manage Species. The information below is based on known sites found up to August 2012. More sites may be found during surveys in the summer of 2013. The Outlook Planning Area Botanical Report will contain a complete list of sites found in this watershed.

A complete list of the vascular and non-vascular plants from the 2011 Regional Forester's Sensitive and Strategic Species list is located in the Appendix. Sensitive and Strategic species found in the watershed are listed in Table 1 below. Review, Watch and Concern plant species are also tracked on the Willamette and the species and number of sites found in the watershed are listed below. The Survey and Manage Program has been through several changes in the last 15 years. In 2011 a Settlement agreement was signed and the policy and species related to that settlement agreement are what was used for this analysis. Survey and Manage Species are also listed in the table below. More information on Sensitive Species and Survey and Manage Species can be found by going on line to the site listed in the References.

Table 1

Species	Lifeform	List	Number of Populations	Threats to populations
Chaenotheca furfuracea	Lichen	SM	1	
Chrysomphalina grossula	Fungi	Strategic	1	Ground disturbance
Cladonia norvegica	Lichen	Sensitive	1	Timber harvest
Hypogymnia oceanica	Lichen	SM	1	
Lathyrus holochlorus	Vascular	Sensitive	1	Road Maintenance
Romanzoffia thompsonii	Vascular	Sensitive	9	Ground disturbance, hydrological changes
Sidalcea cusickii	Vascular	Watch	1	
Ramalina thrausta	Lichen	SM	4	
Usnea longissima	Lichen	SM	10	
Woodwardia fimbriata	Vascular	Review	3	Ground disturbance
SM: Survey and Manage 2001 ROD and 2011 Settlement Agreement.				

Chaenotheca furfuracea (sulphur pin lichen) is a Survey and Manage lichen species that is found under tree roots, tipped over stumps and under rock overhangs. Populations are susceptible to intense fires. Maintaining the microclimate humidity and shade is critical to its survival. The population in this watershed is in a riparian area near Hardesty Mountain.

Woodwardia fimbriata is on the Willamette National Forest Review list. It grows in wet, seepy areas and is only found in five places on the forest, all on the Middle Fork District. This species is common in California but rare this far north. It has been found in three different locations in the watershed.

Cladonia norvegica is a small lichen that grows on trees. One site has been found on old stumps in the watershed area. *Ramalina thrausta* and *C. norvegica* are listed as oligotroph (lichens found in areas with low nitrogen areas) lichens that are "most abundant under nitrogen deposition regimes averaging 0.5 to 2.5 kgN/ha/yr and are increasingly difficult to find as deposition increases." (National Lichens & Air Quality Database and Clearinghouse) Oligotroph lichens are an important for winter forage, nitrogen fixation and insect habitat. *Usnea longissima* is also an oligotroph but it may also be sensitive to high levels of ozone. *Hypogymnia oceanica* is considered a mesotroph with a low to moderate N requirement.

Lathyrus holochlorus is Sensitive Species found on the edge of a cut bank on the 5824 road. It is the only population of this species on the Forest. This species is more common at lower elevations in the

Willamette Valley and foothills but, is still considered rare. This site is threatened by road maintenance activities and should be monitored and buffered from road brushing. The site also has a lot of poison oak and it is cut back by hand every year to maintain the Lathyrus. This species often occurs in oak woodland areas that were previously maintained by fires. Prescribed fire in oak and meadows in the watershed could help provide more habitat for this species.

Special Habitats

Current Condition

The Lookout Watershed has hardwood stands made up of big leaf maple *(Acer macrophyllum*), vine maple (*A. circinatum*) and red alder (*Alnus rubra*). Some areas of Quercus garryana (Oregon white oak) are present. Ash swales are common on the north side of the reservoir and *Fraxinus latifolia (*Oregon ash) is the dominant tree species in these wet areas. The table for Special Habitats will be updated in 2013 when surveys are completed for the Outlook Planning area.

Ash swales may have been included in the hardwood portion of the watershed analysis 15 years ago. On the Middle Fork these are unique areas. This plant community is classified as an Oregon ash/slough sedge association (*Fraxinus latifolia/Carex obnupta*). ORBIC ranks this plant community as G4S4, meaning it is "apparently secure, though it may be quite rare in parts of its range, especially at the periphery" (Kagan et al. 2000).

Northshore meadow on the north side of the reservoir has been burned twice in the last 15 years by prescribed fire. Prescribed fire may be appropriate in other dry or mesic meadows in the watershed to kill encroaching conifers and maintain meadow vegetation.

Non-Native Species

Invasive Plant Species

Current Condition

The biggest change in the analysis area in the last 15 years is the introduction and establishment of false brome (*Brachypodium sylvaticum*) throughout the watershed. This invasive grass species is found throughout the planning area on most major system roads and on many spurs. In some places false brome has established off the road under the forest canopy. False brome is a perennial grass that is native to Europe, Asia and North Africa but is invasive in western Oregon. It is capable of growing in open and closed canopies including undisturbed forests and meadows. It is not palatable to wildlife and it may slow or prevent other plants from establishing. False brome often completely takes over the understory excluding other plant species and thereby excluding and impacting the habitat of many species of plants and wildlife. False brome is considered established in this area and control methods should be focused on high priority areas, treating outliers and

containment. It should be a top priority to keep it out of stands, meadows, thinning units and prescribed burn areas.

Sulfur Cinquefoil (*Pontentilla recta*) is another invasive plant species that has been introduced into the watershed in the last 15 years. Currently it is only known from the Buckhead Wildlife Area along the power line corridor. It is native to the eastern Mediterranean region of Eurasia and North Africa and has become an invasive throughout the United States. The Middle Fork District is the only area on the Willamette where it has been detected so far. In Montana sulfur cinquefoil has taken over rangeland areas outcompeting native plants and competing with yellow star thistle. Sulfur cinquefoil has a low palatability rating for elk and deer and is usually avoided because of its bitter taste (FEIS plants database). We have been manually and chemically treating this species in the Buckhead Wildlife area since 2010. It is persistent but so far control efforts seem to have kept it from spreading outside the known area. We will keep monitoring and treating this area and try to eradicate it from the watershed.

Yellow archangel (Lamiastrum galeobdolon) is another new invader that is found in one location in the watershed at the entrance to Shady Dell campground off of Highway 58. This site was probably created when someone dumped off their garden waste. We have been manually treating it since 2011. It is too close to the water to treat chemically. This species can spread by seed but, also by nodes on the stem and stem fragments making it very difficult to control. Currently we are trying to eradicate yellow archangel and prevent it from spreading by pulling and mulching. This species should be watched for in other parts of the watershed where garden dumping is common and should be eradicated as soon as possible.

Buckhead Weed Management Plan

Extensive restoration efforts over the last 10 years with partners in the public and private sector have succeeded in removing non-native blackberry and scotch broom and planting of native grass, forbs and shrubs. In 2010 we completed the Buckhead Weed Management Plan. This plan covers the Buckhead Wildlife area, the power line right of way, the Westfir seed orchard and the river corridor and outlines and suggests treatment schedules for invasive plants in the area. It is on file at the Middle Fork office and is changed year to year to reflect priorities and budget.

References

False brome fact sheet
http://appliedeco.org/invasive-species-resources/FBWG/brsybrochuresmall.pdf

Interagency Special Status/Sensitive Species Program
(ISSSSP) http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/

Sensitive Species Fact Sheets
http://www.fs.fed.us/r6/sfpnw/issssp/species-index/flora-lichens.shtml

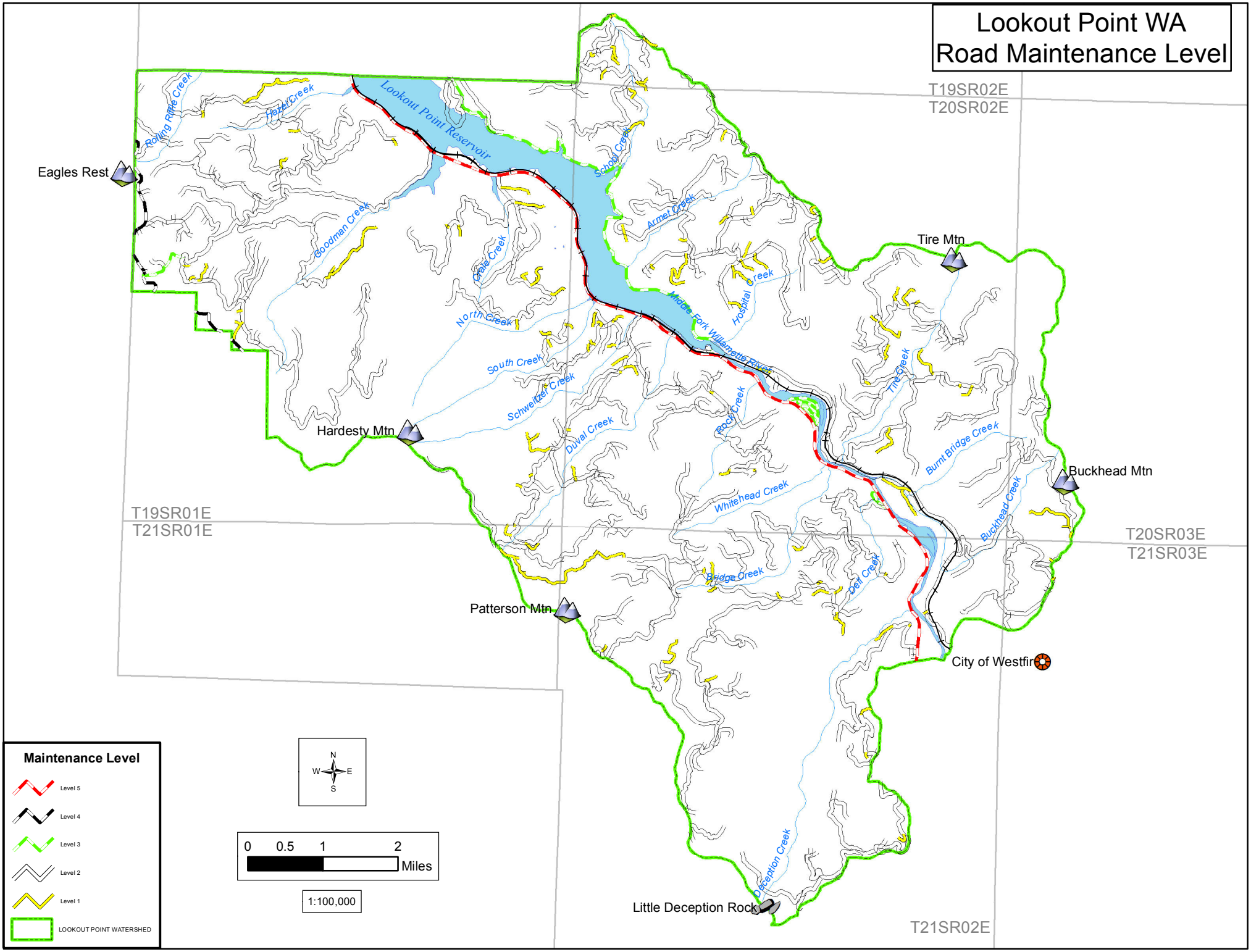
Sulfur Cinquefoil facts
http://www.fs.fed.us/database/feis/plants/forb/potrec/all.html

Survey and Manage Homepage
http://www.blm.gov/or/plans/surveyandmanage/index.php

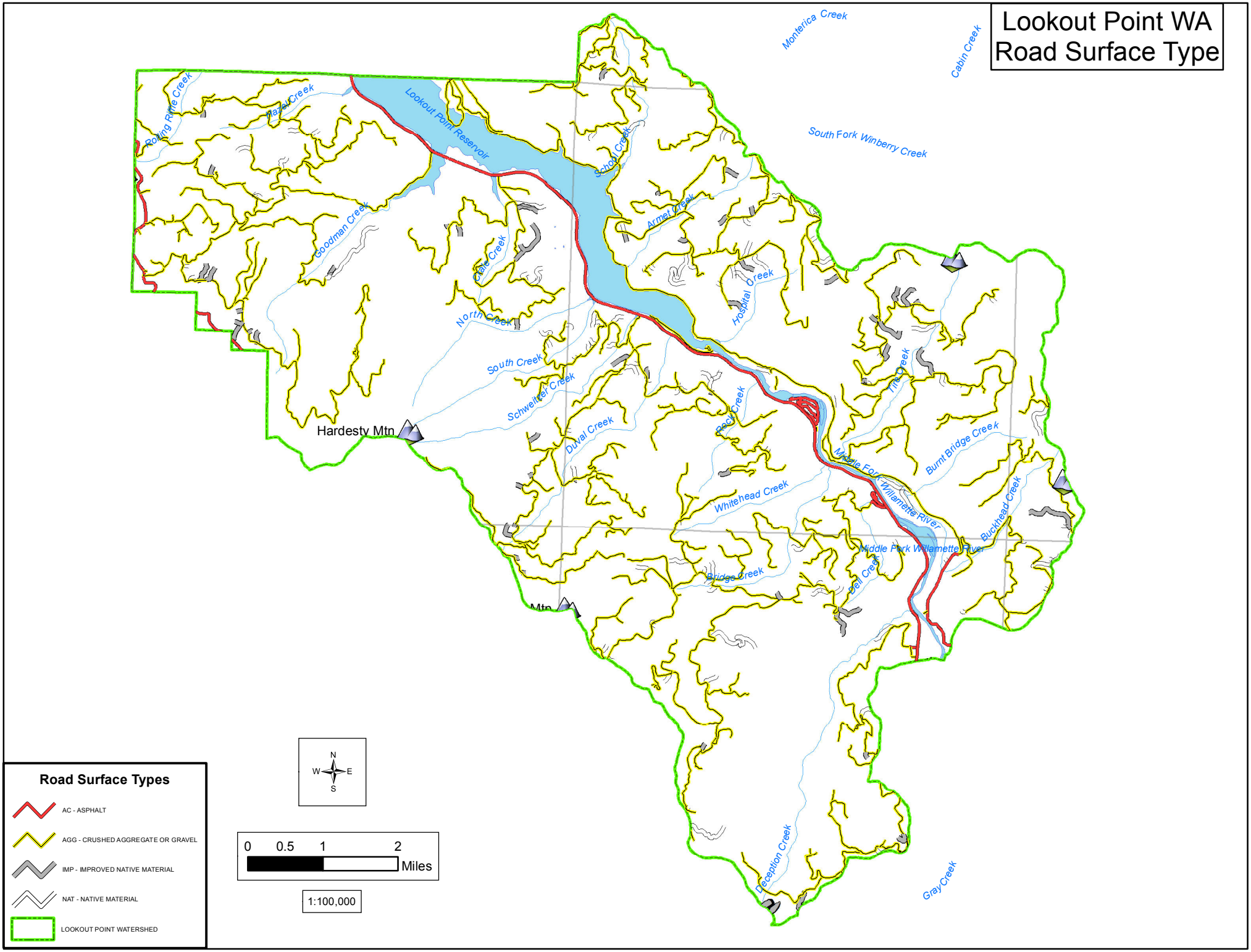
USFS National Lichens & Air Quality Database and
Clearinghouse http://gis.nacse.org/lichenair/index.php

Yellow Archangel Fact Sheet
http://www.nwcb.wa.gov/detail.asp?weed=81

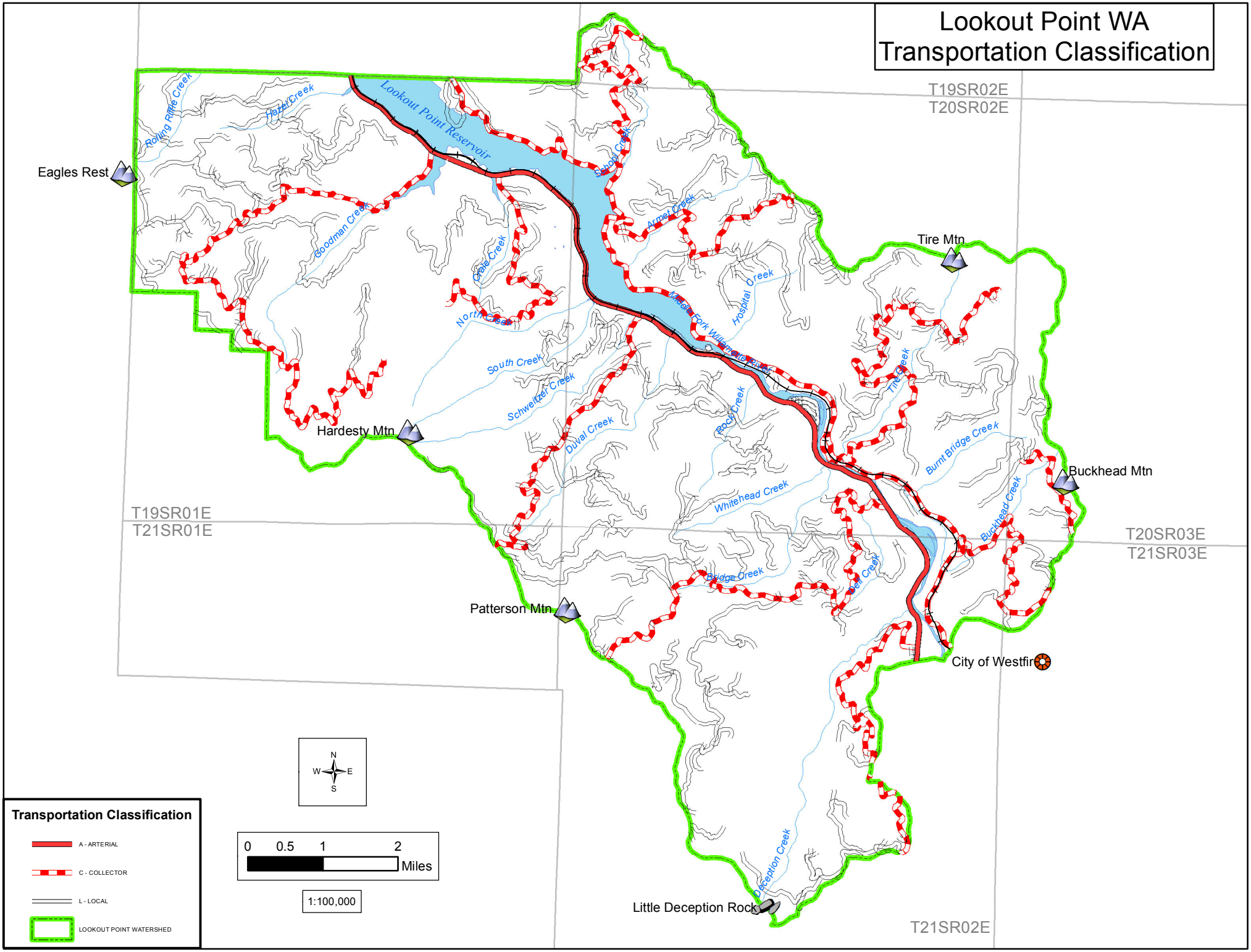
Lookout Point WA
Road Maintenance Level



Lookout Point WA Road Surface Type



Lookout Point WA Transportation Classification



Transportation

Lookout Point Watershed Analysis Area (WAA) has a total of 266.8 miles of road. Roads are managed by the USDA Forest Service, Lane County, Bureau of Land Management, and Oregon Department of Transportation (ODOT). Road density for drainage groups in the WAA ranges from 1.8 to 5.3 miles per square mile, with an average of 3.76 miles per square mile. Roads provide a source of fine sediment to streams, particularly in earthflow terrain. School, Tire and Rolling - Fern Drainages have the highest percentage of earthflow terrain within the WAA.

A study by Sam Dimas (USDA, 1996) on the Lowell Ranger District, suggests that higher quality road surfaces decrease sediment runoff concerns. Table xx indicates the miles and percentage of roads for each drainage, separated by type of road surface. Paved and aggregate are the highest quality surface and produce the least amount of fines. Those two surface types comprise 89% of the total roads within the WAA. Native roads are of highest concern as they have no surfacing. However, since these comprise only 7% of the WAA, fine sediment produced by these roads does not appear to be a significant concern.

Table xx: Miles and percentages of roads for each drainage.

	Paved		**Aggregate**		**Improved (Pit Run)**		**Native**	
Drainage Group	Miles	%	Miles	%	Miles	%	Miles	%
Burnt-Buckhead	1.58	8	14.62	77	0.75	4	2.06	11
Cain-Armet	0	0	11.61	88	0.53	4	1.02	8
Crale	2.3	19	7.33	62	1.21	10	1.02	9
Duval	0.57	2	27.91	88	1.36	4	1.89	6
East Deception	0.84	6	12.88	85	0.57	4	0.81	5
Hospital-Carpet	0	0	11.14	78	0.88	6	2.32	16
Lower Goodman	0.39	10	3.27	88	0.06	2	0	0
Middle Deception	0	0	2.74	78	0.09	3	0.68	19
North-South	0.96	15	4.57	72	0.14	2	0.72	11
North Shore Tributaries	0	0	5.42	93	0.04	1	0.37	6
Rhodes-School	0	0	19.45	95	0.19	1	0.8	4
Rock	4.65	34	8.1	59	0.24	2	0.82	6
Rolling-Fern	1.89	14	11.62	84	0.1	1	0.29	2
Schweitzer	0.71	6	9.08	82	0.58	5	0.75	7
Tire	0	0	17.81	85	1.91	9	1.34	6
West Deception	0.77	6	10.62	77	0.71	5	1.77	13
West Goodman	2.08	9	19.8	84	0.77	3	0.87	4
White-Dell	2.64	11	19.77	81	0.11	0	1.91	8
Totals	**19.38**	**7**	**217.74**	**82**	**10.24**	**4**	**19.44**	**7**

Maintenance levels for roads within each drainage group are shown in Table xx. Level I roads are closed to all motor vehicles. Level II roads are opened to high clearance vehicles. Level III roads are open to

standard passenger vehicles driven by a prudent driver. All Level IV and V roads within this WAA are paved and open to all vehicles. Level IV roads are typically single lane roads and level V usually has double lanes.

Eighty percent of the roads with in the WAA area are Maintenance Level II. This is of concern since these roads generally do not receive regular maintenance. Inadequate maintenance increases the likelihood of ruts to develop in roadway, ditches becoming blocked, culverts that are beyond their design life and other roadway failures. These situations increase the chance that fine sediment may be deposited into stream channels.

Aquatic and wildlife concerns, as well as lack of road maintenance funding, have led to the decommissioning and closure of roads. This has reduced fine sediment deposition into streams and decreased the open road density to benefit big game. The Middle Fork Ranger District completed a supplemental Road Analysis (USDA, February 17, 2004) to provide project level closure recommendations for the District's transportation system. There are 130 miles of recommended road closure within the Lookout Point WAA, 26.35 of those miles have already been closed.

Table xx: Maintenance level for roads per drainage.**Drainage Group**	**Level I**		**Level II**		**Level III**		**Level IV**		**Level IV**	
	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%
Burnt-Buckhead	2.2	12	16.81	88	0	0	0	0	0	0
Cain-Armet	1.28	10	9.98	76	1.9	14	0	0	0	0
Crale	1.82	19	7.74	81	0	0	0	0	2.3	23
Duval	5.11	16	26.06	83	0	0	0.24	1	0.33	1
East Deception	0.83	6	13.55	94	0	0	0	0	0.73	5
Hospital-Carpet	2.47	17	10.84	76	1.03	7	0	0	0	0
Lower Goodman	0.06	2	3.27	98	0	0	0	0	0.39	11
Middle Deception	0	0	3.51	100	0	0	0	0	0	0
North-South	0.83	15	4.6	85	0	0	0	0	0.96	17
North Shore Tributaries	0.21	4	5.62	96	0	0	0	0	0	0
Rhodes-School	1.91	9	14.61	71	3.92	19	0	0	0	0
Rock	0.28	3	8.8	79	1.99	18	0	0	2.73	20
Rolling-Fern	1.47	12	10.54	85	0	0	0.37	3	1.51	12
Schweitzer	1.86	18	8.56	82	0	0	0	0	0.71	8
Tire	2.47	12	18.6	88	0	0	0	0	0	0
West Deception	1.38	11	11.72	89	0	0	0	0	0.77	6
West Goodman	0.79	3	19.9	85	0.74	3	2.08	9	0	0
White-Dell	1.38	6	20.67	92	0.41	2	0	0	1.96	9
Totals	**26.35**	**10**	**215.38**	**80**	**9.99**	**4**	**2.69**	**1**	**12.39**	**5**

Lookout Point Watershed Analysis Update, 2012

Middle Fork Ranger District
Willamette National Forest

INTRODUCTION

The following information and data will update the 1997 Lookout Point Watershed Analysis. The 1997 analysis covered the same area as this effort, however, the 1997 analysis neglected to include several important aspects of the fisheries resources in the watershed. Spring Chinook salmon and bull trout were released into areas upstream of Lookout Point Watershed in 1995 and 1997 respectively and today those fish emigrate though Lookout Point Reservoir and inhabit streams within the watershed. Oregon chub have also expanded their range since the original watershed analysis was completed. The focus of this fisheries update is to provide a comprehensive overview of listed fish species and their habitat within the Lookout Point Watershed. The following information includes the most current release information and data from surveys for listed fish species in the watershed. This report also includes recommendations for aquatic restoration projects if opportunities and funding become available in the future.

Spring Chinook Salmon

Salmon in the Lookout Point Watershed are part of the Upper Willamette River Evolutionarily Significant Unit (ESU), and have been designated as a Threatened species under the ESA by the National Marine Fisheries Service (NMFS) (64 FR 14308). This listing decision was effective as of May 24, 1999. A subsequent decision by NMFS reaffirmed the Threatened status for wild stocks of spring Chinook salmon and added protection for the hatchery component (Willamette Hatchery, ODFW stock #22) of the spring Chinook salmon population present in this portion of the ESU (70 FR 37160). This rule was effective on August 29, 2005. NMFS has released their final rule designating critical habitat for Upper Willamette River spring Chinook salmon (70 FR 52630), effective January 2, 2006, and it includes the upper Middle Fork Willamette River and includes sections of the river that runs through the watershed as well as Lookout Point Reservoir. Streams in the Action Area are not considered Essential Fish Habitat (EFH); the NMFS ended the upstream designation of EFH at Dexter Dam.

Spring Chinook salmon are the only anadromous fish species present in the Lookout Point Watershed. Winter and summer steelhead were introduced downstream of the watershed in the 1950's and 1980's respectively, but have not naturalized to areas within the Lookout Point Watershed. Only adult spring Chinook salmon are transported upstream of Dexter Dam and released into other watersheds. Spring Chinook salmon spawn in the upper Middle Fork Willamette River and the North Fork of the Middle Fork Willamette River watersheds and the progeny of those fish emigrate back though the Lookout

Point Watershed as fry and smolts. Juvenile salmon may spend one to two years rearing in Lookout Point Reservoir before they find their way downstream and continue their journey to the sea.

From the 1950's through 1993, wild spring Chinook salmon were absent from the watershed due to the presence of Dexter and Lookout Point dams, both constructed without fish passage facilities. All returning adult salmon were utilized in the hatchery program. Starting in 1993, the Oregon Department of Fish and Wildlife (ODFW) began capturing adult spring Chinook salmon below Dexter Dam, and those that were deemed excess to their hatchery broodstock needs were transported above the dam and released into several watersheds, including the Middle Fork Willamette River Watershed. The size of the adult spring Chinook salmon population in the Middle Fork Willamette Watershed is entirely dependent on the number of adult salmon moved by ODFW each year.

Spring Chinook salmon artificial propagation efforts on the upper Willamette River began early this century, when the state of Oregon began operating a hatchery on the McKenzie River in 1902 (Olsen et al. 1992). From 1909 to 1942 eggs were collected from spring-run adults returning to the Santiam and Middle Fork Willamette Rivers, incubated at the state's Bonneville Hatchery, and the resulting fry returned to the Willamette Basin (Howell et al. 1985). There are currently no fish of wild origin present in the watershed. Hatchery production continues to dominate in sustaining Willamette spring Chinook salmon. Therefore, genetic fitness of the spring Chinook population may be at risk because 100% of the population is of hatchery origin. Connectivity to other populations is limited due to the dams in place.

The current distribution of spring Chinook salmon upstream of Lookout Point Dam is likely equivalent to the historic distribution with the exception of a loss of stream habitat due to the inundation of Lookout Point Reservoir. Seasonal fluxuations in water levels within the reservoir create fish passage barriers that prevent juvenile salmon from utilizing rearing habitat at confluence areas and prevent other salmonids from moving into smaller tributaries to spawn in the spring. Stream reaches utilized for salmon spawning are largely concentrated in the watersheds upstream of the Lookout Point Watershed however, the watershed does provide rearing habitat for juvenile salmon.

Spring Chinook salmon redds have been observed in the Middle Fork Willamette River, upstream of Lookout Point Reservoir, each year since the adult transport/release program began. Salmon were also released in the North Fork of the Middle Fork Willamette River in the late 1990's and the salmon successfully spawn there as well. Like the Middle Fork Willamette population, juvenile salmon from the North Fork of the Middle Fork Willamette River emigrate downstream into the Lookout Point Watershed where they rear in the reservoir and continue their downstream emigration towards the sea. Studies and trapping programs in other reservoirs, such as Hill Creek Reservoir, show juvenile spring Chinook salmon emigrations can be delayed or impeded within reservoirs due to the long stretches of slack water and the inability to find downstream passage. At least three year classes of spring Chinook salmon were trapped while emigrating out of Hills Creek Reservoir in 2000, which indicates a delayed emigration to the sea.

Fish emigrate through project dams in large numbers. Larson (2000), operated screw traps below Hills Creek Dam and calculated 5,473 spring Chinook salmon passed through the turbines between October 25 and December 1, 1999 (95% CI 3,467-13,000), and 3,328 juvenile salmon passed through the regulating outlet from December, 13 1999 to January 30, 2,000 (95% CI 1,911- 12,867). The high number of juvenile spring Chinook salmon indicates successful natural production of the transported adults upstream of the Lookout Point Watershed. Nearly the same results were found in 2004. Much of this production occurs upstream of Lookout Point Watershed however the majority of these fish pass downstream and into the Lookout Point Watershed where they rear and continue their journey to the sea. Reduced habitat complexity and substrate coarseness within the Lookout Point Watershed likely limits the quality of spawning and rearing habitat for spring Chinook salmon in many areas.

Mortality associated with downstream passage through project dams can be very high. In 2000, Larson (2000) estimated high mortality rates of 59% for juvenile spring Chinook salmon that passed through the turbines and 32% mortality through the regulating outlets of Hills Creek Dam. Angling pressure from an active fishery on Hills Creek Reservoir and the Middle Fork Willamette River has a negative effect on juvenile and sub-adult survival. Fishing regulations were recently modified, and they now only allow retention of fin-clipped fish. Since there is no stocking of spring Chinook salmon hatchery fish above Hills Creek Dam, all of the spring Chinook salmon juveniles and smolts have an intact adipose fin, and cannot be legally harvested. They are however subject to harassment and catch-release injury from the active rainbow trout fishery on Hills Creek Reservoir and along the Middle Fork Willamette River

Bull Trout

Bull trout require cold clean water with low amounts of fine sediment in the stream bed, relatively constant flows, and high frequencies of large and fine woody material to successfully spawn and rear. Adult bull trout require relatively cold temperatures (4 to 10^0C preference range) for spawning, and optimal juvenile growth requires 4 to 15^0C stream temperatures. Bull trout growth and survival within the Lookout Point Watershed is low due to habitat conditions that are not suitable for the bull trout life cycle. Higher water temperatures in the lower basin streams as well as water quality conditions within Lookout Point Reservoir, which include elevated water temperatures, turbid and stagnant water, and poor visibility for sight feeders are not conducive to bull trout requirements.

Historical references indicate that bull trout *Salvelinus confluentus* in Oregon were once distributed throughout 12 basins in the Klamath River and Columbia River systems. Bull trout were probably found throughout the Willamette Basin; however available documentation is limited (Buchanan et al. 1997). Bull trout in the Lookout Point Watershed likely ranged throughout the Middle Fork Willamette River and associated larger tributaries, however, the primary spawning and rearing habitat was likely further upstream in the Upper Middle Fork Willamette and North Fork of the Middle Fork Willamette River watersheds. Reports of bull trout observations in the watershed along the Middle Fork Willamette River gradually declined until the last observed native bull trout was captured in 1990 upstream of the

Lookout Point Watershed. Buchanan, et al. (1997) rated this population of bull trout as “probably extinct”.

Limiting Factors that have adversely affected Upper Middle Fork Willamette bull trout populations include habitat alterations, especially impassable dams and culverts (Wevers et al. 1992). Ratliff and Howell (1992) list habitat degradation, passage barriers, over harvest, chemical treatment projects, and hybridization and competition with non-native brook trout as possible reasons for the decline or extirpation of Willamette Basin bull trout. The construction of Dexter, Lookout Point, and Hills Creek Dam in the 1950’s and 1960’s and chemical treatment projects prior to completion of Hills Creek Dam in 1961 to remove “rough fish” have undoubtedly had a significant impact on bull trout populations throughout the area. Habitat alterations from timber harvest and associated road construction, loss of juvenile spring Chinook salmon as an important food source, and over harvest from angling also contributed to the decline of the Willamette Basin bull trout population.

Starting in 1997, the Willamette National Forest and Oregon Department of Fish and Wildlife (ODFW) began a cooperative effort to reintroduce bull trout upstream of the Lookout Point Watershed. Fry-stage bull trout are trapped in Anderson Creek, a tributary to the McKenzie River, and transported/released into areas upstream of the Lookout Point Watershed in the upper Middle Fork Willamette River. Reintroduction sites were selected principally on criteria and life history information related to water temperature, juvenile rearing habitat and food availability. In May 1997, ODFW and the Middle Fork Ranger District transferred bull trout fry from Anderson Creek, a tributary of the McKenzie River, to three tributaries (Skunk Creek, Chuckle Springs, and Indigo Springs) of the Middle Fork Willamette River. Through 2001, six additional release sites (Iko Springs, Shadow Springs, Swift Creek, Bear Creek, Found Creek, and Echo Creek) were identified and added to the reintroduction program. To date over 11,000 bull trout fry have been released in the Upper Middle Fork Willamette Watershed and adult bull trout successfully spawn in several areas upstream of the Lookout Point Watershed. Like spring Chinook salmon the released bull trout emigrate downstream to Hills Creek Dam and also travel through the dam and enter the Lookout Point Watershed. Once they move downstream of the dams they become isolated as there was no fish passage structures placed in the dams to get fish back upstream.

Since the bull trout reintroduction began there have been numerous reports of adult bull trout downstream of Hills Creek Dam and within the Lookout Point Watershed. An adult bull trout was captured in 2001 near the town of Oakridge, approximately 20 miles downstream of the bull trout natal area. In 2010, a large PIT tagged adult bull trout that was tagged upstream of Hills Creek Dam was recorded at a PIT tag interrogation site downstream of Hills Creek Dam. In 2011 two additional tagged adults passed through the dam however it is not known if wither of these adults continued downstream into the Lookout Point Watershed.

Critical Habitat was designated for bull trout by the US Fish and Wildlife Service (70 FR 56212; effective October 26, 2005). The USFWS designated critical habitat for bull trout in the Willamette

River basin in the following streams: Blue River, Horse Creek, Lost Creek, McKenzie River, Middle Fork Willamette River, South Fork McKenzie River, Swift Creek, West Fork Horse Creek and Willamette River. However, they **excluded** (pursuant to section 4 (a)(3) of the ESA) **all stream reaches flowing through Federal land in the basin** stating that it is adequately protected by the Northwest Forest Plan Aquatic Conservation Strategy. On October 18, 2010 the Service republished a new designation of Critical Habitat that does include streams on Federal lands. As of October, 2010 Critical Habitat for bull trout includes all sections of the Middle Fork Willamette River upstream of the Forest boundary on the Willamette National Forest. The designation also includes Lookout Point Reservoir.

Further threats to the bull trout population are primarily related to changes in the water quality and habitat alterations in the Lookout Point Watershed. These changes are a directly related to the flood control dams in the basin. Without the annual fluctuations in flow the habitat in the Lookout Point Watershed has become much more simplified and unable to accommodate some of the native aquatic life it once supported. The combined effects of habitat quality deterioration and high rate of mortality when fish pass through the dams has had a profound effect on growth and survival, population size and life history patterns in the Lookout Point Watershed. The potential for hybridization between brook trout and bull trout exists in watershed. This has the potential to negatively affect the bull trout gene pool and persistence. Brook trout were first introduced to the Upper Middle Fork Willamette River Watershed in the early 1900's. Although stocking has ceased in this area, a naturalized population of brook trout is well established in several upstream watersheds. These fish also pass through the Lookout Point Watershed in a similar pattern as salmon and bull trout.

Oregon Chub

Oregon chub *Oregonichthys crameri*, a small minnow native to the Willamette Valley were designated an "*Endangered*" species under the Endangered Species Act in 1993. In 2010, the status of Oregon chub was upgraded to "*Threatened*". Like other aquatic species in the Lookout Point Watershed, changes in flow fluctuations and habitat characteristics created from the construction of three flood control dams had a profound effect on the species viability. Historically, Oregon chub were distributed throughout the Willamette River Valley and occupied off-channel habitats such as beaver ponds, oxbows, sloughs, and marshes. Prior to flood control dam construction these types of habitats would have been common and ubiquitous throughout the Willamette Basin. Channelization of the Middle Fork Willamette River and the drainage of wetlands reduced the amount of available habitat for Oregon chub. Oregon chub populations are also threatened by predation and competition by nonnative species. Numerous warm water species have naturalize to the Lookout Point Watershed and either prey upon or compete for resources with chub.

Oregon chub populations within the Lookout Point Watershed include new populations at the Buckhead Wildlife Area. In 2001 and 2010, four new chub ponds were excavated adjacent to the Middle Fork Willamette River in an attempt to increase the overall chub population in the area and to diversify the

existent habitat at the Buckhead Wildlife Area. All four ponds have now been naturally stocked with chub when winter flows inundate other areas within the Buckhead Wildlife Area and transport chub to new sites. Historically, this was the method chub used to populate new areas. When winter floods come the fish are transported to backwater areas and sloughs that maintain water throughout the year,

The Oregon Chub Recovery Plan establishes criteria for delisting the Oregon chub and these criteria include, establishing 20 populations of at least 500 adult chub, established populations must remain stable or increasing in size for seven years, and at least four populations meeting the first two criteria must be located in each of the three recovery areas. The Lookout Point Watershed is within the Middle Fork Willamette drainage recovery area and has three stable populations. These include Shady Dell Pond, Hospital Pond, and the Buckhead Wildlife Area population. However the general consensus among biologists is that the Oregon chub population will remain at risk for some time due to the loss of suitable habitat, flow regime changes from flood control dams, competition from non-native aquatic species, chemical contamination and others.

Recommendations

Aquatic Restoration Projects

Enhance aquatic habitat and stream complexity by adding large wood to stream channels. The original Lookout Point Watershed Analysis included stream survey information for several major tributaries to the Middle Fork Willamette River and Lookout Point Reservoir. The tributaries include School, Tire, Deception, and Goodman creeks. All of these creeks have at least one surveyed reach that is deficient in the amount of desirable large wood within the channel. Most sources for stream habitat condition refer to desirable levels of large wood to be around 80 pieces per mile.

Large wood benefits the stream network by providing habitat for aquatic organisms, reducing water velocity that results in retaining sediment and spawning gravels, stabilization of the banks and adding organic material to the aquatic environment.

Stream restoration projects are typically completed to enhance existent aquatic habitat using a variety of proven techniques such as adding additional large wood from outside sources, pulling over whole trees within the riparian area to form anchor points that capture additional wood and organic material as it moves downstream.

Thinning in Riparian Area

The rationale for riparian thinning is stated as follows: The primary concern is that, if riparian areas are not thinned, their ability to reach site potential tree height (180-200 feet) in the riparian areas will be reduced and the timeframe to reach that height will be at a minimum greatly extended. Many of the

riparian stands are already in a state of diminished crown ratio percentage for the height and age of the trees due to overcrowding. This condition can lead to further loss of structural integrity of the trees as the low crown ratio does not provide enough photosynthetic area to allow the trees to put on girth/diameter that would otherwise strengthen the tree. Current growth is primarily vertical due to competition for sunlight and other important characteristics of growth are not being adequately provided. By applying most of the available energy to vertical growth the trees are not able to support heavy snow loads, which increases the probability of breaking or knocking the tree down.

The overall intent of thinning these stands is to open the entire canopy by removing some of the poorly developed existing trees, especially their crowns, to provide the remaining trees room to expand and increase photosynthetic area that will lead to the production of more energy the trees can invest in other types of growth other than vertical. Opening the over-story canopy and allowing sunlight to penetrate to the forest floor, under-story plants such as young trees of a diverse nature, shrubs and forbs will experience increased growth rates and assist in creating a multi-layered forest that previously existed.

Thinning the canopy will undoubtedly increase the amount of solar radiation that reaches the ground in thinned areas. Boyd and Sturdevant (1997), state that the majority of energy responsible for increases in stream temperature is contributed by solar radiation. Large quantities of heat energy will be directed to a stream when the surface is exposed to midday solar radiation. However, additional sunlight will not reach stream channels in riparian areas that are thinned because a no cut buffer of specified width and distance will be left to continue to shade the waterways at all times. The width of the buffer will be determined by the average height of the existent trees in a given area, aspect, and slope of the ground adjacent to the stream channel. The distance a tree of given height can cast shade can be accurately calculated by considering the angle of an imaginary right angle that exists from the top of a tree next to a stream channel and extending to the center of the stream channel. Based on the angle of the sun during June 21, when the sun is at its highest point in the year (approximately 70°) and considering the average tree height (Example: 90 ft. tall) we can calculate the distance a tree of that height will shade a stream channel using the following formula;

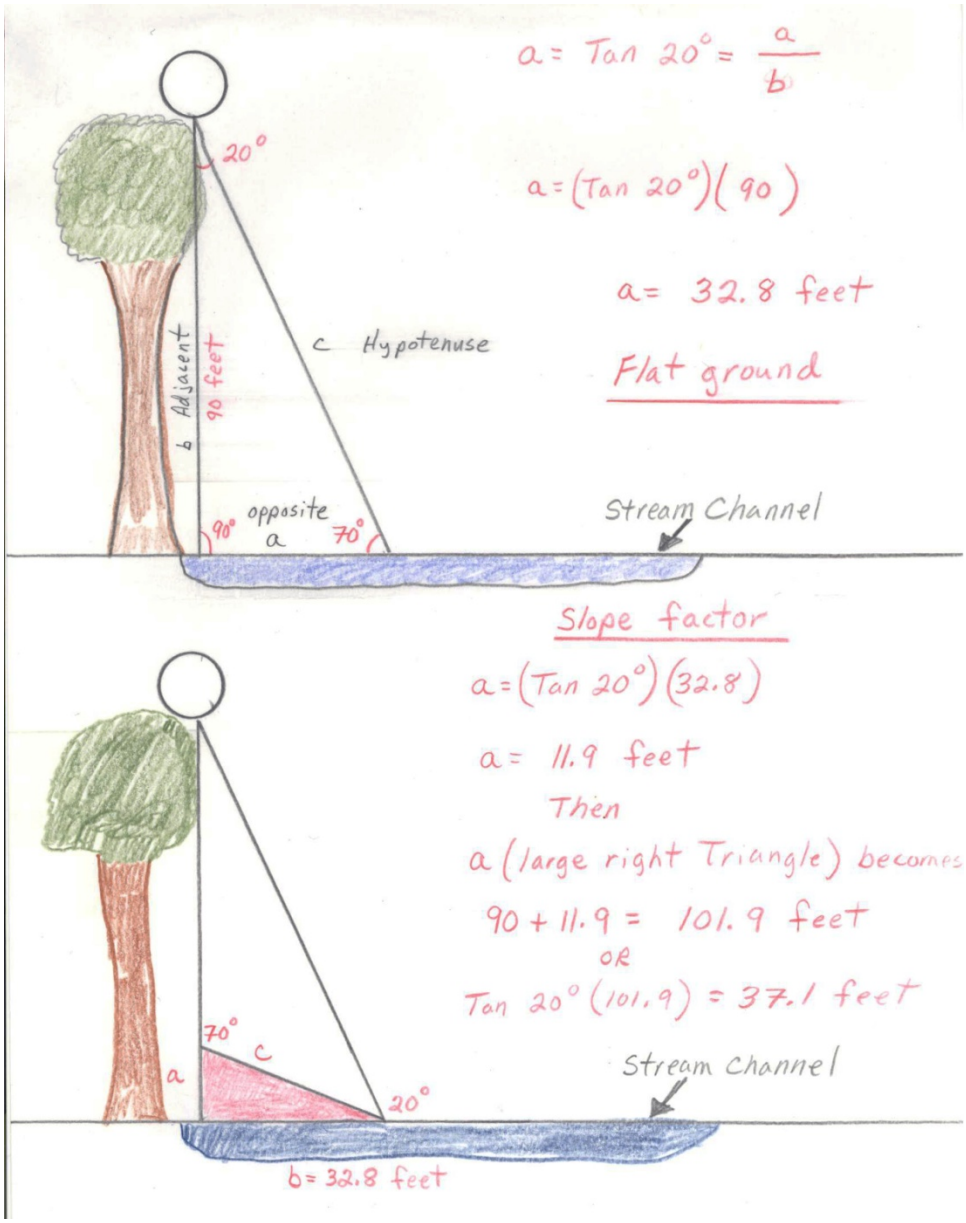
$$\textbf{Tan } \theta = \frac{\textbf{Opposite}}{\textbf{Adjacent}} \quad \text{or} \quad \textbf{Tan } 20^\circ \textbf{ (90) = 32.8 Feet}$$

With this model we can assume a 90 ft. tall tree on the outer edge of a 50 ft. no cut buffer will not contribute shade to the stream channel. That is because the average tree can only cast shade for a distance of 32.8 feet (See Fig. 1). Furthermore, this calculation is based on the assumption that all trees are standing on flat ground at the same elevation of the stream channel. If the trees are on a sloped stream bank and higher in elevation than the stream channel, like many are in the western Cascades, than we must also consider the angle of elevation and add the distance of the opposite side of the imaginary right triangle to the height of the tree before making the final calculation.

We can apply the same method for predicting the width of the riparian area that should be maintained in the future. The site potential tree height for this area is approximately 180-200 ft. If the overall goal of riparian thinning is to achieve this tree height, than the question becomes, at what height will trees on the outer edge of a no cut buffer begin to cast shade on a stream channel? Applying the formula above we can calculate that a tree must be at least 137 ft. tall to cast shade on a stream channel from 50 ft. away. Also, if the site potential of trees in the area is realized in the future, than we can predict a 200 ft. tall tree will cast shade for 72.8 ft. The use of this model adds credibility to riparian thinning projects and an understandable rationale for this management tool. There is also a valid reason to assess each riparian area thinning project on a case by case basis and it may be necessary to adjust the no thin buffer width in some cases where tree height is already close to or actually shading the stream channel.

In summary, thinning within riparian areas would occur with the expectation that overall within stand structure and species diversity would increase, recovery of trees in the riparian areas to pre-thinned condition would be accelerated, remaining trees would have room to expand their crowns, which will assist in development of mass and girth, and assist in the ultimate goal of providing more shade to the stream channel and providing larger more stable wood to the stream channel that creates and sustains aquatic habitat.

Figure 1. Diagram of Shade Potential Related to Tree height.



REFERENCES

Boyd, M.S. and D. Sturdevant. 1997. The Scientific basis for Oregon's Stream temperature Standard: Common Questions and Straight Answers. Oregon Department of Environmental Quality. Portland Oregon.

Buchanan, D.V., M.L. Hanson, and R.M. Hooton. 1997. Status of Oregon's bull trout. Oregon Department of Fish and Wildlife, Portland, Oregon. 168pp. +

Howell, P., K. Jones, D. Scarnecchia, L. Lavoy, W. Knedra, and D. Orrmann. 1985. Stock Assessment of Columbia River Anadromous Salmonids. Vol: I. U.S. Department of Energy, Bonneville Power Administration. Project No. 83-335, 558 p.

Larson, D. 2000. Spawning Migration Movements and Emigration through Hills Creek Dam of Spring Chinook Salmon (Oncorhynchus tshawytscha) in the Upper Middle Fork Willamette River, Lane County, Oregon. Pacific Northwest Region, Willamette National Forest. Oakridge. Oregon.

Olsen, E., P. Pierce, M. McLean, and K. Hatch. 1992. Stock Summary Reports for Colombia River Anadromous Salmonids Volume I: Oregon. U.S. Dep. Energy., Bonneville Power Administration. Project No. 88-108. (Available from Bonneville Power Administration, Division of Fish and Wildlife, Public Information Officer - PJ, P.O. Box 3621, Portland, Oregon 97208

Ratliff, D.E., and P.J. Howell. 1992. The status of bull trout in Oregon. Pages 10-17 in P.J. Howell and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Weavers, M.J., J. Wetherbee, and W. Hunt. 1992. Santiam and Calapooia Subbasin Fish Management Plan. Oregon Department of Fish and wildlife, Salem.

Lookout Point
Watershed Analysis Area
Updated Pages 45-48

Prepared by Jose Mercado and Alison Richards 8/2012

FIRE REGIMES

Reference Condition

The historical fire regime for Lookout Point WAA is characterized as a fire regime 3B: mixed-severity as described by Agee (1981) with a combination of mixed-severity fire effects ranging from low intensity underburning to high intensity stand replacing fire. In a natural landscape categorized by fire regime 3B, we would expect to see a mixed-severity fire at least once every 50-100 years on any given piece of ground. In the era of modern fire suppression, we will continue to see natural (lightning) ignitions according to the same historical fire regime schedules. What is different now is that natural wildfires are quickly suppressed by firefighters and are not able to spread and grow naturally. When a fire is immediately suppressed, a fire return interval is essentially skipped, causing natural, healthy forest conditions to degrade over time. Because fire regimes range from 50-100 years within the Lookout Point Watershed area, deteriorating forest health may not (at present) be readily apparent. However, going forward, it would be prudent to manage natural ignitions for multiple objectives by utilizing a combination of fire management strategies ranging from monitoring the fire to full suppression.

Observation of the current seral stages indicates that the majority of trees are 95-130 years old or in the understory re-initiation stage. Notable exceptions are Patterson Mountain, upper Duval and Whitehead Creeks, the lower two thirds of Deception Creek, and lower Bridge and Rock Creeks. On the north side of the Middle Fork Willamette River only Buckhead Creek, the lower third of Burnt Creek, and the very top of Tire Mountain show significant stands of late successional old-growth. This is consistent with surveys completed in 1854-55, only ten years after settlement began and about the same time as cessation of aboriginal burning in the Willamette Valley basin (Morris, 1934; Cole, 1977; Burke, 1979).

Current Condition

The Lookout Point WAA is currently classified as a mixed-severity fire regime. Historical fire records show that Lookout Point WAA had 336 fires totaling 808.35 acres from 1949-2012. The average annual fire occurrence was 5.3 fires per year with an average fire size of 2.4 acres. The watershed fire causes have shifted from predominately human caused ignitions, 88.6% of total fire causes being railroad and other human from 1949 to 1995, to 58.7% from 1995 to 2012.

Although a high percentage of the fires occurring prior to the 1980's were caused by railroad activity ignitions, most of these fires were small and only amounted for 11.2% of the total acreage consumed by fire during this record period. In fact, the number of railroad-related fires has decreased significantly

during the past three decades, from 147 fires in the 1960s and 1970s, to 10 fires from 1980 to 1995, to 4 fires from 1995 to 2012. This decrease in railroad-related fires is a direct result of improved train brake systems and an increased effort to control vegetation along railroad tracks.

Lightning fires in the Lookout Point WAA has increased in total percentage of fire causes in the watershed since the 1995 analysis. In the 1995 analysis, lightning only accounted for 11.4% of the total fire causes. From 1995 to 2012 lightning accounted for 41.3% of the total fires in the watershed. Similarly, lighting has increased in the total number of acres burned. In the 1995 analysis, lightning accounted for less than 1% of the total percentage of acres burned. From 1995 to 2012, lightning accounted for 31.6% of the total acres burned.

Taking into consideration the fire history from 1995 to 2012, Table 18 below is updated to reflect the total fire history for the watershed from 1949 to 2012.

Table 18. Lookout Point Watershed Fire History 1949-2012

Fire Causes	Number of Fires	Percent of Total Fires	Number of Acres	Percent of Total Acreage
Railroad	166	49.4%	134.57	16.6%
Lightning	57	17.0%	134.01	16.6%
Other Human	80	33.6%	539.77	66.8%
Totals	336	100.00%	808.35	100.00%

FUELS

Average fuel loading for seral stages was calculated using PNW photo series (PNW-51 (Maxwell and Ward, 1976), PNW-105 (Maxwell and Ward, 1980) and PNW-GTR-258 (Ottmar, 1990)) (*see Table 19*).

Table 19. Average Fuel Loading by Seral Stage

Seral Stage	Stand Age (years)	0-3”Fuels (tons/acre)	3-9”Fuels (tons/acre)	9-20” Fuels (tons/acre)
Stand Initiation (Early-Seral)	0-20	7.15	12.1	11.75
Stem Exclusion (Mid-Seral)	21-80	6.6	6.7	11.7
Understory Re-initiation (Late-Seral)	81-200	3.8	5.0	18.5
Late Successional Old Growth	201+	3.8	5.5	30.0

Table 20. Maximum Acceptable Fuel Loading from WNF-LRMP

Allowable Down Woody Material			
Diameter (small end)	**Tons/Acre**	**Pieces/Acre**	**Length**
0”-3”	7-11	NA	NA
3”-9”	8-12	NA	NA
9”-16”	18-20	NA	NA
>16”	NA	8-15	>20 feet

Reference and Current Condition

The reference and current conditions for the seral-stage distribution is covered extensively in the Forest Resources Report written by Tim Bailey February 2012 (Lookout Point Watershed Analysis Update). Please refer to the Forest Resources Report for reference and current conditions.

Naturally occurring fuels in each of the seral-stages is not covered in the Willamette National Forest Land and Resource Management Plan as a fuels management concern. All activity (harvest) generated fuels regardless of seral-stage are to be managed according to the maximum acceptable fuel loading listed above in table 20.

Fuels Treatments

Fuels in harvested areas have traditionally been treated for hazard reduction using prescribed fire. Treatments have included dozer piling and burning, grapple piling and burning, hand piling and burning, burning of slash concentrations, jackpot burning and broadcast burning. In very few cases (< 1%), harvest generated fuels were left untreated.

Historically, the majority of clear-cut harvest units were treated by prescribed broadcast burning. Until 1986, broadcast burns primarily occurred between July 15 and September 30. During the summer broadcast burn window, fuel consumption and smoke emissions during this time were high with burns completely consuming the majority of fuels <9”. Burning during the summer burn window was costly, as most units required burning crews, holding crews and extensive mop-up. Additionally, resource damage in the form of burned timber lands (“slop-overs”), soil damage and increased wildlife tree mortality was not uncommon.

In 1986 the Oregon Smoke Management Plan banned most smoke-creating fuels treatment from July 1 to September 30. Utilizing best burn practices to reduce smoke emissions, the majority of broadcast burning and jackpot burning now occurs during the spring months of March through June. When burning during the spring burn window, consumption of fuels in the 0-3” diameter size class is still significant enough to reduce fire hazard and allow for reforestation, without incurring the additional resource damage to soil and timber due to excessive heat typically associated with summer burning.

Recommendations – August, 2012 Update of the Lookout Point Reservoir Watershed Analysis

The following recommendations were interdisciplinarily developed after the 2012 update of watershed conditions was completed (see the preceding specialist reports documenting watershed changes). These recommendations are to be added to the list of recommendations in the 1997 Watershed Analysis, along with the attached Riparian Thinning Appendix.

General

Close roads as per recommendations in the 2004 District Roads Analysis, as funding becomes available. This recommendation benefits aquatic, wildlife, botanic and recreational resources.

Vegetation/Botany/Fuels

Thin dense plantations (commercial and pre-commercial) to increase stand and landscape diversity;

False brome should be contained. In areas that contain false brome and where ground disturbing activities will take place, the population should be surveyed and treated with herbicides before the activity occurs, spread should be minimized by avoiding ground disturbing actions in occupied sites where possible, and post-activity monitoring should occur; herbicide should be applied if the species persists post-activity;

Use experimental prescribed burning for weed eradication;

Continue implementation of the Buckhead Weed Management Plan;

Maintain and improve special plant habitats by abating weeds, removing conifer encroachment, and application of prescribed fire;

Treat activity generated fuels near other land ownerships to reduce resistance to control during future wildfires;

Use prescribed fire in mature stands to return the low intensity portion of the mixed severity fire regime to improve stand resiliency.

Wildlife

Consider Big Game Emphasis Area conditions when prioritizing road closures; prioritize road closures in Big Game Emphasis Areas that exceed Forest Plan standards and guidelines, as per the table in the Wildlife Report;

Create and/or maintain early-successional habitat in plantations;

Look for opportunities to create large snags in deficient habitats, typically in 100 year old stands with a repeated fire history;

Avoid habitat disturbance/changes within 300 meter (70 ac.) northern spotted owl nest patches.

Use the new Westside Modeling to identify big game habitat improvement opportunities and implement treatments within the watershed that increase DDE and predicted use values, and result in the most strategic improvement in forage habitat for deer and elk where possible.

Fish/Hydrology

No treatment riparian buffer widths should be determined based upon existing riparian conditions and the interests below, rather than using hard-wired widths for all similar areas. Buffer widths should be determined on a case by case basis taking in to account the following interests:

- Maintain all primary shading vegetation to avoid water temperature increases;
- Protect active stream channels from mechanical disturbance that could affect sediment storage and routing or habitat disruption;
- Prevent the introduction of sediment (course or fine) into active stream channels, or mobilization of sediment stored within channels;
- Provide for diverse riparian vegetation in terms of species and structure;
- Allow for channel migration laterally and vertically.

Depending upon riparian reserve vegetation conditions, terrain, slope stability, slope and stream orientation, soil type and condition, proposed yarding system, and stream class and condition, no-treatment buffers will vary in width from minimal (as in stable areas to the north of east/west trending streams where little vegetation contributes to direct shading of the channel) to substantial (as in extensive and/or steep areas of unstable soils), as needed to achieve the interests above, to be measured from the active, bank-full, floodplain channel edge, or break in an unstable slope;

Introduce suitably-sized large wood material into stream channels where needed, as funding is available;

When culverts are replaced during routine road maintenance, analyze and provide for passage of aquatic organisms.

The Benefits and Rationale for Thinning In Riparian Reserves

Background

This Appendix has been added to the 1997 Lookout Point Watershed Analysis Area document to more completely justify and support the need to thin young managed stands (plantations) within riparian reserves. The Recommendations section of the Lookout Point Watershed Analysis Area (USDA, 1997) did not specifically mention commercial thinning of young, managed stands in riparian reserves, though it did speak to the benefits of thinning with the LSR in terms of achieving stand diversity objectives. In a general sense, the Standards and Guidelines for the Northwest Forest Plan (USDA/USDI, 1994, page C-32) indicate silvicultural practices should be applied in riparian reserves to control stocking, reestablish, and manage stands to acquire desired characteristics needed to attain Aquatic Conservation Strategy Objectives. These Objectives all relate to maintaining or restoring original conditions:

ACS #1: distribution, diversity and complexity of watershed and landscape features
ACS #5: elements of sediment regime; storage
ACS #8: species composition and structural diversity of plant communities in riparian areas to supply amounts and distributions of coarse woody debris to sustain physical complexity and stability
ACS #9: habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian dependent species.

Of most direct applicability is Objective 8. We are directed to "maintain and restore the species composition and structural diversity of plant communities in riparian areas…..and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability". Virtually all the commercial thinning we propose on this District and in this watershed consists of young stands regenerated after clearcutting. Sometimes the stream channels associated with these riparian areas were cleaned of woody material, or a debris torrent removed it. Some of the older of these stands retain large amounts of down wood in the riparian and terrestrial portions due to low merchantability standards at the time or original harvest.

The stands which existed prior to these young, harvest-created stands were all old-growth or late successional forests with a high level of structural and species diversity, likely with large amounts of standing and down wood, and the stream channels likely also contained typical amounts of large down wood. It is these conditions we are charged to restore. While these previously harvested areas may eventually return to something near their original conditions if left alone, that return may take a long time, as explained below, and in some limited cases may never happen. Restoration of riparian area second-growth stands may be imperative if we want these stands to develop the same structure they had before they were regeneration harvested. Recent thinking in the research community (Tappeneir, et. al., 2000; Spies and Franklin, 1991) indicates that young, relatively dense and uniform stands may never attain the expected, classic old-growth structure without some density control early in the stands' history. The discussion

below describes how stand density management can accelerate the development of late-successional conditions in young, even-aged, single-storied riparian stands created by past clearcutting and planting.

Thinning Effects

Thinning, within or outside of riparian reserves, has two basic and equally important effects. One is the focusing of growth on selected, usually the largest, trees, and the other is stimulation or regeneration of understory vegetation. The ramifications of these effects are discussed below in relation to riparian reserves. Thinning is proposed in riparian reserves specifically to create these effects. Generally, and especially in application to smaller stream course up to smaller class II streams, riparian reserves tend not to be much different in composition and structure to upland stands in generally steep topography. Larger streams in valley bottoms that have an active floodplain typically have a more diverse riparian vegetation where floods cause channel changes that can produce and maintain a significant hardwood component in riparian areas.

On the Middle Fork District, virtually all proposed commercial thinning occurs in stands created from past clearcutting and tree planting. These stands are typically from 30 to 60 years old and were planted primarily with Douglas-fir with an objective of maximizing the amount of future commercial timber harvest volume potential. As such, these stands are all fairly dense, with crown closures, on the average, of about 75 to 90+ percent. These stands are also, by and large, not especially diverse from a species perspective, as most trees are Douglas-fir and their density has in most situations shaded out much of the understory vegetation. The Douglas-fir themselves, due to inter-tree competition, typically have slender stems and small crowns, with crown ratios (a measure of the vigor of an individual tree) from 30 to 10 percent.

It should also be noted that riparian reserves are also expected to provide various terrestrial benefits, and their prescribed widths have taken this objective into account (USDA/USDI, 1994, page B-13; see also Aquatic Conservation Strategy Objectives 2 and 8, page B-11). Much of the aquatic functions provided by riparian buffers are provided within less than a site potential tree height (USDA et al., 1993, pages V-26 and 27). Thinning in the outer portions of riparian reserves also needs to take into account the terrestrial objectives of connectivity, and terrestrial habitat restoration

Diameter Growth

Thinning increases average stand diameter through development of larger crown volumes, resulting in more photosynthate available for radial stem growth. Fewer dominant canopy trees mean more sunlight available per tree. Diameter growth is one of the most important factors over which the forester can exercise considerable control (Daniel, et al, 1979 page 328, Curtis and Marshall, 1986)

One reason to prescribe thinning of a riparian forest is get tree diameters to increase more quickly than they would in a dense stand. Diameter growth increase is desirable to provide large diameter trees that will be available to enter the stream channel in the future; hopefully sooner rather than much later. The increase in crown size that drives diameter growth also provides for

a deeper, denser crown with heavier branches, and the important wildlife and plant habitat that requires such crown structure. The number of trees per acre in a stand will influence the average stand diameter (Daniel, et al., 1979, page 328). Thinning, depending upon the prescription, can increase diameter growth by a factor of up to 2.5, and thinning in a twenty year old stand can result in average stand diameters of 17 inches versus nine inches in an unthinned stand 20 years later (Marshall, et al., 1992). Trees at a wider spacing have larger crowns, produce more photosynthate, and so continue rapid diameter growth longer than closely spaced trees (Oliver and Larson, 1990, page 208) While thinning initially decreases snag recruitment, as the trees most likely to die from suppression effects are typically those removed by thinning, Garman's (2000) growth modeling shows that moderate intensity thinning will generate large snags more quickly than avoidance of thinning, usually due to random, non-density-related mortality.

Most of the riparian thinning proposed on the Middle Fork district is in stands which do not contain residual trees from the previous stand, so these stands have no existing sources for large woody material. Without thinning in a dense stand, it may take longer than 150 years for a tree to grow larger than 30 inches. Agar (1997) found through stand growth modeling that thinning a 40 year old managed stand to a 20 percent relative density will generate an average diameter of 20 inches 80 years sooner than without thinning. The wider the thinning spacing, the quicker the accomplishment of any given diameter objective, but one must weigh that objective with the desire to maintain a more or less closed canopy forest to provide for other important riparian values.

According to Tappeiner et al. (2000) and Spies and Franklin (1991), it appears that many young stands are growing on a trajectory quite different than that upon which old-growth stands developed, so density management or thinning many be needed to enable them to achieve any sort of old-growth structure. They found that many old-growth trees were nearly 40 inches in diameter when they were 100 years old. Oliver and Larson (1990) indicate that trees in a closed canopy stand increased in diameter growth after thinning, but they do not attain the large diameters of trees initially grown at wide spacing.

Another reason to increase the diameter of a Douglas-fir stand is if it has become so dense as to become "unstable". In very dense stands of the age we typically thin (30 to 60 years old) the individual trees are as tall as they would be in a less dense stand but have a much smaller diameter stem, due to the small amount of crown they have as a result of intra-tree competition. The trees are obligated to continue to grow in height or they will die from lack of sunlight, and they have little food available for radial stem growth due to the small crown (Oliver and Larson, 1990, pages 85 and 208). This condition is of concern as the slender stem at some point become unable to effectively support even a small crown (Long, et. al., 1981) and a small crown also results in a small, weak root system (Oliver and Larson, 1990, page 224). The rule of thumb is if the tree's bole diameter is less than one percent of its height, the tree is susceptible to either stem breakage or root failure (Oliver and Larson, 1990, pages 83 and 210). Stands proposed for thinning on the Middle Fork District typically have diameters ranging from 1.4 to 1.1 percent of average tree heights.

This extremely dense condition recently resulted in some widespread stand damage in young managed stands on the Middle Fork District. In 1996 several warm winter storms deposited a

considerable amount of heavy wet snow between 3000 and 4000 feet in elevation. In a number of places where dense second-growth stands occurred in this elevation band, this heavy snow load resulted in widespread stem breakage and root failure (see also Oliver and Larson, 1991, page 210). In many places whole swaths of trees came down, creating openings as large as 50 feet by 150 feet. This "snow-down" event also resulted in creation of large amounts of forest floor fuels which will put these stands at risk for intense wildfire (should an ignition occur) for some years to come.

While many of the stands proposed for thinning over the past several years are not quite so dense as to be physically unstable as described below, it is desirable to thin these stands well before such conditions develop. This unstable condition is more commonly found in older second-growth stands (age 50 to 70) which were not pre-commercially thinned early in their life. Thinning can do little to quickly correct this stem stability problem once it has developed; a stand of slender, small crowned trees takes quite a while to develop larger crowns with which to grow a larger stem once thinning is done. In the interim, these stands are still vulnerable to windthrow and snow damage (Oliver and Larson, 1990). The point of thinning is to prevent these stand conditions from developing in the first place. There is not a large acreage of stands with these extreme conditions on the Middle Fork District that are in eminent risk of this kind of damage; thinning is proposed in part to prevent such an unstable stand structure from developing later.

Understory Reinitiation

The second primary effect of thinning is to increases the number of species and amount of biomass in the understory by allowing some sunlight past the tree canopy. The understory reinitiation phase, according to Oliver and Larson (1990, pages 151 and 152), is that portion of a stand's development when the dense canopy discussed above begins to open through tree mortality and crown damage, thereby providing more light to the forest floor. This additional sunlight drives the revitalization or reestablishment of the understory layer. It is this stage of stand development that thinning is meant to bring about earlier than would occur through natural events in these uniform, dense stands (Garman, 2000, Chan et. al., 1996, Daniel, et. al., 1979, page 307). This is a particularly import in riparian reserves given the Aquatic Conservation Strategy Objective #8 and the relatively low diversity of the understory in the stands typically proposed for thinning.

As a young Douglas-fir stand develops the trees grow in height and their crowns grow in width until the canopy closes. At this point the amount of sunlight falling on the forest floor is diminished, dramatically if the stand reforested quickly and thoroughly. The shaded forest floor can become nearly devoid of vascular plants (Oliver and Larson, 1990, page 147) or some very shade tolerant plants persist but at very low numbers and coverage (Spies, 1991). There can be a marked increase in herb and shrub diversity between mature and old-growth stands (Berg and Clement, 1992, Halpern and Spies, 1995). Spies and Franklin (1991) note that understory structure is strongly controlled by the overstory, but is not closely linked to stand age. Overstories casting dense shade may occur in dense young Douglas-fir stands and in old-growth stands with dense hemlock understories canopies.

The type of stands typically proposed for commercial thinning are in the stem exclusion stage as described by Oliver and Larson (1990). These younger managed stands created 30 to 60 years ago are not exactly the complete monoculture that some perceive, but they were all typically planted primarily with Douglas-fir. Though some other conifer species may also have been planted, most native conifer species seeded in naturally, to some extent. Douglas-fir is usually the dominant conifer in these stands and due to its notorious capacity for height growth, it typically dominates these stands relatively quickly. Reforestation efforts twenty to fifty years ago on the Willamette National Forest typically involved planting 600 or more trees per acre. The typical Douglas-fir late-successional or old-growth stand will contain 150 to 30 trees per acre.

Understory reinitation in Douglas-fir stands may not occur naturally until age 80 to 100. In addition to the suppression driven mortality which occurs as a stand ages, the crowns move more in the wind and start to abrade each other as these stands mature and grow in height, ultimately providing for more space between crowns and more light on the forest floor. A Douglas-fir overstory can also suppress western hemlock through mechanical damage of the weaker hemlock terminal leader and branches (Oliver and Larson, 1990, page 236). Thinning for timber production maximization opens the canopy some, but not enough to promote development of understory conifers (Chan et al., 1996) since volume maximization objectives require the stand to be maintained as near to full stocking as possible at all times without undue loses to mortality.

On the Middle Fork District, 40 to 50 year old Douglas-fir stands have been observed to be so dense that small shade tolerant trees such as western hemlock, which became established before canopy closure occurred but could not match the height growth of Douglas-fir, eventually die of suppression, so complete is the shade cast by the Douglas-fir overstory. Halpern and Spies (1995) report that it may take centuries for suppressed individuals of Pacific yew (*Taxus brevifolia*) to emerge from the understory in naturally developing stands.

Some people appear to prefer that natural processes be allowed to eventually thin out dense Douglas-fir stands. While the process of crown differentiation, eventually leading to severe tree suppression and death of the most suppressed trees, will eventually reduce the density of stand, a long time may elapse before the stand is open enough to provide for an increase in understory vegetation. The smaller diameter trees in a stand occupy the smallest amount of growing space; when they succumb to suppression, the adjacent, more dominant trees can quickly capture its growing space (Chan et al, 1996; MacLean, 1979; Oliver and Larson, 1990, pages 242 and 253), resulting in little additional sunlight to the forest floor to drive the development or maintenance of an understory layer.

Conclusions

The Middle Fork District has had some experience with snow damage in young, dense, unthinned stands; stand examination and growth modeling projections have been extensively done to document the conditions of the thousands of acres of young, closed canopy stands created by past harvest, and observations have been made of natural stands that began and remain very dense. From this locally generated information, and a review of the large body of stand development literature (only a small segment of which has been cited in this paper), it is

clear that stand density management needs to occur in many young managed stands which were initially reforested at a density which presupposed future thinning activities, if late-successional conditions are to be developed quickly.

The Northwest Forest Plan's Aquatic Conservation Strategy directs us to "maintain and restore, the species composition and structural diversity of plant communities in riparian area" (ACS objective #8). There are tens of thousands of acres of riparian reserves that were harvested and planted within riparian reserves on the Middle Fork District over the last 70 years. Given those facts and the background in stand development summarized above, it appears that thinning riparian reserves which have young stands of Douglas fir within which the canopy has closed by age 30 is essential if we are to truly restore these important portions of the ecosystem to their conditions prior to past management. Silvicultural prescriptions need to recognize the many objectives involved in this restoration; they need to address creation of future large wood sources, diversification of the canopy structure, diversification of the understory vegetation, as well as maintenance of existing stream temperatures.

How Thinning in Riparian Reserves Relates to The Northwest Forest Plan Aquatic Conservation Strategy Objectives

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to assure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Thinning will help to better achieve this objective. Thinning is proposed in these young stands to provide for a more diverse riparian and terrestrial stand by opening up the canopy somewhat such that shade tolerant conifers and ground vegetation can become established or to provide for the more vigorous growth of that which already exists. Thinning will also provide for greater long-term structural diversity by generating larger stem diameters, overall greater variation in stem sizes, a structurally more complex dominant tree crown (deeper, with thicker branches) and future sources of appropriately large snags and down woody material. If these dense, young stands are not thinned there will be, to a large extent, a detrimental impact on aquatic and terrestrial populations and communities in the long-run as these stands may take a very long time to generate large stem calipers and late-successional habitat conditions in general if they remain at their current densities.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian dependent species.

Thinning will not affect the connectivity these recovering riparian stands now provide. While there may be some short-term negative effects in terms of micro-climate changes by reducing the current crown coverage, or in terms of branches and trees tops creating barriers to animal movement, such a reduction generally has a relatively short life as tree crowns expand into the

gaps created by thinning. Local experience has shown that a crown closure of less than 20 percent after a heavy thinning recovers to greater than 50 percent in less than 10 years. There is an overall benefit in creating more structurally complex habitat for animals to travel through in the future.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks and bottom configurations.

Yarding systems and harvest prescriptions would be designed to maintain channel stability in all cases, including intermittent stream channels. Portions of Riparian Areas that provide for stream channel stability are not thinned. Trees to be removed will not be transported across stream channels unless an analysis shows that additional road construction needed to avoid yarding across streams would be more harmful than a narrow skyline corridor through the riparian area. Skyline yarding corridors across stream channels would be minimized, however where analysis determines that yarding across a stream channel could be accomplished while protecting stream banks and channels, stream crossing corridors would be allowed. Logs would be fully suspended above intermittent and perennial stream channels unless analysis determined yarding could be accomplished while maintaining objectives for protection stream banks and channels.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Thinning would have a neutral effect on water quality in the short run. In the long run it may have a slightly beneficial effect as thinning will speed up the creation of large stems, some of which will eventually fall into the channels to provide for more stable channels. No treatment buffers of some width will be placed to avoid the potential for increases in stream temperature or physical disturbance to the channel by retention of all trees providing primary shade, or trees and down wood providing for channel edge stability and sediment storage.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate and character of sediment input, storage and transport.

See the above discussion; thinning will have neutral effect on sediment regimes as long as road construction effects are balanced with the desire to minimize yarding across stream channels. Thinning would enhance development of LWD which when incorporated into stream channels has beneficial effects on storage and routing of sediment. No harvest areas adjacent to stream channels should mitigate the potential for stream bank erosion.

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

Thinning will have a neutral effect on in-stream flows. Though thinning would reduce the amount of evapotranspiration in riparian zones and adjacent uplands, this effect would be very temporary; there would not be long-term change in the amount of leaf area supported by these sites. To a large extent thinning can be thought of as an activity that re-structures, rather than reduces, the vegetation occurring on a site. Thinning would also have a long-term positive effect on sediment, nutrient, and wood routing as discussed in objectives 4. and 5. above.

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

Thinning will have a neutral effect on the timing and variability of floodplain inundation and wetland water table levels, similar to the effects on in-stream flows as discussed above.

8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration to supply amount and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

Thinning is proposed in riparian stands primarily to better accomplish this strategic objective. Thinning will modify the species composition and structure of these stands to more closely approximate the composition of stands occurring in these riparian areas prior to the regeneration harvest. Reducing the density of these stands will provide for growth of large tree boles which will ultimately have a number of positive effects on channel stability and complexity, as well as general stand structural diversity. Thinning will provide for the establishment and growth of understory vegetation which will provide for greater structural diversity and for better thermal regulation and nutrient filtering. Thinning will have a neutral effect on surface and bank erosion. Thinning, through the eventual generation of larger in-channel woody debris, could influence future channel migration but the introduction of larger woody debris would also enhance channel stability.

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian species.

The young, previously managed stands proposed for thinning do not currently comprise late-successional habitat. One of the primary objectives of this proposed thinning is to make these dense, young stands more diverse from a structural and species composition perspective. Thinning will ultimately produce a more structurally diverse stand that provides well distributed plant and animal habitat.

Literature Cited

Agar, J.K., 1997. Silvicultural Prescription for Lower Willow-Coffeepot #3A. Rigdon Ranger District, Willamette National Forest. March, 1997.

Berg, D. R., and N. C. Clement, 1992. Differences in Diversity of Vegetation Between Mature and Old-Growth Forests in the Cascade Range of the Pacific Northwest, USA. Northwest Environmental Journal 8: 190-193.

Chan, S., K. Maas-Hebner, and B. Emmingham, 1996. Thinning Hardwood and Conifer Stands to Increase Light Levels: Have You Thinned Enough? COPE Report, Vol. 9 No. 4, November, 1996.

Curtis, R. O. and D. D. Marshall, 1986. Levels-of-Growing-Stock Cooperative Study in Douglas-fir: Report No. 8 – The LOGS Study: Twenty-Year Results. Research Report PNW-356, March, 1986. Pacific Northwest Forest and Range Experiment Station. UDA Forest Service.

Daniel, T. W., J. A. Helms, F. S. Baker, 1979. Principles of Silviculture, Second Edition. McGraw-Hill inc., 1979, 500 pp.

Garman, S. L., 2000. Biodiversity of Thinned Stands: Young Stand Thinning and Diversity Study. Silviculture/Wildlife Workshop, Newport, Oregon, March 7, 2000.

Halpern, C. B., T. A. Spies, 1995. Plant Species Diversity In Natural and Managed Forests of the Pacific Northwest. Ecological Applications, 5(4), 1995, pp. 913-934.

Long, J.F., F.W. Smith, and D.R.M. Scott. 1981. The Role of Douglas-fir Stem sapwood and Heartwood in the Mechanical and Physiological Support of Crowns and Development of Stem Form. Canadian Journal of Forest Research 11:459-464.

MacLean, C. D. 1979. Relative Density: The Key to Stocking Assessment in Regional Analysis – a Forest Survey Viewpoint. Gen. Tech. Report PNW-78, January, 1979. Pacific Northwest Forest and Range Experiment Station. UDA Forest Service.

Marshal, D. D., J. F. Bell, and J. C. Tappeiner, 1992. Levels-Of-Growing Stock Cooperative Studies in Douglas-fir: Report No. 10 – The Hoskins Study, 1963-83. Research Paper PNW-RP-448, September, 1992. Pacific Northwest Forest and Range Experiment Station, UDA Forest Service.

Oliver, C. D., B. E. Larson, 1990. Forest Stand Dynamics. McGraw-Hill, Inc. 1990. 467 pp.

Spies, T. A. 1991. Plant Species Diversity and Occurrence In Young, Mature, and Old-growth Douglas-fir Stands in Western Oregon and Washington. Pages 111-121 in: L. F. Ruggeiro, K. B. Aubry, A. B., and M. H. Huff, coordinators. Wildlife and Vegetation of Unmanaged Douglas-fir Forests. USDA Forest Service General Technical Report PNW-GTR-285

Spies, T. A. and J. F. Franklin, 1991. The Structure of Natural Young, Mature, and Old-Growth Douglas-fir Forests in Oregon and Washington. Pages 91-109 Pages 111-121 in: L. F. Ruggeiro, K. B. Aubry, A. B., and M. H. Huff, coordinators. Wildlife and Vegetation of Unmanaged Douglas-fir Forests. USDA Forest Service General Technical Report PNW-GTR-285

Tappeiner, J.C., N. Poage, T. Sensening, 2000. Old-Growth Stand Development. *In:* The Cooperative Forest Ecosystem Research Program Annual Report, Janet Erickson, editor. December, 2000.

USDA, 1997. Lookout Point Watershed Analysis Area. Willamette National Forest, Lowell Ranger District, September, 1997.

USDA/USDI, 1994. Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. USDA Forest Service and USDI Bureau of Land Management. April, 1994.

USDA/USDI/USDOC/USEPA, 1993. Forest Ecosystem Management: An Ecological Economic, and Social Assessment. Report of the Forest Ecosystem Management Assessment Team. USDA Forest Service, USDI Fish and Wildlife Service, National Marine Fisheries Service, USDI Park Service, USDI Bureau of Land Management, US Environmental Protection Agency. July, 1993.

The Benefits of Density Management Through Thinning In Riparian Reserves

Prepared by Tim Bailey
Middle Fork Ranger District
Willamette National Forest

Background

The Standards and Guidelines for the Northwest Forest Plan (USDA/USDI, 1994, page C-39) indicates silvicultural practices should be applied in riparian reserves to control stocking, reestablish, and manage stands to acquire desired characteristics needed to attain Aquatic Conservation Strategy Objectives. These Objectives all relate to maintaining or restoring original conditions:

ACS #1: distribution, diversity and complexity of watershed and landscape features
ACS #5: elements of sediment regime; storage
ACS #8: species composition and structural diversity of plant communities in riparian areas to supply amounts and distributions of coarse woody debris to sustain physical complexity and stability
ACS #9: habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian dependant species.

Of most direct applicability is Objective 8. We are directed to "maintain and restore the species composition and structural diversity of plant communities in riparian areas…..and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability". Virtually all the commercial thinning we propose consists of young stands regenerated after clearcutting. Sometimes the stream channels associated with these riparian areas were cleaned of woody material, or a debris torrent removed it. Some of the older of these stands retain large amounts of down wood in the riparian and terrestrial portions due to low merchantability standards at the time or original harvest.

The stands which existed prior to these young, harvest-created stands were all old-growth or late successional forests, likely with large amounts of standing and down wood, and the stream channels likely also contained typical amounts of large down wood. It is these conditions we are charged to restore. While these previously harvested areas may eventually return to something near their original conditions if left alone, that return may take a long time, as explained below, and in some limited cases may never happen. The discussion below describes how stand density management can accelerate the development of late-successional conditions in young, even-aged, single-storied riparian stands created by past clearcutting and planting.

Watershed Analysis – The Recommendations section of North Fork Watershed Analysis (USDA, 1995) determined that commercial thinning of young, managed stands in riparian reserves is beneficial to riparian reserve objectives if it is shown that thinning

will increase the average stand diameter and/or accelerate the development of a shade-tolerant understory (page 2- Recommendations). Appendix K of the Watershed Analysis determined the advantages to thinning in riparian reserves; thinning would provide for a greater overall structural and species diversity by increasing dominant tree diameters and provide for a more structurally and species diverse understory. The recommendation also included the need to retain an un-thinned buffer of 25 to 50 feet either side intermittent and permanent streams respectively to minimize the potential for water temperature increases. Appendix K also addressed how thinning relates to the ACS Objectives (pages 98-100, attached).

Restoration may be imperative if we want these stands to develop the same structure they had before they were regeneration harvested. Recent thinking in the research community (Tappeneir, et. al., 2000; Spies and Franklin, 1991) indicates that young, relatively dense and uniform stands may never attain the expected, classic old-growth structure without some density control early in the stands' history.

Thinning Effects

Thinning, within or outside of riparian reserves, has two basic and equally important effects. One is the focusing of growth on selected, usually the largest, trees, and the other is stimulation or regeneration of understory vegetation. The ramifications of these effects are discussed below in relation to riparian reserves. Thinning is proposed in riparian reserves specifically to create these effects. On the Middle Fork District, virtually all proposed commercial thinning occurs in stands created from past clearcutting and tree planting. These stands are typically from 30 to 60 years old and were planted primarily with Douglas-fir with an objective of maximizing the amount of future commercial timber volume potential. As such, these stands are all fairly dense, with crown closures, on the average, of about 75 to 90 percent. These stands are also, by and large, not especially diverse from a species perspective, as most trees are Douglas-fir and their density has in most situations shaded out much of the understory vegetation. The Douglas-fir themselves, due to inter-tree competition, typically have slender stems and small crowns, with crown ratios (a measure of the vigor of an individual tree) from 30 to 10 percent.

It should also be noted that riparian reserves are also expected to provide various terrestrial benefits, and their prescribed widths have taken this objective into account (USDA/USDI, 1994, page B-13; see also Aquatic Conservation Strategy Objectives 2 and 8, page B-11). Much of the functions provided by riparian buffers are provided within less than a site potential tree height (USDA at al., 1993, pages V-26 and 27). Thinning in the outer portions of riparian reserves also needs to take into account the terrestrial objectives of connectivity, and terrestrial habitat restoration

Diameter Growth

Thinning increases average stand diameter through development of larger crown volumes, resulting in more photosynthate available for radial stem growth. Fewer dominant canopy trees means more sunlight available per tree. Diameter growth is one of the most important factors over which the forester can exercise considerable control (Daniel, et al, 1979 page 328, Curtis and Marshall, 1986)

One reason to prescribe thinning for a riparian forest is get tree diameters to increase more quickly than they would in a dense stand. Diameter grown increase is desirable to provide large diameter trees that will be available to enter the stream channel in a reasonable amount of time. The increase in crown size that drives diameter growth also provides for a deeper, denser crown with heavier branches, and the important wildlife and plant habitat that requires such crown structure. The number of trees per acre in a stand will influence the average stand diameter (Daniel, et al., 1979, page 328). Thinning, depending upon the prescription, can increase diameter growth by a factor of up to 2.5, and thinning in a twenty year old stand can result in average stand diameters of 17 inches versus nine inches in an unthinned stand 20 years later (Marshall, et al., 1992). Trees at a wider spacing have larger crowns, produce more photosynthate, and so continue rapid diameter growth longer than closely spaced trees (Oliver and Larson, 1990, page 208) While thinning initially decreases snag recruitment, as the trees most likely to die from suppression effects are typically those removed by thinning, Garman's (2000) growth modeling shows that moderate intensity thinning will generate large snags more quickly than avoidance of thinning, usually due to random, non-density-related mortality.

Most of the riparian thinning proposed on the Middle Fork district is in stands which do not contain residual trees from the previous stand, so these stands have no existing potential sources for large woody material. Without thinning in a dense stand it may take longer than 150 years for a tree to grow larger than 30 inches. Agar (1997) found through stand growth modeling that thinning a 40 year old managed stand to a 20 percent relative density will generate an average diameter of 20 inches 80 years sooner than without thinning. The wider the thinning spacing, the quicker the accomplishment of any given diameter objective, but one must weigh that objective with the desire to maintain a more or less closed canopy forest to provide for other important riparian values.

According to Tappeiner et al. (2000) and Spies and Franklin (1991), it appears that many young stands are growing on a trajectory quite different than that upon which old-growth stands developed, so density management or thinning many be needed to enable them to achieve any sort of old-growth structure. They found that many old-growth trees were nearly 40 inches in diameter when they were 100 years old. Oliver and Larson (1990) indicate that trees in a closed canopy stand increased in diameter growth after thining, but they do not attain the large diameters of trees initially grown at wide spacings.

Another reason to increase the diameter of a Douglas-fir stand is if it has become so dense as to become "unstable". In very dense stands of the age we typically thin (30 to 60 years old) the individual trees are as tall as they would be in a less dense stand but have a much smaller diameter stem, due to the small amount of crown they have as a result of intra-tree competition. The trees are obligated to continue to grow in height or

they will die from lack of sunlight, and they have little food available for radial stem growth due to the small crown (Oliver and Larson, 1990, pages 85 and 208). This condition is of concern as the slender stem at some point become unable to effectively support even a small crown (Long, et. al., 1981) and a small crown also results in a small, weak root system (Oliver and Larson, page 224). The rule of thumb is if the tree's bole diameter is less than one percent of its height, the tree is susceptible to either stem breakage or root failure (Oliver and Larson, 1990, pages 83 and 210). Stands proposed for thinning on the Middle Fork District typically have diameters ranging from from 1.4 to 1.1 percent of average tree heights.

This extremely dense condition recently resulted in some widespread stand damage in young managed stands on the Middle Fork District. In 1996 several warm winter storms deposited a considerable amount of heavy wet snow between 3000 and 4000 feet in elevation. In a number of places where dense second-growth stands occurred in this elevation band, this heavy snow load resulted in widespread stem breakage and root failure (see also Oliver and Larson, 1991, page 210). In many places whole swaths of trees came down, creating openings as large as 50 feet by 150 feet. This "snow-down" event also resulted in creation of large amounts of forest floor fuels which will put these stands at risk for intense wildfire (should an ignition occur) for some years to come.

While many of the stands proposed for thinning over the past several years are not quite so dense as to be physically unstable as described below, it is desirable to thin these stands well before such conditions develop. This unstable condition is more commonly found in older second-growth stands (age 50 to 70) which were not pre-commercially thinned early in their life. Thinning can do little to quickly correct this stem stability problem once it has developed; a stand of slender, small crowned trees takes quite a while to develop larger crowns with which to grow a larger stem once thinning is done. In the interim, these stands are still vulnerable to windthrow and snow damage (Oliver and Larson, 1990). The point of thinning is to prevent these stand conditions from developing in the first place. There is not a large acreage of stands with these extreme conditions on the Middle Fork District that are in eminent risk of this kind of damage; thinning is proposed in part to prevent such an unstable stand structure from developing later.

Understory Reinitiation

The second primary effect of thinning is to increases the number of species and amount of biomass in the understory by allowing some sunlight past the tree canopy. The understory reinitiation phase, according to Oliver and Larson (1990, pages 151 and 152), is that portion of a stand's development when the dense canopy discussed above begins to open through tree mortality and crown damage, thereby providing light to the forest floor. This additional sunlight drives the revitalization or reestablishment of the understory layer. It is this stage of stand development that thinning is meant to bring about earlier than it would occur through natural events in these uniform, dense stands (Garman, 2000, Chan et. al., 1996, Daniel, et. al., 1979, page 307). This is a particularly import in

riparian reserves given the Aquatic Conservation Strategy Objective #8 and the relatively low diversity of the understory in the stands typically proposed for thinning.

As a young Douglas-fir stand develops the trees grow in height and their crowns grow in width until the conifers' canopy closes. At this point the amount of sunlight falling on the forest floor is diminished, dramatically if the stand reforested quickly and thoroughly. The shaded forest floor can be come nearly devoid of vascular plants (Oliver and Larson, 1990, page 147) or some very shade tolerant plants persist but at very low numbers and biomass. Spies (1991) indicates that as forest canopies close between 20 and 40 years of age, understory species diversity declines to a low point when the dense canopy shades out all but the most shade tolerant of the understory species. There can be a marked increase in herb and shrub diversity between mature and old-growth stands (Berg and Clement, 1992, Halpern and Spies, 1995). Spies and Franklin (1991) note that understory struture is strongly controlled by the overstory, but is not closely linked to stand age. Overstories casting dense shade may occur in dense young Douglas-fir stands and in old-growth stands with dense hemlock understories canopies.

The type of stands typically proposed for commercial thinning are in the stem exclusion stage as described by Oliver and Larson (1990). These younger managed stands created 30 to 60 years ago are not exactly the complete monoculture that some perceive, but they were all typically planted primarily with Douglas-fir. Though some other conifer species may also have been planted, most native conifer species seeded in naturally, to some extent. Douglas-fir is usually the dominant conifer in these stands and due to its is notorious capacity for height growth, it typically dominates these stands relatively quickly. Reforestation efforts twenty to fifty years ago on the Willamette National Forest typically involved planting 600 or more trees per acre. The typical Douglas-fir late-successional or old-growth stand will contain 150 to 30 trees per acre.

Understory reinitation in Douglas-fir stands may not occur naturally until age 80 to 100. Young, dense stands have overlapping crowns. In addition to the suppression driven mortality which occurs as a stand ages, the crowns move more in the wind and start to abraid each other as these stands mature and grow in height, ultimately providing for more space between crowns and more light on the forest floor. A Douglas-fir overstory can also suppress western hemlock through mechanical damage of the weaker hemlock terminal leader an branches (Oliver and Larson, 1990, page 236). Thinning for timber production maximization opens the canopy for greater light penetration but not enough to promote development of understory conifers (Chan et al., 1996).

On the Middle Fork District, 40 to 50 year old Douglas-fir stands have been observed to be so dense that small shade tolerant trees such as western hemlock, which became established before canopy closure occurred but could not match the height growth of Douglas-fir, eventually die of suppression, so complete is the shade cast by the Douglas-fir overstory. Halpern and Spies (1995) report that it may take centuries for suppressed individuals of Pacific yew (*Taxus brevifolia*) to emerge from the understory.

Some appear to prefer that natural processes be allowed to eventually thin out dense Douglas-fir stands. While the process of crown differentiation, eventually leading to severe tree suppression and death of the most suppressed trees, will eventually reduce the density of stand, a long time may elapse before the stand is open enough to provide for an increase in understory vegetation. The smaller diameter trees in a stand occupy the smallest amount of growing space; when they succumb to suppression, the adjacent, more dominant trees can quickly capture its growing space (Chan et al, 1996; MacLean, 1979; Oliver and Larson, 1990, pages 242 and 253), resulting in little additional sunlight to the forest floor to drive the development or maintenance of an understory layer.

Conclusions

The Middle Fork District has had some experience with snow damage in young, dense, unthinned stands; stand examination and growth modeling projections have been extensively done to document the conditions of the thousands of acres of young, closed canopy stands created by past harvest, and observations have been made of natural stands that began and remain very dense. From this locally generated information, and a review of the large body of stand development literature (only a small segment of which has been cited in this paper), it is clear that stand density management needs to occur in many young managed stands which were initially reforested at a density which presupposed future thinning activities, if late-successional conditions are to be developed quickly. The Northwest Forest Plan's Aquatic Conservation Strategy directs us to "maintain and restore, the species composition and structural diversity of plant communities in riparian area" (ACS objective #8). There are tens of thousands of acres of riparian reserves that were harvested and planted within riparian reserves on the Middle Fork District over the last 70 years. Given those facts and the background in stand development summarized above, it appears that thinning riparian reserves which have young stands of Douglas fir within which the canopy has closed by age 30 is essential if we are to truly restore these important portions of the ecosystem to their conditions prior to past management. Silvicultural prescriptions need to recognize the many objectives involved in this restoration; they need to address creation of future large wood sources, diversification of the canopy structure, diversification of the understory vegetation, as well as maintenance of existing stream temperatures.

Literature Cited

Agar, J.K., 1997. Silvicultural Prescription for Lower Willow-Coffeepot #3A. Rigdon Ranger District, Willamette National Forest. March, 1997.

Berg, D. R., and N. C. Clement, 1992. Differences in Diversity of Vegetation Between Mature and Old-Growth Forests in the Cascade Range of the Pacific Northwest, USA. Northwest Environmental Journal 8: 190-193.

Chan, S., K. Maas-Hebner, and B. Emmingham, 1996. Thinning Hardwood and Conifer Stands to Increase Light Levels: Have You Thinned Enough? COPE Report, Vol. 9 No. 4, November, 1996.

Curtis, R. O. and D. D. Marshall, 1986. Levels-of-Growing-Stock Cooperative Study in Douglas-fir: Report No. 8 – The LOGS Study: Twenty-Year Results. Research Report PNW-356, March, 1986. Pacific Northwest Forest and Range Experiment Station. UDA Forest Service.

Daniel, T. W., J. A. Helms, F. S. Baker, 1979. Principles of Silviculture, Second Edition. McGraw-Hill inc., 1979, 500 pp.

Garman, S. L., 2000. Biodiversity of Thinned Stands: Young Stand Thinning and Diversity Study. Silviculture/Wildlife Workshop, Newport, Oregon, March 7, 2000.

Halpern, C. B., T. A. Spies, 1995. Plant Species Diversity In Natural and Managed Forests of the Pacific Northwest. Ecological Applications, 5(4), 1995, pp. 913-934.

Long, J.F., F.W. Smith, and D.R.M. Scott. 1981. The Role of Douglas-fir Stem sapwood and Heartwood in the Mechanical and Physiological Support of Crowns and Development of Stem Form. Canadian Journal of Forest Research 11:459-464.

MacLean, C. D. 1979. Relative Density: The Key to Stocking Assessment in Regional Analysis – a Forest Survey Viewpoint. Gen. Tech. Report PNW-78, January, 1979. Pacific Northwest Forest and Range Experiment Station. UDA Forest Service.

Marshal, D. D., J. F. Bell, and J. C. Tappeiner, 1992. Levels-Of-Growing Stock Cooperative Studies in Douglas-fir: Report No. 10 – The Hoskins Study, 1963-83. Research Paper PNW-RP-448, September, 1992. Pacific Northwest Forest and Range Experiment Station, UDA Forest Service.

Oliver, C. D., B. E. Larson, 1990. Forest Stand Dynamics. McGraw-Hill, Inc. 1990. 467 pp.

Spies, T. A. 1991. Plant Species Diversity and Occurrence In Young, Mature, and Old-growth Douglas-fir Stands in Western Oregon and Washington. Pages 111-121 in: L. F. Ruggeiro, K. B. Aubry, A. B., and M. H. Huff, coordinators. Wildlife and Vegetation of Unmanaged Douglas-fir Forests. USDA Forest Service General Technical Report PNW-GTR-285

Spies, T. A. and J. F. Franklin, 1991. The Structure of Natural Young, Mature, and Old-Growth Douglas-fir Forests in Oregon and Washington. Pages 91-109 Pages 111-121 in: L. F. Ruggeiro, K. B. Aubry, A. B., and M. H. Huff, coordinators.

Wildlife and Vegetation of Unmanaged Douglas-fir Forests. USDA Forest Service General Technical Report PNW-GTR-285

Tappeiner, J.C., N. Poage, T. Sensening, 2000. Old-Growth Stand Development. *In:* The Cooperative Forest Ecosystem Research Program Annual Report, Janet Erickson, editor. December, 2000.

USDA, 1995. Watershed Analysis – North Fork of the Middle Fork of the Willamette River. Willamette National Forest, Oakridge Ranger District, September, 1995.

USDA/USDI, 1994. Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. USDA Forest Service and USDI Bureau of Land Management. April, 1994.

USDA/USDI/USDOC/USEPA, 1993. Forest Ecosystem Management: An Ecological Economic, and Social Assessment. Report of the Forest Ecosystem Management Assessment Team. USDA Forest Service, USDI Fish and Wildlife Service, National Marine Fisheries Service, USDI Park Service, USDI Bureau of Land Management, US Environmental Protection Agency. July, 1993.

The Benefits of Thinning In Riparian Reserves

Background

This Appendix has been added to the 1997 Lookout Point Watershed Analysis Area document to more completely justify and support the need to thin young managed stands within riparian reserves. The Recommendations section of the Lookout Point Watershed Analysis Area (USDA, 1997) did not specifically mention commercial thinning of young, managed stands in riparian reserves, though it did speak to the benefits of thinning with the LSR in terms of achieving stand diversity objectives. In a general sense, the Standards and Guidelines for the Northwest Forest Plan (USDA/USDI, 1994, page C-32) indicate silvicultural practices should be applied in riparian reserves to control stocking, reestablish, and manage stands to acquire desired characteristics needed to attain Aquatic Conservation Strategy Objectives. These Objectives all relate to maintaining or restoring original conditions:

ACS #1: distribution, diversity and complexity of watershed and landscape features
ACS #5: elements of sediment regime; storage
ACS #8: species composition and structural diversity of plant communities in riparian areas to supply amounts and distributions of coarse woody debris to sustain physical complexity and stability
ACS #9: habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian dependent species.

Of most direct applicability is Objective 8. We are directed to "maintain and restore the species composition and structural diversity of plant communities in riparian areas…..and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability". Virtually all the commercial thinning we propose on this District and in this watershed consists of young stands regenerated after clearcutting. Sometimes the stream channels associated with these riparian areas were cleaned of woody material, or a debris torrent removed it. Some of the older of these stands retain large amounts of down wood in the riparian and terrestrial portions due to low merchantability standards at the time or original harvest.

The stands which existed prior to these young, harvest-created stands were all old-growth or late successional forests with a high level of structural and species diversity, likely with large amounts of standing and down wood, and the stream channels likely also contained typical amounts of large down wood. It is these conditions we are charged to restore. While these previously harvested areas may eventually return to something near their original conditions if left alone, that return may take a long time, as explained below, and in some limited cases may never happen. Restoration of riparian area second-growth stands may be imperative if we want these stands to develop the same structure they had before they were regeneration harvested. Recent thinking in the research community (Tappeneir, et. al., 2000; Spies and Franklin, 1991) indicates that young, relatively dense and uniform stands may never attain the expected, classic old-growth structure without some density control early in the stands' history. The discussion

below describes how stand density management can accelerate the development of late-successional conditions in young, even-aged, single-storied riparian stands created by past clearcutting and planting.

Thinning Effects

Thinning, within or outside of riparian reserves, has two basic and equally important effects. One is the focusing of growth on selected, usually the largest, trees, and the other is stimulation or regeneration of understory vegetation. The ramifications of these effects are discussed below in relation to riparian reserves. Thinning is proposed in riparian reserves specifically to create these effects. Generally, and especially in application to smaller stream course up to smaller class II streams, riparian reserves tend not to be much different in composition and structure to upland stands in generally steep topography. Larger streams in valley bottoms that have an active floodplain typically have a more diverse riparian vegetation where floods cause channel changes that can produce and maintain a significant hardwood component in riparian areas.

On the Middle Fork District, virtually all proposed commercial thinning occurs in stands created from past clearcutting and tree planting. These stands are typically from 30 to 60 years old and were planted primarily with Douglas-fir with an objective of maximizing the amount of future commercial timber harvest volume potential. As such, these stands are all fairly dense, with crown closures, on the average, of about 75 to 90+ percent. These stands are also, by and large, not especially diverse from a species perspective, as most trees are Douglas-fir and their density has in most situations shaded out much of the understory vegetation. The Douglas-fir themselves, due to inter-tree competition, typically have slender stems and small crowns, with crown ratios (a measure of the vigor of an individual tree) from 30 to 10 percent.

It should also be noted that riparian reserves are also expected to provide various terrestrial benefits, and their prescribed widths have taken this objective into account (USDA/USDI, 1994, page B-13; see also Aquatic Conservation Strategy Objectives 2 and 8, page B-11). Much of the aquatic functions provided by riparian buffers are provided within less than a site potential tree height (USDA et al., 1993, pages V-26 and 27). Thinning in the outer portions of riparian reserves also needs to take into account the terrestrial objectives of connectivity, and terrestrial habitat restoration

Diameter Growth

Thinning increases average stand diameter through development of larger crown volumes, resulting in more photosynthate available for radial stem growth. Fewer dominant canopy trees mean more sunlight available per tree. Diameter growth is one of the most important factors over which the forester can exercise considerable control (Daniel, et al, 1979 page 328, Curtis and Marshall, 1986)

One reason to prescribe thinning of a riparian forest is get tree diameters to increase more quickly than they would in a dense stand. Diameter growth increase is desirable to provide large diameter trees that will be available to enter the stream channel in the future; hopefully sooner rather than much later. The increase in crown size that drives diameter growth also provides for

a deeper, denser crown with heavier branches, and the important wildlife and plant habitat that requires such crown structure. The number of trees per acre in a stand will influence the average stand diameter (Daniel, et al., 1979, page 328). Thinning, depending upon the prescription, can increase diameter growth by a factor of up to 2.5, and thinning in a twenty year old stand can result in average stand diameters of 17 inches versus nine inches in an unthinned stand 20 years later (Marshall, et al., 1992). Trees at a wider spacing have larger crowns, produce more photosynthate, and so continue rapid diameter growth longer than closely spaced trees (Oliver and Larson, 1990, page 208) While thinning initially decreases snag recruitment, as the trees most likely to die from suppression effects are typically those removed by thinning, Garman's (2000) growth modeling shows that moderate intensity thinning will generate large snags more quickly than avoidance of thinning, usually due to random, non-density-related mortality.

Most of the riparian thinning proposed on the Middle Fork district is in stands which do not contain residual trees from the previous stand, so these stands have no existing sources for large woody material. Without thinning in a dense stand, it may take longer than 150 years for a tree to grow larger than 30 inches. Agar (1997) found through stand growth modeling that thinning a 40 year old managed stand to a 20 percent relative density will generate an average diameter of 20 inches 80 years sooner than without thinning. The wider the thinning spacing, the quicker the accomplishment of any given diameter objective, but one must weigh that objective with the desire to maintain a more or less closed canopy forest to provide for other important riparian values.

According to Tappeiner et al. (2000) and Spies and Franklin (1991), it appears that many young stands are growing on a trajectory quite different than that upon which old-growth stands developed, so density management or thinning many be needed to enable them to achieve any sort of old-growth structure. They found that many old-growth trees were nearly 40 inches in diameter when they were 100 years old. Oliver and Larson (1990) indicate that trees in a closed canopy stand increased in diameter growth after thinning, but they do not attain the large diameters of trees initially grown at wide spacing.

Another reason to increase the diameter of a Douglas-fir stand is if it has become so dense as to become "unstable". In very dense stands of the age we typically thin (30 to 60 years old) the individual trees are as tall as they would be in a less dense stand but have a much smaller diameter stem, due to the small amount of crown they have as a result of intra-tree competition. The trees are obligated to continue to grow in height or they will die from lack of sunlight, and they have little food available for radial stem growth due to the small crown (Oliver and Larson, 1990, pages 85 and 208). This condition is of concern as the slender stem at some point become unable to effectively support even a small crown (Long, et. al., 1981) and a small crown also results in a small, weak root system (Oliver and Larson, 1990, page 224). The rule of thumb is if the tree's bole diameter is less than one percent of its height, the tree is susceptible to either stem breakage or root failure (Oliver and Larson, 1990, pages 83 and 210). Stands proposed for thinning on the Middle Fork District typically have diameters ranging from 1.4 to 1.1 percent of average tree heights.

This extremely dense condition recently resulted in some widespread stand damage in young managed stands on the Middle Fork District. In 1996 several warm winter storms deposited a

considerable amount of heavy wet snow between 3000 and 4000 feet in elevation. In a number of places where dense second-growth stands occurred in this elevation band, this heavy snow load resulted in widespread stem breakage and root failure (see also Oliver and Larson, 1991, page 210). In many places whole swaths of trees came down, creating openings as large as 50 feet by 150 feet. This "snow-down" event also resulted in creation of large amounts of forest floor fuels which will put these stands at risk for intense wildfire (should an ignition occur) for some years to come.

While many of the stands proposed for thinning over the past several years are not quite so dense as to be physically unstable as described below, it is desirable to thin these stands well before such conditions develop. This unstable condition is more commonly found in older second-growth stands (age 50 to 70) which were not pre-commercially thinned early in their life. Thinning can do little to quickly correct this stem stability problem once it has developed; a stand of slender, small crowned trees takes quite a while to develop larger crowns with which to grow a larger stem once thinning is done. In the interim, these stands are still vulnerable to windthrow and snow damage (Oliver and Larson, 1990). The point of thinning is to prevent these stand conditions from developing in the first place. There is not a large acreage of stands with these extreme conditions on the Middle Fork District that are in eminent risk of this kind of damage; thinning is proposed in part to prevent such an unstable stand structure from developing later.

Understory Reinitiation

The second primary effect of thinning is to increases the number of species and amount of biomass in the understory by allowing some sunlight past the tree canopy. The understory reinitiation phase, according to Oliver and Larson (1990, pages 151 and 152), is that portion of a stand's development when the dense canopy discussed above begins to open through tree mortality and crown damage, thereby providing more light to the forest floor. This additional sunlight drives the revitalization or reestablishment of the understory layer. It is this stage of stand development that thinning is meant to bring about earlier than would occur through natural events in these uniform, dense stands (Garman, 2000, Chan et. al., 1996, Daniel, et. al., 1979, page 307). This is a particularly import in riparian reserves given the Aquatic Conservation Strategy Objective #8 and the relatively low diversity of the understory in the stands typically proposed for thinning.

As a young Douglas-fir stand develops the trees grow in height and their crowns grow in width until the canopy closes. At this point the amount of sunlight falling on the forest floor is diminished, dramatically if the stand reforested quickly and thoroughly. The shaded forest floor can become nearly devoid of vascular plants (Oliver and Larson, 1990, page 147) or some very shade tolerant plants persist but at very low numbers and coverage (Spies, 1991). There can be a marked increase in herb and shrub diversity between mature and old-growth stands (Berg and Clement, 1992, Halpern and Spies, 1995). Spies and Franklin (1991) note that understory structure is strongly controlled by the overstory, but is not closely linked to stand age. Overstories casting dense shade may occur in dense young Douglas-fir stands and in old-growth stands with dense hemlock understories canopies.

The type of stands typically proposed for commercial thinning are in the stem exclusion stage as described by Oliver and Larson (1990). These younger managed stands created 30 to 60 years ago are not exactly the complete monoculture that some perceive, but they were all typically planted primarily with Douglas-fir. Though some other conifer species may also have been planted, most native conifer species seeded in naturally, to some extent. Douglas-fir is usually the dominant conifer in these stands and due to its notorious capacity for height growth, it typically dominates these stands relatively quickly. Reforestation efforts twenty to fifty years ago on the Willamette National Forest typically involved planting 600 or more trees per acre. The typical Douglas-fir late-successional or old-growth stand will contain 150 to 30 trees per acre.

Understory reinitation in Douglas-fir stands may not occur naturally until age 80 to 100. In addition to the suppression driven mortality which occurs as a stand ages, the crowns move more in the wind and start to abrade each other as these stands mature and grow in height, ultimately providing for more space between crowns and more light on the forest floor. A Douglas-fir overstory can also suppress western hemlock through mechanical damage of the weaker hemlock terminal leader and branches (Oliver and Larson, 1990, page 236). Thinning for timber production maximization opens the canopy some, but not enough to promote development of understory conifers (Chan et al., 1996) since volume maximization objectives require the stand to be maintained as near to full stocking as possible at all times without undue loses to mortality.

On the Middle Fork District, 40 to 50 year old Douglas-fir stands have been observed to be so dense that small shade tolerant trees such as western hemlock, which became established before canopy closure occurred but could not match the height growth of Douglas-fir, eventually die of suppression, so complete is the shade cast by the Douglas-fir overstory. Halpern and Spies (1995) report that it may take centuries for suppressed individuals of Pacific yew (*Taxus brevifolia*) to emerge from the understory in naturally developing stands.

Some people appear to prefer that natural processes be allowed to eventually thin out dense Douglas-fir stands. While the process of crown differentiation, eventually leading to severe tree suppression and death of the most suppressed trees, will eventually reduce the density of stand, a long time may elapse before the stand is open enough to provide for an increase in understory vegetation. The smaller diameter trees in a stand occupy the smallest amount of growing space; when they succumb to suppression, the adjacent, more dominant trees can quickly capture its growing space (Chan et al, 1996; MacLean, 1979; Oliver and Larson, 1990, pages 242 and 253), resulting in little additional sunlight to the forest floor to drive the development or maintenance of an understory layer.

Conclusions

The Middle Fork District has had some experience with snow damage in young, dense, unthinned stands; stand examination and growth modeling projections have been extensively done to document the conditions of the thousands of acres of young, closed canopy stands created by past harvest, and observations have been made of natural stands that began and remain very dense. From this locally generated information, and a review of the large body of stand development literature (only a small segment of which has been cited in this paper), it is

clear that stand density management needs to occur in many young managed stands which were initially reforested at a density which presupposed future thinning activities, if late-successional conditions are to be developed quickly.

The Northwest Forest Plan's Aquatic Conservation Strategy directs us to "maintain and restore, the species composition and structural diversity of plant communities in riparian area" (ACS objective #8). There are tens of thousands of acres of riparian reserves that were harvested and planted within riparian reserves on the Middle Fork District over the last 70 years. Given those facts and the background in stand development summarized above, it appears that thinning riparian reserves which have young stands of Douglas fir within which the canopy has closed by age 30 is essential if we are to truly restore these important portions of the ecosystem to their conditions prior to past management. Silvicultural prescriptions need to recognize the many objectives involved in this restoration; they need to address creation of future large wood sources, diversification of the canopy structure, diversification of the understory vegetation, as well as maintenance of existing stream temperatures.

How Thinning in Riparian Reserves Relates to The Northwest Forest Plan Aquatic Conservation Strategy Objectives

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to assure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Thinning will help to better achieve this objective. Thinning is proposed in these young stands to provide for a more diverse riparian and terrestrial stand by opening up the canopy somewhat such that shade tolerant conifers and ground vegetation can become established or to provide for the more vigorous growth of that which already exists. Thinning will also provide for greater long-term structural diversity by generating larger stem diameters, overall greater variation in stem sizes, a structurally more complex dominant tree crown (deeper, with thicker branches) and future sources of appropriately large snags and down woody material. If these dense, young stands are not thinned there will be, to a large extent, a detrimental impact on aquatic and terrestrial populations and communities in the long-run as these stands may take a very long time to generate large stem calipers and late-successional habitat conditions in general if they remain at their current densities.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian dependent species.

Thinning will not affect the connectivity these recovering riparian stands now provide. While there may be some short-term negative effects in terms of micro-climate changes by reducing the current crown coverage, or in terms of branches and trees tops creating barriers to animal movement, such a reduction generally has a relatively short life as tree crowns expand into the

gaps created by thinning. Local experience has shown that a crown closure of less than 20 percent after a heavy thinning recovers to greater than 50 percent in less than 10 years. There is an overall benefit in creating more structurally complex habitat for animals to travel through in the future.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks and bottom configurations.

Yarding systems and harvest prescriptions would be designed to maintain channel stability in all cases, including intermittent stream channels. Riparian areas within 10 to 50 feet of stream channels are generally not thinned. Trees to be removed will not be transported across stream channels unless an analysis shows that additional road construction needed to avoid yarding across streams would be more harmful than a narrow skyline corridor through the riparian area. Skyline yarding corridors across stream channels would be minimized, however where analysis determines that yarding across a stream channel could be accomplished while protecting stream banks and channels, stream crossing corridors would be allowed. Logs would be fully suspended above intermittent and perennial stream channels unless analysis determined yarding could be accomplished while maintaining objectives for protection stream banks and channels.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Thinning would have a neutral effect on water quality in the short run. In the long run it may have a slightly beneficial effect as thinning will speed up the creation of large stems, some of which will eventually fall into the channels to provide for more stable channels. Retention of all trees within 50 feet of stream channels will provide for shade to maintain cool stream temperatures.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate and character of sediment input, storage and transport.

See the above discussion; thinning will have neutral effect on sediment regimes as long as road construction effects are balanced with the desire to minimize yarding across stream channels. Thinning would enhance development of LWD which when incorporated into stream channels has beneficial effects on storage and routing of sediment. No harvest areas adjacent to stream channels should mitigate the potential for stream bank erosion.

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

Thinning will have a neutral effect on in-stream flows. Though thinning would reduce the amount of evapotranspiration in riparian zones and adjacent uplands, this effect would be very temporary; there would not be long-term change in the amount of leaf area supported by these sites. To a large extent thinning can be thought of as an activity that re-structures, rather than reduces, the vegetation occurring on a site. Thinning would also have a long-term positive effect on sediment, nutrient, and wood routing as discussed in objectives 4. and 5. above.

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

Thinning will have a neutral effect on the timing and variability of floodplain inundation and wetland water table levels, similar to the effects on in-stream flows as discussed above.

8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration to supply amount and distributions of coarse woody debris sufficient to sustain physical complexity
and stability.

Thinning is proposed in riparian stands primarily to better accomplish this strategic objective. Thinning will modify the species composition and structure of these stands to more closely approximate the composition of stands occurring in these riparian areas prior to the regeneration harvest. Reducing the density of these stands will provide for growth of large tree boles which will ultimately have a number of positive effects on channel stability and complexity, as well as general stand structural diversity. Thinning will provide for the establishment and growth of understory vegetation which will provide for greater structural diversity and for better thermal regulation and nutrient filtering. Thinning will have a neutral effect on surface and bank erosion. Thinning, through the eventual generation of larger in-channel woody debris, could influence future channel migration but the introduction of larger woody debris would also enhance channel stability.

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian species.

The young, previously managed stands proposed for thinning do not currently comprise late-successional habitat. One of the primary objectives of this proposed thinning is to make these dense, young stands more diverse from a structural and species composition perspective. Thinning will ultimately produce a more structurally diverse stand that provides well distributed plant and animal habitat.

<u>Literature Cited</u>

Agar, J.K., 1997. Silvicultural Prescription for Lower Willow-Coffeepot #3A. Rigdon Ranger District, Willamette National Forest. March, 1997.

Berg, D. R., and N. C. Clement, 1992. Differences in Diversity of Vegetation Between Mature and Old-Growth Forests in the Cascade Range of the Pacific Northwest, USA. Northwest Environmental Journal 8: 190-193.

Chan, S., K. Maas-Hebner, and B. Emmingham, 1996. Thinning Hardwood and Conifer Stands to Increase Light Levels: Have You Thinned Enough? COPE Report, Vol. 9 No. 4, November, 1996.

Curtis, R. O. and D. D. Marshall, 1986. Levels-of-Growing-Stock Cooperative Study in Douglas-fir: Report No. 8 – The LOGS Study: Twenty-Year Results. Research Report PNW-356, March, 1986. Pacific Northwest Forest and Range Experiment Station. UDA Forest Service.

Daniel, T. W., J. A. Helms, F. S. Baker, 1979. Principles of Silviculture, Second Edition. McGraw-Hill inc., 1979, 500 pp.

Garman, S. L., 2000. Biodiversity of Thinned Stands: Young Stand Thinning and Diversity Study. Silviculture/Wildlife Workshop, Newport, Oregon, March 7, 2000.

Halpern, C. B., T. A. Spies, 1995. Plant Species Diversity In Natural and Managed Forests of the Pacific Northwest. Ecological Applications, 5(4), 1995, pp. 913-934.

Long, J.F., F.W. Smith, and D.R.M. Scott. 1981. The Role of Douglas-fir Stem sapwood and Heartwood in the Mechanical and Physiological Support of Crowns and Development of Stem Form. Canadian Journal of Forest Research 11:459-464.

MacLean, C. D. 1979. Relative Density: The Key to Stocking Assessment in Regional Analysis – a Forest Survey Viewpoint. Gen. Tech. Report PNW-78, January, 1979. Pacific Northwest Forest and Range Experiment Station. UDA Forest Service.

Marshal, D. D., J. F. Bell, and J. C. Tappeiner, 1992. Levels-Of-Growing Stock Cooperative Studies in Douglas-fir: Report No. 10 – The Hoskins Study, 1963-83. Research Paper PNW-RP-448, September, 1992. Pacific Northwest Forest and Range Experiment Station, UDA Forest Service.

Oliver, C. D., B. E. Larson, 1990. Forest Stand Dynamics. McGraw-Hill, Inc. 1990. 467 pp.

Spies, T. A. 1991. Plant Species Diversity and Occurrence In Young, Mature, and Old-growth Douglas-fir Stands in Western Oregon and Washington. Pages 111-121 in: L. F. Ruggeiro, K. B. Aubry, A. B., and M. H. Huff, coordinators. Wildlife and Vegetation of Unmanaged Douglas-fir Forests. USDA Forest Service General Technical Report PNW-GTR-285

Spies, T. A. and J. F. Franklin, 1991. The Structure of Natural Young, Mature, and Old-Growth Douglas-fir Forests in Oregon and Washington. Pages 91-109 Pages 111-121 in: L. F. Ruggeiro, K. B. Aubry, A. B., and M. H. Huff, coordinators. Wildlife and Vegetation of Unmanaged Douglas-fir Forests. USDA Forest Service General Technical Report PNW-GTR-285

Tappeiner, J.C., N. Poage, T. Sensening, 2000. Old-Growth Stand Development. *In:* The Cooperative Forest Ecosystem Research Program Annual Report, Janet Erickson, editor. December, 2000.

USDA, 1997. Lookout Point Watershed Analysis Area. Willamette National Forest, Lowell Ranger District, September, 1997.

USDA/USDI, 1994. Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. USDA Forest Service and USDI Bureau of Land Management. April, 1994.

USDA/USDI/USDOC/USEPA, 1993. Forest Ecosystem Management: An Ecological Economic, and Social Assessment. Report of the Forest Ecosystem Management Assessment Team. USDA Forest Service, USDI Fish and Wildlife Service, National Marine Fisheries Service, USDI Park Service, USDI Bureau of Land Management, US Environmental Protection Agency. July, 1993.