

## **Native Plant Forage Forest Year 1 Assessment**



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For the Galiano Conservancy Association**

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**University of Victoria ES 471 / ER 412**

## **Introduction**

The primary objective of this assessment was to follow up on the extensive plantings done in spring 2018, with the goal of determining what was planted, the plant locations, and the success of the plantings. There were discrepancies between our data and the NPFF planting plan, suggesting that the plan was not followed precisely, and that several plants died. These plants have been presumed dead because they have not been located in the forage forest, it is possible they were never planted. This is a likely scenario as the planting was primarily conducted by volunteers and may have been inconsistent in their planting. That being said, at the time of the assessment, 270 individual plants were located, and many more were dormant underground; a great start to a promising project! The vigour of the plants was medium to very high in 78.2% of individuals. This suggests that most of the plants have been placed in good locations. With reduced browsing pressure, increased shade cover over time, and possibly a few transplants for unhealthy individuals, the NPFF will become even more successful.

The Native Plant Forage Forest (NPFF) is a half hectare eco-cultural restoration site managed by the Galiano Conservancy Association (GCA; Huggins, 2017). It is a previously disturbed site that has been heavily impacted by human use, with a history of intensive logging and use of machinery. While restoration of this area began in 2017, numerous native food, medicine, and culturally significant plants were introduced to the site in early 2018, many of which were planted with the help of volunteers (A. Huggins, personal communication, August 2018). According to the *Restoration Plan* for the NPFF (Huggins, 2017), the five main goals of this restoration project are as follows:

- 1) Restore ecological function and structure to a logged and degraded site
- 2) Engage the Penelakut and Galiano communities in the planning, treatment, and ongoing maintenance of the restoration site
- 3) Document the creation and evolution of the project through various media
- 4) Produce harvestable native plant foods, medicines, and materials
- 5) Monitor the site, report results, and adapt management accordingly

In addition to these goals, underlying goals of food forests include the following: restoration of forest function; diversity of yields; education and cultural sharing; healthy habitats for people



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## **Methods**

The NPFF site was divided into five zones based on the ecological sub-sites suggested in the NPFF *Restoration Plan* (Huggins, 2017; Figure 1), and assessments were conducted zone by zone. Plants were located using existing site maps and the knowledge of GCA members, and unfamiliar species were identified using *Plants of the Pacific Northwest Coast* (Pojar & Mackinnon, 1994). The health of each plant added to the site in 2018 was assessed using an established scale from previous assessments (Galiano Conservancy Association, 2014). This scale from 0-5 was used to describe plant vigour as follows:

- 0 – dead; no new growth, no buds
- 1 – very poor; significant dieback and poor condition/colour of leaves
- 2 – poor; dieback on branches, obvious discolouration, new growth is poor
- 3 – moderate; some dieback on branches, possible discolouration, new growth
- 4 – healthy; plant looks generally healthy with some new growth
- 5 – very healthy; no dieback, robust new growth, no discolouration

Additional observations were recorded for any plants growing under unique circumstances. For example, weedy species growing nearby or together with planted individuals were noted, as well as shade cover from nearby plants or topographic characteristics, and/or unique soil moisture regimes.

Besides individual plant assessments, additional ecological observations were recorded for each of the five zones. These included naturally occurring native species, percent cover of invasive plants, sun exposure, topography, and hydrological characteristics. All factors assessed were based on observations alone, and are therefore strictly qualitative and subjective in nature. Permanent vegetation survey quadrats have been recommended in order to provide more accurate and comparable assessment of plant vigour and species richness across the site (Voicescu, 2018).

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## **Results**

See Appendix A for raw data collected on plant presence, location, vigour and size. These data corresponds to the plant map in Figure 2.

### **I. Presence**

Of the 47 species included in the planting plan, 42 were present (see Appendix A), including: *Acer macrophyllum*, *Achillea millefolium*, *Allium cernuum*, *Amelanchier alnifolia*, *Arbutus menziesii*, *Arctostaphylos columbiana*, *Berberis aquifolium*, *Berberis nervosa*, *Clinopodium douglasii*, *Corylus cornuta cornuta*, *Crataegus douglasii*, *Dodecatheon pulchellum*, *Festuca roemerii*, *Fragaria vesca/virginiana*, *Heracleum maximum*, *Lysichiton americanus*, *Malus fusca*, *Oemleria cerasiformis*, *Prunus emarginata*, *Quercus garryana*, *Rhamnus purshiana*, *Ribes divaricatum*, *Ribes sanguineum*, *Rosa gymnocarpa*, *Rosa nutkana*, *Rubus leucodermis*, *Rubus parviflorus*, *Rubus spectabilis*, *Sambucus racemosa*, *Sisyrinchium canadensis*, *Spirea douglasii*, *Taxus brevifolia*, *Trifolium wormskioldii*, *Vaccinium ovatum*, *Vaccinium parvifolium*, *Viburnum edule*. There were inconsistencies with the number of plantings and the number individuals found, which are shown in table 1.

**Table 1.** Plant count by species.

<b>Latin Name</b>	<b>Common Name</b>	<b># Planted</b>	<b># Found</b>	<b>Notes</b>
<i>Abies grandis</i>	Grand Fir	0	0	
<i>Acer macrophyllum</i>	Bigleaf Maple	3	1	
<i>Achillea millefolium</i>	Yarrow	15	14	
<i>Allium cernuum</i>	Nodding Onion	25	20	
<i>Amelanchier alnifolia</i>	Saskatoon Berry	15	13	
<i>Arbutus menziesii</i>	Pacific Madrone	3	1	
<i>Arctostaphylos columbiana</i>	Hairy Manzanita	0	3	
<i>Artemisia suksdorfii</i>	Coastal Mugwort	5	0	
<i>Berberis aquifolium</i>	Tall Oregon Grape	25	23	
<i>Berberis nervosa</i>	Dull Oregon Grape	13	10	

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<i>Camassia leichtlinii</i>	Great Camas	50+	N/A	dormant
<i>Camassia quamash</i>	Common Camas	50+	N/A	dormant
<i>Clinopodium douglasii</i>	Yerba Buena	5	1	Some occurring naturally were not recorded
<i>Corylus cornuta cornuta</i>	Beaked Hazelnut	1	2	
<i>Crataegus douglasii</i>	Black Hawthorn	3	3	
<i>Dodecatheon pulchellum</i>	Shooting Star	10	N/A	dormant
<i>Festuca roemerii</i>	Roemer's Fescue	10	7	
<i>Fragaria vesca / virginiana</i>	Native and woodland Strawberries	25	17	
<i>Heracleum maximum</i>	Cow Parsnip	5	5	
<i>Lomatium nudicaule</i>	Indian Consumption Plant	25	N/A	mostly dormant
<i>Lysichiton americanus</i>	Skunk Cabbage	3	2	
<i>Malus fusca</i>	Pacific Crabapple	5	3	
<i>Oemleria cerasiformis</i>	Indian Plum	3	2	
<i>Polypodium glycyrrhiza</i>	Licorice Fern	5	0	
<i>Prunus emarginata</i>	Bitter Cherry	0	3	
<i>Quercus garryana</i>	Garry Oak	5	4	
<i>Rhamnus purshiana</i>	Cascara	3	3	
<i>Ribes divaricatum</i>	Wild Gooseberry	15	12	
<i>Ribes sanguineum</i>	Red-flowering Currant	3	3	
<i>Rosa gymnocarpa</i>	Baldhip Rose	5	5	
<i>Rosa nutkana</i>	Nootka Rose	15	12	
<i>Rubus leucodermis</i>	Blackcap Raspberry	20	18	Many were showing up naturally, and not recorded.
<i>Rubus parviflorus</i>	Thimbleberry	15	15	

<i>Rubus spectabilis</i>	Salmonberry	15	19	Some that occurred naturally had been staked and recorded.
<i>Salix scouleriana</i>	Scouler's Willow	3	0	
<i>Sambucus nigra caerulea</i>	Black Elderberry	0	0	
<i>Sambucus racemosa</i>	Red Elderberry	3	1	
<i>Shepherdia canadensis</i>	Soopolallie	3	5	
<i>Sisyrinchium idahoense</i>	Idaho Blue-eyed Grass	20	14	
<i>Spiraea douglasii</i>	Hardhack	3	5	
<i>Taxus brevifolia</i>	Western Yew	2	2	
<i>Trifolium wormskioldii</i>	Springbank Clover	5	3	
<i>Vaccinium ovatum</i>	Evergreen Huckleberry	15	15	
<i>Vaccinium parvifolium</i>	Red Huckleberry	10	8	
<i>Viburnum edule</i>	Highbush Cranberry	5	3	

Species that were reported to be planted but were not found are: *Artemisia suksdorfii*, *Polypodium glycyrrhiza* and *Salix scouleriana*. There were also species that were not reported as planted, but were observed, including *Prunus emarginata* (bitter cherry) and *Arctostaphylos columbiana* (hairy manzanita). There were many discrepancies in the number of individuals reported as planted and those present. Often, fewer were found. In the case of *R. spectabilis*, there were four more individuals observed than had been planted, and some of these occurred naturally in planting areas but had been staked.

## II. Location

The location of individual plants and groupings of plants were mapped (Figure 2), and can be compared to the proposed layout from the NPPF *Restoration Plan* (Huggins, 2017; Figure 3). In addition, an updated map of the pathways throughout the NPPF has been included, as the paths are notably different from those in the original layout map (Figure 4).

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**Figure 2.** Map of all individuals and plant groupings introduced to the site in 2018. Refer to datasheet in Appendix A for corresponding plant information.



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Figure 3. Proposed layout of the Native Plant Forage Forest.

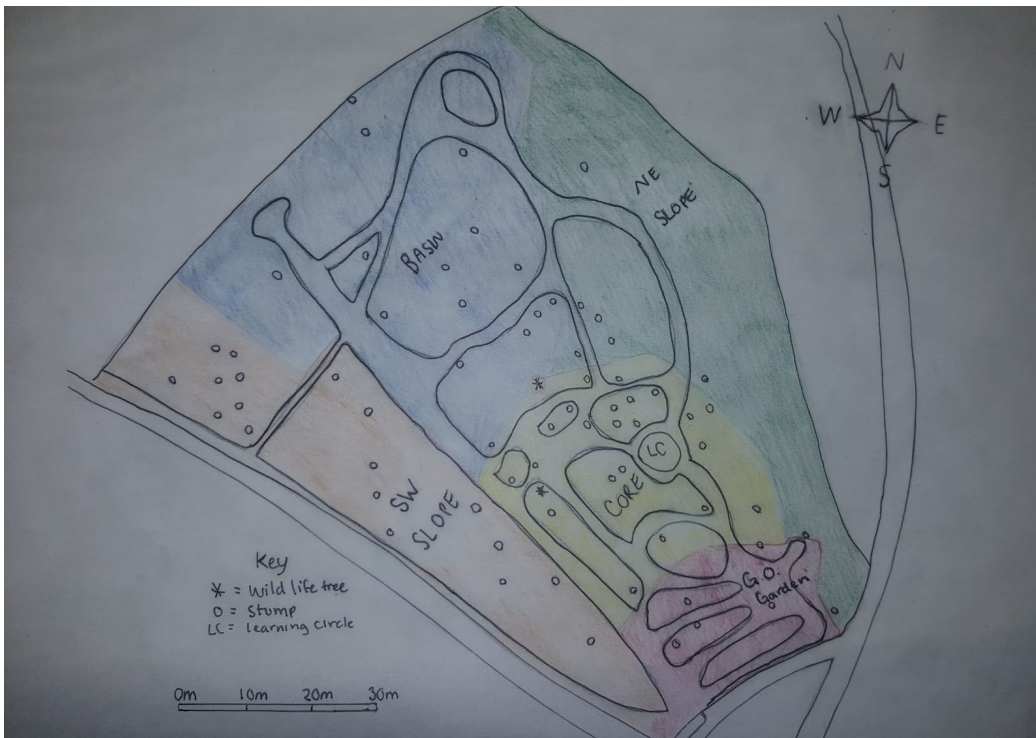
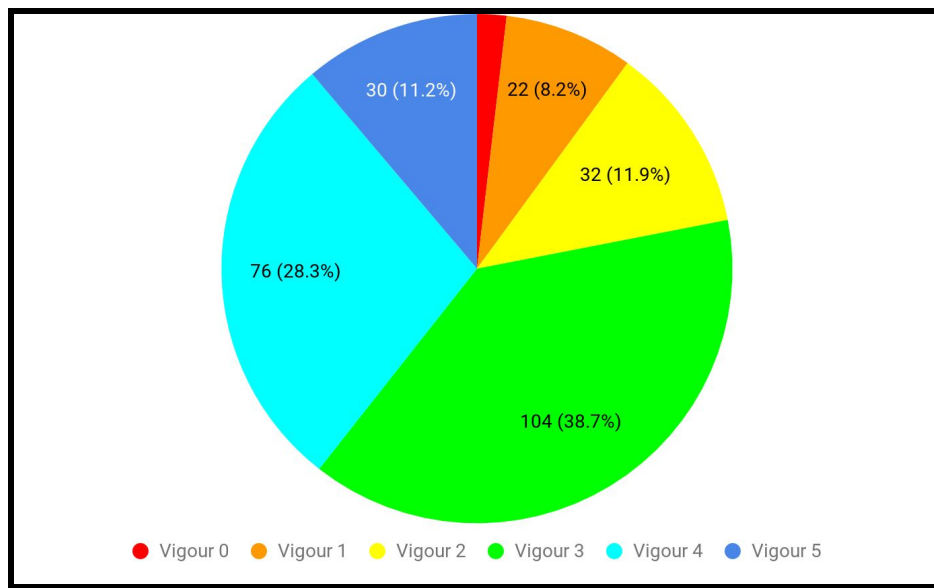


Figure 4. Hand-drawn map of approximate locations of pathways throughout the NPF.

### III. Plant Vigour

Data on plant vigor and location was recorded for 269 individuals from 40 species. There were five species that had no above ground structure at the time of the assessment, so their vigor could not be determined. Those species are: *C. leichtlinii*, *C. quamash*, *D. pulchellum*, *H. maximum* and *L. nudicaule*. The vigor of the plantings has been represented in Figure 5. Of the 269 plants, 104 were moderately healthy (vigor 3), 76 were healthy (vigor 4), and 30 were thriving (vigor 5). Only 5 plants were dead (0), 22 were doing very poorly (1), and 32 were doing poorly (2). Deer browsing was reported as a cause for poor vigor in 38 individuals. Another cause of poor vigor was sun damaged, which was observed on 26 of the plants.

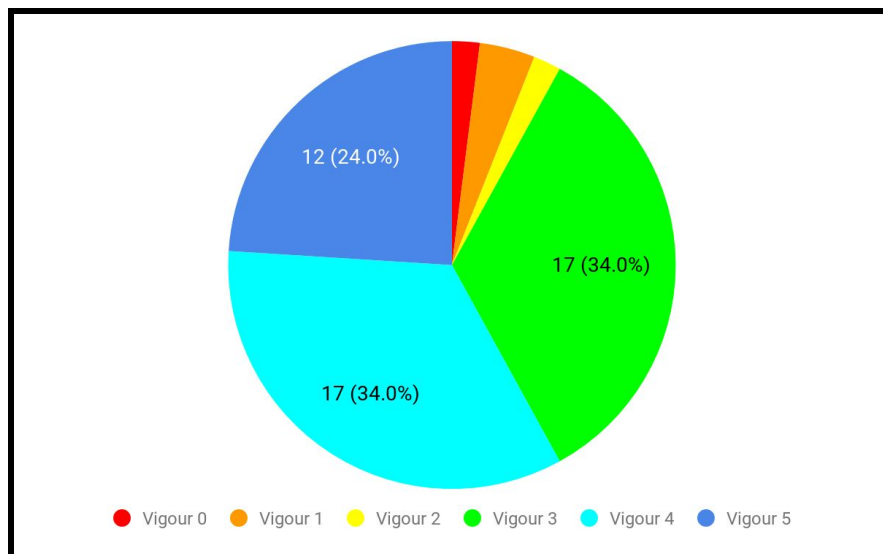


**Figure 5.** Plant vigor as assessed for all individuals introduced to the NPFF in spring 2018.

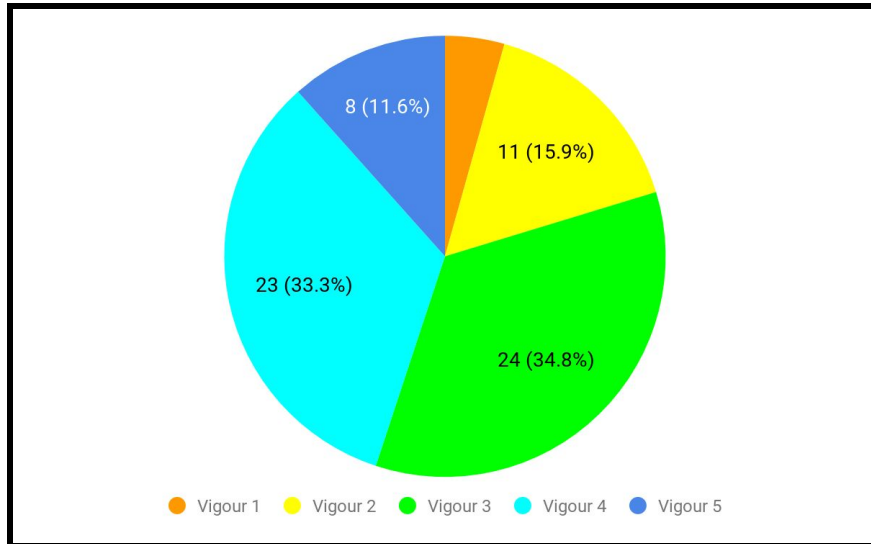
Data on the vigor of the plantings was also assessed by zone. In the Garry oak meadow garden (zone 1), a measurement of vigor was performed on 49 individuals from seven species: *A. macrophyllum*, *A. cernuum*, *A. millefolium*, *F. roemerii*, *R. leucodermis*, *S. idahoense*, *Q. garryana* (Figure 6). In this zone, 92% of the plants showed a medium to very high vigor. One *Q. garryana* (Garry oak) was observed to be dead, and another was never found. In the core area (zone 2), vigor was measured for 69 individuals from 15 species *A. millefolium*, *B. aquifolium*, *B. nervosa*, *Clinopodium douglasii*, *F. vesca/virginia*, *O. cerasiformis*, *R. divaricatum*, *R. gymnocarpa*, *R. leucodermis*, *R. sanguineum*, *S. douglasii*, *T. brevifolia*, *V. ovatum*, *V.*

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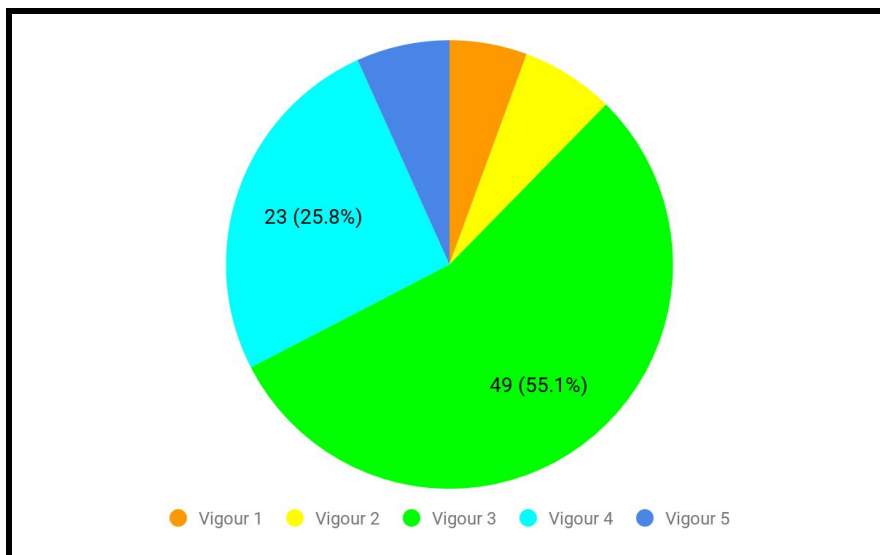
*parvifolium*, and *Q. garryana*. Eighty percent of the plants showed moderate to high vigour (Figure 7) and 20% of the plants in this zone were assessed at poor or very poor health, but no dead individuals were found. There were several individuals of each species planted, and a wide range of vigour was often recorded within a species. The Basin area (zone 3) had the highest number of individuals planted at 89. The 18 species planted were: *C. corunta corunta*, *Crataegus douglasii*, *L. americanus*, *M. fusca*, *P. emarginata*, *R. purshiana*, *R. sanguineum*, *R. gymnocarpa*, *R. nootkana*, *R. leucodermis*, *R. parviflorus*, *R. spectabilis*, *S. racemosa*, *S. canadensis*, *T. brevifolia*, *T. wormskioldii*, *V. parvifolium*, and *V. edule*. The majority (55.1%) of the plantings had a medium vigour, while 32.5% of the plants were healthy or very healthy, and 12.3% were doing poorly or very poorly (Figure 8). The Northeast slope (zone 4) contained the fewest plantings, with a total of only 6 individuals and 2 species from *S. douglasii* and *V. ovatum*. Plant vigour within this zone ranged from very poor to healthy (Figure 9). There were 54 plantings on the SW slope (zone 5), with vigour plotted in Figure 10 below. The following species were planted: *A. alnifolia*, *A. menziesii*, *A. columbiana*, *B. aquifolium*, *B. nervosa*, *Crataegus douglasii*, *F. roemeri*, *R. parviflorus*, *V. ovatum*, and *V. parvifolium*. Four plants in this zone were observed to be dead, all of which were *M. aquifolium* that had been planted along the ridgeline. In addition, all plants observed with very poor health in this zone were *M. aquifolium*. Otherwise, 25.9% of plantings were very healthy or healthy and 50% of the plants showed moderate to poor health.



**Figure 6.** Vigour of plants in Garry Oak Meadow Garden Zone of the NPFF.



**Figure 7.** Vigour of plants in the Core Zone of the NPF.



**Figure 8.** Plant vigour as assessed for the Basin Zone of the NPF.

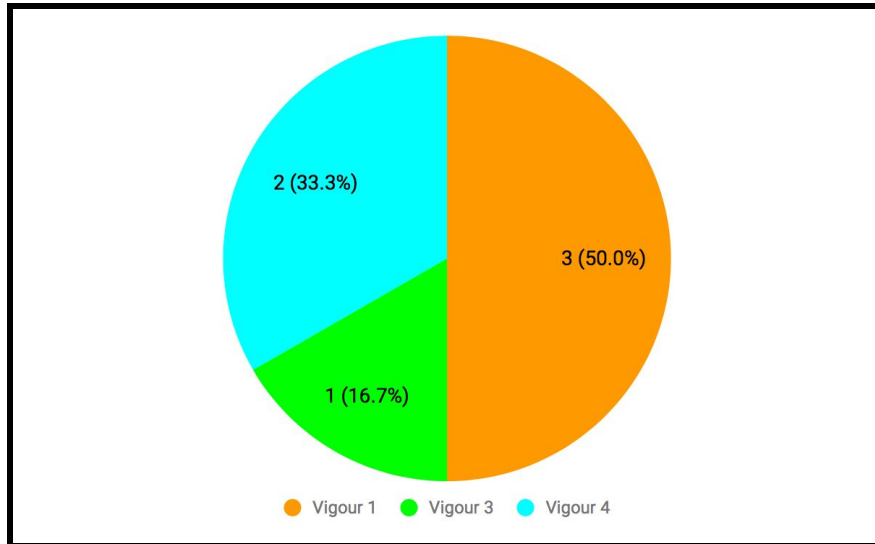


Figure 9. Vigour of plantings in The Northeast Slope Zone of the NPF.

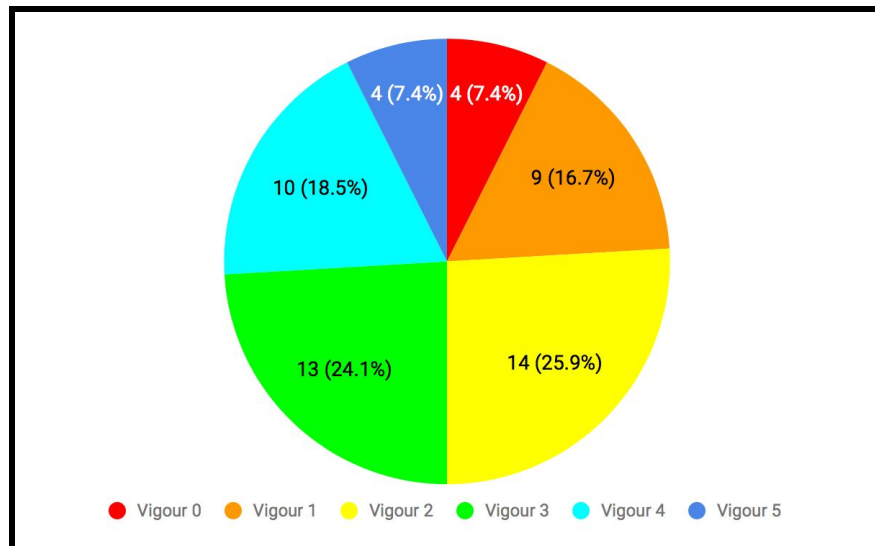


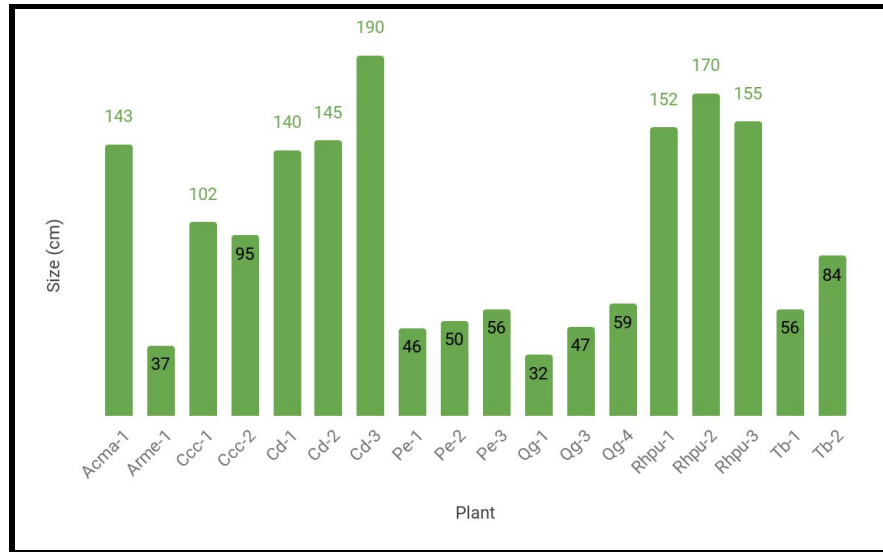
Figure 10. Vigour of plantings in the Southwest Slope Zone of the NPF.

#### IV. Height

There were 8 species and 18 individual tree saplings planted in the forage forest and found during the assessment. The species include: *A. macrophyllum* (Acma -1), *A. menziesii* (Arme -1), *C. cornuta cornuta* (Ccc-1,2), *Crataegus douglasii* (Cd 1-3), *P. emarginata* (Pe 1-3), *Q. garryana* (Qg 1-4), *R. prushiana* (Rhpu 1-3), and *T. brevifolia* (Tb 1,2). Tree size is displayed in Figure 11 below. *A. menziesii*, *P. emarginata*, *Q. garryana*, and *T. brevifolia* were shorter, with

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values ranging from 32 to 84 cm, while *C. cornuta cornuta*, *Crataegus douglasii*, and *R. purshiana* were taller, ranging from 95 to 190 cm tall. The height of each woody shrub in the forage forest was also recorded, of which there were 13 species and 115 individuals. Shrub heights ranged from 24 to 105 cm. Data on the current size of each shrub can be found in Appendix A.



**Figure 11.** Height of tree saplings planted spring 2018 in the NPFF, recorded August 2018.

## V. Ecological Observations

Garry Oak Meadow Garden (Zone 1):

The garry oak meadow garden has three berms with plantings. The berms have been mulched with bark mulch. Naturally occurring species on the berms and in pathways include *Urtica dioica ssp. Gracilis* (stinging nettle), *R. leucodermis*, *Cirsium vulgare* (bull thistle), and unidentified invasive grasses. On the outskirts of its edge, towards the Northeast slope, there is a cover of *Gaultheria shallon* (salal), *Rubus ursinus* (trailing blackberry) and *Pteridium aquilinum* (bracken ferns) with some *Alnus rubra* (red alder) and *A. macrophyllum* saplings.

Core (Zone 2):

Half of the core area is covered by invasive grasses and *P. aquilinum*. *Anaphalis margaritacea* (pearly everlasting), *R. ursinus* and *R. leucodermis* are naturally occurring in this zone. The learning circle is also located in this zone, with a small SW slope that offers some shade. The

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rough and loose method to reduce soil compaction was used on the North circle, under the shade cloth, and in the plantings on the western boundary of the zone.

#### Basin (Zone 3):

The rough and loose method was used on compacted soils throughout this zone on all areas planted. Similar to zone 2, there was approximately 70% coverage of *P. aquilinum* and grasses at higher elevations within this zone. At lower elevations, the species composition changed. Likewise, the North and South sides had different compositions of naturally occurring species. In the North, *Juncus* grass, *Equisetum telmateia* (horsetail), *Polystichum munitum* (sword ferns), and *R. spectabilis* were common, while the South side had mostly *P. munitum*, *G. shallon*, and exotic grasses. Approximately 10% of the basin area was exposed soil. Both planted and naturally occurring *R. leucodermis* were observed in this section. One individual surrounded by weeds was observed to be healthy, while a nearby individual with no weeds showed sun damage. The grandmother cedar offered substantial shade in the basin.

#### Northeast Slope (Zone 4):

At lower elevations within this site, *P. aquilinum* and invasive grasses dominated. At higher elevations, *G. shallon* and *C. vulgare* were common, and a large patch of *C. vulgare* was observed. This zone also contained the most trees, including 5 *Pseudotsuga menziesii*, 5 *Thuja plicata*, 4 *Alnus rubra*, and 1 *Acer macrophyllum*.

#### Southwest slope (Zone 5):

Naturally occurring species included: *G. shallon*, *B. nervosa*, and a small patch of *V. ovatum* *P. munitum*, and *P. margaritacea*. At the western boundary, there was a couple individuals of *Clinopodium douglasii* that came up on their own. There were also fifteen *T. plicata* saplings growing on the slope that were not planted. The rough and loose method was used for the plantings below the ridge. High compaction on was observed on the ridge, with approximately 80% thistle coverage there. Bracken ferns provided shade for struggling *B. aquifolium*, and *B. nervosa* occurred naturally near planted individuals, but were much healthier than those that had been planted.

## **Discussion**

Browsing by deer influenced our results by affecting the vigour of approximately one-fifth of the plantings in the NPFF. Because the issue with fencing has since been resolved, the vigour of

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those plants should improve significantly. *B. aquifolium* on the SW ridgeline were also trampled by deer, but some individuals may recover with time. Ongoing fence maintenance will be important for the NPFF as the ecosystem establishes.

The soil compaction problem across the NPFF site was addressed in the spring when a heavy equipment backhoe was used to break up the soil with a “rough and loose” method over many of the planting sites. A negative effect of this method is the disturbance of the soil nutrient profile and soil biota. The effects of this disturbance were observed in the Core (zone 2), where *R. divaricatum* was planted in groupings, and although subject to the same environmental pressures, some had poor vigour while others were healthy. This disparity may be due to unequal nutrient access as result of soil disturbance, and adding mulch or mycorrhizae may be beneficial to re-establish healthy soils in these these areas.

The most notable invasive species was *C. vulgaris*. Although present throughout the forage forest, management efforts should be concentrated on the Southwest ridge, where approximately 80% of the zone was covered by *C. vulgaris*, as well as on the Northeast slope, where there was a large contiguous patch covering about 30% of the zone. There were also a wide range of invasive grasses on site, particularly in the core and basin zones, but this may be a secondary priority for removal since grasses do not tend to spread as quickly as *C. vulgaris*.

Naturally occurring invasive and non-invasive plants provided clues to the hydrology and soil composition of the site, particularly in the basin zone. Close to the West boundary are two large planting areas separated by a swath of weeds. On the North side, *E. telmateia*, *R. spectabilis*, *Juncus ssp.*, and *P. munitium* were common, while to the South, *G. shallon*, *P. munitium*, and unidentified exotic grasses dominated. *E. telmateia*, *R. spectabilis*, and *Juncus* tend to grow in moist soils, yet they are not present in the SW basin (Pojar & Mackinnon, 1994). This suggests that the West basin area retains more moisture, perhaps due to a difference in soil type; clay may have been brought to the surface when the south basin when the soil was disturbed. With this new knowledge, it is recommended that species needing very wet soil conditions, such as *L. americanus*, and *R. spectabilis*, be moved to the West basin.



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Also found in the basin area were naturally occurring nursery stumps. These stumps were home to *G. shallon*, *P. aquilinum*, and *V. parvifolium*, and other species. The *V. parvifolium* on these stumps were observed to be thriving, perhaps due to ecological interactions with nearby species or the natural shade that they provided. The stumps were also quite cool and retained more moisture than the surrounding area. All *V. parvifolium* planted in the NPFF were sown on stumps, mimicking these nursery stumps. However, those individuals planted are solitary and located on dry, exposed stumps in need of shading. It is recommended that the plantings be moved to stumps that have been established by other species, or that additional species be added to the existing plantings.

A problem for the *V. parvifolium* and many other species in the NPFF was the lack of shade throughout the site. On the berms in the Garry Oak Meadow Garden, a single *S. idahoense* individual found growing under weeds was much more vigorous than its exposed neighbours. For this reason, along with the benefit of added nutrients, the use of a cover crop on the berms is suggested. There is also a serious lack of shade on the Southwest ridge. Most *B. aquifolium* in this area are in very poor health or dead, and *A. alnifolia* showed sun stress. It is advised to put a few feet of landscape fabric along the fence to act as a shade, or to plant ferns along the fenceline for the same effect. As years pass, the many saplings in the NPFF will grow taller and cast a significant amount of shade across the site. A map of sapling locations has been created, in order to track their growth over time, and eventually, to devise a plan for thinning the canopy. For now, however, the more shade the better.

Due to the limitation of field time, and time to submit this assessment, there are likely errors in the data. A second pass to double check the identification of the plants and to locate missing individuals was not done, otherwise, we suspect more plants may have been found. In addition, invasive grass species were not identified, so it is difficult to recommend a management strategy for these species, however they will likely diminish with shade cover. Additionally, pathways throughout the NPFF could not be delineated and mapped using a GPS, and they may therefore be inaccurate. Finally, due to the time of year that this assessment took place, five species were dormant and could not be assessed. A follow-up assessment is therefore recommended to record the number, distribution, and health of *C. leichtlinii*, *C. quamash*, *D. pulchellum*, *H. maximum*, and *L. nudicaule*.

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**Appendix A**

Latin Name	Number Planted	Plant ID	Location (Zone)	Health (0-5)	Size (cm)	Observations
<i>Acer macrophyllum</i>	3	Acer	1	4	143	Naturally occurring (i.e. not planted)
<i>Achillea millefolium</i>	15	Am-1	1	5		Berm 1
		Am-2	1	3		Berm 2
		Am-3	1	3		Berm 3
		Am-4	1	2		Berm 3
		Am-5	1	4		Surrounding Q. garryana (Plant ID Qg-3)
		Am-6	1	4		Surrounding Q. garryana (Plant ID Qg-3)
		Am-7	1	4		Surrounding Q. garryana (Plant ID Qg-3)
		Am-8	1	4		Surrounding Q. garryana (Plant ID Qg-3)
		Am-9	1	4		Surrounding Q. garryana (Plant ID Qg-3)
		Am-10	2	3		Learning Circle
		Am-11	2	4		Learning Circle
		Am-12	2	5		Along NE main path
		Am-13	2	4		Along NE main path
		Am-14	2	4		Along NE main path
<i>Allium cernuum</i>	25	Ac-1	1	4		Berm 1, North slope
		Ac-2	1	5		Berm 1, North slope

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		Ac-3	1	5		Berm 1, North slope
		Ac-4	1	5		Berm 1, North slope
		Ac-5	1	5		Berm 1, North slope
		Ac-6	1	5		Berm 1, North slope
		Ac-7	1	4		Berm 1, North slope
		Ac-8	1	4		Berm 1, North slope
		Ac-9	1	3		Berm 1, North slope
		Ac-10	1	5		Berm 1, North slope
		Ac-11	1	3		Berm 2, North slope; browsed
		Ac-12	1	3		Berm 2, North slope; browsed
		Ac-13	1	4		Berm 2, North slope; browsed
		Ac-14	1	3		Berm 2, North slope; browsed
		Ac-15	1	4		Berm 2, North slope; browsed
		Ac-16	1	3		Berm 2, North slope; browsed
		Ac-17	1	3		Berm 3
		Ac-18	1	3		Berm 3
		Ac-19	1	3		Berm 3
		Ac-20	1	3		Berm 3
Amelanchier alnifolia	15	Aa-1	5	3	68	SW slope, browsed
		Aa-2	5	3	42	Ridgeline, browsed
		Aa-3	5	2	58	Ridgeline, very few leaves
		Aa-4	5	2	40	Ridgeline, browsed, sun damage
		Aa-5	5	2	50	Ridgeline, browsed, sun damage
		Aa-6	5	2	49	Ridgeline, browsed, sun damage
		Aa-7	5	3	64	Ridgeline, some browsing
		Aa-8	5	2	70	Ridgeline, browsed
		Aa-9	5	2	46	Ridgeline, browsed

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		Aa-10	5	2	72	Ridgeline, browsed
		Aa-11	5	3	44	Ridgeline, sun damage
		Aa-12	5	2	35	Ridgeline, pruned
		Aa-13	5	2	76	Ridgeline, browsed, sun damage
<i>Arbutus menziesii</i>	3	Arme	5	5	37	
<i>Arctostaphylos columbiana</i>	0	Arc-1	5	3	59	SW slope, browsed
		Arc-2	5	3	76	SW slope, browsed
		Arc-3	5	2	60	SW slope, browsed
<i>Artemisia suksdorfii</i>	5	-	-	-	-	Not found
<i>Berberis aquifolium</i>	25	Ba-1	2	3		Tiny, few leaves
		Ba-2	5	4		SW slope, small
		Ba-3	5	1		Ridge line, no leaves
		Ba-4	5	1		Ridge line, sun damage
		Ba-5	5	1		Ridge line
		Ba-6	5	3		Ridge line, tiny
		Ba-7	5	0		Ridge line
		Ba-8	5	0		Ridge line
		Ba-9	5	1		Ridge line
		Ba-10	5	1		Ridge line
		Ba-11	5	2		Ridge line
		Ba-12	5	3		Ridge line
		Ba-13	5	3		Ridge line
		Ba-14	5	1		Ridge line
		Ba-15	5	2		Ridge line
		Ba-16	5	0		Ridge line, could be <i>B. nervosa</i>
		Ba-17	5	3		Ridge line
		Ba-18	5	0		Ridge line, could be <i>B. nervosa</i>

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		Ba-19	5	1		Ridge line
		Ba-20	5	1		Ridge line, could be <i>B. nervosa</i>
		Ba-21	5	2		Ridge line
		Ba-22	5	2		Ridge line
		Ba-23	5	1		Ridge line
<i>Berberis nervosa</i>	13	Bn-1	2	5		Along central path, pearly everlasting nearby
		Bn-2	2	4		Shade cloth area, very small
		Bn-3	2	5		North circle
		Bn-4	2	3		North circle
		Bn-5	2	5		North circle
		Bn-6	2	4		North circle
		Bn-7	5	4		SW slope
		Bn-8	5	4		SW slope
		Bn-9	5	3		SW slope
		Bn-10	5	4		SW slope
<i>Camassia leichtlinii</i>	50+	-	-	-	-	Dormant at this time
<i>Camassia quamash</i>	50+	-	-	-	-	Dormant at this time
<i>Clinopodium douglasii</i>	5	Yb-1	2	4		Learning circle
<i>Corylus cornuta cornuta</i>	1	Ccc-1	3	3	102	Browsed
		Ccc-2	3	3	95	Browsed, sun damage, discolouration
<i>Crataegus douglasii</i>	3	Cd-1	3	4	140	West basin
		Cd-2	3	3	145	Central basin, browsed, possible pests eating leaves
		Cd-3	5	4	190	SW slope
<i>Dodecatheon pulchellum</i>	10	Dp-1	1	-		Berm 1, dormant
		Dp-2	1	-		Berm 1, dormant
<i>Festuca roemerii</i>	10	Fr-1	1	4		Berm 2

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		Fr-2	1	3	Berm 2
		Fr-3	1	3	Berm 2
		Fr-4	1	3	Berm 2
		Fr-5	5	5	Surrounding <i>A. menziesii</i>
		Fr-6	5	5	Surrounding <i>A. menziesii</i>
		Fr-7	5	5	Surrounding <i>A. menziesii</i>
<i>Fragaria vesca / virginiana</i>	25	Fv-1	2	3	Learning circle
		Fv-2	2	3	Learning circle
		Fv-3	2	3	Learning circle, runners
		Fv-4	2	4	Learning circle, runners
		Fv-5	2	3	Learning circle, runners
		Fv-6	2	3	Learning circle
		Fv-7	2	2	Learning circle
		Fv-8	2	5	Learning circle, runners
		Fv-9	2	4	Learning circle, runners
		Fv-10	2	3	Learning circle, runners
		Fv-11	2	2	Learning circle
		Fv-12	2	4	Learning circle, runners
		Fv-13	2	2	Learning circle
		Fv-14	2	4	Shade cloth area, runners
		Fv-15	2	5	Shade cloth area, runners
		Fv-16	2	4	Shade cloth area, runners
		Fv-17	2	4	Shade cloth area, runners
<i>Heracleum maximum</i>	5	Hm-1	3	-	Gone to seed, unable to assess plant health
		Hm-2	3	-	Gone to seed, unable to assess plant health

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		Hm-3	3	-		Gone to seed, unable to assess plant health
		Hm-4	3	-		SW basin, gone to seed (unable to assess)
		Hm-5	3	-		SW basin, gone to seed (unable to assess)
<i>Lomatium nudicaule</i>	25	Ln-1	1	4		Berm 1, not dormant (?)
		Ln-2	1	-		Berm 1, gone to seed (unable to assess plant health)
		Ln-3	1	-		Berm 1, gone to seed (unable to assess plant health)
		Ln-4	1	-		Berm 1, gone to seed (unable to assess plant health)
		Ln-5	1	-		Berm 1, gone to seed (unable to assess plant health)
		Ln-6	1	-		Berm 1, gone to seed (unable to assess plant health)
		Ln-7	1	-		Berm 2, gone to seed (unable to assess plant health)
<i>Lysichiton americanus</i>	3	La-1	3	4		SW basin, very small
		La-2	3	2		SW basin, very small
<i>Malus fusca</i>	5	Mf-1	3	4	75	
		Mf-2	3	3	100	
		Mf-3	3	1	102	West basin, no leaves, budding at top
<i>Oemleria cerasiformis</i>	3	Oc-1	2	3	72	Browsed
		Oc-2	2	3	53	Browsed, sun damage
<i>Polypodium glycyrrhiza</i>	5	-	-	-	-	Not found
<i>Prunus emarginata</i>	0	Pe-1	3	1	46	Pruned, browsed
		Pe-2	3	1	50	Central basin



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		Pe-3	3	2	56	SW basin
<i>Quercus garryana</i>	5	Qg-1	1	3	32	SE fence line
		Qg-2	1	0	-	Berm 2, dead
		Qg-3	1	5	47	Surrounded by <i>A. millefolium</i> , <i>G. shallon</i>
		Qg-4	2	2	59	Along NE main path, growing with <i>A. millefolium</i>
<i>Rhamnus purshiana</i>	3	Rhu-1	3	3	152	W basin, slightly browsed
		Rhu-2	3	4	170	SW basin
		Rhu-3	3	3	155	SW basin, yellowing leaves
<i>Ribes divaricatum</i>	15	Rd-1	2	2	51	North circle
		Rd-2	2	4	59	North circle
		Rd-3	2	3	48	North circle
		Rd-4	2	3	62	North circle, browsed
		Rd-5	2	2	34	North circle
		Rd-6	2	2	36	North circle
		Rd-7	2	3	40	North circle, browsed
		Rd-8	2	2	35	North Circle
		Rd-9	2	2	53	Along NE main path
		Rd-10	2	4	30	Along NE main path
		Rd-11	2	3	31	Along NE main path
		Rd-12	2	4	42	Along NE main path
<i>Ribes sanguineum</i>	3	Ris-1	2	3	74	Highly browsed
		Ris-2	3	3	54	W basin
		Ris-3	3	4	52	W basin
<i>Rosa gymnocarpa</i>	5	Rg-1	2	2	84	Browsed, naturally occurring <i>R. parviflorus</i> & <i>Juncus</i>
		Rg-2	2	4	56	North Circle

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		Rg-3	3	3	47	
		Rg-4	3	2	59	
		Rg-5	3	5	48	W basin near fence line
<i>Rosa nutkana</i>	15	Rn-1	3	4	46	W basin
		Rn-2	3	2	65	W basin, browsed
		Rn-3	3	3	57	W basin near fence line, browsed
		Rn-4	3	3	75	W basin near fence line, browsed
		Rn-5	3	2	35	W basin near fence line, browsed
		Rn-6	3	4	56	SW basin, browsed
		Rn-7	3	3	54	SW basin
		Rn-8	3	4	63	SW basin
		Rn-9	3	3	83	SW basin
		Rn-10	3	3	50	SW basin
		Rn-11	3	3	56	SW basin, naturally occurring <i>R. parviflorus</i>
		Rn-12	3	3	55	SW basin
<i>Rubus leucodermis</i>	20	RI-1	1	5		Berm 1
		RI-2	1	5		Berm 3
		RI-3	2	3		Along main central path
		RI-4	2	3		Along main central path
		RI-5	2	4		Along main central path
		RI-6	2	3		Along main central path
		RI-7	2	3		Along main central path
		RI-8	2	4		Along main central path
		RI-9	2	5		Along main central path
		RI-10	3	5		
		RI-11	3	5		
		RI-12	3	3		NW of grandmother cedar

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		RI-13	3	3		NW of grandmother cedar
		RI-14	3	3		
		RI-15	3	3		
		RI-16	3	3		
		RI-17	3	4		
		RI-18	3	5		SW basin
Rubus parviflorus	15	Rp-1	3	3	66	
		Rp-2	3	3	53	
		Rp-3	3	3	54	
		Rp-4	3	3	69	W basin, sun damage
		Rp-5	3	4	31	Central basin
		Rp-6	3	3	34	Central basin, sun damage
		Rp-7	3	3	66	Central basin, sun damage
		Rp-8	3	3	40	Central basin, sun damage
		Rp-9	3	3	28	Central basin, sun damage
		Rp-10	3	3	40	Central basin, sun damage
		Rp-11	3	3	52	Central basin, sun damage
		Rp-12	3	4	50	Central basin
		Rp-13	3	4	45	SW basin along path
		Rp-14	5	4	65	
		Rp-15	5	4	62	
Rubus spectabilis	15	Rs-1	3	4	83	W basin, browsed
		Rs-2	3	3	45	W basin, sun damage
		Rs-3	3	5	60	W basin
		Rs-4	3	3	36	W basin
		Rs-5	3	4	94	W basin, discolouration
		Rs-6	3	4	90	W basin

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		Rs-7	3	4	46	W basin
		Rs-8	3	4	39	W basin
		Rs-9	3	3	48	W basin, discolouration
		Rs-10	3	3	42	Central basin
		Rs-11	3	3	92	Central basin, staked but possible volunteer
		Rs-12	3	3	68	SW basin, sun damage
		Rs-13	3	3	50	SW basin, sun damage
		Rs-14	3	3	55	SW basin, sun damage
		Rs-15	3	3	34	SW basin, sun damage
		Rs-16	3	3	37	SW basin, sun damage
		Rs-17	3	3	35	SW basin, sun damage
		Rs-18	3	1	39	SW basin along trail
		Rs-19	3	3	65	SW basin along trail
<i>Salix scouleriana</i>	3	-	-	-	-	Not found
<i>Sambucus racemosa</i>	3	Sr-1	3	1	104	W basin, no leaves
<i>Shepherdia canadensis</i>	3	Sc-1	3	4	66	
		Sc-2	3	3	86	Sun damage, naturally occurring R. leucodermis
		Sc-3	3	3	105	SW basin at fence line
		Sc-4	3	4	95	SW basin
		Sc-5	3	3	58	SW basin
<i>Sisyrinchium idahoense</i>	20	Si-1	1	5		Berm 1
		Si-2	1	3		Berm 1
		Si-3	1	1		Berm 1
		Si-4	1	4		Berm 1
		Si-5	1	3		Berm 1
		Si-6	1	1		Berm 1

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		Si-7	1	4		Berm 1
		Si-8	1	3		Berm 2
		Si-9	1	3		Berm 2
		Si-10	1	3		Berm 2
		Si-11	1	3		Berm 2
		Si-12	1	5		Berm 2
		Si-13	1	4		Berm 3
		Si-14	1	4		Berm 3
<i>Spiraea douglasii</i>	3	Sd-1	2	4		Learning circle
		Sd-2	2	4		Learning circle
		Sd-3	2	5		Shade cloth area, but full sun exposure
		Sd-4	2	4		Shade cloth area, shaded
		Sd-5	4	4		P. menziesii sapling nearby
<i>Taxus brevifolia</i>	2	Tb-1	2	3	56	Discoloration
		Tb-2	3	4	84	
<i>Trifollum wormskjoldii</i>	5	Tw	3	4		
		Tw	3	4		
		Tw	3	5		
<i>Vaccinium ovatum</i>	15	Vo-1	2	4	55	Shade cloth area, shaded
		Vo-2	2	4	38	Shade cloth area, shaded
		Vo-3	2	1	52	Brown, dropping/sprawling
		Vo-4	2	1	69	Brown, dropping/sprawling
		Vo-5	2	3	57	Shaded due to natural slope
		Vo-6	2	2	75	Growing with bracken fern
		Vo-7	4	1	54	Along N path
		Vo-8	4	3	50	Along N path
		Vo-9	4	1	48	Along N path

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		Vo-10	4	4	73	Along N path
		Vo-11	4	1	50	Along N path
		Vo-12	5	3	46	Naturally occurring <i>R. leucodermis</i>
		Vo-13	5	4	70	Naturally occurring <i>R. leucodermis</i>
		Vo-14	5	4	39	Naturally occurring <i>R. leucodermis</i>
		Vo-15	5	4	48	
<i>Vaccinium parvifolium</i>	10	Vp-1	2	3	64	Staked and shaded
		Vp-2	2	3	47	Staked and shaded, adjacent to GC, sun damage
		Vp-3	2	1	30	Staked and shaded, almost dead
		Vp-4	2	4	40	Staked and shaded
		Vp-5	3	3	53	Staked and shaded
		Vp-6	3	4	45	Staked and shaded, adjacent to GC
		Vp-7	3	3	50	Staked and shaded, SW basin
		Vp-8	5	3	24	Staked and shaded, slope, growing w/ <i>R. ursinus</i>
<i>Viburnum edule</i>	5	Ve-1	3	2	73	W basin
		Ve-2	3	3	100	W basin, browsing
		Ve-3	3	3	65	W basin, browsing

OTHER SPECIES OBSERVED

<i>Alnus rubra</i>	Red Alder	~8 seedlings
<i>Arbutus menziesii</i>	Arbutus	Wildlife tree
<i>Gaultheria shallon</i>	Salal	Widespread
<i>Holodiscus Discolor</i>	Oceanspray	Naturally occurring
<i>Polystichum munitum</i>	Sword fern	Common on SW slope

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<i>Pseudotsuga menziesii</i>	Douglas fir	
<i>Pteridium aquilinum</i>	Bracken Fern	Widespread
<i>Rubus ursinus</i>	Trailing blackberry	
<i>Urtica dioica ssp. gracilis</i>	Stinging nettle	

### Appendix B

