United States Department of Agriculture
Forest Service

North Clack Integrated Resource Project

Silviculture Specialist Report

Prepared by:

/S/ *Philip G. Monsanto*

Philip G. Monsanto
Certified Silviculturist

for:
Clackamas River Ranger District
Mt. Hood National Forest

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Executive Summary

"This report shows that the proposed action which includes thinning and regeneration harvests to improve forest health, growth, diversity, enhance forage, improve or promote owl habitat and provide forest product complies with direction in the Forest Plan, as amended (page 13) and that vegetation management actions are appropriate to move stands in the desired direction in terms of health, growth, productivity and the diversity of habitats in both the short and long term while minimizing effects to other resources (pages 14-19). The proposed action was developed to be in full compliance with NFMA by meeting Forest Plan standards and guidelines for suitability of the land for timber management, opening size, and reforestation requirements. Cumulative effects were found to be minimal (page 19). Exceptions to Forest Plan standards and guidelines are needed for FW-306 and 307."

Project Description

Table 1 - Purpose and Need and proposed actions for North Clack Vegetation Treatment

Purpose & Need	Proposed Action	Acres	Notes
Improve Forest Health, Growth and Diversity while Providing Forest Products	Variable-density thinning with Skips and Gaps	3,495	• 2,067 acres in Matrix, with two acre gaps and heavy thins for forage enhancement • 191 acres in LSR • 947 acres in Riparian Reserves • 202 acres of Matrix with an emphasis of improving owl habitat in the home range • 88 acres of thinning with a huckleberry enhancement emphasis
Improve Forest Health, Growth and Diversity	Noncommercial thinning and brushing in young plantations	1,037	• 985 acres of young-stand thinning and brushing • 52 acres of young-stand thinning and brushing and the removal of trees in diseased areas followed by planting
Improve Owl Habitat	Create gaps	60	Cut and leave trees in small gaps to improving owl habitat in Matrix
Create Early-Seral Habitat while Providing Forest Products	• Regeneration Harvest with Reserves • Site Preparation and Planting	255	In Matrix
Enhance Forage	• Meadow Burn	2	
Fire Hazard Reduction	• Burning • Fuel Break	541	• 150 acres of piling and burning of slash along Road 4610 and property lines • 136 acres of under burning of thinned stands • 255 acres of under burning and grapple piling in regeneration harvest units

Regulatory Framework

There are numerous laws which govern the management and restoration of National Forest Lands, including the Organic Act, the Knutson-Vandenberg Act, Sikes, Act, Multiple-Use Sustained Yield Act of 1960, and the National Environmental Policy Act of 1969. These and other laws are listed in the Forest Service Manual 2020.11, pages 3-7.[1] URL accessed 5/15/2018.

Direction and Policy

Ecological Restoration and Resilience provides foundational policy for using ecological restoration to manage National Forest System lands in a sustainable manner. Forest Service Manual Chapter 2020 lists objectives including healthy, resilient landscapes with greater capacity to survive natural disturbances and large scale threats to sustainability, especially under changing and uncertain future environmental conditions such as those driven by climate change and increasing human uses.

The guidance in Forest Service Manual 2020 includes developing goals and objectives within the framework defined by laws, Indian treaties and regulations, collaboratively developed public and Indian tribal values and desires, historical conditions, current and likely future ecological capabilities, a range of climate change projections, the best available scientific information and technical and economic feasibility to achieve desired conditions. More information can be found at Forest Service Manual 1900.

Handbook Direction

Proposed actions for North Clack follow Handbook direction which incorporates principles of ecosystem direction. For example the Silvicultural Practices Handbook, found at Forest Service Handbook 2409.17 pages 4-5,[2] includes direction to, "…integrate ecosystem concepts in silvicultural prescriptions…" and to incorporate landscape-level analysis into planning and silvicultural development. URL accessed 5/15/2018. The Renewable Resources Handbook, found at Forest Service Handbook 2409.19 page 6,[3] also directs that ecological approaches be incorporated into all projects using regional-level Knutsen Vandenburg funds. URL accessed 5/15/2018.

[1] https://www.fs.fed.us/im/directives/fsm/2000/wo_2020-2016-1.docx
[2] https://www.fs.fed.us/im/directives/field/r6pnw/fsh/2409.17/2409-17-zero-code-2011-1.docx
[3] https://www.fs.fed.us/im/directives/fsh/2409.19/wo_2409.19_zero_code.doc

Methodology

An array of available information and tools were used in the analysis of vegetation treatments for North Clack. These include the North Fork Clackamas River Watershed Analysis, Aerial Insect & Disease Detection Survey data, Local and Forest-level GIS data, local knowledge, walkthroughs of stands, and collected common stand exam (CSE) data. Plant associations found within North Clack Units can be found in Appendix A.

CSE data were uploaded into the US Forest Service Field Sampled Vegetation (FSVEG) database and prepared for the Forest Vegetation Simulator (FVS), a forest growth simulation model developed by the US Forest Service. It is an individual tree, distance dependent growth and yield model which can help to answer how vegetation could change in response to proposed management actions. Depending on region or location different variants use different assumptions for calculating growth and yield. For North Clack the Westside Cascades variant was used (Keyser 2008 (revised November 2, 2015)).

Affected Environment

Existing Conditions

Plant Associations

Plant association classification describes repeating patterns of plant communities that indicate different biophysical environments. The combinations of factors, such as moisture and temperature regimes, light, and soil nutrients, provide habitat for a group of plant species. There are few distinct boundaries along the environmental continua. However, categorizing discrete plant associations provides a means to track and predict vegetation composition, structure, and response to disturbance. Plant association classification of forested lands has been a forest management tool for many years. Ecosystem management and concerns with biodiversity also require understanding the plant and animal habitats that occur across our landscapes. Existing Forest records were used to estimate the plant associations within the vegetation treatment areas Table 2). In all a total of 18 plant associations are identified, with approximately 87.9% of the vegetation treatment area dominated by four plant associations: (1) Western hemlock/sword fern-salal-Oregon Grape; (2) Pacific silver fir/Alaska huckleberry, dry; (3) Western hemlock/sword fern, moist; (4) Western hemlock/rhododendron. Note that the total GIS acres is off by roughly 6% from the acres estimated for proposal because of the difference in data types used to create this table (raster type). However the table still offers a reasonable idea of the plant associations found across the units. For the top four associations, Appendix A provides their descriptions.

Table 2 - Plant Associations within Vegetation Treatment Areas

Description	GIS Acres	Percent
Western hemlock/swordfern-salal-Oregon grape, mesic	2778.2	56.7
Pacific silver fir/Alaska huckleberry, dry	639.2	13
Western hemlock/swordfern, moist	461.7	9.4
Western hemlock/rhododendron	433.0	8.8
PSFZ,RHMA-Pacific silver fir/rhododendron	148.1	3
Western hemlock/nonforest-other	100.1	2
Pacific silver fir/vine maple-vanilla leaf	75.4	1.5
Western hemlock-dry salal	56.7	1.2
Pacific silver fir/nonforest-wet	47.4	1
Western hemlock/rhododendron-beargrass	43.6	0.9
White fir/OR grape/princes pine	36.9	0.8
Pacific silver fir/salal-Oregon grape	24.2	0.5
White fir/OR grape-whipplevine	18.5	0.4
Undefined	15.1	0.3
Pacific silver fir/big huckleberry/beargrass	14.5	0.3
Douglas-fir/Oregon grape-salal-oceanspray	4.4	0.1
Western hemlock/devil's club or skunkcabbage	3.3	0.1

History

Settlement was limited by the steep terrain until the 1890's, and homesteaders primarily used the land for sheep and cattle grazing. By 1920 interest moved towards logging and this continued to be the major land use especially after Ladee Logging Company began full-scale operations. Signs of a railroad line through Ladee Flats used to move logs are still present. Logging continued until 1929 when an approximately 15,000-acre stand-replacement fire burned through the watershed.

This is a good segue into the watershed's fire history over the past 100 years. The area experienced a number of large, stand replacement fires in the early 1900s (Figure 1). Much of the burned area was salvage logged. The Union Lumber Company went bankrupt and the land was transferred to the Forest Service as part of a settlement for fire damages. The area was eventually replanted and reseeded. The salvage logging which occurred after the 1929 fire, and other fires that contributed to the watershed's vegetative history are the major events which initiated new stands that have since developed into the watershed's mid-seral forest today. The fires and salvage logging during the early 20th century also left few remnant structures such as snags, down logs, and trees especially in the western portion of the watershed.

Interestingly in 2014 the 36 Pit Fire burned up the southerly aspect of the Planning Area in stand replacement fashion, but when it got to the plateau the fire behavior minimized, likely as a result of topographical change and commercial harvests which occurred just prior to the fire event.

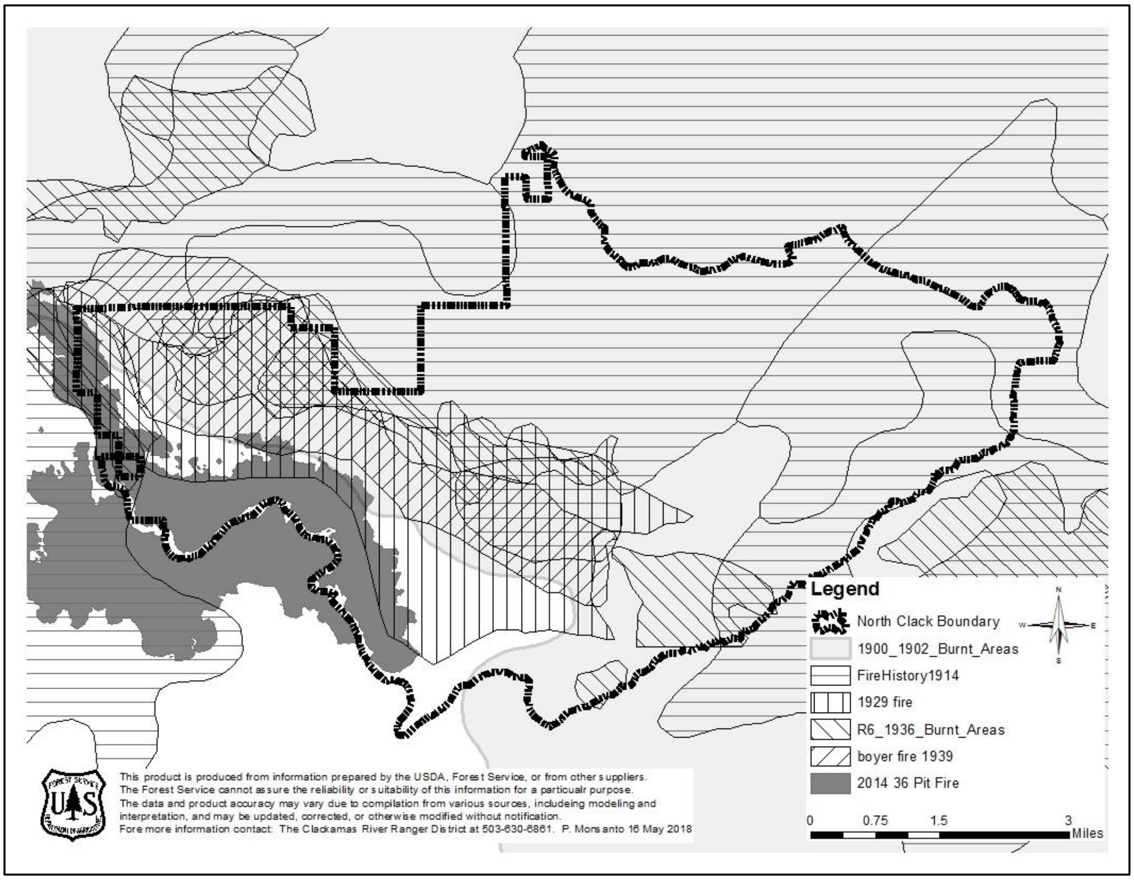

Figure 1 - Fire History of the Project Area

After 1939 through 2015 logging continued (Figure 2). Given available data clearcutting and reforestation was the silvicultural system from 1939 through 1990, and likely brush and slash disposal was done either by burning piles at landings or through broadcast burning of stands as part of site preparation for replanting. It is also likely during this time period that as part of site preparation herbicide was used to reduce vegetative competition, and timber stand improvements in the form of precommercial thinning and pruning were implemented to increase diameter growth and reduce knots in wood for higher quality timber products for purchasers.

From 1990 to 2015 a shift in management occurred in which stands which were previously clearcut and managed as described above underwent commercial thinnings, again to increase vigor of remaining trees, and to provide spatial diversity and foraging habitat for ungulates such as deer and elk.

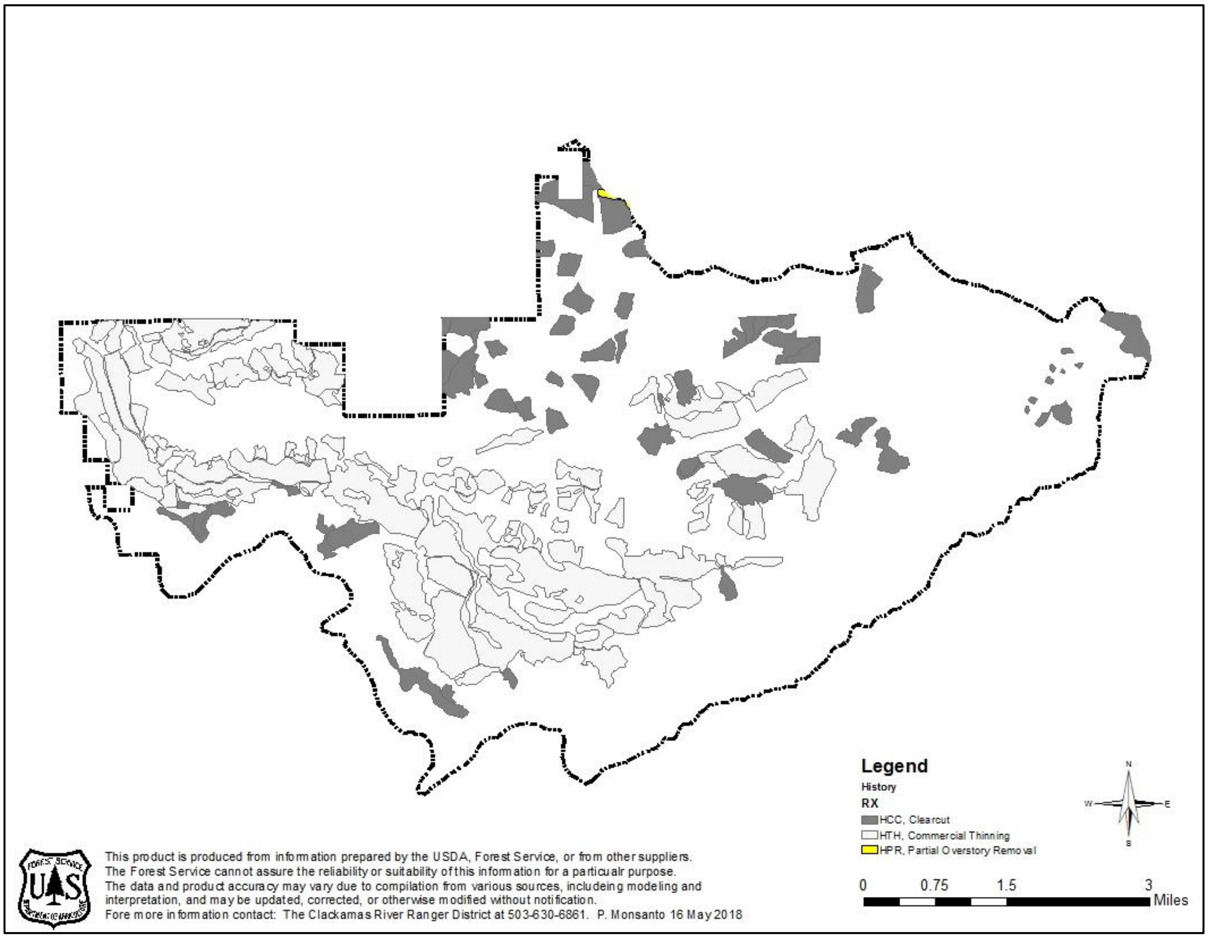

Figure 2 - Logging History in the North Clack Planning area, 1952-2015. Logging occurred before 1952, but it was difficult to distinguish from available data.

Insect & Disease

This section describes some of the major insects and diseases found within the North Clack Integrated Resource Planning Area. It is broken into three parts, based on how information was gathered. The first is from the North Clackamas River Watershed Analysis, the second is from Aerial Detection Surveys using Region 6 Protocol, and the third is from findings during walkthroughs or CSE.

North Clackamas River Watershed Analysis

The Watershed Analysis has a narrative on the existence of laminated root rot (Phellinus *weirii*) on roughly 10% of the National Forest (USDA Forest Service 1996). However in the intervening years the disease has not been shown to dramatically spread, but still should be noted that it can exist in the watershed. In the watershed the fungal root rot disease, which affects the highly susceptible Douglas-fir, is found in both aggregated patterns with distinct centers and in diffuse patterns with hard to detect centers. It can also frequently create openings of substantial size. Western hemlock is also affected by laminated root rot, but rarely killed. It has been documented on Ladee Flats since 1945 in plantation records. For the Clackamas River Ranger District this location (Figure 3) is considered an area of concern because of the frequency of centers and size of pockets (as much as 10 acres). Some of the recommendations to control laminated root rot include: cutting all host trees in infection centers along with a 50-foot buffer around each, and replant with non-host species such as western redcedar - by planting non-host species the inoculum has nowhere to go and the fungus will simply die in time; removing all infected roots and stumps and/or killing the pathogen with fumigants; cutting all trees in sapling stands with all with any symptoms as well as adjacent nonsymptomatic host species (USDA Forest Service 1986).

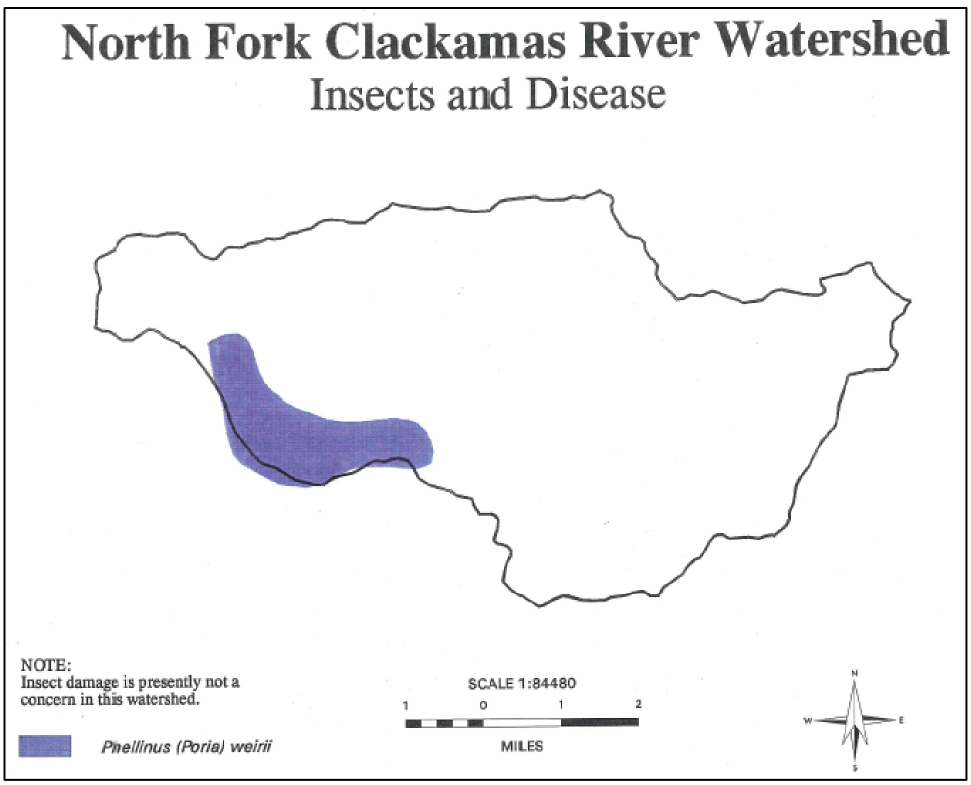

Figure 3 - Area of largest concern for laminated root rot in the Ladee Flats area. Image taken from USDA Forest Service 1996.

Each year all forested federal, state and private land in Oregon and Washington are aerially surveyed for insect and disease activity. These data (accessed at the Repository for Aerial

Insect and Disease Survey GIS Data for Oregon and Washington from 1947 to Present)[4] are collected to determine regional insect and disease trends and to serve as an indicator to land owners/managers on insect and disease activity in their area. For North Clack the primary pathogens were identified from 2013 to 2016 (Figure 4). North Clack thinning units were also overlaid to show if any showed signs of insect or disease activity. In summary the severity of the damaging agents could be considered low, ranging in 1 tree every two acres to 8 trees per acre (in those polygons that were also affected by fire from the 36 Pit Fire of 2014). A few of the pathogens identified in the surveys are highlighted below.

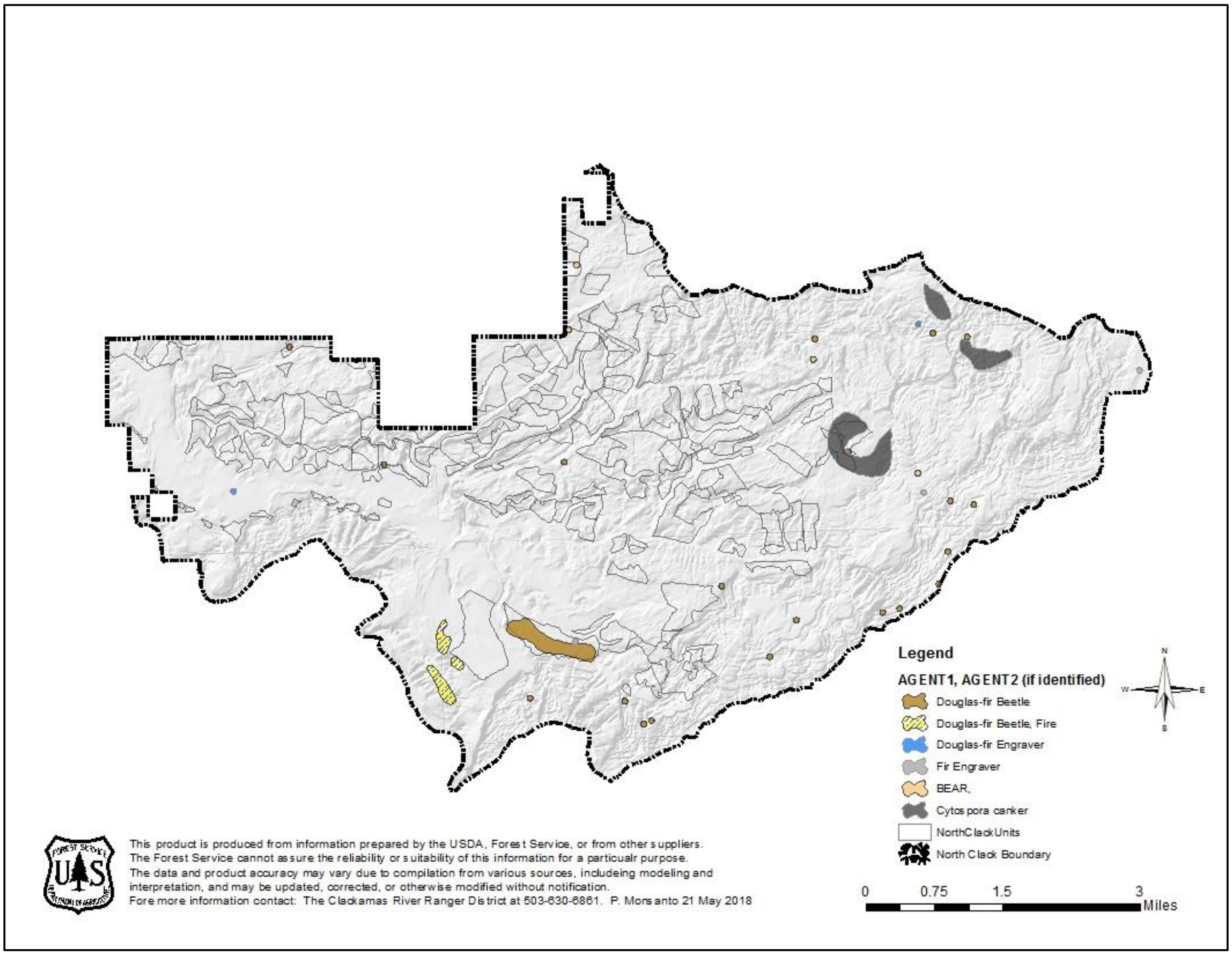

Figure 4 - Insects and Diseases Aerially Detected, 2012-2016

Douglas-fir beetle (Dendroctonus *pseudotsugae*) was discovered through the detection survey, but in 26 isolated pockets throughout the planning area. In the planning area they appear to be

[4] http://www.fs.usda.gov/detail/r6/forest-grasslandhealth/insects-diseases/?cid=stelprd3791643

at endemic levels at a rate of one dead tree per acre. But, the highest level of Douglas-fir beetle mortality occurred in those areas affected by fire, at a rate of 8 dead trees per acre. In unmanaged stands Douglas-fir beetle attacks are most successful on mature, large diameter trees in more densely stocked stands. At low or endemic levels (Schmitz 1996) the beetle normally breeds in felled, injured, windthrown, or diseased (especially root-diseased) trees (Goheen and Willhite 2006). At times the beetle's population increases to epidemic levels and kills apparently healthy trees over large areas; Long-term management of Douglas-fir include thinning young stands to maintain vigorous growth, reduce moisture stress, and remove trees injured by wind, disease, and other agents. Managed stands which are mature or overmature should be regenerated.

Another insect discovered by the survey is the fir engraver beetle (Scolytus *ventralis*). A wide-ranging native beetle, it attacks most species of firs in the Western United States. The surveys suggest that the insect's mortality impact is low at a rate of just 1 tree per acre affected, and were located to 3 isolated pockets. They seem to attack more or less by chance rather than by any characteristic of the host (Ferrel 1986). However if the beetles are able to successfully attack a tree without pitch out they emit attractants which lures many other beetles. The host trees successfully attacked are usually those already stressed from drought, competition, or disease(s). Silviculturally the best practices to minimize fir engraver damage are those which help to maintain healthy stand conditions. Also the removal of diseased, injured or decadent trees should be considered to reduce successful attacks, and dense stands should be thinned to reduce competition.

A cousin to the fir engraver is the Douglas-fir engraver beetle (Scolytus *unispinosus*). Mortality rate is low at a rate of 1 tree per acre, and was only found in one location during the detections surveys between 2012 and 2016. They tend to affect individual branches, small trees, and the tops of larges trees. They also attack logging slash, weakened or recently dead young trees, and larger trees stressed by drought or other agents (Goheen 2006) such as fire. Oftentimes they are associated with root disease or those trees colonized by Douglas-fir beetle. Promoting stand vigor by thinning and promptly removing windthrown trees or trees damaged by other stand disturbances are the best management approaches to this insect.

Cytospora canker is a disease of stressed trees. They overwinter in cankered bark and disperse during wet weather. The fungus causes branch and stem cankers, and opportunistically invade trees weakened by other factors such as drought, insects, or other diseases. Mortality is rare, but like other pathogens can slow and alter the growth rate of its host. To prevent their impacts trees should be managed by increasing their vigor and reducing injuries to their stem and bark.

Other Diseases of Interest

During Common Stand Examinations and walkthroughs at many plot centers (Figure 5) a disease widely spread towards the central part of the planning area was dwarf mistletoe in western hemlock (Arceuthobium *tsugense subsp. tsugense*). Secondarily it can attack Pacific silver fir, noble fir, western white pine, and occasionally western redcedar (Goheen 2006). The disease is an obligate parasite that depends entirely on its host for food. The disease is spread when its seeds are shot as much as 50 feet from fruits in the fall. The seeds germinate in the spring and infection usually occurs on thin barks. The host experiences growth loss, distortion, topkill, and predisposition to attack by bark beetles (Goheen 2006). The development of "witch's brooms" is not uncommon in trees infected with dwarf mistletoe. Infections on stems may cause bole swellings and cankers that can be colonized by stem decay fungi. They tend to damage much more in stands over 100 years than in younger stands (USFS Region 6 Forest Disease Management Notes: Hemlock Dwarf Mistletoe)[5]. Where timber emphasis is of concern the preferred management for the disease is to clearcut severely infested stands, remove infested overstory and plant non-host species, remove severely infected trees in lightly infested stands, and destroy infected live residuals left after clearcutting, fires, or blowdown.

Found in older stands another disease is the Schweinitzii Root and Butt Rot (Phaeolus *schweinitzii*). All conifers can be hosts, but is most commonly found on Douglas-fir. They rarely outwardly display symptoms, but a diagnostic is the fruiting body emerging from diseased roots which look like "cow pies." It is generally confined to the heartwood and is found in the roots and lower 10 feet of the stem (USDA Forest Service 2011)[6]. As the tree loses structural integrity from decay the tree is more susceptible to breakage and windthrow. Some methods to manage for the disease is to minimize wounding of trees to create an entrance for the disease, removing infected trees, and harvesting on shorter rotations.

Armillaria root disease, caused by the fungal agent Armillaria *ostoyae*, is common in Pacific Northwest conifer forests. While Armillaria is present at endemic levels, field reconnaissance revealed heavy infection rates in Unit 346. All conifers in Oregon and Washington are susceptible to infection (USFS Region 6 Root Diseases in Oregon and Washington Conifers) with Douglas-fir, true firs, hemlock, pine, and spruce being major hosts (Shaw 2009). In western Oregon, it is found mostly in Douglas-fir plantations less than 30 years old (Goheen and Willhite 2006). Above-ground symptoms of infection include heavy resin flow; however, the most conclusive identification of Armillaria infection is the presence of white, thick, fan-like mycelial sheets between the wood and bark that peel away like latex paint (Goheen and Willhite 2006). Tree mortality is the most common damage caused by Armillaria and trees tend to die standing

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[5] https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_025978.pdf

[6] https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5347109.pdf

(Hadfield 1986). Other damage includes root and butt decay, growth loss and uprooting (USFS Region 6 Forest Disease Management Notes: Armillaria Root Rot). While Armillaria is generally found on weakened trees in overstocked stands, it can be very severe locally and can create large openings (Goheen and Willhite 2006). Management options include favoring resistant species and thinning to decrease root-to-root contact and increase individual tree vigor (Shaw et al. 2009). In heavily infected areas, plant and/or favor species that appear to resist infection (USFS Region 6 Forest Disease Management Notes: Armillaria Root Rot)[7].

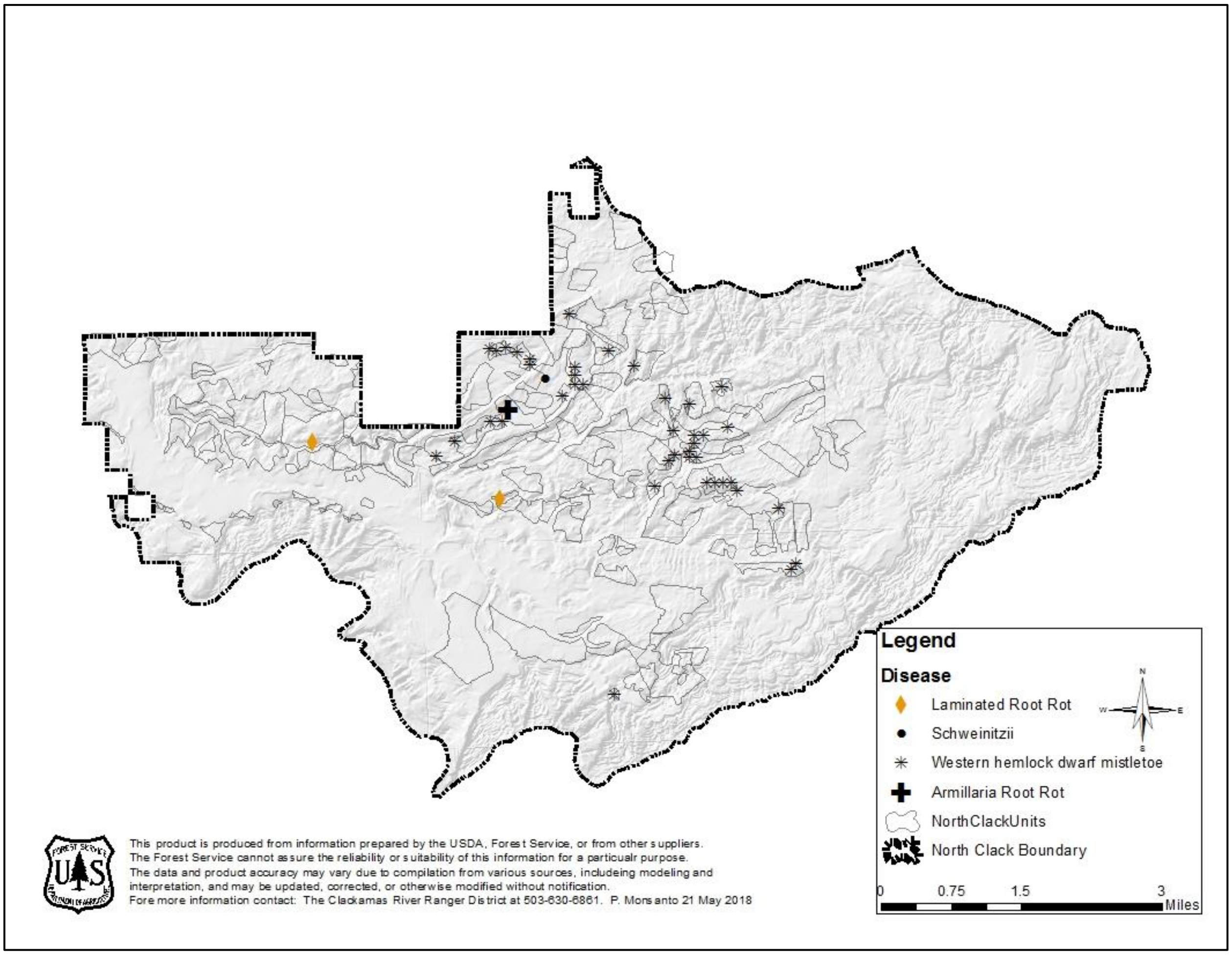

Figure 5 - Other Locations of Diseases Found Through Walkthroughs and Common Stand Examinations. Points on map where diseases were found are plot centers.

[7] https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_025981.pdf

Stand Conditions Found Through Local GIS, Local Knowledge, Walkthroughs, and CSE Data Collection

Forest Health, Growth and Diversity

Age class statistics suggest that the North Clack Planning Area is homogenous, with the majority of the stands planned for treatment in older plantations (Table 3). Regeneration harvests created these plantations in the past and were subsequently planted with conifers.

Table 3 - Age Statistics for Stands Proposed for Treatment

Age Condition	Mean Age	Youngest/ Oldest	Acres	Percent of Area
Young Plantation	25	5/30	1037	21%
Plantation	55.4	35/67	504	10%
Old Plantation	67.8	50/104	2098	42%
Fire Originated	102	76/123	1315	27%

Trees were placed in a uniform pattern throughout the stands. Approximately 1,037 acres are between approximately 20 and 30 years old. Some may have been managed precommercially, but many have not been managed since they were regeneration harvested. Many of these "young" plantations which have not been managed are becoming thickets of predominantly Douglas-fir and/or western hemlock tree species, with some western redcedar, western white pine and true firs that may have been planted or naturally seeded. Many of these stands are also covered with brush such as rhododendron that are heavily competing with the trees which were planted.

Approximately 2,602 acres of these plantations have reached a stage in their development where tree growth is slowing due to overcrowding. Many of these stands have some understory tree species component, but they are mainly shade-tolerant western hemlock. In general the older plantations have fewer understory tree species that are mainly shade-tolerant than the stands considered "plantations." In addition, the project area contains about 1,315 acres of forested land that seeded in following a fire approximately 100 years ago. Many of these fire-originated stands also have a heavy component of shade-tolerant understory tree species, namely western hemlock. Both the 2,602 acres of plantations and 1,315 acres of fire-originated stands are characterized by densely stocked trees that are now competing for resources such as soil nutrients, water, and sunlight.

A metric used to help indicate the degree of inter-tree competition within a stand is Curtis' Relative Density (RD) (Curtis 1982). It is based on a stand's basal area (BA) per unit area and quadratic mean diameter (QMD). Basal area is simply the cross-sectional area of a tree taken at 4.5' above ground level, and QMD is the diameter of a tree with average basal area. For a given constant QMD, RD would increase *with an increase* in BA. And for a given constant BA, RD would increase *with a decrease* in QMD. The implication is that higher values of RD would mean that there is a greater degree of competition in the stand. It is expected that with a RD above 50, ie. above the upper thinning limit, a stand could begin to experience mortality and/or reduced diameter growth (Table 4). Appendix B provides stand-level attributes derived from FVS for stands proposed for treatment, including estimated RD derived from common stand exam data.

Table 4 - Relationships between Standards and Curtis Relative Density (RD)

Standard	Curtis RD
Maximum	100
Normal	70
Upper Thinning Limit	50
Lower Thinning Limit	35
Crown Closure	20

Appendix B also displays those units which currently meet Culmination of Mean Annual Increment (CMAI) or which will meet it within five years of the writing of this report. This is a metric to estimate the age at which average rate of annual tree growth, measured in cubic feet, stops increasing and begins to decline. Economically this is the point at which a stand could be considered for starting over if wood production is the primary driver. However there are other reasons not to start a stand over at this point. For example if one were to start over all stands within a planning area at once, essentially all these stands would have the same age class, which could make it difficult to provide timber products regularly over time. Another example would be other management reasons, such as prolonging, enhancing, or improving spotted owl habitat within an historical owl circle.

Diversity within these densely stocked forested stands is also lacking. The lack of structural diversity is evident in plantations as well as fire-originated stands. These stands contain trees of mostly the same age class and with a single canopy later. Plantations, in particular, typically lack species diversity as they were primarily planted with Douglas-fir. In addition, because these stands are densely stocked with trees, little light reaches the forest floor. This has resulted in lower levels of diversity of ground vegetation.

Where these plantations and fire-originated stands occur in Late-Successional Reserves and Riparian Reserves, the forest is not meeting the desired condition. Late-Successional Reserves are to be managed to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl. Riparian Reserves are intended to protect the health of the aquatic system and its dependent species and are to be managed for late-successional forest consistent with the Aquatic Conservation Strategy Objectives. In these land allocations, there is a need to hasten the transition of these stands to a forest with mature characteristics, including a multi-layered canopy with large diameter trees, a well-developed understory, more than one age class, and sufficient quantities of snags and down woody debris. (NWFP p. B-5, p. C-31). Where these plantations and fire-originated stands occur in the Matrix land allocation, the forest is not meeting the desired condition. Within the Matrix, the desired condition is to have a mix of seral stages including early-seral habitats. There is a need to improve forest health within these stands by reducing competition, encouraging growth, and reducing fuels. There is also a need to increase diversity of forest conditions within the Matrix. Maintaining the health and diversity of forested stands in the Matrix is important, as many of the land allocations within the Matrix include timber production (C-1 Timber Emphasis Land Allocation).

Desired Future Conditions

Desired Conditions (DFC) describes what a forest in a planning area should be like given the implementation of management direction. In North Clack there are different existing stand conditions with their respective proposed actions to meet their DFC's. Those are described in Table 5.

Table 5 - Desired Future Conditions for Existing Stand Conditions

Stand Condition	Desired Future Condition
Forest Health/Diversity Low in Plantations & Fire-Originated Stands	Stands healthy with growth rates commensurate with the site's capability (FW-148-150, FW-154-155, Four-67). For the matrix component of the landscape is to have live productive forest stands that can provide wood products now and in the future (C-1 Four-290). For the components in Riparian Reserve & LSR is a multi-layer canopy with large diameter trees, well-developed understory, more than one age class, and sufficient quantities of snags and down woody debris (B-7 Four-254)
Deer & Elk Habitat	To have forest stands across the landscape with a mix of ages and densities sufficient to provide all of the habitat needs for deer and elk including adequate forage (C-1 Four-290)

Effects Analysis

No-Action Alternative, Direct and Indirect Effects

Under this alternative, no active management would occur on any plantations or fire-originated stands. Current stand conditions would be maintained with little change to forest structure, competition, density, and ecological processes. In other words, subject to natural/human disturbances, these stands would develop and continue on its current trajectory. Also no forest products from what could have been harvested timber would be available for local economies.

Over time, trees would continue to grow in height to capture available sunlight with little diameter growth. The stands would remain dense except for small canopy gaps caused by mortality of individual or small groups of trees. When openings do occur, the adjacent trees are at an increased risk of windthrow due to a high height to diameter ratio. Growth rates would decrease and mortality rates would increase due to high density levels.

Diversity within these densely stocked forested stands would continue to be lacking for longer periods under the no action alternative. Structural diversity would continue to be maintained as a single-canopy layer with only one age class. Species diversity especially in the plantations would also continue to be lacking as they were primarily planted with Douglas-fir, and with a closed canopy due to high densities other tree species, herb, shrub and forb cover would continue to not readily establish. These stands would continue to have low diversity in ground vegetation and overstory vegetation.

Alternative 1, Direct and Indirect Effects

Improve Forest Health, Growth and Diversity: Variable-density thinning with Skips and Gaps

A variable density thinning approach would be implemented to treat these stands. Variable density thinning can increase spatial heterogeneity in stand density and tree growth as well as heterogeneity in understory vegetation within stands (Harrington 2005). By inducing fine-scale variation in these otherwise homogeneous plantations using variable density thinning as a tool can promote biological and structural heterogeneity in the short term which can promote habitat while providing forest products. Skips are areas "skipped" over during thinning operations, and preferably where no logging equipment would be allowed. By retaining skips, all snags, downed logs and any ground vegetation within could be more protected. By offering more protection to snags and down woody within skips associated animals could benefit as these make up part of their habitat. However if snags are still of operational concern they may still be fallen to increase safety.

Conversely "gaps" are small openings created in stands to encourage and enhance understory vegetation development. Gaps can also be good locations to develop a new cohort and age class of trees. The percentage and size of gaps made or skips retained within units would depend on the land allocation in which they are located (Table 6). In addition, and again within a variable density thinning framework, some units will also employ at least one additional two-acre gap. The majority of the unit would still maintain one age class, but in one or multiple two-acre gaps new age classes would be created to diversify age classes and promote small-scale early-seral patches across the planning area. As much as 15 percent of the density by basal area of these two-acre patches would be retained for seed trees and snag recruitment. These two-acre gaps would also be monitored for natural conifer tree seedling regeneration and could, with additional site preparation such as brushing, be planted with other tree species such as western white pine and western redcedar for example, thereby increasing species diversity across the landscape. If gaps are created to reduce the spread of root rot and dwarf mistletoe then non-host species would likely be planted. As an example western redcedar would be planted where laminated root rot existed. These two-acre gaps would be located where impacts from future management would be minimized.

Outside of skips and gaps the remainder of the stand would be thinned from below. Thinning from below, or low thinning, is the removal of trees from the lower crown classes to favor those in the upper crown classes. Diseased trees such as those infected with dwarf mistletoe would also be targeted to reduce their impact and spread in the unit. In as much as 10% of the area outside of skips and gaps within the Matrix land allocation heavy thins would occur, where approximately 25 to 40 trees per acres would be retained. Doing so would increase structural diversity while providing foraging opportunities.

It should be noted that not all units which include a forest product output have a RD exceeding 50, although they are close. Appendix B suggests when those units with RD < 50 could meet that in the absence of treatment. However, entering these units now can still help to prolong their ability to grow vigorously, while infusing additional horizontal and vertical diversity not only through them, but across the landscape.

In total an approximate 80 acres, or 40 two-acre gaps, of early-seral habitat would be created and contribute to foraging habitat would be created, as much as approximately 0.3% of the total planning area. Within the additional gaps and heavy thins outside of the two-acre gaps as much as an additional approximately 461 acre (1.8%) of the planning area would offer foraging habitat. In summary this proposal could provide as much as 2.1% new foraging habitat in the planning area. This isn't to say the remaining portions of units outside of gaps would not have foraging opportunities, but these openings and heavy thins can persist on the landscape for a longer time as such given the lower canopy cover for sunlight to reach the ground.

Table 6 - Skips and Gaps for Northwest Forest Plan Land Allocations

Land Allocation	% Unit Area in Skips	Size Range of Skips	% Unit Area in Gaps	Size Range of Gaps
Riparian Reserve	Up to 5%	Minimum ¼ ac	0 to 10%	0
Late-Successional Reserve	Minimum 10%	Minimum ¼ ac	3 to 10%	0 to 1/4 ac
Matrix	Up to 5%	Minimum ¼ ac	Up to 5%*	0 to 2 ac

*In addition to these gaps in Matrix, at least one 2-acre gap would be created in some of the units to increase foraging opportunity and to alter their age class.

In order to demonstrate the differences in effects between the no action alternative and the proposed action alternative FVS was used to calculate silvicultural metrics for a plantation and fire-originated stand. Each stand's growth was set at time = 0 and projected for fifty years (Tables 7 and 8). In both instances QMD increased post treatment, and was greater than the no-action alternative in year 50. Whereas the simulation shows a 50% and 25% decrease in trees greater than 5" DBH at year 50 under the no action alternative in both, suggesting the unit may have succumbed to some level of competition mortality, the action alternative shows a small increase post treatment, suggesting the treatment provided additional growing space for other trees. RD also decreased post treatment, but in these examples RD remained under 50 longer in the fire-originated stand. This is not to say that treatments would cause RD to remain under 50 for longer in only fire-originated stands. Each stand may have enough distinct differences because of age and site conditions that when projected over time and with different nuances to prescriptions for each unit the rate at which RD changes would be different.

Table 7 - Calculated metrics* outside of skips and gaps for a plantation to compare alternatives

	Age	BA	TPA > 5"	QMD> 5"	RD	CC
Pre treatment Year 0	61	272	244	14.3	72	84
Post Treatment Year 0	61	180	88	19.3	41	56
Post Treatment Year 50	111	312	93	24.9	63	69
No Treatment Year 50	111	380	130	23.2	79	81

*BA = Basal Area in square feet. TPA = Trees per Acre. QMD = Quadratic Mean Diameter in inches. RD = Relative Density. CC = Canopy Cover in percent.

Table 8 - Calculated metrics to compare alternatives in a fire-originated stand outside of skips and gaps.

	Age	BA	TPA > 5"	QMD	RD	CC
Pre treatment Year 0	105	322	263	14.8	83	85
Post Treatment Year 0	105	200	66	23.6	41	54
Post Treatment Year 50	155	247	74	24.8	50	58
No Treatment Year 50	155	380	192	19.0	87	84

*BA = Basal Area in square feet. TPA = Trees per Acre. QMD = Quadratic Mean Diameter in inches. RD = Relative Density. CC = Canopy Cover in percent.

In general, thinning tends to improve the overall vigor, growth, health and architecture of trees. Thinning can directly affect productivity and forest health by maintaining growth rates of young stands. Thinning would redistribute growth potential to fewer trees, while maximizing the site's potential, leaving a stand with a desired structure and composition (Oliver 1996).

Thinning provides growing space, which gives the trees with the best competitive advantage the opportunity to take advantage of this growing space for the longest practical time, fully utilizing the ability of the trees to expand their crowns into the growing room provided by the removal of neighboring trees (Oliver 1996). Trees with larger crowns have greater stem taper, that is, the base of the tree is relatively large compared with trees that have small short crowns. Thinning increases a tree's resistance to the wind (windfirmness) by maintaining a larger crown and increasing stem taper. Trees with more taper are less likely to suffer stem breakage or wind damage. In general, thinning increases both stem and root strength. Thinning can also improve the resistance of some trees to some pathogens by manipulating the structure and species composition of a stand.

In support of increasing foraging opportunities and because of their adjacency to areas proposed for regeneration harvest, a few units (151, 164, 171) would also be burned with a light intensity fire to reduce brush and increase palatable forb, herb and brush species. A small two-acre meadow towards the eastern end of the planning area is also proposed for a prescribed burn for the same reason. Although not rigorously studied, portions of the 2014 36 Pit fire where the fire affected previously commercially treated units expressed an increase in deer and elk sign and forage use. Also the fire behavior was reduced in units above by the 36 Pit Fire in the area of Ladee Flat, minimizing tree mortality even four years afterwards, and essentially slowing and stopping the fire on that portion of its perimeter. Care with timing and lighting of the prescribed fire would be required to reduce mortality of remaining trees in units 151, 164, and 171. On the same token a light intensity fire in these units could help to recruit snags in the landscape.

A light intensity burn may also be employed in conjunction with reducing the overstory in units 136 and 138 as part of the proposal of enhancing huckleberry near the Huxley Lake Trailhead. Additional brushing could also be done to help give competitive advantage to them. Along with Alaska (Matthews 1992) and red huckleberry (Tirmenstein 1990), desirable big huckleberry (Simonin 2000) was discovered in small, isolated pockets within these units. Reducing the overstory was found to be positively associated with big huckleberry (Dahlgreen 1984), and taking measures to minimize mechanical damage and plant/rhizome damage, such as using designated skid trails, would be utilized. Again a light intensity burn can help these species to resprout by stimulating their rhizomes while minimizing damage to them. Also care should be taken to minimize damage and mortality to Pacific silver fir that are found in these units, which is known to be a fire intolerant species. Having said that a few trees which may succumb to a light-intensity burn could help to recruit snags in an otherwise snag-deficient area. Berry production could be enhanced up to 15 years, but depending on conditions it could take at least three years postfire treatment (Minore 1979). Some of the effects of this proposal would include increased foraging opportunity, and increased recreation opportunities near a trailhead once berries come into production.

Improve Forest Health, Growth and Diversity: Precommercial Thinning and Brush Release

A precommercial thinning and brush release would be implemented in the young plantations, reducing tree densities and competition (Table 9). By increasing growing space, young trees would have more availability to resources, such as light, water, and nutrients. A lop-and-scatter slash treatment would be used, spreading activity created slash across the forest floor and allowing for decomposition and nutrient cycling. In units adjacent to the National Forest boundary, activity created slash within 66 feet of the boundary would be hand piled and burned.

Table 9 - Calculated metrics * *for young plantations to compare alternatives*

	Age	TPA	QMD	RD
Pre treatment Year 0	25	3305	2.5	51
Post Treatment Year 0	25	242	6.1	20
Post Treatment Year 50	75	219	14.7	67
No Treatment Year 50	75	530	11.6	109

* TPA = Trees per Acre. QMD = Quadratic Mean Diameter in inches. RD = Relative Density.

Units 304 through 318 were planted with conifer species in 2016 and 2017 following the 36 Pit fire. A seedling release will be implemented to reduce seedling competition from brush and other vegetation. By reducing competition, the probability of seedling survival will improve due to the increased availability to light, water, and other resources. Increased survival rates will aide in the reestablishment of conifer species in fire-burned areas.

Unit 346 is a young plantation that was artificially regenerated following harvest, primarily with Douglas-fir and a lesser amount of western white pine. Field reconnaissance revealed heavy Armillaria infection rates in Unit 346. Because Douglas-fir is a primary host of Armillaria, the stand is currently experiencing a high level of mortality. A sanitation treatment would be implemented to remove the dying and dead Douglas-fir. Western white pine would be pruned for white pine blister rust prevention on those individuals where it can be effective given the current level of tree infection. A site preparation treatment would be done prior to inter-planting of species that are less susceptible to Armillaria infection. Site preparation treatments may be done with hand tools or with ground-based machinery such as a masticator. Seedlings would be planted using hand tools.

Create Early-Seral Habitat

A regeneration harvest (seedtree with reserve silvicultural system) would be used in those units proposed for promoting early-seral habitat. In two of these units the regeneration harvest method would also be used to reduce the spread of western hemlock dwarf mistletoe. Fifteen percent of the area by percent cover would be retained as seed sources for natural regeneration to provide additional structural diversity to the unit, and also to provide opportunities for future snag recruitment. The trees retained would generally be clumped in small patches ranging from 0.5 to 2.5 acres in 70% of the unit and left as individuals or patches <0.5 acres in 30% of the unit.

As part of site preparation for regeneration, grapple piling and burning of slash, and/or a light-intensity underburn is proposed to create seed bed and reduce short-term competition to give an advantage to planted seedlings or natural regeneration. Some brushwork by hand or mechanically may also be involved to reduce competition to seedlings. The units would then be planted with as much as 300 trees per acre and monitored so that minimum stocking level (125 trees per acre) would be achieved within five years after the harvest. If monitoring suggests the minimum stocking level may not be achieved, then additional fill-in planting may need to be done. The species primarily planted would be Douglas-fir, with western redcedar, western white pine, and noble fir considered to increase species diversity. Other species could be considered, but on a case-by-case basis. For example western hemlock would likely be not considered where western hemlock dwarf mistletoe occurred in past. Also with a dispersal distance as far as 300 feet it is unlikely western hemlock would have problems naturally seeding.

An indirect effect of the site preparation using a low intensity fire is how some forage species could positively respond. Vine maple (Uchytil 1989), huckleberries, ocean spray (Fryer 2010), Oregon oxalis (Halpern 1989), grasses, trailing blackberry (Tirmenstein 1989), beargrass (Crane 1990), salal (Termenstein 1990) and fireweed (Pavek 1992) are examples of good deer and elk forage species which could vigorously resprout or colonize sites after site preparation burns. Huckleberries were found to have higher production 8 to 15 years after a clearcut harvest than in older stands with higher canopy cover (Martin 1980). On the same token noxious weeds and invasive species would have an easier time establishing onto these sites with less vegetation with which to compete.

The units proposed for regeneration harvest would provide for approximately 20 years new early-seral habitat, about as much as 1% of the total planning area. When combined with what was created through the variable density thinning framework as much as approximately 3.1% of the planning area would have new early-seral habitat or forage enhancements.

Improve Owl Habitat

In this proposal some units would employ light thinnings, with products either removed or left in place to promote spotted owl habitat. An example of a unit with light thinning and removal of product is Unit 200. As modeled in FVS a light removal of the overstory concurrently with an understory thinning of western hemlock would move the unit into old forest multi-strata structure 10 years faster than under the no-action alternative. For a couple units (208 and 210) the largest trees or clumps or trees would be identified and cleared 25 to 50 feet around them. Trees would either be girdled to artificially create snags, or felled and left in place to provide additional down woody debris. With the limited manipulation proposed it is likely that a new cohort of trees, of which are most likely shade-tolerant western hemlock, would begin to develop in these openings. The largest tree or clump of trees would continue to be the foundation for suitable owl habitat as the stand moves forward into an old forest multi-strata structure.

Forest Products

One of the direct effects of improving forest health, growth and diversity and creating early-seral habitat is the forest product output. With the use of FVS, an estimate of timber volume of trees > 5” diameter was made for removals in thinnings, gaps, heavy thins, and the regeneration harvest units. Approximately 45.2 million board feet (mmbf) of viable commercial timber products would be available after treatment. Overall average volume per acre could be in the range of 13.7 to 18.3 mbf (thousand board feet), with a minimum 4.2 mbf per acre to a maximum of 67.2 mbf per acre.

Noxious Weeds and Invasive Species

One indirect effect of all components of this proposal is that openings or a reduction in canopy cover could provide new seed beds for noxious weeds and invasive species. One species existing in North Clack which could take advantage of these openings is scotch broom (Figure 6). As these sites are exposed to more sunlight, unwanted vegetative species could more easily enter these portions of units and take advantage of available resources. Monitoring and rapid response would help this from occurring.

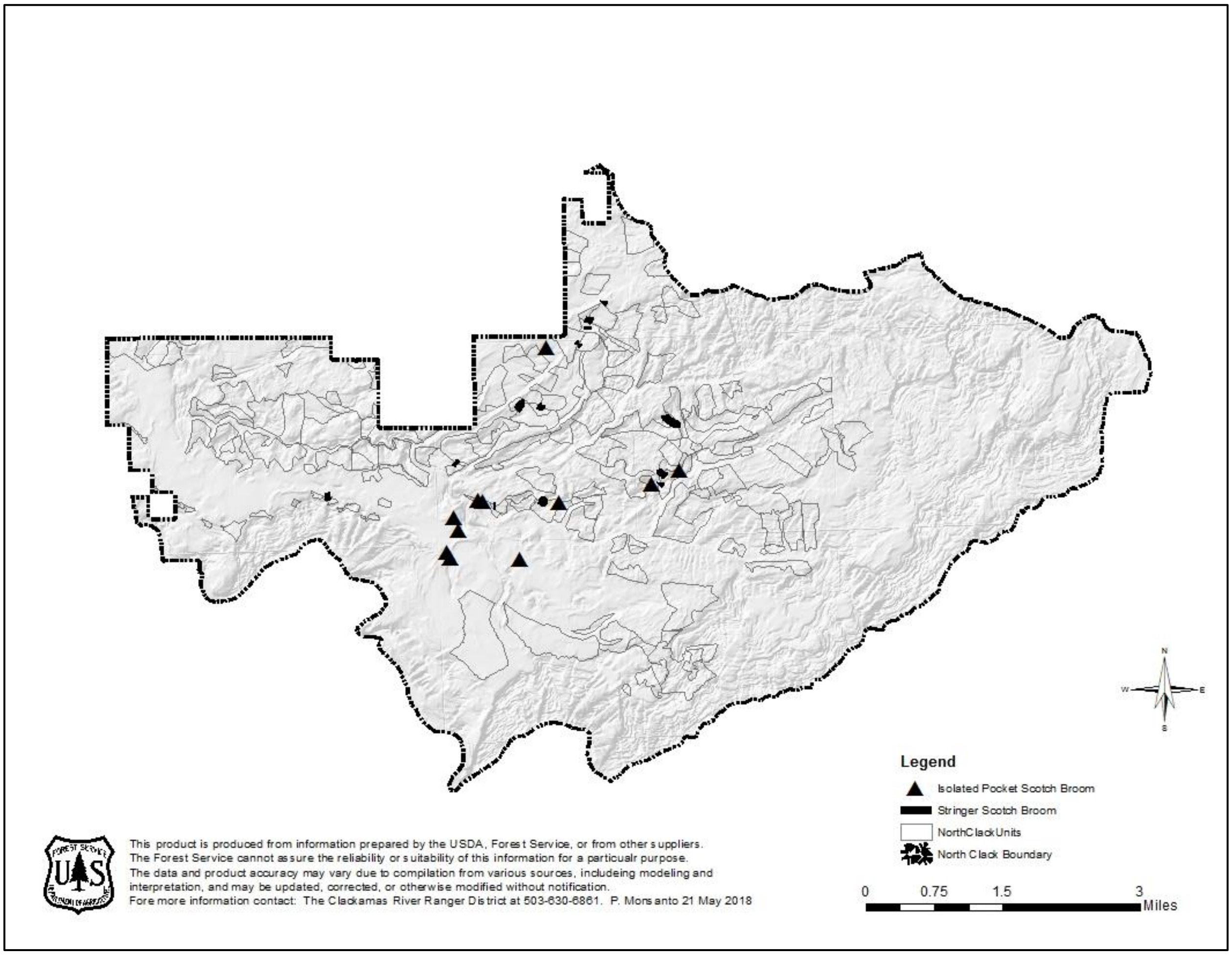

Figure 6 – Some Scotch Broom Locations

Alternative 2, Direct and Indirect Effects

In response to scoping comments a few units were reconsidered for regeneration harvest to address the Purpose and Need for providing forest products. The stands in this proposed alternative for regeneration harvest include 76, 107, 133, 195, and 201. The remaining units would maintain their respective proposal originally described in Appendix B. They were not initially considered for a regeneration harvest for an assortment of reasons such as location, forage species. Because these units have met at least 95% of CMAI they were added to this alternative. Units 76 and 133 have retained their boundary, whereas units 107, 195, and 201 were delineated from the units in the first proposal (106, 190, 202). In this alternative 373 acres of regeneration harvest would be proposed. These units would also be considered for grapple piling and burning of slash, and/or a light-intensity underburn to create seed bed and reduce short-term competition to give an advantage to planted seedlings or natural regeneration. The direct and indirect effects in Alternative 2 would be the same as in

Alternative 1 with the exception of an increase in early-seral habitat and volume of timber (Table 10).

Table 10 - Comparison of three metrics under each alternative.

Metric	Alternative 1	Alternative 2
Early-Seral Habitat, %	1%	1.5%
Volume Timber, MMBF	45.2	49.8
Volume per Acre, MBF	13.7	15.1

Cumulative Effects

The effects of thinning or regeneration harvest on stand growth and productivity are generally experienced or expressed within the stands; therefore the analysis area for cumulative effects would be the unit boundaries. The time scale for cumulative effects analysis is quite long: some impacts from 30 to 60 years ago when stands were clearcut or burned remain today, and alterations made during harvest have the potential to benefit health and growth many years into the future. The existing condition and the changes projected above include past actions as they have affected growth including previous logging, site preparation, planting (including the selection of genetically appropriate seed), precommercial thinning and recreational activities such as shooting and user created OHV routes. The one foreseeable future projects occurring inside the units that can overlap in time and space and therefore have cumulative effects is managing noxious weeds/invasives to prevent their spread. As an example scotch broom is growing along roads and adjacent or slightly within some of the units. In the case of scotch broom, as well as other noxious weeds and invasives, openings and reductions in canopy cover would increase sunlight which could be taken advantage of by it. Management of these could be by pulling, cutting and burning, or herbicide use. The management of noxious weeds/invasives can add or compound to the proposed action by (1) reducing competition thereby giving competitive advantage to forage species, and (2) reduce competition to and potentially eliminate the need for release of seedlings proposed to be planted in reforestation operations.

Management of Competing and Unwanted Vegetation

This analysis is guided by the 1988 Record of Decision and Mediated Agreement for the "Managing Competing and Unwanted Vegetation" Final Environmental Impact Statement (referred to as VEG EIS). The purpose of this analysis is to provide information to decision makers and interested publics about proposed treatments and how they might affect unwanted vegetation. Appropriate design criteria would be identified and incorporated into any vegetation management project work to minimize potential adverse impacts to the environment, project workers, and public. Herbicide use to treat invasive plants is no longer applicable but the direction in the 1988 documents is still applicable to unwanted native vegetation, brush control and fuel treatments. Fuels treatments in thinning projects are exempt.

Site Analysis for Site Preparation

Site-specific vegetation management objectives have been developed. The following list of objectives will be used to identify the "damage thresholds" for vegetation management, vegetation management strategies and the feasible treatment methods.

Site-Specific Objectives:

1. Meet the recommended stocking levels within five years after harvesting.
2. Meet standards for minimizing soil erosion and soil degradation.
3. Maintain adequate levels of downed woody debris and snags.

Nature and Role of Associated Vegetation

Currently, these are the following stand conditions where site preparation, reforestation, or seeding are proposed:

1. Approximately 255 acres are proposed for a regeneration harvest to create early-seral habitat and to reduce spread of western hemlock dwarf mistletoe in Matrix Land Allocation (C-1 LRMP). Post-harvest site preparation for reforestation could include grapple piling and burning of slash, and/or a light-intensity underburn to create seed bed and reduce short-term competition to give an advantage to planted seedlings or natural regeneration. Some brushwork by hand or mechanically may also be involved to reduce competition to seedlings. Tree species to plant could include Douglas-fir, western redcedar, western white pine, and noble fir.
2. Approximately 985 acres in stands approximately less than 30 years of age are proposed for an assortment of noncommercial treatments, which could include brushing of rhododendron and vine maple to release overtopped seedlings. Slash would be lopped-and-scattered to spread activity fuels across forest floor for quicker decomposition and nutrient cycling.
3. A young, approximately 52-acre plantation is proposed for a sanitation treatment, using machinery such as a masticator and/or handtools to remove trees infected with Armillaria root rot. In the same unit western white pine infected with white pine blister rust may also be pruned or removed. Additional site preparation such as brushing of

rhododendron would also be implemented prior to interplanting of conifers less susceptible to Armillaria root rot.

4. Approximately 150 acres of slash and piled and burned to create a fuel break along the 4610 road and also along portions of the district boundary.
5. In support of increasing foraging opportunities and because of their adjacency to areas proposed for regeneration harvest, a few units (151, 164, 171), in all 136 acres, would also be burned with a light-intensity fire to reduce brush and increase palatable forb, herb and brush species. A small two-acre meadow towards the eastern end of the planning area is also proposed for a prescribed burn for the same reason.

Damage Thresholds

Post-treatment/pre-planting "damage thresholds" have been identified for this site based upon operational experience and the site-specific management objectives. If slash or live vegetation exceeds the following levels prior to planting, treatment would be needed.

Damage thresholds:

- Greater than 20% cover of live vegetation.
- Less than 350 well-distributed planting spots per acre.
- Greater than 15 tons/acre of slash in the 0-3" size class (could exceed 15 tons per acre if the arrangement of the fuels do not present a fire hazard).

Harvest units are expected to need treatment of both live vegetation and slash so that management objectives can be attained. Past experience in this area shows that if trees are established immediately after site preparation, no release treatments from competing brush are required to meet the stand growth objectives. This past experience includes professional expertise of local silviculturists and monitoring data from plantation survival exams and precommercial thinning exams from adjacent plantations.

Strategies

Five strategies for controlling unwanted vegetation are identified in the FEIS and Exhibit A of the Mediated Agreement. These are prevention, early treatment, maintenance, correction and no action. The following analysis will focus on the prevention, correction and no action strategies (refer to Section II-72 through 11-74 in the Vegetation Management FEIS). The prevention strategy is a required element and the preferred strategy in the VEG EIS to consider and analyze.

No Action Strategy

"No Action" means that after harvest, planting would occur with no site preparation activity and slash and brush would be left unaltered on the site. It would be the appropriate strategy anytime there is evidence that the damage thresholds would not be exceeded. Within the North Clack harvest units, there is evidence that the no-action strategy would not meet management objectives and standards and guidelines because the damage thresholds would be exceeded.

Prevention Strategy

The prevention strategy would not involve direct treatment but would detect and ameliorate the conditions that cause or favor the presence of competing or unwanted vegetation before damage thresholds are reached. The removal of conifer encroachment would prevent openings from converting into forested stands.

Correction Strategies

Early corrective strategies through vegetation management actions would likely be necessary to reduce the amount of post-harvest live vegetation and slash to a point below the damage threshold. A post-harvest review would be conducted to make a final determination because there may be small areas where the no-action strategy is appropriate. Grapple piling and burning or other mechanized equipment similar to a slashbuster that is capable of masticating slash and brush may occur where the correction strategy is selected.

Mechanical Treatment and Burning - This method could use a track-mounted vehicle with a grapple-type device to pile a large portion of the slash. This method could also use a track-mounted vehicle with a masticating device to crush and/or chip slash and cut brush. Mechanized equipment using a masticating type device is a very effective corrective method on sites with more than 30% cover of larger vegetative plants such as dense western hemlock seedlings/saplings and rhododendron. Both of these treatments would remove the larger vegetation, but are not very effective on the smaller individual plants or species such as beargrass. In the case of mastication, the material would be left on site and as best as possible distributed evenly across the stand. Some raking and/or scalping would be required in order to plant tree species. The masticated material would act as mulch which could prevent rapid spread of rhododendron and give a competitive advantage to planted seedlings.

Both grapple piling and burning are very effective at reducing fire hazards on slopes less than 40%. More than 500 well-distributed planting spots per acre would be made available. Piles would be burned prior to planting. Piles can be burned in the fall when smoke dispersal conditions are favorable and pile burning has a relatively low level of safety concern for workers doing the burning and there is low risk of escaped fire situations. This method would cost approximately $300 per acre.

Design Criteria

In addition to the design criteria for the North Clack project, the following general guidelines from the Vegetation Management FEIS (Chapter II) should be followed:

- Develop a silvicultural prescription, approved by a certified silviculturist with a site-specific diagnosis and treatment needs.
- Develop a site-specific prescribed burning plan approved by a line officer.
- A job hazard analysis would be developed and discussed by workers to reduce exposure to hazards such as use of power tools, fire and walking in difficult terrain.

Human Health Effects

The human health effects of mechanical treatments would be very low and would be limited to the operator who is inside a protected machine. Risks would increase as slopes increase. The risk to the general public would be very low.

Prescribed burning has the potential for both short and long-term effects to both workers and members of the public. There is the possibility of an escaped fire situation. Burning is only conducted during specific parameters of fuel moisture, humidity and wind speeds when the risk of catastrophic fire is low.

Alternatives

Alternative A

The No-Action Strategy for vegetation management would apply. Rhododendron brush would continue to thrive.

Alternative B

A combination of prevention and correction strategies would be most effective. The preventative strategy would help maintain openings as foraging habitat. The corrective strategy would reduce both the amount of live vegetation presently on site and the expected level of fuel loading and/or fire hazard following harvesting. Successful completion of this treatment would prevent the need for the use of herbicide to control unwanted vegetation at a later date.

Project Monitoring

Post treatment monitoring would be conducted to determine the effectiveness of site preparation and survival rates for planted trees.

Forest Plan Compliance

Those standards which relate and are pertinent to Alternative 1 and Alternative 2 are discussed below (Tables 11-12).

Table 11 - NWFP and Forestwide Standards and Guidelines pertinent to the Regeneration Harvest Proposed Actions, and Forest Openings.

Standard & Guideline	Text	Comment
NWFP S&G C-41	Specific measures for green tree and snag retention follow. These measures are intended to be applied throughout the matrix forests. Their intent should be met in Adaptive Management Areas, but standards and guidelines are not prescribed for those areas.… B. For all other lands, retain at least 15 percent of the area.	Patches of trees ranging from 0.5 acres to 2.5 acres would be retained across 70% of the unit, and individual trees and patches <.5 acres would be retained in the remaining 30% of the unit. Total percentage of trees retained in this configuration would be 15% of the unit area.
FW-306 and FW-307 (page Four-86)	Timber stands should not be regeneration harvested until they have reached or surpassed 95 percent of culmination of mean annual increment measured in cubic feet. Exceptions may be made where resource management objectives or special resource considerations require earlier harvest.…"	Units 116 and 182 are proposed to reduce spread of western hemlock dwarf mistletoe in a timber emphasis area. Unit 82 has a high ratio of western hemlock to Douglas-fir. Given the unit is in a timber emphasis area, it is proposed in order to reverse this ratio. Unit 152 is in a location to help enhance deer and elk habitat. Data suggests that unit does not meet 95% culmination in year 2018, but

Standard & Guideline	Text	Comment
		would by 2023 if not beforehand.
FW-308 (page Four-86)	Regulated timber harvest activities shall occur only on those lands classified as suitable for timber production.	Units proposed for regeneration harvest are in C-1 Timber Emphasis land allocation under the LRMP.
FW-331-332 (page Four-88)	Uneven-age management may be applied when there is reasonable assurance of natural regeneration that will contribute to the desired objective stand structure within 5 years of harvest entry. Planting or interplanting may be considered to maintain genetic quality, desired species composition, or to assure timely regeneration.	Part of the intent is to provide additional short-term foraging opportunity for deer and elk by creating additional two-acre openings in some stands across North Clack. These two-acre openings will also be monitored for natural regeneration, and in many cases may be planted with other species such as western redcedar and western white pine, for diversity and to alter the age class of the stand.
FW-333-334 (page Four-88)	Uneven-age management should not be applied on slopes where cable logging systems would be necessary…. Exceptions may be made if an analysis indicates that available logging methods can provide a reasonable assurance of continuous access without producing unacceptable damage to the remaining trees….	Location of two-acre openings on those units with a proposed logging system of cable logging would be towards the bottom and outside of riparian reserve. By keeping openings towards the bottom of cable logging units would essentially keep it out of any future logging operations. In consultation with wildlife biologist good locations to create openings to benefit browse species important for deer and elk

Standard & Guideline	Text	Comment
		are on southerly aspects, some of which are on units which would need cable yarding in skyline operations.
FW 341 (page Four-88)	Uneven-aged management may be most readily applied where stands are free from root rots. However, silvicultural prescriptions may specify appropriate mitigation measures in Management Areas where uneven-age management is being considered to fulfill resource objectives other than timber production. Uneven-age management should not be considered in stands where root rot losses would be inconsistent with management objectives.	Part of the intent is to provide additional short-term foraging opportunity for deer and elk by creating additional two-acre openings in some stands across North Clack. The action would be consistent with this Standard and Guideline where root rot pockets in excess of 2 acres exist in units where this may exist the removal of infected trees would occur and reforestation using non-host species such as western redcedar would be applied to (1) increase stand diversity, (2) reduce spread of the disease, and (3) alter the age of the stand.
FW-346-347 (page Four-88)	Uneven-age management implies that each harvest entry should be followed within 5 years by establishment of a new age class in the space vacated by the harvested trees. Natural regeneration, or planting and interplanting may be employed.	See answer to FW-331-332. Two acre gaps would retain 15% of area after harvest to promote diversity and offer seed source for natural regeneration. Other species such as western redcedar or western white pine could also be planted to promote additional diversity in the unit.

Standard & Guideline	Text	Comment
FW-382 (page Four-92)	Silvicultural methods and cultural treatments should be applied to reduce hazards from…diseases….	Units 116 and 182 are proposed for regeneration harvest because of their high degree of western hemlock dwarf mistletoe. Because of this the silvicultural prescription to reduce its spread is to regeneration harvest and replace with non-host species

Table 12 - Forestwide Standards and Guidelines pertinent to Reforestation, Timber Stand Improvement, and Vegetation Management.

Standard & Guideline	Text	Comnment
FW-358 (page Four-90)	Timber harvesting shall be completed in a fashion that reasonably assures each harvest area can be adequately restocked within 5 years after final harvest.	In those units proposed for regeneration harvest with reserves, 15% of the unit area would be retained to promote diversity and seed source. Artificial reforestation with an approximate density of 200-300 trees per acre would occur within five years. Additional fill-in planting would occur where needed.
FW-361 (page Four-90)	Conifer seedling stocking levels shall exceed a minimum of 125 trees per acre…	See answer to FW-358.
FW-372 (page Four-91)	Commercial thinning should maintain the desired stocking level to achieve a vigorously growing stand throughout the rotation, while	By reducing Curtis Relative Density, and use of variable density thinning and openings as large as two acres, an assortment of

Standard & Guideline	Text	Comnment
	considering wildlife cover needs.	wildlife needs would be provided, especially foraging but also cover needs.
FW-380 (page Four-91) and FW-381 (pages Four-91-92)	Competing vegetation should be controlled where there is a possibility that timber harvest areas cannot be reforested within the required 5-year period without vegetation control. In timber harvest areas, measures should be taken to: … (b) Prevent stocking from falling below desired levels; (c) Insure reforestation to desired levels within the prescribed 5 year period.	On those units considered for regeneration harvest and two-acre openings, commercial thinning units, and units planned for precommercial thinning, brush growth would be assessed to determine if they would outcompete natural and artificial reforestation of crop trees, and also in part to increase foraging species. Brush may be masticated, mowed, or lopped and scattered.

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Appendix A. Top Four Plant Associations in North Clack Units

(1) western hemlock/swordfern-salal-Oregon grape, mesic. This is a shrubby plant association, dominated by swordfern, dwarf Oregon grape, and salal. Vine maple is also common. The canopy is often open, and usually consists of a mix of Douglas-fir and western hemlock, with red cedar. However mature trees can have canopy closure over 70%. A dense shrub cover layer can develop where the canopy is open. It is generally found in the lower half of the zone on middle and upper slope positions with south to west aspects. Soils appear to be relatively deep and fine-textured. Sites are moderately productive. Where the association occurs on south-facing slopes

(2) Pacific silver fir/Alaska huckleberry, dry. This plant association is found in warm, high precipitation areas at an elevation averaging 2,759 feet (range 2,450-3,00) with gently to steep slopes averaging 29% (range 8-60%). It is found mainly on westerly, upper to mid slope positions. Rainfall can be as high as 112 inches annually. The association is dominated by western hemlock and Douglas-fir in the overstory with western red cedar and pacific silver fir. In the understory pacific silver, western hemlock and western red cedar typically exists. In mature trees canopy closure averages 58%, and the understory canopy cover averages 12%. It is one of the most shrubby and least herbaceous of the pacific silver fir plant associations. Low-shrub cover averages 30% and is generally composed of salal, huckleberry and dwarf Oregon grape. High shrub cover averages 55%, herb cover averages 14% with bunchberry dogwood and bear grass expected to be found, and moss cover averaging 37%. Soils are moderately deep, usually fine-textured, loamy sands to clay loams often becoming more clayey at depth. They are also well drained and dry. Parent material is colluvium or volcanic mudflow. The sites are moderately productive, but moisture stress can be a problem on dry slopes.

(3) western hemlock/swordfern moist. This plant association is commonly found throughout the foothills and Old Cascades. They are found on flat ground to slopes on average 49% on lower to upper-slope positions. Soils are well drained, relatively deep and fertile with high coarse fragment content. Stands are dominated by Douglas-fir, with a large component of western hemlock and some redcedar and/or big-leaf maple. In mature stands average canopy cover is 80%. In these stands shrub layer is sparse, tall shrubs average 6% cover, and low shrubs averaging 6%. The herb layer is dominated by sword fern, with herb cover averaging 33%. Moss cover averages 33%.

(4) western hemlock/rhododendron. This plant association is commonly found in the Old Cascades, the ancient, deeply eroded foothills that form the foundation of the high peaks. They are found on flat to steep slopes within lower to upper-slope positions. The overstory is typically dominated by Douglas-fir, with a large component of western hemlock and some western red cedar. The canopy closure of mature trees can range from 73 to 78%. Additional information about the plant association based on secondary shrub layer dominance besides rhododendron or herbaceous layer is found in Table 6.

Appendix B. Stand Attributes Table for Units

Not all stands have data described in Data Dictionary because they were either (1) not collected or (2) for reasons described in Data Dictionary.

Data Dictionary for Table

Unit = Unit Number
Acres = Area of unit analyzed measured in Acres
Origin = to best of knowledge description of stand's origin
CSE Age = calculated age of unit from Common Stand Exam Data
RD 2018 = calculated Relative Density of unit at year 2018
RD50 YR = if it hasn’t already, the calculated year in which relative density of unit is estimated to reach 50
95% CMAI 2018 = "Y" for "yes" or "N" for "no" if unit has meet or exceeded 95% of CMAI at year 2018
95% CMAI 2023 = "Y" for "yes" or "N" for "no" if unit has meet or exceeded 95% of CMAI at year 2023
YR CMAI = year in which unit meets CMAI
TPA = calculated Trees per Acre for unit
TPA >5” = Calculated Trees per Acre for all >=5" DBH
TPA <5” = Calculated Trees per Acre for all < 5" DBH
QMD >5” = Quadratic Mean Diameter, or the diameter of a tree of average per-tree basal area
BA >5” = Calculated Basal Area (square feet/acre) trees >=5" DBH (diameter in inches at 4.5' above ground level) from Common Stand Exam Data
HT >5” = Mean Height of Trees in unit in Feet for all >=5" DBH
CC = Canopy Cover in percent
H:D Ratio = Height of tree (in inches) divided by DBH of tree (in inches). Value of 80 or greater may indicate stand is susceptible to windthrow
Snag >10” = Calculated snags per acre >= 10" DBH
Snag >20” = Calculated snags per acre >= 20" DBH
$\bar{x}$ Elev = calculated mean elevation of unit using zonal statistics from DEM10 model
Proposal = general proposal for unit

Unit	Acres	Origin	CSE Age	RD 2018	RD50 YR	95% CMAI 2018	95% CMAI 2023	YR CMAI	TPA	TPA >5"	TPA <5"	QMD >5"	BA >5"	HT >5"	CC	H:D Ratio	Proposal
2	55.2	Old Plantation	75	47	2022	N	N	2087	107	100	7	19.7	210	118	51	72	VDT to promote spatial and species diversity
4	30.2	Old Plantation	59	49	2022	Y	Y	2017	197	140	57	15.8	195	125	68	95	VDT to promote spatial and species diversity
6	22.7	Old Plantation	60	54		Y	Y	2017	141	141	0	17.0	221	111	67	78	VDT to promote spatial and species diversity
14	32.8	Old Plantation	63	58		Y	Y	2042	139	139	0	17.9	244	125	77	84	VDT to promote spatial and species diversity
16	36.3	Old Plantation	62	72		N	Y	2047	262	244	18	14.3	272	96	87	81	VDT to promote spatial and species diversity
18	35.1	Old Plantation	60	57		Y	Y	2017	172	140	32	17.8	242	120	74	81	VDT to promote spatial and species diversity
22	17.5	Plantation	56	45	2027	N	N	2087	127	127	0	16.1	180	98	54	73	VDT to promote spatial and species diversity
24	6.9	Plantation	48	70		N	Y	2042	287	287	0	12.6	248	93	76	89	VDT to promote spatial and species diversity
26	93.1	Old Plantation	66	54		N	N	2077	185	161	24	15.5	211	99	74	77	VDT to promote spatial and species diversity
28	7.5	Old Plantation	57	71		Y	Y	2017	225	193	32	16.5	287	122	74	89	VDT to promote spatial and species diversity
30	42.7	Old Plantation	67	46	2027	N	N	2087	231	116	115	17.5	192	118	74	81	VDT to promote spatial and species diversity
32	21.2	Old Plantation	65	47	2027	N	N	2077	152	110	42	18.4	202	130	65	85	VDT to promote spatial and species diversity
36	32.0	Old Plantation	65	53		N	N	2067	215	139	76	17.0	218	110	74	78	VDT to promote spatial and species diversity
38	16.7	Old Plantation	63	64		N	N	2067	272	159	113	17.6	270	109	82	74	VDT to promote spatial and species diversity

Unit	Acres	Origin	CSE Age	RD 2018	RD50 YR	95% CMAI 2018	95% CMAI 2023	YR CMAI	TPA	TPA >5"	TPA <5"	QMD >5"	BA >5"	HT >5"	CC	H:D Ratio	Proposal
40	73.9	Old Plantation	64	53		N	N	2097	226	177	49	14.5	202	84	80	70	VDT to promote spatial and species diversity
42	215.1	Old Plantation	74	52		N	N	2067	934	117	817	19.6	232	99	85	61	VDT to promote spatial and species diversity
43	15.7	Old Plantation	80	71		Y	Y	2016	398	233	165	14.7	274	83	85	68	VDT to promote spatial and species diversity
44	53.5	Old Plantation	74	50		N	N	2087	1039	106	933	19.7	224	111	69	68	VDT to promote spatial and species diversity
46	17.8	Old Plantation	81	51		N	N	2077	452	156	296	15.3	199	93	62	73	VDT to promote spatial and species diversity
48	11.6	Fire	110	65		Y	Y	2057	137	119	18	21.6	302	116	74	64	VDT to promote spatial and species diversity
50	121.8	Plantation	67	58		N	N	2097	228	190	38	14.7	224	89	73	73	VDT to promote spatial and species diversity
54	28.7	Plantation	66	62		N	N	2057	320	191	129	15.2	240	91	84	72	VDT to promote spatial and species diversity
58	4.7	Plantation	65	61		N	N	2077	408	212	196	14.1	231	89	91	76	VDT to promote spatial and species diversity
62	21.4	Plantation	62	50		N	N	2067	204	120	84	17.9	210	95	73	64	VDT to promote spatial and species diversity
64	33.0	Old Plantation	62	65		Y	Y	2017	185	146	39	18.8	282	112	72	72	VDT to promote spatial and species diversity
66	14.7	Old Plantation	69	43	2037	Y	Y	2016	538	63	475	25.0	215	137	70	66	VDT to promote spatial and species diversity
68	7.9	Old Plantation	65	59		Y	Y	2037	170	121	49	20.0	263	118	88	71	VDT to promote spatial and species diversity
69	39.6	Old Plantation	76	65		N	Y	2042	223	153	70	18.2	275	108	86	71	VDT to promote spatial and species diversity
70	21.1	Old Plantation	71	77		Y	Y	2016	229	229	0	15.6	303	74	85	57	VDT to promote spatial and species diversity

Unit	Acres	Origin	CSE Age	RD 2018	RD50 YR	95% CMAI 2018	95% CMAI 2023	YR CMAI	TPA	TPA >5"	TPA <5"	QMD >5"	BA >5"	HT >5"	CC	H:D Ratio	Proposal
71	10.5	Old Plantation	94	117		Y	N	2016	458	366	92	15.0	454	82	94	66	VDT to promote spatial and species diversity
72	113.7	Old Plantation	78	82		N	N	2067	404	316	88	13.2	299	68	88	62	VDT to promote spatial and species diversity
74	26.6	Plantation	54	97		Y	Y	2016	567	396	171	12.6	342	85	96	81	VDT to promote spatial and species diversity
76	43.5	Fire	104	53		Y	Y	2017	3445	143	3302	16.7	218	89	85	64	VDT to promote spatial and species diversity
78	84.0	Plantation	44	72		N	N	2057	611	275	336	13.3	264	77	91	70	VDT to promote spatial and species diversity
79	3.5	Fire	104	53		Y	Y	2017	3445	143	3302	16.7	218	89	85	64	VDT to promote spatial and species diversity
80	50.7	Fire	94	72		Y	Y	2032	382	150	232	19.7	318	109	79	66	VDT to promote spatial and species diversity
82	8.6	Fire	97	46	2029	N	N	2167	904	189	715	12.6	163	52	72	50	VDT to promote spatial and species diversity
84	10.6	Old Plantation	67	71		N	N	2057	333	333	0	11.6	243	78	73	81	VDT to promote spatial and species diversity
86	10.0	Old Plantation	72	61		Y	Y	2016	249	249	0	12.7	218	74	73	70	VDT to promote spatial and species diversity
88	16.4	Old Plantation	71	71		Y	Y	2016	286	177	109	17.6	298	116	79	79	VDT to promote spatial and species diversity
89	11.0	Old Plantation	67	66		N	N	2057	350	213	137	14.7	251	93	82	76	VDT to promote spatial and species diversity
90	45.2	Old Plantation	88	68		N	N	2067	266	201	65	15.7	271	90	85	69	VDT to promote spatial and species diversity
92	29.7	Old Plantation	73	61		N	Y	2057	229	213	16	14.1	229	86	84	73	VDT to promote spatial and species diversity
94	18.3	Old Plantation	69	53		Y	Y	2032	133	94	39	22.0	250	122	59	67	Regen Harvest. Site Prep. Plant 200-300 TPA

Unit	Acres	Origin	CSE Age	RD 2018	RD50 YR	95% CMAI 2018	95% CMAI 2023	YR CMAI	TPA	TPA >5"	TPA <5"	QMD >5"	BA >5"	HT >5"	CC	H:D Ratio	Proposal
96	4.4	Old Plantation	84	65		Y	Y	2047	335	164	171	17.4	272	106	75	73	Regen Harvest. Site Prep. Plant 200-300 TPA
98	46.6	Old Plantation	62	71		N	N	2067	234	182	52	17.4	295	105	84	72	VDT to promote spatial and species diversity
100	26.4	Old Plantation	74	49	2022	N	N	2067	105	88	17	21.9	230	122	63	67	VDT to promote spatial and species diversity
102	18.3	Old Plantation	72	62		Y	Y	2016	222	202	20	14.7	237	95	83	78	VDT to promote spatial and species diversity
106	63.1	Fire	105	56		Y	Y	2017	461	107	354	21.0	259	104	74	59	VDT to promote spatial and species diversity
108	50.3	Fire	95	60		Y	Y	2032	142	120	22	20.3	270	128	73	76	VDT to promote spatial and species diversity
110	34.1	Fire	107	69		Y	Y	2016	300	188	112	16.6	282	99	83	72	VDT to promote spatial and species diversity
112	38.9	Fire	95	61		N	N	2087	756	326	430	10.6	198	61	89	69	VDT to promote spatial and species diversity
114	10.9	Fire	100	64		Y	Y	2016	1104	132	972	19.8	283	99	84	60	VDT to promote spatial and species diversity
116	5.7	Fire	105	69		N	N	2033	480	255	225	13.6	255	85	93	75	Regen Harvest. Site Prep. Plant 200-300 TPA
118	27.8	Plantation	62	41	2032	N	N	2052	795	167	628	12.7	148	70	76	66	VDT to promote spatial and species diversity
119	3.5	Plantation	55	60		Y	Y	2016	1068	212	856	13.9	224	67	83	58	VDT to promote spatial and species diversity
120	14.9	Plantation	55	60		Y	Y	2016	355	212	143	13.9	224	89	89	77	Regen Harvest. Site Prep. Plant 200-300 TPA
122	5.4	Fire	91	58		N	N	2097	485	245	240	12.3	203	90	90	88	VDT to promote spatial and species diversity
123	34.3	Fire	94	73		N	N	2087	557	352	205	11.3	247	71	96	75	VDT to promote spatial and species diversity

Unit	Acres	Origin	CSE Age	RD 2018	RD50 YR	95% CMAI 2018	95% CMAI 2023	YR CMAI	TPA	TPA >5"	TPA <5"	QMD >5"	BA >5"	HT >5"	CC	H:D Ratio	Proposal
124	38.1	Fire	105	69		Y	Y	2017	2216	265	1951	13.2	250	70	92	64	Promote NSO Habitat
125	3.8	Plantation	44	61		N	N	2087	2691	244	2447	12.7	216	74	90	70	Promote NSO Habitat
126	37.8	Plantation	54	64		N	N	2077	539	257	282	12.8	229	74	91	69	Promote NSO Habitat
130	15.9	Plantation	58	48	2027	Y	Y	2016	226	168	58	14.0	180	78	82	67	Promote NSO Habitat
132	42.5	Fire	102	54		Y	Y	2016	4825	121	4704	18.8	233	107	82	68	Regen Harvest. Site Prep. Plant 200-300 TPA
133	12.0	Fire	90	86		Y	Y	2047	236	212	24	17.7	362	86	89	58	VDT to promote spatial and species diversity
134	24.9	Fire	89	69		N	N	2108	942	263	679	13.2	251	75	92	68	VDT to promote spatial and species diversity
135	23.8	Fire	76	52		N	N	2117	477	137	340	17.0	215	81	79	57	VDT to promote spatial and species diversity
136	50.7	Fire	82	93		N	N	2067	1865	332	1533	13.8	347	68	93	59	VDT (Huckleberry Enhancement)
138	37.0	Fire	90	104		N	N	2037	421	358	63	14.2	392	72	94	61	VDT (Huckleberry Enhancement)
140	9.0	Old Plantation	67	49	2022	N	N	2077	234	114	120	18.4	210	119	70	78	VDT to promote spatial and species diversity
142	21.0	Old Plantation	84	79		Y	Y	2016	241	217	24	16.5	323	108	75	79	VDT to promote spatial and species diversity
144	24.4	Old Plantation	104	61		N	Y	2057	174	110	64	21.7	282	131	78	72	VDT to promote spatial and species diversity
146	54.8	Old Plantation	72	57		N	Y	2048	179	117	62	19.9	254	123	76	74	VDT to promote spatial and species diversity
148	24.9	Old Plantation	62	52		N	N	2067	185	126	59	17.9	220	115	73	77	VDT to promote spatial and species diversity
150	133.0	Old Plantation	60	64		N	N	2057	192	168	24	16.9	261	99	82	70	VDT to promote spatial and species diversity

Unit	Acres	Origin	CSE Age	RD 2018	RD50 YR	95% CMAI 2018	95% CMAI 2023	YR CMAI	TPA	TPA >5"	TPA <5"	QMD >5"	BA >5"	HT >5"	CC	H:D Ratio	Proposal
151	15.2	Old Plantation	56	43	2038	N	Y	2052	68	68	0	24.0	213	129	54	65	VDT to promote spatial and species diversity
152	48.3	Old Plantation	50	53		Y	Y	2043	221	144	77	16.6	215	95	71	69	Regen Harvest. Site Prep. Plant 200-300 TPA
153	13.9	Old Plantation	58	72		Y	Y	2037	296	277	19	13.1	259	91	83	83	VDT to promote spatial and species diversity
154	11.3	Old Plantation	63	55		Y	Y	2027	103	103	0	21.2	252	109	61	62	VDT to promote spatial and species diversity
155	11.4	Old Plantation	62	79		Y	Y	2017	316	291	25	13.5	290	101	80	90	VDT to promote spatial and species diversity
156	71.7	Old Plantation	54	45	2032	N	N	2107	211	145	66	14.6	175	86	73	71	VDT to promote spatial and species diversity
158	77.8	Old Plantation	51	51		N	N	2087	228	142	86	16.4	207	96	70	70	VDT to promote spatial and species diversity
160	57.4	Old Plantation	57	42	2047	N	N	2067	91	91	0	19.2	183	118	55	74	VDT to promote spatial and species diversity
164	34.0	Old Plantation	57	51		Y	Y	2017	181	165	16	14.8	198	93	69	75	VDT to promote spatial and species diversity
165	33.6	Old Plantation	62	55		Y	Y	2017	255	190	65	14.0	204	88	76	75	Regen Harvest. Site Prep. Plant 200-300 TPA
166	7.4	Old Plantation	69	67		Y	Y	2032	198	198	0	15.6	264	98	91	75	VDT to promote spatial and species diversity
168	47.6	Old Plantation	59	89		Y	Y	2017	379	355	24	12.1	287	84	75	83	VDT to promote spatial and species diversity
170	10.4	Old Plantation	61	84		Y	Y	2027	488	433	55	10.8	276	73	81	81	Regen Harvest. Site Prep. Plant 200-300 TPA
171	7.8	Old Plantation	61	84		Y	Y	2027	488	433	55	10.8	276	73	81	81	VDT to promote spatial and species diversity
172	12.1	Old Plantation	65	77		Y	Y	2016	266	266	0	14.1	289	81	77	69	VDT to promote spatial and species diversity

Unit	Acres	Origin	CSE Age	RD 2018	RD5 0 YR	95% CMAI 2018	95% CMAI 2023	YR CMAI	TPA	TPA >5"	TPA <5"	QMD >5"	BA >5"	HT >5"	CC	H:D Ratio	Proposal
174	58.8	Old Plantation	72	82		N	N	2057	559	316	243	13.2	299	81	94	74	VDT to promote spatial and species diversity
176	60.0	Fire	106	61		N	N	2057	239	135	104	19.1	268	99	78	62	VDT to promote spatial and species diversity
178	32.7	Fire	108	85		N	N	2057	364	288	76	14.3	323	79	92	66	VDT to promote spatial and species diversity
179	34.8	Old Plantation	80	80		N	N	2077	512	315	197	13.0	289	82	95	76	VDT to promote spatial and species diversity
180	68.8	Plantation	35	73		N	N	2047	784	352	432	11.3	244	74	96	79	VDT to promote spatial and species diversity
182	19.5	Plantation	61	70		N	N	2067	704	333	371	11.4	236	71	98	75	Regen Harvest. Site Prep. Plant 200-300 TPA
184	5.0	Fire	104	94		Y	Y	2047	395	298	97	14.9	362	98	92	79	Regen Harvest. Site Prep. Plant 200-300 TPA
186	25.1	Fire	96	60		N	N	2077	495	233	262	13.0	216	74	92	68	VDT to promote spatial and species diversity
188	10.3	Fire	99	59		Y	Y	2017	146	113	33	20.8	267	124	81	72	VDT to promote spatial and species diversity
190	94.8	Fire	108	80		Y	Y	2047	788	292	496	13.6	297	80	92	71	VDT to promote spatial and species diversity
191	26.5	Fire	115	55		Y	Y	2047	403	172	231	15.2	216	82	85	65	Regen Harvest. Site Prep. Plant 200-300 TPA
192	26.5	Fire	108	98		N	N	2087	729	450	279	11.7	334	71	96	73	VDT to promote spatial and species diversity
193	10.7	Fire	108	94		Y	Y	2047	497	357	140	13.3	344	84	88	76	VDT to promote spatial and species diversity
194	73.6	Fire	110	73		N	N	2107	481	315	166	12.1	254	77	89	76	VDT to promote spatial and species diversity
196	30.7	Fire	100	85		Y	Y	2017	332	212	120	17.5	354	101	83	69	Promote NSO Habitat

Unit	Acres	Origin	CSE Age	RD 2018	RD5 0 YR	95% CMAI 2018	95% CMAI 2023	YR CMAI	TPA	TPA >5"	TPA <5"	QMD >5"	BA >5"	HT >5"	CC	H:D Ratio	Proposal
198	23.4	Fire	105	83		Y	Y	2037	364	236	128	16.1	334	96	86	72	Promote NSO Habitat
200	69.2	Fire	113	74		Y	Y	2016	136 8	195	117 3	16.9	303	10 3	86	73	Promote NSO Habitat
202	42.8	Fire	106	77		Y	Y	2057	504	208	296	16.7	317	94	82	68	VDT to promote spatial and species diversity
203	9.4	Fire	123	106		Y	Y	2057	626	305	321	15.9	421	89	92	67	VDT to promote spatial and species diversity
204	17.3	Fire	113	86		Y	Y	2016	321	293	28	14.2	322	90	90	76	Regen Harvest. Site Prep. Plant 200-300 TPA
206	68.1	Fire	106	83		N	N	2077	343	343	0	12.6	294	67	90	64	Promote NSO Habitat
208	13.6	Fire	106	107		Y	Y	2016	879	408	471	13.2	387	70	91	64	NSO. Noncommercial
210	46.3	Fire	107	92		Y	Y	2037	328	283	45	15.3	362	86	90	68	NSO. Noncommercial
212	14.9	Fire	107	83		Y	Y	2016	327	263	64	15.0	322	79	87	63	VDT to promote spatial and species diversity
300	2.0	Other															Burn Meadow to enhance wildlife habitat
304	5.9	Young Plantation	5														seedling release
306	3.6	Young Plantation	5														seedling release
308	5.0	Young Plantation	5														seedling release
310	3.0	Young Plantation	5														seedling release
312	2.8	Young Plantation	5														seedling release
314	8.6	Young Plantation	5														seedling release
316	8.3	Young Plantation	5														seedling release

Unit	Acres	Origin	CSE Age	RD 2018	RD50 YR	95% CMAI 2018	95% CMAI 2023	YR CMAI	TPA	TPA >5"	TPA <5"	QMD >5"	BA >5"	HT >5"	CC	H:D Ratio	Proposal
318	5.3	Young Plantation	5														seedling release
320	6.6	Young Plantation	25	39					729			4.6					thin/brush
322	12.7	Young Plantation	25	38					2177			2.2					thin/brush
324	175.9	Young Plantation	30	104					6767			2.0					thin/brush
326	124.1	Young Plantation	20	38					12068			0.7					thin/brush
328	7.1	Young Plantation	20	179					6411			3.0					thin/brush
330	10.3	Young Plantation	25	77					2165			3.5					thin/brush
332	40.5	Young Plantation	30														thin/brush
334	47.9	Young Plantation	30	75					1867			3.8					thin/brush
336	46.0	Young Plantation	30	17					1841			1.4					thin/brush
338	73.3	Young Plantation	15	58					5567			1.5					thin/brush
340	1.1	Young Plantation	25														thin/brush
342	58.3	Young Plantation	10	12					7900			0.4					thin/brush
344	35.6	Young Plantation	35	132					4233			3.2					thin/brush
346	51.5	Young Plantation	25	38					2000			2.3					thin/brush/interplant OR regen/site prep/plant

Unit	Acres	Origin	CSE Age	RD 2018	RD50 YR	95% CMAI 2018	95% CMAI 2023	YR CMAI	TPA	TPA >5"	TPA <5"	QMD >5"	BA >5"	HT >5"	CC	H:D Ratio	Proposal
348	24.0	Young Plantation	30	107					9800			1.6					thin/brush
350	11.3	Young Plantation	25														thin/brush
352	36.6	Young Plantation	30	41					1733			2.7					thin/brush
354	31.5	Young Plantation	25	36					840			3.9					thin/brush
356	18.7	Young Plantation	25	73					2759			2.9					thin/brush
358	31.2	Young Plantation	30	45					1212			3.6					thin/brush
360	62.7	Young Plantation	30	44					1335			3.3					thin/brush
362	46.3	Young Plantation	30	32					1042			3.2					thin/brush
364	40.0	Young Plantation	25														thin/brush, reduce spread of armillaria root rot