Restoration Project Stewardship Plan
North Creek Forest/Blarney Forest
Bothell, Washington

University of Washington Restoration Ecology Network
2012-2013

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1. Project Description

The 2013 UW-REN restoration project at the North Creek Forest (NCF) is approximately 850 square meters and sits at the toe of a leeward, moderately steep east-facing slope. The 2013 UW-REN restoration site contains Indianola sandy clay loam soils with increasing clay content moving east approaching the drainage ditch along 112th. On the South Eastern section there are soil patches with higher than expected clay content leading to slower water infiltration and highly irregular hydrology throughout the site.

Prior to restoration, the site was dominated by Himalayan blackberry (*Rubus armeniacus*) with interspersed clumps of salmonberry (*Rubus spectabilis*) (Figure 4). Other seeding and fruiting vegetation on site included; apple tree (*Malus sp.*), red alder (*Alnus rubra*), and big leaf maple (*Acer macrophyllum*) (Figure 5). The restoration site is prime habitat for many avian, mammalian, and invertebrate species, the clumped salmonberry and surrounding trees create cover and nesting sites for the many avian species that visit this site. Additionally there is a substantial quantity of large woody debris throughout the site which provides habitat for small mammals, as well as habitat for insects, reptiles, and amphibians. We suspect a variety of other wildlife such as: rabbit (*Sylvilagus floridanus*), raccoon (*Procyon lotor*), and coyote (*Canis latrans*), use this site but have limited evidence to support it at this time.

The 2013 UW-REN restoration project at the North Creek Forest has been carried out with two comprehensive goals. The project has sought to "promote native plant and animal biodiversity, by establishing a Puget Sound lowland forest ecosystem," and to "create opportunities for meaningful human engagement" (Gorle, C. et al 2013).

In order to ensure the completion of our first goal, which is to, "promote native plant and animal biodiversity, by establishing a Puget Sound lowland forest ecosystem" (Figure 5) the site was carefully cleared of all Himalayan blackberry rhizomes. Following the removal of Himalayan blackberry, a variety of native plant species were installed which will produce an upper to mid and lower canopy layer. In addition to early successional plants, which will quickly develop robust vertical structure, a variety of native tree and shrub species were installed that will produce food for native species throughout the greatest extent of the growing season possible. In an effort to reduce the chance of invasive reseeding a thick layer of mulch (3-6 inches deep) has been treated throughout the restoration area. During the installation process we worked to protect and enhance existing habitat features whenever possible including. but not limited to, woody debris and mountain beaver (*Aplodontia rufa*) tunnels.

Our second goal was to, "create opportunities for meaningful human engagement" (Figure 5). The UW-REN team established monitoring plots in each polygon, which will be studied in the future for compatibility, structure, and functionality (Figure 2). In order to reduce disturbance, a system of trails have been developed to lead visitors to monitoring plots. By

directing human traffic to trails, newly installed plants should have a reduced mortality caused by trampling (Lutz, Halpern 2006).

Expanding community awareness of the North Creek Forest has been one of the most important goals of the North Creek Forest restoration project and UW-REN 2013. By encouraging students from the UW, UWB, CCC, Bothell and Woodinville high schools, The Cub Scouts of America and local Montessori students to utilize North Creek Forrest, a new generation of stewards has hopefully developed. Through various means of outreach, the UW-REN has effectively recruited large numbers of volunteers, and helped Friends of North Creek Forest spread their message of stewardship and preservation on and off the restoration site. With the help of Friends of North Creek Forest (FNCF) and generous community support, many very successful work parties were held. If time permits, the UW-REN team plans to install a willow bench on site within the coming weeks which will act as a community gathering point as well as enrich the site aesthetically and ecologically.

2. Post-installation Site Description with as-built Map

The site has been created to promote native plant communities that will develop through natural succession. The invasive vegetation has been removed, and native species have been installed to best mimic natural communities with similar hydrology. The various hydrological characteristics on site have enabled a high degree of diversity in plantings with an approximate area of 280 meters each. The significant habitat features of the site create three distinct microhabitats, which have been divided into three polygons for planting activity (Figure 3).

Polygon 1

Polygon one encompasses the southernmost section of the site and has sandy loam soils (Figure 1). The site receives uneven amounts of sunlight, with polygon three receiving the most direct sun, and one receives the least. The site has a substantial amount of seasonal surface and subsurface water, flowing west to east through polygon two and three. Polygon one receives the lowest amount of direct sunlight per day, making the polygon most appropriate for species adapted to upland environments in low-light, mature forests. Polygon was dominated by Himalayan blackberry with the exception of an apple tree and the European mountain ash (Figure 4). Polygon one will support species that are adapted to well drained soils and low sunlight.

Polygon 2

The location of polygon two is found due north of polygon one defined by arbitrary borders defined by soil conditions (Figure 1). Polygon two was also dominated by Himalayan Blackberry (Figure 4). Polygon two receives more light than polygon one, and is defined by a slight topographical depression and increased surface and subsurface water flow. This makes it suitable for species adapted to wetland environments and saturated soils.

Polygon 3

Polygon three is the furthest north and extends to the pinnacle of our site (Figure 1). Polygon three is defined by silty clay loam soils, high seasonal hydrologic variability, and receives the most sun of the three. Polygon three was predominately overrun by Himalayan blackberry (Figure 4). Also, polygon three has highly disturbed soils and a substantial amount of fill, consisting largely of 5-6" rocks. Therefore, polygon three is suitable for pioneer species and those which tolerate seasonal water variation. Moreover, polygon three will support species that are adapted to partial sunlight, disturbed soils and irregular water availability.

3. Maintenance plan

Introductory Paragraph

The overall success of our restoration efforts heavily rely on maintenance and preservation of established site conditions with post-installation/treatments. There are four main facets of our comprehensive maintenance to ensure the subsistence and livelihood of the site; plant care, pest control, mulching, and invasive control. At the peak of our maintenance efforts, native plant care is an essential underpinning of the restoration efforts. Moreover, the survival of these installations will determine the success of this project and the adaptability of the newly established lowland Pacific Northwest forest ecosystem. There is a long standing interrelationship between native plants and Pacific Northwest animals which have persevered throughout our region for thousands of years (Leigh 1999). To preserve this interrelationship, pest and invasive vegetation control are of the utmost concern. Bedded within our project goals are varying techniques utilized in order to create a foundation for native plant and animal diversity in the North Creek Forest. Our ability to mitigate these externalities will govern the persistence of our treatments. Ideally, organisms similar to those that naturally occur in intact ecosystems nearby will protect and assist in the survival of local and native plants (Leigh 1999). Mulch management along with manual removal of rhizome will be our main aggressor in combating pest and invasive species. Mulch will naturally improve soil structure, enhance water infiltration, provide plants nutrients, and collectively increases overall ecosystem biodiversity (Chalker-Scott 2009).

Watering

A) Live stakes

Why: The live stake plants used for the project are water-loving plants that do not tolerate over-drying (K. Ewing personal communication). The live stake plants are located in areas which receive substantial natural water, and watering requirements will lessen as shade cover increases.

Where: Live stake plants are located at the East end of polygon two and three.

When: Live stake specimens need to be watered once to twice per week. Over watering in the summer months is unlikely to adversely affect live stake specimens (Leigh, 1999).

Resources & Tools: The water available on site comes from either a spigot located at the center of the 2012 UW-REN restoration site (West of UW-REN 2013 Site) or from a spigot at a neighboring property to the South.

How: Prior to watering, the site should be surveyed for wilting and signs of drought stress. Special attention should be paid to plants showing drought stress. Plants should receive up to one gallon of water depending on conditions. The site has sharply varying hydrology and receives uneven amounts of sunlight, necessitating selective watering to best conserve water resources. When watering plants, care should be taken not to disturb the soil and mulch around the base. Water on the leaves of plants can intensify sunlight and cause damage, it is best to water in the early morning or late evening, but care should be taken to avoid wetting the foliage of plants.

B.) Bare root Shrubs

Why: The bare root shrub specimen installed on site are a mixture of common Pacific Northwest evergreen and deciduous shrubs which can tolerate varied soil moisture but do not thrive in saturated soils. These species will create a varied vertical structure and provide habitat and food production for native animal species.

Where: Bare root shrubs have been placed throughout polygons 1-3 with special consideration for available soil conditions. Species tolerant of moist poorly drained soils have been placed in areas with higher clay content, whereas less tolerant species have been placed in more well drained areas.

When: Bare root specimens need to be watered once to twice per week. Special attention should be paid to ensure mitigate against over watering in poorly draining areas (Leigh, 1999).

Resources and Tools: The water available on site comes from either a spigot located at the center of the 2012 UW-REN site, or from a spigot at a neighboring property to the South.

How: Prior to watering, the site should be surveyed for wilting and signs of drought stress. Special attention should be paid to plants showing drought stress. Plants should receive up to one gallon water depending on conditions. The site has sharply varying hydrology and receives uneven amounts of sunlight, necessitating selective watering to best conserve water resources. When watering plants, care should be taken not to disturb the soil and mulch around the base. Water on the leaves of plants can intensify sunlight and cause damage, it is best to water in the early morning or late evening, but care should be taken to avoid wetting the foliage of plants.

C.) Bare root Evergreen Trees

Why: The bare root Evergreen species installed on site area mixture of Western red cedar (*Thuja plicata*), Douglas fir (*Pseudotsuga menziesii*), Western hemlock (*Tsuga heterophylla*), and Sitka spruce (*Picea sitchensis*). By utilizing the four species and staging them in areas which meet their specific soil tolerances we hope to accelerate secondary succession.

Where: Bare root Evergreen trees have been placed throughout polygons 1-3 with special consideration for available soil conditions. Species tolerant of moist poorly drained soils have been placed in areas with higher clay content, whereas less tolerant species have been placed in more well drained areas.

When: Bare root specimens need to be watered once to twice per week. Special attention should be paid to ensure mitigate against over watering in poorly draining areas (Leigh, 1999).

Resources and Tools: The water available on site comes from either a spigot located at the center of the 2012 UW-REN site, or from a spigot at a neighboring property to the South.

How: Prior to watering, the site should be surveyed for wilting and signs of drought stress. Special attention should be paid to plants showing drought stress. Plants should receive up to one gallon water depending on conditions. The site has sharply varying hydrology and receives uneven amounts of sunlight, necessitating selective watering to best conserve water resources. When watering plants, care should be taken not to disturb the soil and mulch around the base. Water on the leaves of plants can intensify sunlight and cause damage, it is best to water in the early morning or late evening, but care should be taken to avoid wetting the foliage of plants.

D.) Potted Plants

Why: Potted plant species utilized on site were a mixture of evergreen and deciduous shrubs, and evergreen and deciduous trees. These species have had more time to develop than the bare root species and thus will allow for additional varying structure and will produce appreciable habitat more rapidly.

Where: Potted plants have been placed throughout polygons 1-3 with special consideration for available soil conditions. Species tolerant of moist poorly drained soils have been placed in areas with higher clay content, whereas less tolerant species have been placed in more well drained areas.

When: Potted specimens need to be watered once to twice per week. Special attention should be paid to species with new growth or during the summer months (Leigh, 1999).

Resources and Tools: The water available on site comes from either a spigot located at the center of the 2012 UW-REN site, or from a spigot at a neighboring property to the South.

How: Prior to watering, the site should be surveyed for wilting and signs of drought stress. Special attention should be paid to plants showing drought stress. Plants should receive up to one gallon water depending on conditions. The site has sharply varying hydrology and receives uneven amounts of sunlight, necessitating selective watering to best conserve water resources. When watering plants, care should be taken not to disturb the soil and mulch around the base. Water on the leaves of plants can intensify sunlight and cause damage, it is best to water in the early morning or late evening, but care should be taken to avoid wetting the foliage of plants.

E.) Plugs

Why: Plug species installed on site were a mixture of sedges and rushes. These species are excellent for binding saturated soils and provide cover for small animal species, as well as edible seeds (Leigh, 1999). Sedges and rushes have been placed in polygons two and three to help combat invasion from reed canary grass located in the drainage ditch adjacent to 112th Ave.

Where: Sedges and rushes have been placed in polygons two and three with special consideration for available soil conditions. Most of the sedges and rushes have been placed in polygons two and three, which are the wettest and borders the drainage ditch.

When: Plugs need to be watered once to twice per week. Special attention should be paid to species with new growth or during the summer months (Leigh, 1999).

Resources and Tools: The water available on site comes from either a spigot located at the center of the 2012 UW-REN site, or from a spigot at a neighboring property to the South.

How: Prior to watering, the site should be surveyed for wilting and signs of drought stress. Special attention should be paid to plants showing drought stress. Plants should receive up to one gallon water depending on conditions. The site has sharply varying hydrology and receives uneven amounts of sunlight, necessitating selective watering to best conserve water resources. When watering plants, care should be taken not to disturb the soil and mulch around the base. Water on the leaves of plants can intensify sunlight and cause damage, it is best to water in the early morning or late evening, but care should be taken to avoid wetting the foliage of plants.

Pest control

The site is expected to experience herbivory and colonization by invasive species. The site should be monitored for herbivory and colonization by invasive species. Herbivory will likely be carried out by black tailed deer (*Odocoileus hemionus columbianus*), and mountain beaver. Both species have been reported to be deterred from herbivory by applying chili powder to plants (Fitzgerald, Curtis, Richmond, and Dunn). During the final phases of the project, managers have been supplying the mountain beaver with forage stuffs from the adjacent forest, to prevent herbivory of installed plants. Until an alternative solution arises, it is recommended that this practice is continued. The following information applies specifically to collecting forage for the mountain beaver*:*

In addition, mountain beaver subsists largely on sword fern, but has been observed to collect and store Oregon grape (*Mahonia nervosa*),fringe cup (*Tellima grandiflora*), and stinging nettle (*Urtica dioica*), as well as fresh growth of native conifers, Douglas fir, Western red cedar, and Western hemlock. The mountain beaver eats the fleshy cambium of the conifer species, meaning that only supple, new growth is suitable (Campbell & Evans 1988). At present, data suggests that approximately 10 stems of vegetation delivered to the entrance of the burrow every two-three days will prevent herbivory of installed plants.

Mulching

The project goals include a 6" layer of mulch spread across the site to reduce watering requirements, protect soil from erosion, and aide in the maintenance of invasive vegetation. As this stewardship plan is being created, the site has slightly more than half the desired quantity of mulch. Mulch has been applied with consideration to installed plants, to maximize the effects of water retention. Plans are underway to see the remaining quantity of mulch delivered, and applied to the site prior to project completion. However, it may be necessary to acquire additional mulch to ensure maximum project viability. Amendments will be made to this document as mulch is delivered. Furthermore, mulch has been spread throughout the polygons in timely intervals to maintain a substantial layer for invasive control.

Invasive Control

The site has been cleared of invasive species to the greatest degree possible at this time. The site is expected to see re-colonization by reed canary grass (*Phalaris arundinacea*), Himalayan blackberry, and chickweed (*Stellaria media*). All of which are best controlled by manual removal. The chickweed is a shallow rooted plant and can usually be pulled from the ground with little effort. Himalayan blackberry is likely to recolonize on site from boarders as well as from remnant rhizome material on site. It is likely that Himalayan blackberry sprouts will have substantial root systems, but care should be taken to ensure that all rhizome associated with sprouts are removed. Moreover, there is a ditch alongside the eastern border of our site that has an encroaching area of reed canary grass. Similarly to the treatments above, we plan on combating this invasive organism by shading out reed canary grass with native species and mulching areas to prevent the future invasion.

4. Monitoring plan

The objectives of this monitoring plan are to watch particular ecological functions and processes throughout time. There should be particular interest in the successive structural development within all three polygons. Monitoring should be oriented toward the structural integrity of the native flora and vigilance over invasive recurrences. This will be particularly important during the establishment phase of the native plants and trees which will take several years. Monitoring will allow the opportunity to watch successional development of a new forest canopy and sub canopies as well as the transformation to habitat friendly functions. Our first goal was to enhance the ecological services in each polygon. Therefore, there must be treatments in place to allow a variety of successional species to produce viable new habitat for resident and migratory wildlife (Figure 5). The second goal was to create meaningful opportunities for human engagement (Figure 5).

Photo Monitoring

There are three fixed photo observatory pylons installed, one in each polygon. It was the intention to place these monitoring units in areas of easy access in accordance with goal two of our proposal. Please refer to (Figure 2) of the appendix for the location map of these posts.

Polygon one has its photo monitoring unit located up behind the old garage foundation located on the west side of polygon one. It is situated to strap a camera approximately five feet off the ground aimed east to view most of the polygon. Polygon ones photo post is labeled with a reflective letter "A" and resides just south of quadrat (1B).

Polygon two had its photo post placed just to the west of the cross sectional trail. Labeled "B" with a reflective letter, it was placed in this particular position to be used as a three hundred and sixty degree photo point. To monitor this area, place a camera approximately five feet off the ground and take a photograph. (Repeat on all four sides) Using this practice will allow all polygons to be photographed from this vantage point.

Polygon three has a photo pole situated at the corner of the main trail and the cross sectional trail. It is labeled with a reflective letter "C" for identification. Placing a camera approximately five feet off the ground under the letter "C" will allow an eastern exposure of the polygon. It is also possible to place the camera on the south side of the poll and get a photograph of the other polygons.

We suggest late summer and late winter for taking these photographs; by taking photographs during these times of the year. This will allow for a visual record during the more extreme plant conditions (dormancy to full bloom) in relation to the seasonal flora.

Quantitative Plot Sampling

We have installed five quadrats throughout the project site. Each quadrat is sixteen square meters (4m x 4m) and are placed eight or more meters apart. Each of the five quadrats are marked with wooden survey stakes, flagged with green and blue survey tape, and labeled according to which quadrat it is in relation to the polygon it resides in. Please refer to the quantitative table for a list of plants that were installed in all five quadrats (Figure 6). The purpose of these quadrats is to allow the quantitative monitoring of area growth in different micro-environments. It is our judgment that the plants and trees we placed within these quadrats will flourish in the environments they are in, however due to delays and mass influxes of volunteers some variability in where the plants were placed was outside the scope of our plan. Because of this issue it will be important to identify plant and tree mortality within the quadrats and elsewhere on the restoration site.

There are two monitoring quadrats in polygon one. Quadrat (1A) is located on the south side of the main trail on the east side of the polygon by 112th avenue. Within this quadrant there

is a great deal of woody debris. Quadrant (1B) is located approximately one foot to the south of the old garage foundation on the western portion of the polygon, with the main trail traversing inside the northern edge of the quadrant. Both of these quadrats have heavy dense shade most of the day, year round. We placed these two quadrats in their particular location for that reason.

Polygon two also contains two monitoring quadrats. The first quadrat (2A) is located on the east side of the polygon between the cross sectional trail and the ditch line along 112th avenue. This particular quadrat is in the heart of the wetland area and has a high density of new native flora. The second quadrat (2B) is located on the west side of the cross sectional trail on the upper elevation of the polygon running downhill to the east. This quadrat is bordered by dense salmonberry which dominates the area between this quadrat and last year's UW-REN restoration site. Sun exposure is moderate in this polygon. Soil conditions move from dry in the west to saturated in the east.

Polygon three has the smallest planting area, and could only accommodate one quadrat (3A) at the standard size we chose. We placed this quadrat on the north east corner east of the cross sectional trail near the ditch line of 112th avenue. There are several differentiations in the terrain from micro depressions and mounds. This area gets full sun and can dry out quickly however, in the northern part of the quadrat the water table reside approximately twelve inches below the surface and is prevalent on the surface after major rain events.

In each quadrat, vegetation monitoring should be conducted in late spring; this is the easiest time to assess cover (blank sheet at end of document Figure 8). The information collected should include: number of each species present, percent vegetation cover, individual mortality, recruitment of species, and vegetation layer at the time of monitoring. Count the number of individual species seen in the quadrat, if there is an abundance of one species and it is hard to count it, try to estimate the number. Good estimates can be made by considering the average size of the individuals. Canopy cover should be assessed as an estimated vertical projection of the outline of each species (native and non-native) cover and represented as a percent of the quadrat being sampled. It is most accurate to have two to three people making estimates and then coming together to compare their observations in order to make a consensus of the coverage. The species should also be classified in the layer they represent at the time the monitoring takes place. Vegetation whose main leaf structure is from 0 - 50 cm above the ground should be classified as the ground layer. Vegetation whose main leaf structure is from 50 cm - 3 m above the ground should be classified as low mid-canopy layer. Vegetation whose main leaf structure is from 3 - 6 m above the ground should be classified as high mid-canopy layer and vegetation whose main leaf structure is above 6 m above the ground should be classified as upper canopy layer. In the first 10 years of growth, the shrub layer should develop into a low to mid layer deciduous canopy. As the structure of the canopy develops, in approximately 15 - 20 years, it may be helpful split up the layers as listed above to better analyze the development and diversity of the canopy. To get the totals of species and percent cover add each column. To get the totals of each layer and species within that layer add all the individuals of each layer seen. Note that total

vegetation cover for each quadrat can exceed 100% due to canopy overlap. The mortality of species in each quadrat will be easily distinguishable in late spring because there will be no growth and dead brittle branches. Careful observations of the suspected dead species must be taken to ensure they are in fact dead. Recruitment of species may be hard to tell but do what you can to see what new species have arrived; look for seedlings of trees and very small herbaceous species emerging through the mulch.

Monitoring Methods

Polygon one is considered more of an upland forest and has a considerable amount of shade in comparison to the other two polygons. Within polygon one resides mountain beaver which is an herbivore. During the installation phase of polygon one, two and three, there was identifiable activity resulting in the loss of some of the new plant stock. It is advisable to monitor the new plantings for damage by the resident mountain beaver. If damage is found it may be possible to deter further plant and tree loss by mechanical measures, such as live entrapment and relocation of the target species. There is a heavy amount of woody debris in this polygon so it would be advisable to watch for invasive Himalayan blackberry. Due to the large amount of Himalayan blackberry that was removed from the site it was especially difficult to remove it from under some of the woody debris. If the invasive vegetation should have a recurrence in this area, remove it all as soon as possible by digging up the rhizome remnants. As part of the stewardship plan the Cub Scouts from Troop 64 may be a good source for volunteers as well as students from either the University of Washington Bothell or Cascadia Community College.

Polygon two is a very diverse type of ecosystem from the other two. In this polygon there is a large amount of ground water near the surface. Most of the eastern portion of this polygon is a wetland; sedge and other native flora were placed in this area in hopes that it will curb the reed canary grass infestation within the bordering ditch line. This polygon was almost completely covered with Himalayan blackberry at the beginning of the project and will need to be monitored for recurrences regularly. Common rush (*Juncus effusus*) was placed in the ditch line on the eastern border in hopes that it will curb the invasion of reed canary grass that is currently present. Depending on the invasion of reed canary grass into the site, it will need to be removed by hand or covered in sheet mulch to deprive it of light. This would entail covering with organic materials such as jute or burlap sheeting and wood chips. The city of Bothell claims it mows the ditch line four times a year but this will not stop the spread. The use of volunteers from UWB and CCC and other sources would be advisable to remove it from all the polygons and encourage the City of Bothell to maintain the ditch line. The rush and sedge that was installed in the wetland area, and along the ditch line might outcompete the reed canary grass. The installation of various live stake trees should help shade it out through time (Figure 3).

Polygon three includes an existing elevated area on the east side of the cross sectional trail between the wetland area of polygon two, and a similar, smaller, wetland in polygon three to the north. It will be important to monitor these areas for flora hydration (or the lack of) during

the dry season until the plants have had a chance to establish. Many live stake trees were placed along the eastern edge of this polygon to eventually create shade and inhibit the continuous threat of invasive reed canary grass in the ditch line. The installation of common rush along the ditch line may help curb an invasion of the reed canary grass as well as the willow and red osier dogwood (*Cornus sericea*) live stake trees once capable of producing shade. There will be a need to watch for the recurrence of Himalayan blackberry in this polygon as well. Remnant rhizomes of this invasive may still are on this part of the site. If re-emergence occurs, carefully remove it with the remnant rhizome to ensure it will not continue to be an issue. Essentially the tree species installed were placed where they are to create shade as quickly as possible and the common rush was placed to help prevent infestation of the reed canary grass present on the eastern border. If the reed canary grass starts to invade the site we recommend sheet mulching and wood chips until the flora has created enough shade to prevent infestation of the polygon.

Baseline monitoring report

On May 12, 2013 a base line report of species was conducted (Figure 7). As stated above, data was collected regarding: the number of each species present, percent vegetation cover, amount of individual mortality, the recruitment of species, and vegetation layer at the time of monitoring. At this time the species are mainly in the groundcover layer regardless of what their future projected layer is. This is because most of the plantings measure fewer than 50 cm in height and are still very young. There are a couple of exceptions such as a cottonwood (*Populus balsamifera ssp. trichocarpa*) and a few Pacific willow (*Salix lucida ssp. lasiandra) l*ocated in 2-A and in 1-B there is some salmonberry which all fall in the shrub layer. In quadrats 1-A, 1-B, 2-A, and 3-A some species still need to be installed. In quadrats 1-A and 1-B beaked hazelnut (*Corylus cornuta*) will be added, the density is unknown at this time. In 2-A quadrat sawbeak sedge (*Carex stipata*), tufted hairgrass (*Deschampsia caespitosa*), creeping spikerush (*Eleocharis palustris*), slender rush (*Juncus tenuis*), and small-flowered bulrush (*Scirpus microcarpus*) will be added at a density unknown at this time. In quadrat 3-A goat's beard (*Aruncus dioicus*), sawbeak sedge (*Carex stipata*), tufted hairgrass, creeping spikerush, slender rush (*Juncus tenuis*), red elderberry (*Sambucus racemosa*), and small-flowered bulrush (*Scirpus microcarpus*) will be added at a density unknown at this time. It should be noted that in all the polygons some plantings have not yet been added due to availability of species. All should be planted by the middle of June.

5. Long term site management plan

Our long term goals of managing the North Creek Forest are to create a self-sustaining forest that supports natural succession. As the site develops, it will require decreasing levels of maintenance. The anatomy of Himalayan blackberry makes it nearly impossible to remove without continued maintenance. The site will need to be monitored for the persistence of Himalayan blackberry from remnant rhizomes, site boarders, and seed dispersal. The site will

become more resistant to colonization by Himalayan blackberry as the shade producing canopy is established, but the presence of adjacent populations necessitate continued maintenance. During the first 2 years post-installation, it is expected that the installed plants will need to be watered up to twice per week, during dry periods (K. Ewing personal communication).

6. References

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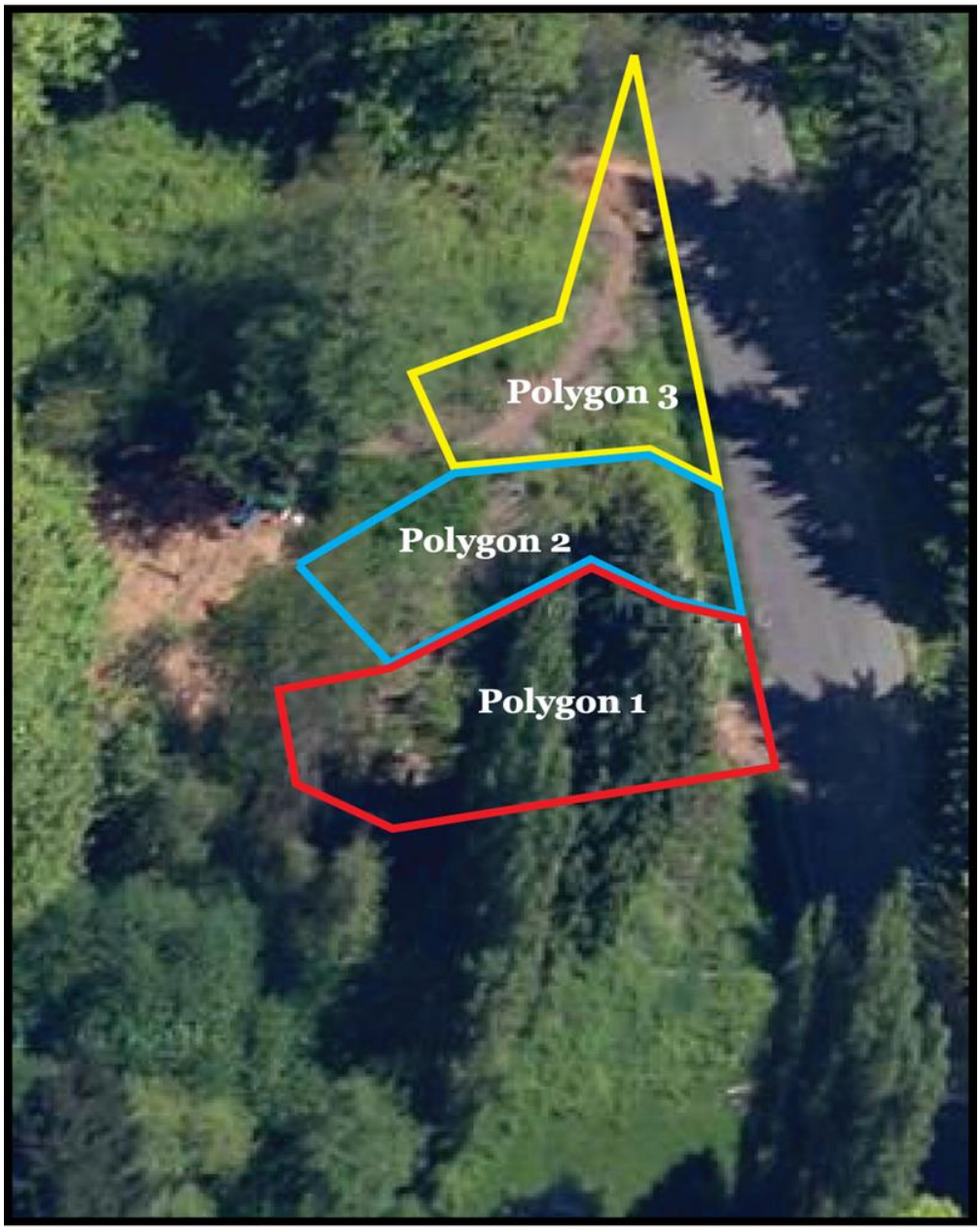
7. Appendices

Polygon Map



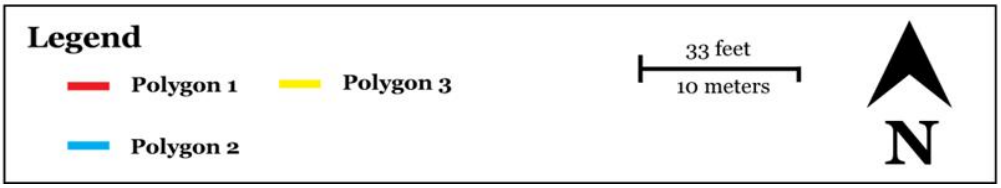


Figure 1. Site boundaries and polygon delineation

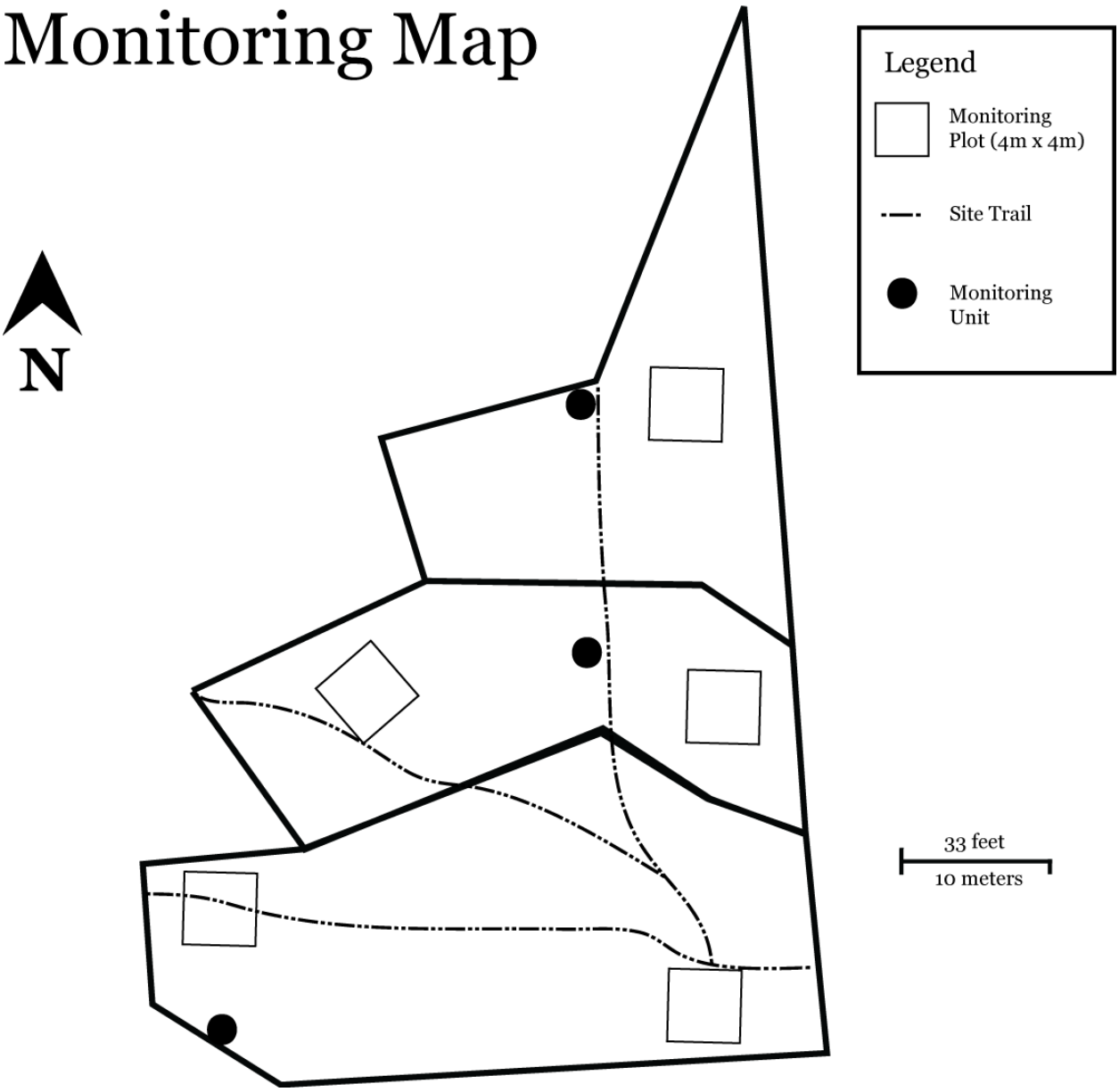


Figure 2. Monitoring map of posts and quadrats.

As-Built Map

Acer circinatum 1

Aruncus dioicus A

Betula papyrifera 2

Carex obnupta 3

Carex stipata B

Cornus sericea 4

Corylus cornuta 5

Deschampsia caespitosa C

Eleocharis palustris D

Gaultheria shallon 6

Juncus tenuis E

Lonicera involucrata 7

Mimulus luteus F

Oemlaria cerasifornis 8

Picea sitchensis 9

Polystichum munitum 10

Pseudotsuga menziesii 11

Ribes sanguineum 12

Rosa Nutkana G

Rosa pisocarpa 13

Rubus parviflorus 14

Salix sitchensis 15

Sambucus racemosa 16

Schoenoplectus tabernaemontani 17

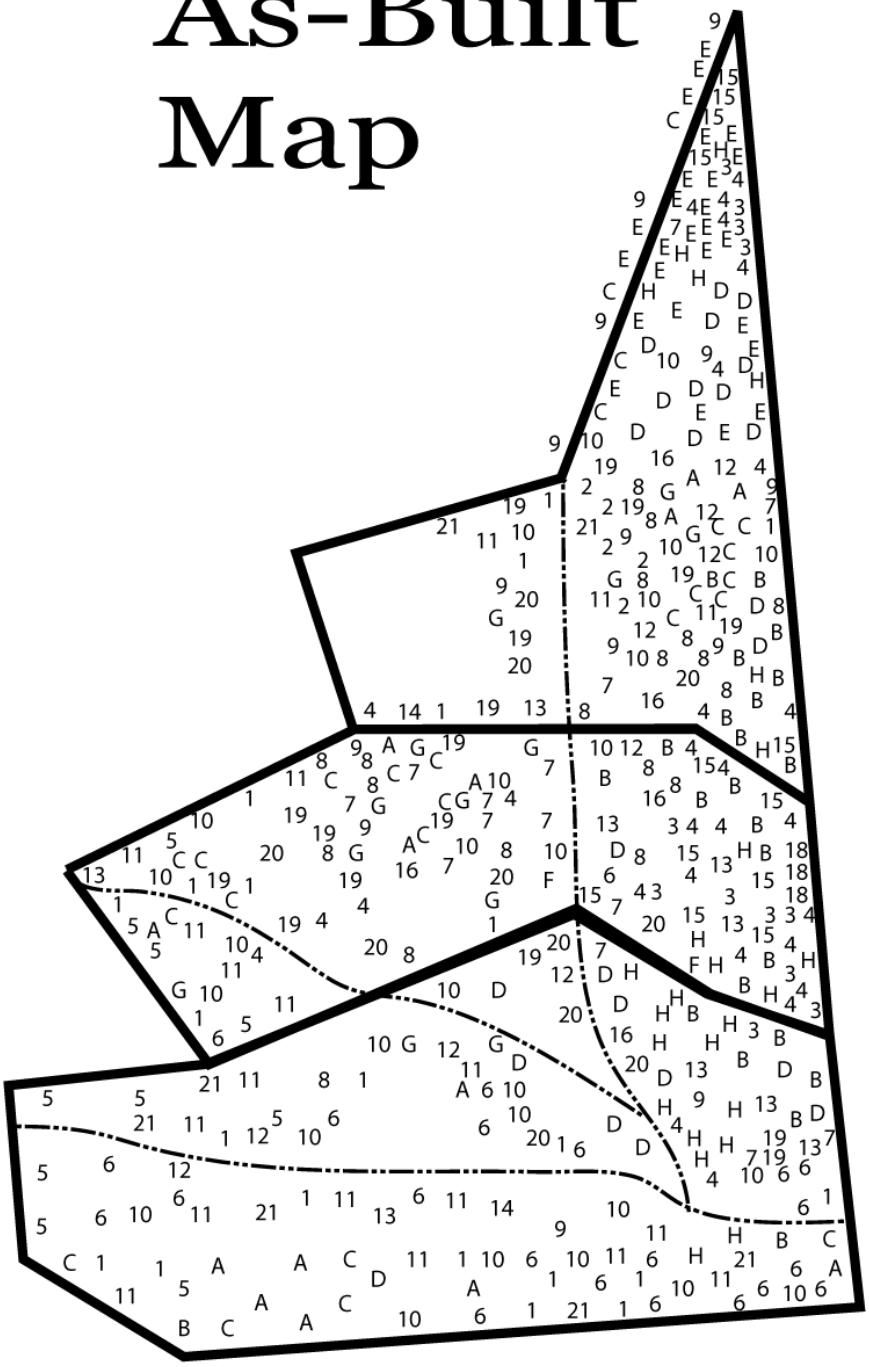
Scirpus microcarpus H

Spiraea douglasii 18

Symphoricarpos albus 19

Thuja plicata 20

Tsuga heterophylla 21



N

***Species sybolized with a letter have not yet been planted. Thier locations are speculative and subject to minor change.**

Figure 3. As-Built Map

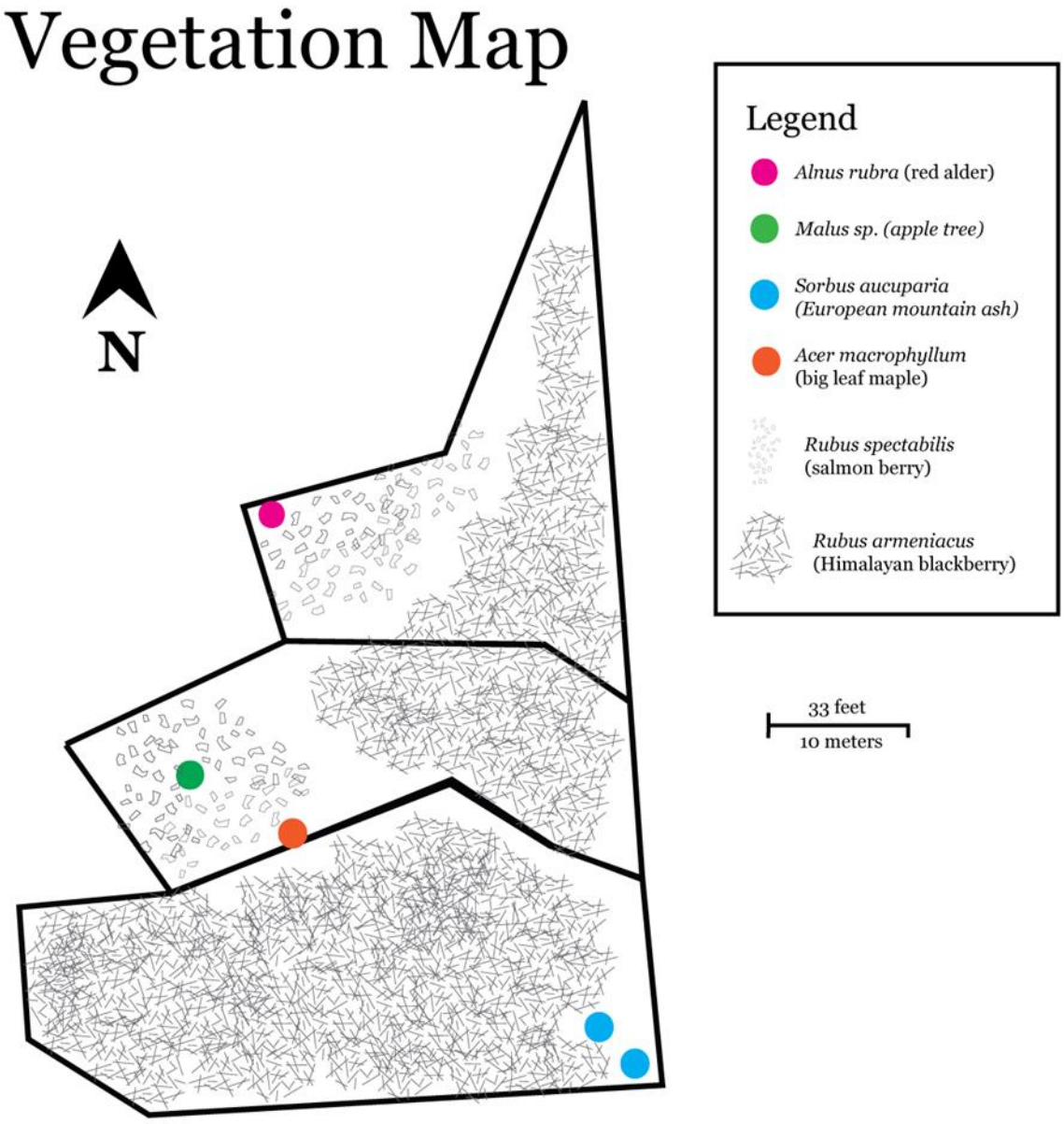


Figure 4. Current Invasive and Native Vegetation

Figure 5. Goals and Objectives

Goal 1) Promote native plant and animal biodiversity establishing a Puget Sound mosaic lowland forests.

Objective 1-1: Remove, and prevent the re-establishment of invasive, exotic plant species,

Objective 1-2: Install a variety of native plant species.

Objective 1-3: Install plant species that will offer habitat features to both observed and potential animal species.

Objective 1-4: Maintain habitat features such as woody debris and underground tunnels.

Goal 2) It is in our interest to create opportunities for meaningful human engagement.

Objective 2-1: Experimental planting areas including ecological communities which will be studied in the future for compatibility, structure and functionality.

Objective 2-2: The areas set aside as experimental quadrats will be located in spaces that are easily accessible, reducing the possibility of disturbances in non-experimental sectors.

Objective 2-3: Expand community awareness of the North Creek Forest by encouraging UW and high school classes to utilize NCF as an asset to develop awareness and community stewardship.

Objective 2-4: Maintain an active relationship with the city of Bothell parks department.

Objective 2-5: Foster engaging and meaningful volunteer events allowing participants to gain a better understanding of the their local ecology, and participate in restoring a native forest.

Objective 2-6: Install an organic art component themed as a habitat structure, designed to contribute both aesthetically and ecologically as it decays. Currently proposed concepts include: record-setting bramble-spheres, large stumps and carvings.

Polygon 1		Polygon 2		Polygon 3	
Quadrat	**Species**	**Quadrat**	**Species**	**Quadrat**	**Species**
1-A	*A. circinatum*	2-A	*C. obnupta*	3-A	*A. dioicus ^*
	C. cornuta ^		*C. sericea*		*C. sericea*
	E. ciliatum		*C. stipata ^*		*Carex stipata*
	G. shallon		*D. caespitosa ^*		*D. caespitosa ^*
	M. nervosa		*E. arvense*		*E. palustris ^*
	P. munitum		*E. palustris ^*		*J. tenuis ^*
	T. grandiflora		*J. tenuis ^*		*L. involucrata*
	T. heterophylla		*M. guttatus*		*O. cerasiformis*
1-B			*O. cerasiformis*		*P. menziesii*
	C. cornuta ^		*P. balsamifera ssp. trichocarpa*		*P. munitum*
	G. shallon		*R. lacustra*		*P. sitchensis*
	O. cerasiformis		*R. pisocarpa*		*R. sanguineum*
	P. munitum		*S. cooleyae*		*S. albus*
	R. spectabilis		*S. lucida ssp. lasiandra*		*S. microcarpus ^*
	T. grandiflora		*S. microcarpus ^*		*S. racemosa ^*
		2-B	*O. cerasiformis*		
			P. menziesii		
			P. munitum		
			R. nutkana		
			R. parviflorus		
			R. pisocarpa		
			*R. repens **		
			S. albus		
			T. grandiflora		
			T. plicata		

Species not in plot but providing cover, also labled as native- "

Exotic species, may not be invasive - *

species still need to be planted - ^

Figure 6. Quantitative plant list

Plot	Species	# Live	# Dead	% Cover	Recruitment ?	Layer
1-A ^	*A. circinatum*	3	0	0.40	N	G
	E. ciliatum	6	0	0.60	Y	G
	G. shallon	7	2	1.00	N	G
	M. nervosa	0	6	0	N	G
	P. munitum	3	0	0.30	N	G
	R. armeniacus	3	0	0.05	Y	G
	T. grandiflora	11	0	0.80	Y	G
	T. heterophylla	1	0	0.20	N	G
	Totals	**34**	**8**	**3.35**		
Totals	**Native**	31	8	3.30		
	Invasive	3	0	0.05		
Totals	**Ground**	34	8	3.35		
	Shrub	0	0	0		
	Canopy	0	0	0		

Some species still need to be planted - ^

Plot	Species	# Live	# Dead	% Cover	Recruitment ?	Layer
1-B ^	*G. shallon*	1	1	0.10	N	G
	O. cerasiformis	3	0	0.50	N	G
	P. munitum	7	0	12.00	Y- existing	G
	R. spectabilis	6	0	35.00	Y- existing	S
	T. grandiflora	50	0	15.00	Y- existing	G
	Totals	**67**	**1**	**62.60**		
Totals	**Native**	67	1	62.60		
	Invasive	0	0	0		
Totals	**Ground**	57	1	27.60		
	Shrub	10	0	35.00		
	Canopy	0	0	0		

Some species still need to be planted - ^

Plot	Species	# Live	# Dead	% Cover	Recruitment ?	Layer
2-A ^	*C. obnupta*	7	0	1.00	N	G
	C. sericea	4	0	0.70	N	G
	E. arvense	6	0	0.70	Y	G
	M. guttatus	1	0	0.30	N	G

	O. cerasiformis	1	0	0.10	N	G
	P. balsamifera ssp. trichocarpa	1	0	0.40	N	S
	R. lacustra	2	0	0.60	N	G
	R. pisocarpa	1	0	0.60	N	G
	S. cooleyae	1	0	0.40	N	G
	S. lucida ssp. lasiandra	7	0	1.00	N	S
	Totals	**31**	**0**	**5.80**		
Totals	**Native**	31	0	5.80		
	Invasive	0	0	0		
Totals	**Ground**	23	0	4.40		
	Shrub	8	0	1.40		
	Canopy	0	0	0		

Some species still need to be planted - ^

Plot	Species	# Live	# Dead	% Cover	Recruitment ?	Layer
2-B	*A. circinatum*	2	1	0.40	N	G
	A. filix-femina	2	0	0.15	Y	G
	E. ciliatum	1	0	0.01	N	G
	Malus sp. "	1	0	90.00	N	C
	O. cerasiformis	1	0	0.10	N	G
	P. menziesii	3	0	0.60	N	G
	P. munitum	3	0	0.30	N	G
	R. nutkana	1	0	0.10	N	G
	R. parviflorus	1	0	0.10	N	G
	R. pisocarpa	1	0	0.20	N	G
	*R. repens **	3	0	0.40	Y	G
	S. albus	4	0	0.20	N	G
	T. grandiflora	3	0	0.05	Y	G
	T. plicata	1	0	0.40	N	G
	Totals	**27**	**1**	**93.01**		
Totals	**Native**	24	1	92.61		
	Invasive	3	0	0.40		
Totals	**Ground**	26	1	2.01		
	Shrub	0	0	0		
	Canopy	1	0	91.00		

Species not in plot but providing cover, also labled as native- "

Exotic species, may not be invasive - *

Plot	Species	# Live	# Dead	% Cover	Recruitment ?	Layer
3-A ^	*C. sericea*	1	0	0.20	N	G
	L. involucrata	2	0	0.20	N	G
	O. cerasiformis	0	1	0	N	G
	P. menziesii	1	0	0.10	N	G
	P. munitum	1	0	0.05	N	G
	P. sitchensis	1	0	0.25	N	G
	R. sanguineum	3	0	0.50	N	G
	S. albus	2	0	0.05	N	G
	Totals	**11**	**1**	**1.35**		
Totals	**Native**	11	1	1.35		
	Invasive	0	0	0.00		
Totals	**Ground**	11	1	1.35		
	Shrub	0	0	0.00		
	Canopy	0	0	0.00		

Some species still need to be planted - ^

Figure 7. Baseline monitoring data taken 5/12/13 at 10:30am to 1:30pm

Monitoring Photo Pylon A

Monitoring Photo Pylon B

Monitoring Photo Pylon C

Plot	Species	# Live	# Dead	% Cover	Recruitment ?	Layer
	Totals					
Totals	Native					
	Invasive					
Totals	Ground					
	Shrub					
	Canopy					

Figure 8. Blank quadrat assessment sheet