North Shore Cedar

121.1 Road Forest Habitat Restoration Project

Project Plan and 2010/2011 As-Built Document

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Purpose

The North Shore Cedar (NSC) Assessment identifies the area between the 121.1 Road and the 100 Road as a priority for a forest habitat restoration project to improve upland forest habitat and connectivity between aquatic, riparian and upland habitats. The purpose of this document is to describe the ecological thinning and planting projects that were planned and implemented to achieve the forest habitat restoration goals and objectives.

Objectives

The overall goals of the North Shore Cedar area are to protect and increase forest habitat connectivity and quality and to protect and improve forest health and resilience. To achieve these overall goals, specific objectives include:

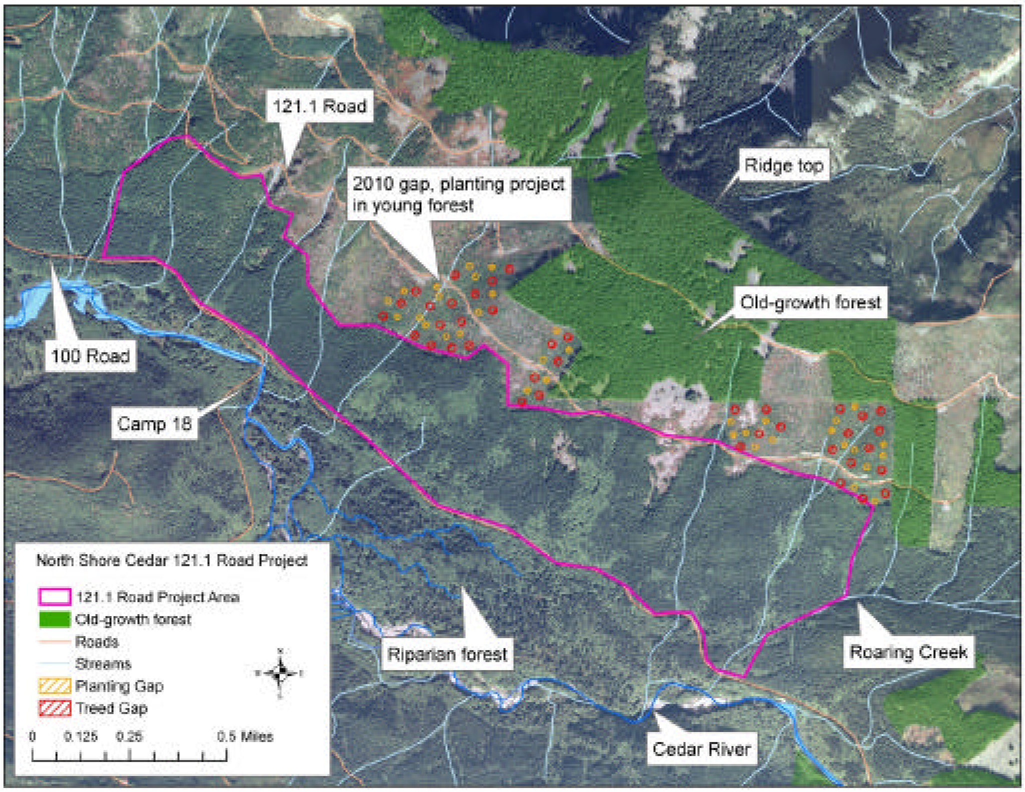
- Increase horizontal structural complexity throughout the forest and within forest patches
- Facilitate individual large tree, branch, and canopy development for future marbled murrelet nesting habitat
- Increase dead wood habitat (both snags and logs) within treatment patches
- Increase understory development within treatment patches
- Enhance existing minor tree species
- Increase species diversity (tree and shrub) within specified treatment patches

Location and physical setting

The project area is located above the main stem of the Cedar River, from Roaring Creek in the east, west for about two miles (portions of Sections 23, 24, 25 and 26 of T22N R9E), upslope of the 100 Road and down slope of the 121.1 Road (Figure 1). It consists of approximately 465 acres of 55 to 80 year-old second-growth forest. Much of the area north of the project area consists of younger forest that was clearcut harvested from 1978 to 1986 and pre-commercially thinned in 1995. In 2010, a project to create both treed and planting gaps within the thinned matrix of this younger forest was completed, and gaps were planted with western white pine and noble fir. Further north are remnant patches of old-growth forest. Patches of talus are scattered throughout the hill slope. South of the project area and the 100 Road is the large floodplain of the mainstem Cedar River, with a complex, high quality riparian forest.

Areas selected for treatment within the project area are located in relatively homogenous patches of second-growth conifer forest and are distributed across the hill slope in order to increase heterogeneity and species diversity at a broad spatial scale. In 2010 the priority was to implement treatments in forests accessible by the 121.1 Road so that road decommissioning of that failure-prone mid-slope road can occur in 2011.

Figure 1: Vicinity map of the North Shore Cedar 121.1 Road forest habitat restoration project



Current conditions

The second-growth forest in the project area is approximately 55 to 80 years old, generated after clearcut harvest. Notes from historical cruise data state that the original forest was dominated by Douglas-fir, with significant amounts of western hemlock, and smaller but varying amounts of western white pine, western red cedar, Sitka spruce, noble fir, and larch.

The older portions of the current forest, along the lower slope near the 100 Road, have good structural heterogeneity, with large diameter trees, variable inter-tree spacing, and mixed species composition. But much of the forest on the mid-slope, especially that near the 121.1 Road, consists of smaller trees in the competitive exclusion stage, with a continuous canopy and very sparse understory. These large patches of forest are generally dominated by dense Douglas-fir and western hemlock from 8 to 15 inches in diameter.

There is noble fir scattered throughout the area, with some very large trees, especially on the lower slope and near the streams. There are only occasional western red cedar and western white pine. A few small natural canopy gaps, generally dominated by vine maple, are scattered throughout the site.

Approximately half way between the 121.1 and 100 Road there is a band of forest that consists of more widely spaced Douglas-fir, many with chlorotic crowns. This section of slope is quite steep with rocky soil, providing a very poor growing site. It is not conducive for planting, and many of the trees may die in the near future, leaving a dry shrub-dominated community with scattered trees.

There is very little large diameter dead wood, either standing snags or downed logs, remaining from the original timber harvest.

Several stream channels, both perennial and ephemeral, dissect the hill, running north to south and draining into the Cedar River. Most of the streams have small steep drainage areas, with narrow valley floors inset into the valley wall. The riparian areas near the streams are variable in size and are generally dominated by deciduous tree and shrubs, some with older senescing red alder.

In summary, the entire hill slope from Cedar River to ridge top currently contains forest of varied ages, structures, and species composition, primarily dominated by conifer but with significant deciduous-dominated riparian areas (Figure 2). Within the project area, while there is some structural heterogeneity on the lower slopes, there are large patches of homogenous second-growth forest providing little dead wood or habitat complexity and poor habitat connectivity between the complex riparian habitats along the Cedar River and the late seral forest on the upper portions of the hill slope.

Desired future conditions

The desired future conditions are to have a variety of forest structures and types across the entire hill slope, with increased horizontal and vertical structural complexity within the currently homogenous second-growth forest of the project area. There will be large individual trees of different species, with multiple canopy layers including herbs, shrubs, and understory trees. Dominant trees will be healthy, with large crowns.

Figure 2. Varied forest stand conditions along the north ridge flanking the Cedar River. Top left photo shows typical high density Douglas-fir stand that is the primary target for thinning treatments. Top right photo shows high density mixed conifer stand (western hemlock, Douglas-fir, noble fir) that is also targeted for thinning (Transect 7A). Bottom left photo shows forest stand with large diameter noble fir. Bottom right photo shows alder dominated stand type with limited regeneration, which will be the target for riparian planting.

Canopy gaps of various sizes will provide opportunity for adjacent trees and those few trees left within the gap to develop large branches that could eventually provide marbled murrelet nesting habitat. Patches with fewer trees and larger and more variable inter-tree spacing, will provide greater opportunity for both canopy and understory development, as well as increased vigor of residual co-dominant and dominant trees, making them more resistant to stresses such as drought, insects, and diseases.

Tree species composition will include a higher proportion of minor tree species, including noble fir, western white pine, western red cedar, and big-leaf maple. This diversity will enable the forest to be more resistant to pathogens and insects that target one or a few related species and more resilient in the face of disturbances.

There will be improved habitat connectivity for a variety of flora and fauna up and down the hill slope from the Cedar River riparian forest to the old-growth forest to the north, as well as to the ridge top and between drainages on the hill. A major component of this connectivity will be increased standing and downed dead wood scattered throughout the hill slope in varied distribution, simulating small-scaled disturbances, such as bark beetle mortality and windthrow.

Management constraints

Forest habitat restoration treatments in the area are restricted to hand work (including cut-and-leave treatments and planting) due to several factors. First, the 121.1 Road is in poor condition, is slated as high priority for decommissioning (planned for 2011) as one of the last mid-slope roads with multiple stream crossings. The hill slope has general instability, with a high landslide and surface erosion hazard, and the 121.1 Road contributes to the landslide hazard of the slope. The expense that would be incurred to improve the road for log haul was estimated to be $40,000, with substantial rebuilding of the stream crossings. Conversely, the quality and volume of the timber to be thinned and potentially removed is low, and would not even pay for the road improvements. Therefore, this project was planned such that treatment of forest patches most easily accessible from the 121.1 Road could be completed by hand, without the use of logging equipment, prior to the start of the decommissioning.

Risks and mitigation strategies

The primary risk in the project area is hill slope instability, landslides, and wind. All steep concave slopes and existing inner gorges associated with the numerous stream channels will be avoided to minimize the risk of future landslides. Careful placement of treatment areas will help ensure there is no increased channel instability caused by the project. Some riparian areas dominated by aging red alder will be inter-planted with long-lived conifer species such as western red cedar, noble fir, and Sitka spruce as well as a variety of deciduous species such as black cottonwood and big-leaf maple. Interplanting should help minimize the risk that these areas will lose stability as the alder dies.

There is a risk of wind throw on this slope, as high winds are often channeled along Chester Morse Lake. Trees growing in these dense stands often have high height to diameter ratios, making them more susceptible to wind throw. There is little evidence, however, of large wind throw events in this area in the past several decades. To minimize the risk of a large event, treatment patches will be scattered and small (thinning patches less than 3 acres, gaps less than 0.5 acre). Small to medium amounts of wind throw could provide greater structural complexity and dead wood to the forest habitat.

There is some laminated root rot present in the stand, especially in the mid-slope band of chlorotic Douglas-fir. Under normal circumstances this native pathogen should merely provide small to moderate canopy gaps and downed wood, adding to structural complexity. Thinning patches and gap creation should result in healthier remaining trees that will be more resistant to root rot.

Although there are Douglas-fir bark beetles and some recent beetle-caused mortality in the watershed, there have been very few trees killed by beetles in the project area. Leaving downed wood (>12 inches) in patches may temporarily increase local beetle populations. Given data from large amounts of downed wood and number of beetle-killed trees in the lower watershed, if beetle populations increase as a result of the treatments they could result in scattered snags being created, adding to structural complexity and habitat diversity.

There are no seasonal restrictions to project implementation due to proximity of nest sites of species of concern such as marbled murrelet, northern spotted owl, or northern goshawk. There are no projected risks to water quality.

Design and Prescriptions

In spring of 2010 teams of two ecosystem staff members (forest ecologists and wildlife biologists) established 13 transects within the project area, generally extending from the 121.1 Road to the 100 Road. Location of transects was determined using remote sensing data on GIS, targeting areas of homogenous, closed canopy. Forest condition and wildlife habitat along and near each transect was evaluated in the field and areas with dense patches of trees, homogenous closed canopy, and little understory were targeted for treatment. Variably sized thinning units, gaps, and individual tree release (ITR) sites were marked in the field and site-specific prescriptions were developed for each unit. Treatments were spaced irregularly along and between transects.

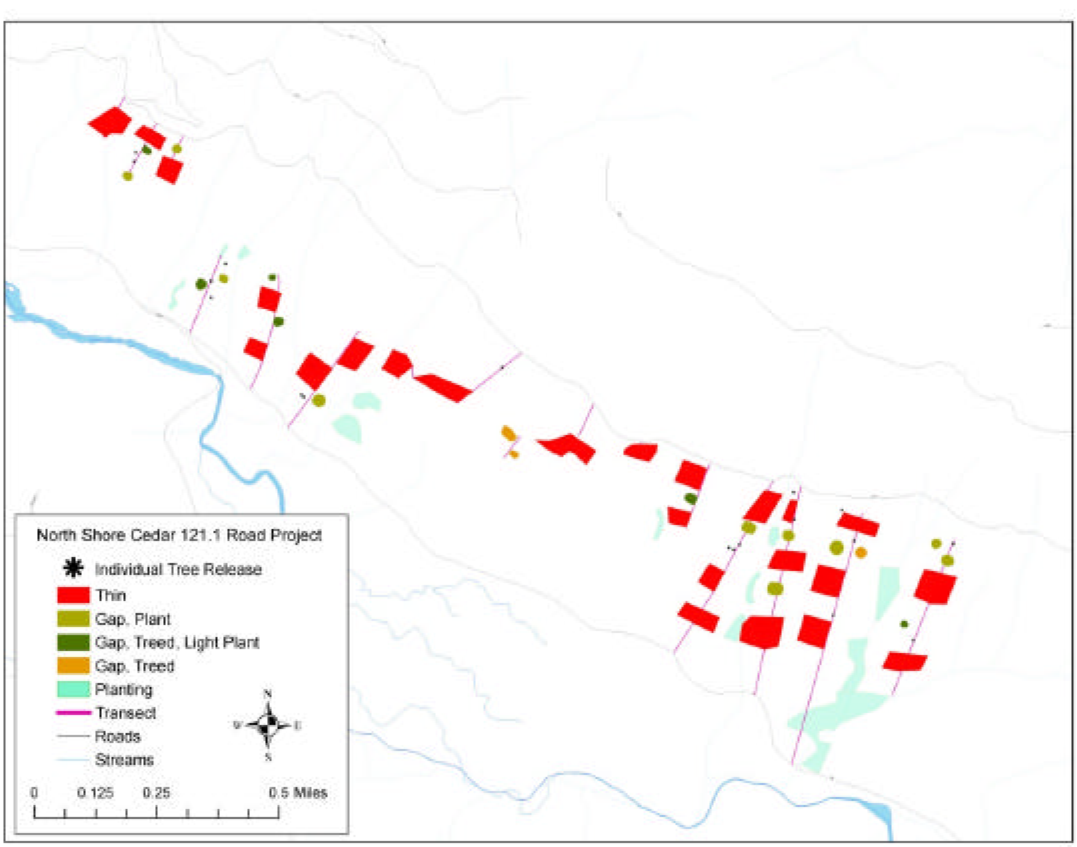
Placement and prescriptions for all three treatments were designed to achieve objectives of increasing stand structural complexity at a broad spatial scale. At a finer scale within treatment areas, objectives included reducing competition among shade intolerant trees (Noble fir, Douglas fir, and western white pine), releasing less common tree species, increasing light for understory vegetation, and providing dead wood for birds, amphibians, and small mammals. All three treatments (individual tree release, thinning, and gap creation) will allow for release of dominant canopy trees that have large crowns and are most likely to respond to release with crown expansion and branch growth.

Gaps were placed both to provide canopy gaps where none existed and to enlarge or combine small existing natural gaps. Some gaps were designed as planting gaps to increase tree species diversity on the hill slope by planting with under-represented tree species, especially species that may tolerate warming regional temperatures and more droughty conditions (e.g., western white pine). Others were treed gaps, where selected dominant trees were left to develop large branches and deep crowns.

Thinning prescriptions were developed to create patches with a significant contrast to the surrounding forest, so generally had wide spacing between leave trees. Thinning units were limited to patches less than 3 acres (mean patch size was 1.6 acres).

In addition, specific areas farther from the transects, including riparian areas, were evaluated for potential planting. All transects and treatment units were mapped in GIS (Figure 3).

Figure 3. All treatments planned for the 121.1 Road project



Specific instructions for the contractors included:

Individual Tree Release – 16 sites, all marked in the field with painted yellow slash or yellow dot on trees to be girdled.

1. Girdle (with two concentric rings deep enough to sever the cambium) two to ten co-dominant competitors of the selected leave trees to increase growing space.

Gaps – 19 gaps totaling 4.8 acres (10 planting, 6 with some trees and light planting, 3 with trees), all marked in the field with pink boundary flags facing into the gap.

1. Fall all trees growing within marked gap boundaries;
2. Retain leave trees as marked (yellow “L”);
3. Girdle trees marked “S” within gaps;
4. Fall all cut trees away from gap center and outside of the gap whenever possible to better distribute down wood in the gap and adjacent forest;
5. Allow for planting sites if indicated;
6. Minimize damage to existing understory vegetation (e.g. vine maple) and minor tree species (e.g. western redcedar); and
7. Clump downed trees together whenever possible, to provide log pile habitat and minimize amount of ground surface covered by downed wood.

Thinning Patches – 24 units totaling 39.2 acres, all marked in the field with pink boundary flags facing into the unit.

1. Cut trees only within the thinning pool, generally >6” Douglas-fir and western hemlock with a variable upper diameter limit as designed specific to the thinning unit;
2. Within the thinning pool, cut trees to the prescribed spacing, generally ignoring trees outside the thinning pool, unless otherwise prescribed;
3. Girdle the largest tree sizes within the thinning pool, specific to each treatment patch;
4. Fall trees in piles as feasible, to provide log pile habitat and minimize the amount of ground surface covered by downed wood; and
5. Allow for planting sites if indicated.

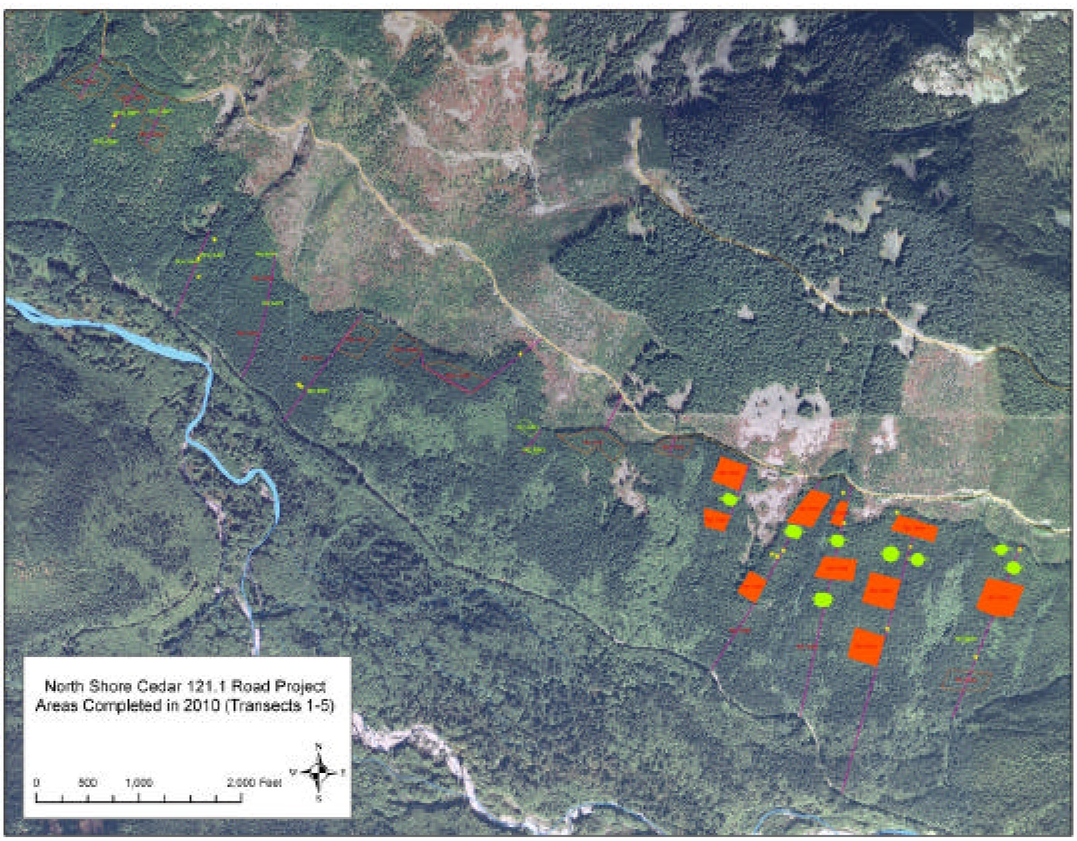
Planting – planting designated gaps plus 12 riparian areas (16.3 acres). Riparian planting areas are not marked in the field.

1. Planting species and densities for each planting gap and riparian planting area will be developed in early 2011, with planting expected to occur in the spring or fall of 2011.

2010 As-Built Information

The bid for tree felling was awarded to 4B Timber Cutting at a rate of $70 per hour per cutter with an estimated production rate of 0.5 acres per hour. Tree felling occurred between 10/25/10 and 11/17/10, with work performed by a two to three person crew. A total of 18.7 acres of ITR, thinning, and gap creation were completed, in a total of 130.5 hours of cutting plus 6 hours of pre-work. Actual production rate averaged 0.13 acres per hour for gaps and 0.15 acres per hour for thinning units, although production rate for thinning increased slightly with experience (to 0.17 acres per hour) if only the last eight units are considered. A total of 6 ITRs (approximately 0.24 acres), 10 thin units (15.93 acres), and 8 gaps (2.52 acres) along the upper portions of five transects were completed (Figure 4). Total contractor costs were $9,555 for an average cost of $511 per acre. Work was stopped after transect 5 was completed due to cost and weather.

Figure 4. Treatments completed in 2010, transects 1 – 5. Completed thin units are in solid orange, gaps in solid green. Units on the lower hillslopes were excluded from treatment to prioritize efforts around the 121.1 Road before decommissioning.



Total staff costs for planning, design, forest evaluation, treatment layout, prescription development, GIS map creation, contracting, and compliance were $25,176. Approximately 240 acres of forest were evaluated for treatment (250 feet on either side of each transect plus riparian areas). Within that, a total of 44.7 acres were marked for cutting (39.16 acres for thinning, 4.83 acres for gap creation, and 0.7 acres for ITR) and 16.34 acres were planned for planting. A total of 23.25 person days (for an approximate cost of $19,760 or 78% of the total staff costs) were used in the field to evaluate the forest and lay out all the treatments. The remaining 22% of the staff costs were for GIS work, contracting, and compliance.

Compliance was conducted by WSD staff during the tree felling. Prescriptions were modified slightly during thinning to improve efficiency of the cutting process. Changes included:

- Not using the lower diameter limit for western hemlock unless they were well formed with full crowns;
- Allowing cutting of saplings (mainly hemlock) if needed;
- Allowing cutting of one or two trees within the untreated areas adjacent to thin areas to create a window for falling into the adjacent dense stand, but leaving the same number of trees within the thinning unit; and
- Allowing cutting of one or two trees within the untreated areas adjacent to gaps to create a window for falling into the adjacent dense stand, without leaving any additional trees within the gap.

Overall, the prescriptions and implementation exceeded expectations in the amount of variability being created, both within the treatment units and over the hillside. The size and relative spacing of the treatment patches is very good, and the prescriptions appear to be highly successful in achieving our objectives. Light penetrates into the adjacent forest from both the gaps and thins. Leave trees within even the small gaps should not interfere with successful planting. Leave trees in gaps, edge trees of gaps, and trees within the more widely spaced thins should all have sufficient light to develop large branches (see Figure 5), which could provide future marbled murrelet habitat. The amount of down wood loading is large, but only in relatively small patches; it doesn't appear that wood loading will significantly impede planting or understory development. It should provide habitat for small mammals, birds, and small carnivores, while enhancing soil development.

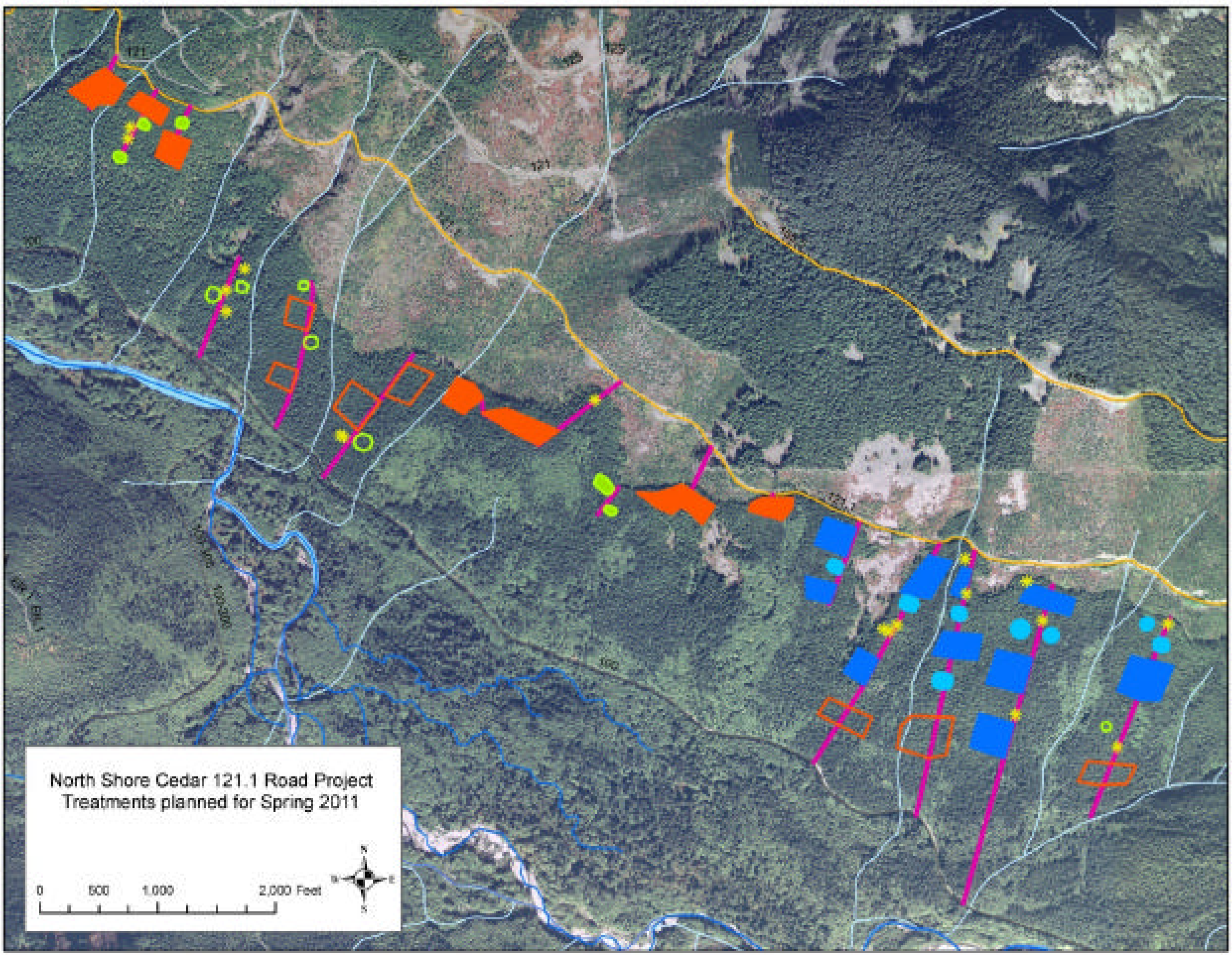
Figure 5. Example of pre-thinning (above) and post-thinning (below) forest canopy in a 2010 thin unit.

Modified Thinning Prescriptions for 2011

The 2010 implementation was more expensive than we anticipated, primarily because the production rate was one third of that estimated. We re-evaluated the prescriptions to see if they could be modified to increase production rate (by decreasing number of trees cut) while still meeting the ecological objectives. In 2011, we modified the remaining thin prescriptions accessible by the 121.1 Road to thin around 30-40 dominant trees or minor tree species per acre. A distance of 20 feet around each target tree was specified for thinning, with 3-7 competitors cut or girdled if above a certain diameter to release each target tree in that area. We anticipated that this prescription would provide greater structural variability within the unit than the even spacing units done in 2010, while decreasing total number of trees cut (and therefore time spent), decreasing the down wood loading and reducing the potential for windthrow. Results were closely monitored during 2011 implementation, but prescriptions were not further modified. Another option we considered for some thinning units was to only girdle trees and not drop any wood; it was determined that this option would be more time consuming that felling for most of the target trees.

The goal was to complete the thinning, gaps, and ITR treatments near the 121.1 Road in the spring of 2011 (Figure 6), so that the road decommissioning work could proceed during the summer. This portion of the project included a total of 11.42 acres, consisting of 7 thinning units (10.28 ac), 5 gaps (1.02 ac), and 3 ITRs (0.12 ac). Remaining treatment areas are easily accessed via the 100 Road, and will be completed at a later date.

Figure 6. Treatments planned for spring, 2011. Thin units completed in 2011 are shown in solid orange, gaps in solid green. Units in shades of solid blue were completed in 2010. Units outlined in orange or green will be treated at a later date.



2011 As-Built for 2011 Implementation

The contract for the spring 2011 tree felling was bid in early 2011, and was awarded in June to Mark Davison Timber Cutting. All target trees for release in the modified thinning prescription were flagged by SPU forest ecology staff prior to thinning. The cutters were paid on an hourly basis ($70/hr), with a not-to-exceed amount of $7,300. Five cutters worked for three days for a total of 98 person hours, with a final cost of $6,860. Even with the modified prescription, the per acre cost was higher than in 2010 with an average of $600/acre and a range of $331-$1,268/acre, although the production rate was similar to the 2010 cutters at an average of 0.13 ac/hr. The per acre cost varied among transects and treatment types (thin, gap, ITR) and depended on the distribution of treatment types along the transects, cutter experience, number of cutters working on a unit. For example, the highest per acre cost of $1,268/acre accrued when two less experienced cutters worked together on a thin unit (the cost basically doubled from the average rate, meaning they did not work twice as fast because they were a team). When these cutters were excluded from the cost/acre calculation, the cost dropped down to $508/acre, which is directly comparable to the cost in 2010. Contrary to 2010, the gap treatments were done more quickly than the thin units at 0.17 ac/hr compared to 0.11 ac/hr, although the difference was slight. Perhaps one factor for the higher total per acre cost was the higher proportion of thinning in 2011 (90% of the treatment area) relative to 2010 (85% of the treatment area).

The modified thinning prescriptions resulted in patchier forest structure than the 2010 spacing prescriptions, but they did not reduce the overall stand density as much as in 2010 (Figure 7). The wide range of trees to cut (3-7) within 20 ft of each target tree allowed the cutters perhaps too much flexibility, and they did err on the lighter side rather than the heavier side of cutting. With the patchier thinning, small canopy gaps were created (rather than a more open canopy as shown in Figure 5 from the spacing prescription), and it will be interesting to contrast the different thinning treatments over time, especially for the development of marbled murrelet habitat conditions. Because fewer trees were cut with the modified thin prescription, the resulting down wood loading is substantially less than in the 2010 thin treatments. Girdling of larger co-dominant competitors of target trees will result in greater snag recruitment in the short term and will phase the pulse of down wood in the thin units.

Figure 7. Post-thinning canopy structure from the 2011 modified thinning prescription.

Planting took place in the eight gaps that were created in 2010. SPU Ecosystems staff planted these gaps in April, 2011 before road decommissioning started. Primary species planted include western white pine (125) and Douglas maple (100), with some western red cedar (50). Approximately 40 seedlings were planted in each of the eight gaps on Transects 1-5.

Remaining Implementation Needs

Three remaining gaps (Transects 11-13) that were created in 2011 still need to be planted. Total gap area is 3 acres, although planting is concentrated in relatively small portions of each gap.

The road abandonment work on the 121.1 Road was mostly completed in 2011 and fully completed in 2012. Two and a half miles of road were planted with a mixture of deciduous and coniferous species, including black cottonwood, bitter cherry, cascara, noble fir, western white pine, and shore pine. Planting was completed in certain sections of the decommissioned road to help control dense patches of Scots broom. In total, 4610 trees were planted along the decommissioned road, including 2790 coniferous trees and 1820 deciduous trees. These trees should be assessed for survival and growth, as the site conditions are relatively harsh.

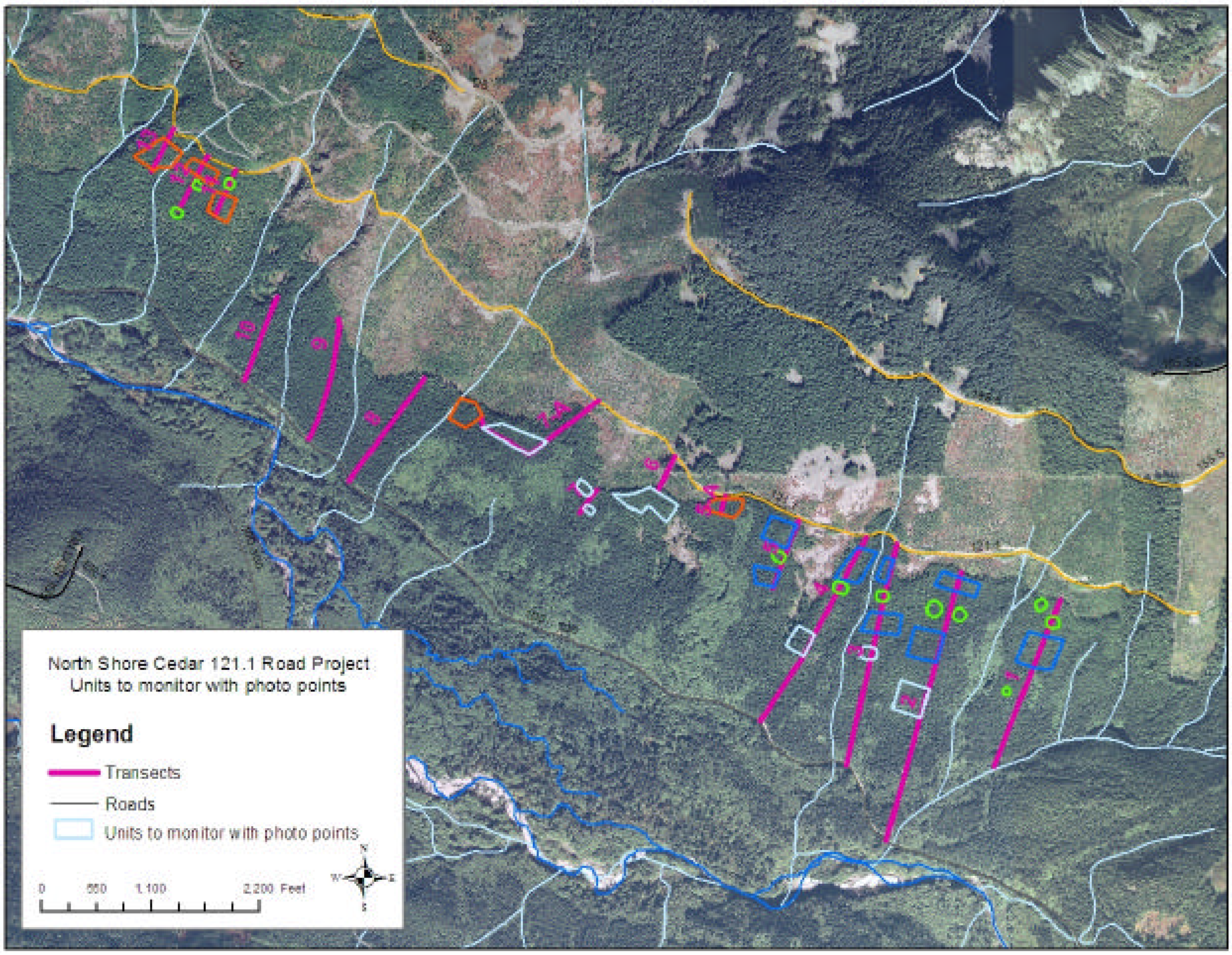
Planting in designated riparian areas will occur in the spring or fall of 2013, and will be accessed from the 100 Road. Approximately 16 acres are targeted for low density planting (50-100 plants/ac), with tree species to include western red cedar, Sitka spruce, noble fir, big-leaf maple, and black cottonwood.

The thin and gap treatments that were designed on the lower slope along the 100 Road should be revisited to determine whether to proceed as currently designed or whether additional/different areas should be treated in the context of a larger habitat restoration project along the 100 Road. This determination should be done in the context of improving marbled murrelet habitat in currently dense stands along the flank of the Cedar River valley.

Monitoring

Since access is difficult and the treatment planning and implementation was very site specific (rather than designed for active adaptive management), there are no intensive monitoring plans for this ecological thinning project. A few photo points will be established in mid-slope treatments that can be accessed from the 100 Road, and notes will be taken on forest response to the treatments. In order to follow both the spacing prescription (2010) and the clumpy thinning prescription (2011), photo points should be established in treatments areas from both years. Also, to minimize monitoring time on this project, the points should be arranged such that they can all be visited in one day. With these considerations, points will be established on transect 2 (thin 3), transect 3 (gap 2), transect 4 (thin 2), transect 6 (thin 1), transect 7 (both gap 1 and 2), and transect 7A (thin 1) as shown in Figure 8.

Figure 8. Of the areas completed in 2010-2011, this map highlights units to establish photo points for monitoring.



Items to evaluate will include immediate post-treatment response (windthrow, stem breakage of residual trees) and longer term response (tree growth response, understory response). The photo point should be marked with a rebar stake (or another durable structure like a flagged tree) and a GPS point taken. At least two photo points should be established for each treatment unit.

Additionally, a three-year post-planting walk-through of the planted gaps on transects 1-5 and plantings on the decommissioned 121.1 Road should be done (in 2013) to see how the planted trees have performed.