An ongoing restoration of

The Mill Site

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Abstract

Restoration of a former saw mill site, a 0.25 hectare area of the Millard Learning Centre property owned by the Galiano Conservancy Association (GCA), was designed and implemented in 2013/14. This initial restoration involved soil decompaction, the addition of decomposable organic matter, invasive species removal, and caging of an experimental area and individual species. To date, little monitoring and maintenance has occurred at the site aside from the removal of the main fencing exclosure around the designated experimental area. Over the years, the site has seen changes with the addition of a deepwater well and associated access trail, and two new public hiking trails. Our project focused on revisiting the original restoration prescription and evaluating the current state of the site. To accomplish this, three goals were established: 1. Create an updated monitoring protocol; 2. Incorporate educational and recreational opportunities within the site boundaries to facilitate land use preferences; and 3. Make recommendations to improve the site ecologically. During site visits in June and July 2020, we assessed the state of 200 individual plants protected with wire cages and flagged them with recommended actions (removal, expand, maintain); located areas with dense invasive species cover; identified locations for photopoint monitoring; and designated locations for future educational and recreational amenities. We found herbivory and invasive species to be the most evident impediments to realizing the design from the original restoration project: eventual return of diverse forest structure to the site. Through our research and observations, we also compiled a list of recommendations for the site based on our data and the resources the GCA provided. We hope that these recommendations will aid the process of ongoing restoration.

Our Recommendations

Herbivory

- As per the actions recommended in *Table 5*, remove, expand, or maintain caging for the planted and protected individual plants on-site.
- Caging individuals has proven successful for many individuals and is encouraged for future planting as demonstrated in *Table 6*.
- In the place of caging, or where caging is set to be removed, consider bark tape on shrub and tree species to discourage herbivory.

Invasive Species

- With new planting at the site, consider control strategies such as shading out invasive or hyperabundant species as the site progresses along the trajectory towards forest structure.
- Some areas, as outlined in *Table 3*, may need to be prioritized and require mechanical or chemical control. These include the well access and other areas subject to higher levels of disturbance.

Future Monitoring

- Repeat species inventory annually to evaluate the success of the restoration project using the 5-point vigour and height scale currently in use by the GCA (*Table 8*).
- Repeat the evaluation of the caging on site annually to ensure that individuals have the opportunity to grow successfully. Consider using copper (or equivalent) tags to allow numbering of caged species for easier inventory.
- Identify volunteer individuals that could benefit from caging.
- Using the suggested photopoints in *Table 2*, maintain a database that can be used to view the ecological development of the site.
- Consider replicating methods performed in Hamann-Benoit's (2014) report in regards to soil compaction, soil texture, and soil chemistry to allow for comparison with original results.

Future of Site

- Create a planting plan for the site, as informed by the success observed from the initial planting plan in *Table 6*.
- Consider establishing a new picnic area to promote the recreational values of the site. Suggested locations are found in *Table 4*.
- Consider updating the restoration project signage, located at the trailhead, to further promote the educational values of the site.

1.0 Introduction and Context

1.1 Geographical Location

Galiano Island is one of the southern Gulf Islands of British Columbia located in the Salish Sea (Huggins, 2017). Due to its geographical location and the presence of a rain shadow created by the Insular and the Olympic mountains, Galiano Island has a Mediterranean type climate characterized by rainy winters and very dry summers (Hamann-Benoit, 2014). As stated by Levi Wilson, who has close ties to Galiano Island and is a member of the Gitga'at First Nation, it is located on the "shared, asserted, and unceded traditional territories of the Lamalcha, Penelakut, and Hwitslum First Nations and other Hul'qumi'num speaking peoples, the Sencoten and Wsanec speaking peoples, and any others with rights and responsibilities in and around what is now called Galiano Island" (Wilson, 2018). Galiano Island is also located on the ceded territory of the Tsawwassen First Nation (Wilson, 2018).

1.2 The Galiano Conservancy

The Galiano Conservancy Association (GCA) is a community-based-non-profit formed in 1989. The GCA is devoted to protecting the environment through conservation and restoration initiatives and in engaging the public through educational and volunteer opportunities. Over the years, the GCA has obtained various properties across Galiano Island. Some of these properties, shown in *Figure 1* below, are a part of the Mid-Galiano Conservation Network. This Network is a shared initiative on Galiano Island to create a corridor across the island

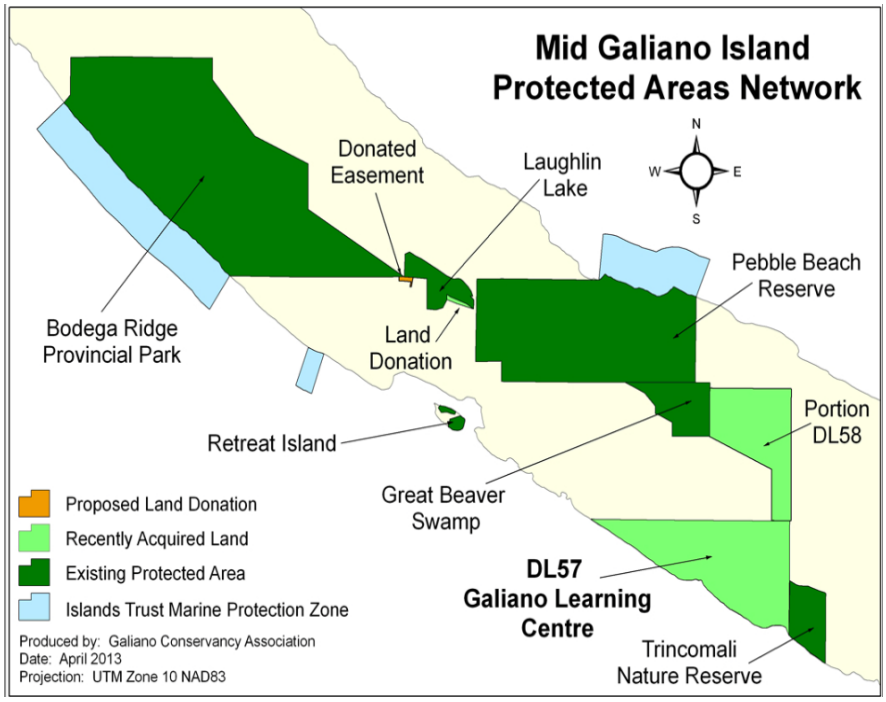

Figure 1. Image portraying the mid Galiano Island protected areas network. Image taken from the Galiano Conservancy Association website with the consent of GCA Restoration Coordinator, Adam Huggins.

by connecting protected areas (Hamann-Benoit, 2014; GCA, N.D). The GCA now owns 185.6 ha of land including Mount Sutil, Retreat Island, Pebble Beach Reserve, Laughlin Lake, Great Beaver Swamp, and the Millard Learning Centre (DL57) (GCA, N.D.).

1.3 History of the Site

The site of interest (referred to as "the Mill Site") is a 0.25 hectare area located at the main entrance of the Millard Learning Centre property, adjacent to the parking area (Hamann-Benoit, 2014). According to Hamann-Benoit, who designed the original restoration project, the site is believed to have been a mature forest consistent with the coastal Douglas-fir moist maritime biogeoclimatic zone until 2001. From 2001 to 2011, the site was used as a sawmill site which led to the degradation of the ecosystem and compaction of the soil, fuel spills, and large amounts of coarse woody sawmill debris. In 2012, the GCA purchased the area for conservation purposes (GCA, N.D.).

Restoration of the site began in 2013 when a literature review and sampling of the site determined that soil compaction was the primary concern (Hamann-Benoit, 2014). Based on these findings, Vincent Hamann-Benoit began a participatory restoration project in collaboration with the Galiano Conservancy Association. The main challenges addressed in Hamann-Benoit's project included: soil compaction; lack of decomposable organic matter; the presence of invasive species such as Scotch broom (*Cytisus scoparius*), Himalayan blackberry (*Rubus*

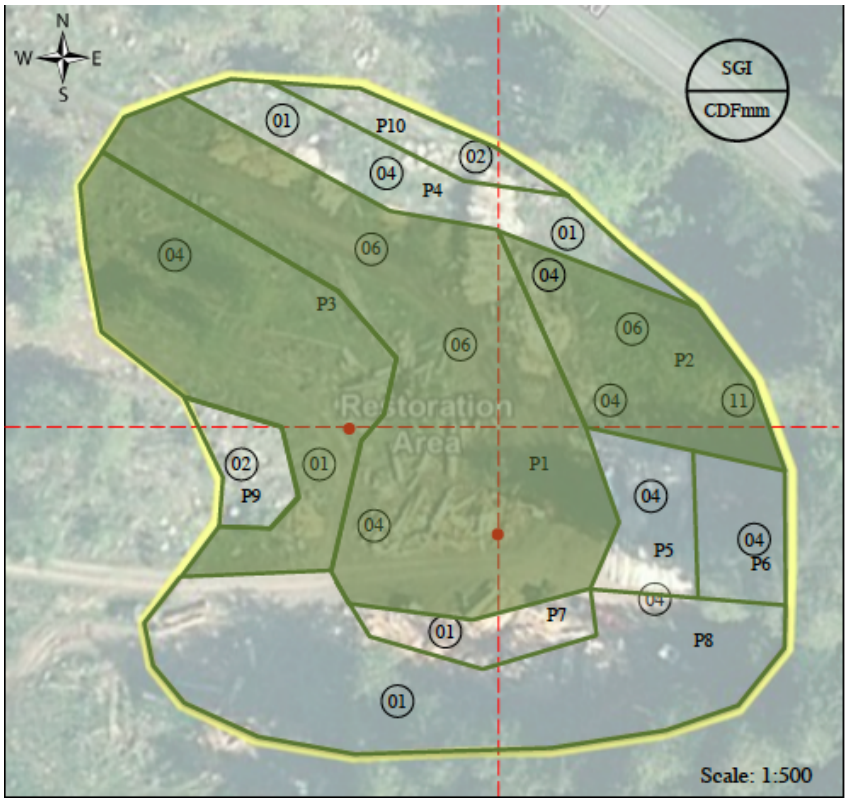

Figure 2. Map of ecological communities created by Hamann-Bennoit (2014). P1 represents the central area; P2 represents the wetland area; and P3 represents the dry slope area.

discolor), invasive grasses (*Poaceae spp*.), and thistles (*Cirsium spp.*); and deer browsing pressure.

In order to address these barriers to restoration, the following procedures, all taken from Hamann- Benoit's technical report (2014), were performed. Initially, the boundaries were decided and the ecological communities were mapped as seen in *Table 1* and *Figure 2*. From there, Hamann- Benoit used a 1m x 1m quadrat to determine species cover, percentage of soil, and woody debris present in the largest polygons (1, 2, and 3 as seen in *Figure 2).* A reference site was identified around 100m East of the Mill Site. Next the issue of soil compaction was addressed through the use of a Cat 315 excavator to de-compact the soil. This method, known as the "rough and loose" method, created a series of mounds and depressions throughout the site in order to increase the topographic heterogeneity, increase the ability of the soil to infiltrate, and to create microsites for various species (p. 34). Once de-compaction was achieved, the next step was to rebuild the soil. This was done first by incorporating wood chips (primarily red alder) into the site. The purpose of the wood chips was to bring more nutrients to the site, provide physical protection (for example rain absorption), and to decrease the success of invasive species. Next, three cubic yards of premium mix compost (75% compost, 25% sand) containing 1.5% nitrogen was sourced from Peninsula Landscape Supplies and added to the site. This was done in order to increase the amount of nitrogen and provide nutrients for microorganisms and plants. Logs and stumps were also left in place, and several felled trees were dug in to mimic standing dead trees. The next step of the restoration process was re-vegetating the area. This included planting 426 plant species from the GCA native plant nursery. Sword ferns (*Polystichum munitum*), salal seedlings (*Gaultheria shallon*), and forest litter were also transported on site. In order to protect species from deer browsing, over 80% of the plants from the nursery were individually caged. Additionally, an experimental area was fully fenced (7 feet high). Invasive species control was also conducted. This involved the removal of invasive species and mitigation efforts such as the incorporation of wood chips, as described above, as well as suppression and out shading techniques particularly for reed canary grass. These techniques involved sheet mulching to suppress the colonization of reed canary grass (*Phalaris arundinacea*) and the use of live willow stakes to create a shade barrier.

1.4 Current State of the Site

Since 2013, the area has undergone extensive revegetation driven by Hamann-Benoit's (2014) initial soil treatment and planting plan. The original 20m x 20m deer exclosure fencing (*Figure 3a*) was removed in May 2020 and decreased in size to 10m x 10m (*Figure 3b*) with some caging still present on individual plants to discourage herbivory. This was done to fix the caging that had become damaged over time and to standardize the size of the cage with other experimental exclosures on the property (Huggins, A, personal communication, August 17, 2020). Educational and recreational infrastructure has been developed on the site, including a picnic table and educational signage. A deepwater well has also been added to the site that provides water to the Millard Learning Centre property, and there is a trail used for well access. A clear challenge is the lack of standardized site monitoring protocols available to the staff of the GCA, as well as unclear future directions for the site. Though the site has become revegetated since the original restoration project, the success of the original restoration has yet to be evaluated, and continued success at this site may be better facilitated with a strong and updated protocol. Our data collection and recommendations seek to inform this management.

1.5 Barriers

Five barriers to natural recovery were determined in Hamann- Benoit's (2014) original report. These included soil compaction, preventing infiltration and root penetration; lack of decomposable organic matter resulting in poor nutrient cycling; invasive species outcompeting native species; and deer browsing pressure. Assessing soil conditions was beyond the scope of the project and the latter two barriers are therefore the focus of this report. Browsing pressure remains an evident control of the growth of many individuals on-site, and several non-native species to the site make up a significant percent cover for herbaceous species and may impact future planting.

2.0 Goals and Objectives

While evaluating the current state of the Mill Site, as well as our role in this project, we have developed three main goals that remain consistent with the Galiano Learning Centre Management Plan (GLCMC, 2013). The goals are presented (numbered) in combination with the

corresponding objectives (lettered) and are somewhat interrelated and dependent on the success of one another. The revised goals are as follows:

1. Create an updated monitoring protocol to assess the ecological integrity at the site, based on developing site characteristics driven by the original restoration project;
    a. Engage in dialogue with staff members for information on past and present observations of the mill site, as well as evaluate current and past monitoring methods.
    b. Conduct a species inventory and compare with the original planting plan.
    c. Re-evaluate original goals and objectives in detail to see how they align with the present state of the site.
    d. Determine the present site boundaries.
    e. Create recommendations for future monitoring.
2. Facilitate land use preferences by incorporating educational and recreational opportunities within the site boundaries;
    a. Make recommendations on how to integrate trailhead information into the restoration site.
    b. Identify a location where additional infrastructure and amenities can be added (i.e. a picnic bench) in a way that does not impede the ecological goals of the site.
3. Make recommendations to improve the site ecologically while honouring the past and memorializing the transformative power of the restoration process (as per the original project);
    a. Flag individual plants to remove caging if they are above the herbivory line.
    b. Flag individual plants impacted by herbivory that could benefit from caging.
    c. Inform a planting plan for the site.

3.0 Methods

3.1 Determining Boundaries

After consultation with the GCA staff, it was decided that the same boundaries would be kept as those created in Hamann-Bennoit's (2014) report to maintain continuity. No previous geographic locations were recorded for this boundary and a perimeter walk was therefore completed and

geographic locations were documented using the app Theodolite. A map of the site boundary can be seen in *Figure 4*.

3.2 Determining Photopoint Locations

Our photographic, or "photopoint," monitoring locations were chosen based on accessibility and proximity to a prominent feature, to aid in locating photopoint locations in years to come. In this case, the feature was the rocky edge (Polygon 10 in *Figure 2)* on the boundary of our site. An initial photo was taken at the location where the tripod and camera would sit and a second photo was taken with prominent features that will aid future staff to relocate the exact point. The UTM coordinates, description of the benchmarks, and description of the scene can be found in the appendix in *Table 2* and the photos for Site 1 and 2 can be found in the appendix in *Figure 5* and *Figure 6* respectively. Photos were taken using the app Theodolite to document coordinates. We maintained the existing photopoint locations used during deer exclosure monitoring by GCA staff. These can be found in *Table 2*.

Figure 4. A map of the original Mill Site boundaries as decided in 2011 prior to the original restoration project. Retrieved from the GCA server.

3.3 Determining Planting Locations

Planting locations were chosen based on areas with little vegetation coverage or areas that would benefit from successful planting with the aid of caging. Three planting locations were chosen as seen in the appendix in *Table 3*, with UTM coordinates recorded using the app Theodolite.

3.4 Determining Amenity Location

Two locations were identified to install a future picnic table. The coordinates were recorded using the app Theodolite. The benchmark for the amenity is the bike pump and rack station recently installed, or the existing trailhead infrastructure. The coordinates and site descriptions can be found in the appendix *Table 4*. Images of both sites can be found in the appendix in *Figure 7a and 7b*.

3.5 Flagging Caged Species

Our main field work consisted of doing a thorough assessment of the Mill Site to flag, identify and georeference caged individuals. Overall, 200 caged individuals were located (see *Table 5* in appendix). Species were flagged with blue, yellow, or pink tape depending on their observed success. If the species inside the caging was still small enough that it had not reached the height or the width of the caging, it was determined that the caging could be left as is (labelled with the action "keep") and flagged with blue tape (see *Figure 8a*). If the species growth was at the cages width or expanded through the caging, but had not made it past deer browsing level (generally this was judged on whether the individual made it past the height of the caging), it was determined that the caging needed to be expanded (labelled with the action "expand") and was flagged with yellow tape (see *Figure 8b*). If the species was exhibiting successful growth past the deer browsing line, it was determined that the caging could be removed (labelled with the action "remove") and flagged with pink tape (see *Figure 8c*). Species were identified using Pojar and Mackinnon's *Plants of Coastal British Columbia* identification guide (1994) and the app iNaturalist. The species inventory list of plants brought from the GCA nursery in Hamann-Bennoit's (2014) report was also used as a general guide. The app Theodolite was used to record the UTM coordinates of each species and the Google Earth application was used to map out the species as seen in *Figure 8*. The georeferencing of the cage sites was subject to some error as per the Theodolite app and the iPhone global positioning system receiver (GPSr), and this is reflected in the mapping of sites. The Google Earth map was colour coded based on action type (*Table 5*) for ease of use by the GCA.

Figure 8a. An example of an individual with blue flagging tape indicating "keep", Oemleria cerasiformis; Figure 8b. An example of an individual with yellow flagging tape indicating "expand", Holodiscus discolor; Figure 8c. An example of an individual with pink flagging tape indicating "remove", Philadelphus lewisii.

3.6 Species Inventory

The following methods are synthesized from the GCA *Deer Monitoring Methods* (2019) from the Conservancy's server: Species composition was recorded in both the open and exclosure plots regardless of abundance. Vegetation cover was calculated using visual percent-cover charts, which may have to be done in several sections of the plot, especially in disturbed areas. Browsing pressure was measured by assigning deformity of an individual plant to a four-point scale, with 0 being unbrowsed, and 3 being heavily browsed. The methods used are subject to differing levels of reliability and biases of the observer.

4.0 Results

4.1 Caging Data

Table 6 outlines the results from flagging the 200 caged individuals throughout the Mill Site and demonstrates the variety of species as well as the overall success of individual species. For the purposes of our project, an individual was deemed successful if it was sufficiently large to no longer require caging. As seen in *Table 5*, under certain instances caging was removed due to overgrowth by an invasive or other non-native species and it would therefore not be considered successful under these circumstances. Based on the results indicated in *Table 6*, *Pseudotsuga menziesii*, *Viburnum edule*, *Salix lucida*, *Crataegus douglasii*, *Rosa nootkana*, *Philedelphus*

lewisii, and *Gaultheria shallon* all had a success rate greater than 50%. *Thuja plicata*, *Abis grandis*, and *Rubus parviflorum* had a success rate between 40-50%. The remaining species had a success rate of less than 40%.

Table 6. Labelled action, total number, and success rate in percentage of each flagged species identified at the Mill Site

Category	Common Name	Scientific Name	Expand	Keep	Remove	Successful	Total number	%success
Trees	Douglas-fir	*Pseudotsuga menziesii*	3		10	10	13	77%
	Grand fir	*Abies grandis*	3	3	7	6	13	46%
	Western red cedar	*Thuja plicata*	3	6	9	8	18	44%
	Bigleaf maple	*Acer macrophyllum*	3	2			5	0%
	Red alder	*Alnus rubra*	10	1	6	6	17	35%
	Western hemlock	*Tsuga heterophylla*	1		1	1	2	50%
	Arbutus	*Arbutus menzeisii*	1			0	1	0
Shrubs	Thimbleberry	*Rubus parviflorus*	1	1	3	2	5	40%
	Evergreen huckleberry	*Vaccinium ovatum*	2	1		0	3	0
	Highbush cranberry	*Viburnum trilobum*			2	2	2	100%
	Red huckleberry	*Vaccinium parvifolium*	1			0	1	0
	Salmonberry	*Rubus spectabilis*	10	2	4	4	16	25%
	Oso berry	*Oemleria cerasiformis*	4	2		0	6	0
	Pacific willow	*Salix lucida*	1		1	1	2	50%
	Pacific ninebark	*Physocarpus capitatus*	3	1		0	4	0
	Black hawthorn	*Crataegus douglasii*	2	1	3	3	6	50%
	Mock-orange	*Philadelphus lewisii*	2	1	3	3	6	50%
	Nootka rose	*Rosa nutkana*	1		5	5	6	83%
	Baldhip rose	*Rosa gymnocarpa*	4	4	1	1	9	11%
	Salal	*Gaultheria shallon*		1	5	5	6	83%
	Common snowberry	*Symphoricarpos albus*	3	3	1	1	7	14%
	Saskatoon berry	*Amelanchier alnifolia*	2	2	1	1	5	20%
	Oceanspray	*Holodiscus discolor*	7		1	1	8	13%
	Red-osier dogwood	*Cornus sericea*	7			0	7	0
Other	Unsuccessful	*N/A*			22		22	0
	Unknown	*N/A*			10		10	0
Total			74	31	95	60	200	

These results along with the complete table of our flagging data as seen in *Table 5*, also indicate a trend that some species were less successful on the southernmost end of our study area across from the parking lot. This section includes cages 87 to 127. Five out of six of the blue flagged *Thuja plicata* species and 100% of the blue flagged *Abis grandis* individuals were found in this section indicating that their growth was not as successful here as it was throughout the rest of the site.

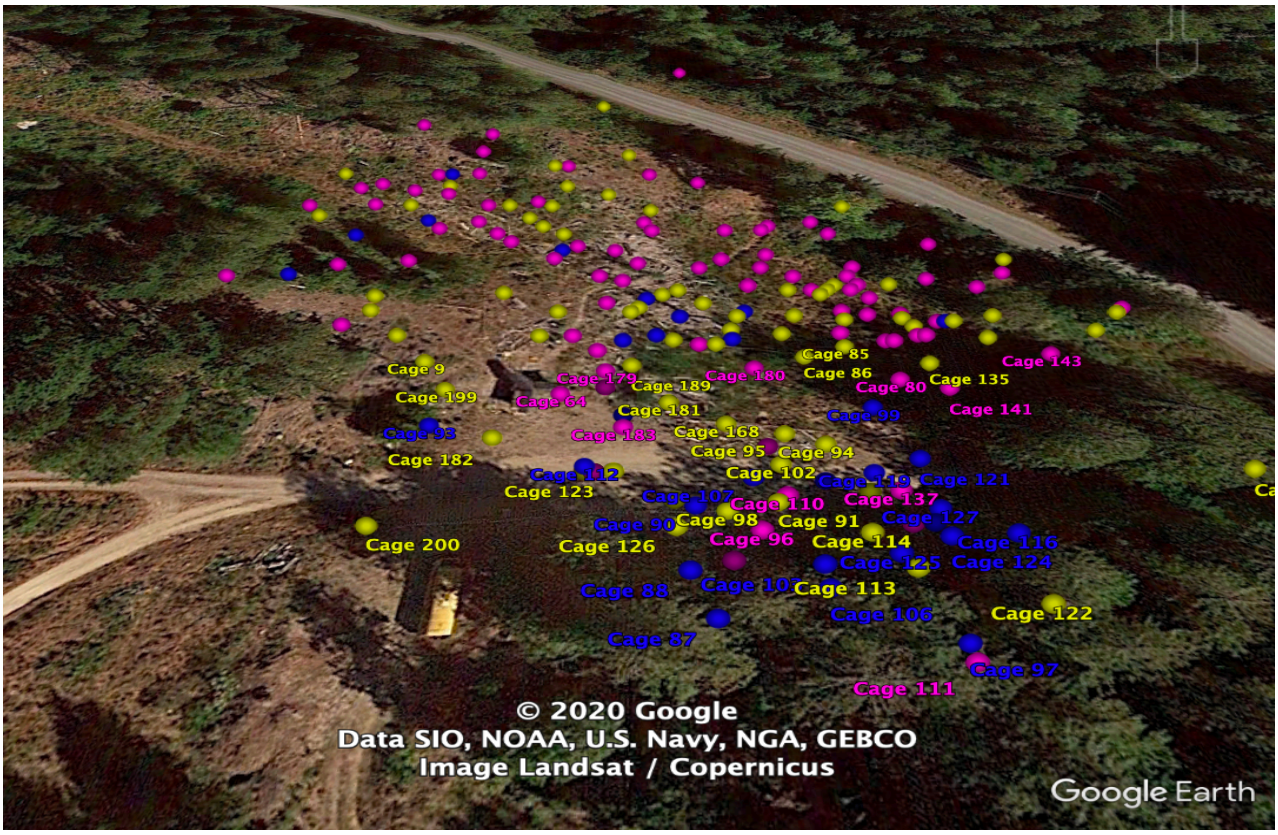

Figure 9. A map of the caged sites created in Google Earth, using georeferenced data from the app Theodolite. Points are colour-coded based on the cage action type. A .kml file is available for upload.

Once mapped, the coverage of the caged individuals can be observed (*Figure 9*). As consistent with observations during data collection, many of the individuals exhibiting slower growth or being flagged with blue tape were located on the southwest side of the main road that divides the site. Caging was more likely to be removed in the central to northeast portions of the site, however, some of the cages flagged for removal were due to unsuccessful growth. These unsuccessful cages generally had no planted species within the cage and many were concentrated in the eastern portion of the site. Some positional outliers are exhibited on the map, which speaks

to the error associated with Theodolite. In total, 31 cages were recommended to be kept, 74 to be expanded, and 95 to be removed.

4.2 Species inventory

The species inventory data is taken from two separate plots and was collected by student interns at the GCA in July 2020. The sites include an open plot subject to herbivory and an exclosure plot surrounded by caging. Complete data from the species inventory is located in the appendix in *Table 7*. Both the open and exclosure plots are characterized by several invasive grasses such as *Holcus lanatus*, *Juncus effuses*, and *Phalaris arundinacea*. *Holcus lanatus* made up 70% cover in the open plot, but only 30% cover in the exclosure plot, with grasses making up less of the plot percent cover in general. Other non-native species present on the site are *Hypochaeris radicata*, *Leucanthemum vulgare*, *Trifolium repens*, *Cirsium arvense*, *Vicia villosa*, *Ranunculus repens*, *Plantago lanceolate*, *Cirsium vulgare*, *Lapsana communis*, *Digitalis purpurea*, and *Rumex cf. crispus*. The exclosure plot was characterized by having more shrubs and herbaceous plant cover than the open plot as less of this area was likely dominated by grass cover. Tree density was significantly higher in the exclosure plot, with *Alnus rubra* making up 40% cover of the fenced plot and only 10% cover of the open plot. Slightly different tree species were found in each plot with *Thuja plicata* only being found in the open plot and *Abies grandis* only being found in the exclosure plot. Species subject to browsing pressure were *Rosa nutkana, Rosa gymnocarpa, Rubus spectabilis, Alnus rubra,* and *Pseudotsuga menziesii*. Some of these individuals were caged yet were still impacted by herbivory.

5.0 Discussion

5.1 Observed Success of the Initial Restoration Project

Although not all of the aspects of the initial restoration project were monitored during the site visits, the results above as well as observations throughout give a general idea of how successful certain areas of the initial restoration project were. From the beginning, the observed distinction between the exclosed experimental area and the remaining portion of the Mill Site was quite evident. This was further proven through the species inventory results discussed above. Within the original exclosed area, there was significantly greater success of tree growth (*Figures 3a and 3b).* This indicates that the use of an exclosure was successful in preventing deer herbivory and

allowing for native species growth. This was also shown through the individually caged species, and particularly those that fit within the "expand" category. As is seen in *Figure 8b*, many of these species were very large in volume, but were unable to make it past the cage height due to browsing pressure. In the absence of caging these species would likely not have succeeded. Volunteer species were also observed throughout our data collection and our overall walk through of the site. The presence of these species indicates some level of success as species are growing and succeeding without being planted, caged, or monitored. Consistent volunteer species on the Mill Site include *Acer macrophyllum*, *Pseudotsuga menziesii*, and *Thuja Plicata.*

5.2 Photopoint Locations and Future Repeat Photography

Repeat photography is a way to document changes in the ecology and geology of landscapes over time (Goforth & Boyer, 2018). This is particularly important in a rapidly changing ecosystem such as the Mill Site. The photos will not only allow the GCA to monitor the changes induced by the original restoration project, but it will also provide evidence of the positive effects of restoration which may be useful for educational purposes and funding opportunities. The photos will also prove to be particularly important in a setting like the GCA where there are often new summer staff every year. Two additional photopoint locations were chosen during our site visits. These areas were chosen as they were not captured in the original photopoint locations and as a significant amount of change was observable since the beginning of the initial restoration in 2014. Over time, the photopoint locations may need to be moved or altered depending on the growth rate and height of species. The second photopoint location captures many *Abies grandis* and *Pseudotsuga menziesii* species which, dependent on their growth, could block the field of view in the future.

Although the work in this project involved determining photopoint locations, future staff or volunteers will need to perform repeat photography at the locations. In order to aid in this task, the following procedures, taken from Goforth & Boyer's (2018) work regarding repeat photography at the Galiano Conservancy, will be introduced. Initially, it is important that the photographer and crew record information that will aid future photographers and staff members to replicate the photo. This includes recording the date, time, weather conditions, dominant plant species, and geographic location as well as information on the camera including the model, lens

setting, the vertical tilt, and compass bearing. The height of the tripod and accurate geographic coordinates at the location of the center of the tripod should be recorded. A photo of the photographer with the camera and tripod is also useful to replicate the position. The original photo is particularly important as it will serve as a model for future photographs. In order to avoid continuous error, ensure that the camera is level and take multiple photos to work with. The app Theodolite could be useful for this purpose as it creates a photo with geographic coordinates displayed.

5.3 Species Inventory

The species inventory data collected by employees of the GCA furthers our understanding of site development when compared against the original planting plan in Hamann-Bennoit's technical report (2014). As the site has seen little monitoring or intervention since the original planting, it was likely that volunteers, non-natives, and hyperabundant species would be present at the site. When walking the site, there is an observational difference between the community present in the original exclosure area, which was fully caged until recently, and the remainder of the site. These differences are in part described by the inventory data (*Table 7*) but are mainly noticeable in terms of the successful growth and maturity of tree and shrub species when they are not subject to browsing pressure on-site. The data on browsing is extremely useful for informing a future planting plan in areas with less coverage or growth success. These observations mirror our field notes, with heavy browsing evident on species such as *Alnus rubra, Rubus spectabilis, Rosa nutkana* and *Rosa gymnocarpa*. The areas outside of the original exclosure are also dominated by grasses and other herbaceous species with the exception of the larger caged shrubs and trees. It is likely that as the site progresses on the trajectory towards a mature forest, some of these low-lying species will be impacted by lack of sun and nutrients. The species inventory through the years may help to illuminate the successional pathways being followed.

As these data are not based on the whole site, but rather two test sites (the open plot versus the exclosure plot) it does not provide a whole picture but is useful in representing species presence within certain site characteristics. In future, it may be of use to perform an annual species inventory of the site with similar methods in order to investigate growth in the microtopographies more accurately. This inventory was beyond the scope of this short project,

however, it could be of use if any statistical analyses of site characteristics and communities was required in the future.

5.4 Amenity Location

The first location indicated for a future picnic area was chosen due to its proximity to the bike station and due to the fact that the area was already cleared and it would therefore not impede on the ecological integrity of the site (*Figure 7a*). This is consistent with our second goal as well as with two of the GCA's goals which include facilitating public access and opportunities for recreation. We envision this picnic area to be a place where cyclists, hikers, and environmental enthusiasts can pause for a lunch break and enjoy the surrounding restoration site. The second option suggested is also situated in a cleared area, and closer to the existing trailhead information and picnic table (*Figure 7b*). This area was selected as adding more infrastructure to the trailhead may turn this area into more of a meeting location, which also remains consistent with both our second goal and the goals of the GCA.

5.5 Planting Plan

Developing an extensive planting plan for the Mill Site was beyond the scope of this project. However, the data collected here and as part of the species inventory can be used to inform future planting. As part of our site assessment, we have identified several locations that should be prioritized for planting individuals located in *Table 3*.

As part of the planting plan, it may be of importance to repeat the original soil analysis (Hamann-Bennoit, 2014) now that communities have developed on the site. As much of the site is dominated by invasive grass cover, some management may be necessary prior to establishing new individuals. Using and maintaining caging as part of the planting plan will be essential for successful establishment and growth of individuals. Based on our observations, browsing pressure appears to be a significant factor in unsuccessful growth, and it is unlikely that many of the successful individuals would have exceeded the browsing height without caging. Particularly successful species, such as *Pseudotsuga menziesii* and *Viburnum trilobum* for example (*Table 6*), may be good candidates to prioritize in planting. Outside of the identified areas for planting, our map displaying the presently caged sites may be useful in evaluating the coverage of planting (*Figure 9*. The desired successional pathway for the site should also be considered in future

planting, as the site continues to progress towards a forest state. Planting trees and large shrubs may be an effective method of managing (via shade) undesirable species, as per our recommendations.

5.6 Limitations

While mapping the caged individuals in Google Earth, it was noted that the app Theodolite 8.2.2 was variably accurate within the limits of our iPhone SE smartphone app and likely between one and three metres. This can be seen in *Figure 9* with the outliers such as cage 47, 51, 90, 104, 168, and 173. For future individuals looking to locate these cages, it would be recommended to refer to the surrounding cages in *Table 5*.

6.0 Conclusion

We believe the recommendations put forward in this report will strengthen current monitoring and facilitate the restorative process. Actions that can be completed are the removal and expansion of some caging, the development of a planting plan, and the addition of education and recreational infrastructure at the site. Suggested monitoring protocols, such as maintaining a species inventory and photopoint locations, should be evaluated and implemented by the GCA staff to ensure their viability. It is our intention that this document serves as a centralized source of information on the Mill Site and can be reviewed by future staff and researchers alike.

7.0 Acknowledgements

This assessment and series of recommendations could not be developed without the knowledge and insight of the GCA Staff, including Adam Huggins, the Restoration Coordinator, as well as our instructor, Dr. Eric Higgs. The Mill Site, and the research and restoration conducted by us and the GCA staff, is situated on the shared, asserted, and unceded traditional territories of the Lamalcha, Penelakut, and Hwitslum First Nations and other Hul'qumi'num speaking peoples, as well as the Sencoten and Wsanec speaking peoples, and the ceded territory of the Tsawwassen First Nation (Wilson, 2018). As settlers working on this land, we feel it is imperative to acknowledge that we do not hold the deep reciprocal relationships as those who have been stewarding this area for time immemorial.

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Appendix

Table 1. Table of 10 outlined ecological communities determined within the Mill Site by Hamann-Bennoit (2014).

Polygon #	Description	Site Series (%)
1	The central part of the area, clear-cut in the early 2000s and used as the main milling and log staging area, compacted and very little vegetation cover, a soil texture and moisture gradient from southwest to northeast, with coarser and drier soil towards the south, area where most of the debris piles were located	06 (60%) 04 (40%)
2	The wetland edge, was clear-cut in the early 2000s, dominated by rushes and agronomic grasses, hummocky terrain with great variations in in soil moisture regime, large stumps indicate that it was a productive site, water table reaching the surface for a few weeks in the winter, transitioning to a wetland community comprising a small pond near Porlier Pass Road, which is home to a cattail (*Typha* sp.) and small-flowered bulrush (*Scirpus microcarpus*) community, in which dwell many Pacific chorus frogs (*Pseudacris regilla*)	06 (50%) 04 (30%) 11 (20%)
3	The western slope, was clear-cut in the early 2000s, largely dominated by agronomic grasses, with some regeneration of Douglas-fir (*Pseudotsuga menziesii*), western redcedar, dull Oregon-grape (*Mahonia nervosa*) and salal (*Gaultheria shallon*), a dry south-facing section and a moister, north-east facing area	01 (70%) 04 (30%)
4	Area with deep, rich and well-drained soil just below the rocky ledge, was clear-cut in the early 2000s, some log staging and debris piles, dominated by common rush (*Juncus effusus*), agronomic grasses and salal, home to some very healthy Scotch broom individuals (prime habitat for the species), some regeneration of trees closer to the forest	04 (80%) 01 (20%)
5	Similar to the central area, but more advanced successional stage, being closer to the forest edge and probably left untouched for longer, some compaction but less severe than in Polygon 1, the south portion will be used as the future area for the garden kiosk	04
6	Western edge of a little remnant of mature Western redcedar – salal-dominated forest	04
7	North-facing slope that was re-contoured and planted with the Galiano Community School in 2012-2013	01
8	Relatively young secondary forest (~75 years old), very little understory vegetation, assumed zonal soil conditions for the CDFmm	01
9	Rocky outcrop with areas of extremely shallow soil, sun-exposed and very dry, some dull Oregon-grape and arbutus (*Arbutus menziesii*) regeneration, agronomic grasses are abundant	02
10	The beginning of the rocky ledge area, south facing and dry, clear-cut in the early 2000s, where most of the Scotch broom population is found, a fair amount of salal, dull Oregon-grape and Douglas-fir regeneration, dominated by agronomic grasses	02

Table 2. UTM coordinates, benchmark descriptions, and scene description of additional photopoint locations, as well as existing locations.

Photopoint Location (UTM Coordinates)	Description of Benchmarks	Description of Scene
1. 10N 465771 5419821	Located on eastern side of rocky ledge situated in ecological community P10 in *Figure 2*	Captures the section between the experimental area and the eastern side of the rocky ledge.
2. 10N 465747 5419826	Located at the base of the western side of the rocky ledge situated at the western end of ecological community P10 in *Figure 2*	Captures the back area located between the signage area/ amenities and western side of rocky ledge.
3. Exclosure Plot (deer monitoring)	South side fence. 3.0m east (right) from southwest corner post.	Looks into the exclosure, in front of the large snag.
4. Open Plot (deer monitoring)	Southwest corner (2m back, at corner of exclosure fence - camera held flush with exclosure fence).	Looks into open plot, adjacent to exclosure fencing.

Table 3. UTM coordinates and description of sites chosen for future planting plan.

Planting Site Location (UTM Coordinates)	Description of Site
1. 10N 465764 5419818	Area with a lot of wood chips and little vegetation located close to the rocky ledge.
2. 10 N 465760 5419791	Woodchip area.
3. 10N 465767 5419815	Well site area, UTM coordinates taken at well head.

Table 4. UTM coordinate and description of area for amenity location.

Amenity Location (UTM Coordinates)	Description of Area
10N 465800 5419771	Located next to the bike rack and pump station. parallel to the driveway.
10N 465758 5419784	Located adjacent to existing trailhead infrastructure in open, grass-covered spot.

Table 5. A complete list of all 200 caged sites with common name, scientific name, coordinates, flagging action and colour, and field notes.

Cage Number	Common Name	Scientific Name	UTM	Action	Flagging Tape Colour	Comments
1	Thimbleberry	*Rubus parviflorus*	10N 465728 5419821	Expand	Yellow	
2	Salal	*Gaultheria shallon*	10N 465719 5419807	Remove	Pink	
3	Evergreen huckleberry	*Vaccinium ovatum*	10N 465727 5419807	Keep	Blue	Fix caging so that the main stem is inside
4	Salal	*Gaultheria shallon*	10N 465726 5419824	Remove	Pink	
5	Rubus spp.	*Rubus spp.*	10N 465735 5419831	Remove	Pink	
6	Douglas-fir	*Pseudotsuga menziesii*	10N 465735 5419825	Remove	Pink	Trunk growing into caging
7	Highbush cranberry	*Viburnum trilobum*	10N 465740 5419829	Remove	Pink	
8	Red huckleberry	*Vaccinium parvifolium*	10N 465740 5419825	Expand	Yellow	
9	Douglas-fir	*Pseudotsuga menziesii*	10N 465747 5419789	Expand	Yellow	
10	Douglas-fir	*Pseudotsuga menziesii*	10N 465745 5419818	Remove	Pink	
11	Unsuccessful	*N/A*	10N 465750 5419821	Remove	Pink	Not clear what was planted here
12	Douglas-fir	*Pseudotsuga menziesii*	10N 465749 5419839	Remove	Pink	Honeysuckle growing around trunk
13	Salmonberry	*Rubus spectabilis*	10N 465729 5419834	Expand	Yellow	
14	Western red cedar	*Thuja plicata*	10N 465733 5419809	Remove	Pink	
15	Thimbleberry	*Rubus parviflorus*	10N 465745 5419833	Keep	Blue	

16	Bigleaf maple	*Acer macrophyllum*	10N 465734 5419816	Keep	Blue	
17	Red alder	*Alnus rubra*	10N 465743 5419821	Keep	Blue	Caging needs to be fixed
18	Salmonberry	*Rubus spectabilis*	10N 465743 5419833	Remove	Pink	
19	Western red cedar	*Thuja plicata*	10N 465732 5419830	Remove	Pink	
20	Grand fir	*Abies grandis*	10N 465749 5419833	Remove	Pink	
21	Grand fir	*Abies grandis*	10N 465745 5419828	Remove	Pink	
22	Grand fir	*Abies grandis*	10N 465749 5419839	Remove	Pink	
23	Grand fir	*Abies grandis*	10N 465750 5419844	Remove	Pink	
24	Huckleberry spp.	*Vaccinium spp.*	10N 465745 5419830	Expand	Yellow	
25	Douglas-fir	*Pseudotsuga menziesii*	10N 465751 5419825	Remove	Pink	
26	Douglas-fir	*Pseudotsuga menziesii*	10N 465755 5419803	Expand	Yellow	
27	Highbush cranberry	*Viburnum trilobum*	10N 465755 5419815	Remove	Pink	
28	Red alder	*Alnus rubra*	10N 465754 5419825	Expand	Yellow	Browsed armenian blackberry
29	Grand fir	*Abies grandis*	10N 465739 5419802	Expand	Yellow	
30	Salmonberry	*Rubus spectabilis*	10N 465739 5419799	Expand	Yellow	
31	Western red cedar	*Thuja plicata*	10N 465742 5419810	Remove	Pink	
32	Oso berry	*Oemleria cerasiformis*	10N 465762 5419830	Expand	Yellow	
33	Pacific willow	*Salix lucida*	10N 465757 5419822	Expand	Yellow	
34	Red alder	*Alnus rubra*	10N 465753 5419817	Remove	Pink	
35	Black hawthorn	*Crataegus douglasii*	10N 465759 5419820	Expand	Yellow	
36	Red-osier dogwood	*Cornus sericea*	10N 465760 5419794	Expand	Yellow	
37	Red alder	*Alnus rubra*	10N 465758 5419826	Remove	Pink	
38	Red alder	*Alnus rubra*	10N 465781 5419831	Remove	Pink	
39	Unsuccessful	*N/A*	10N 465764 5419814	Remove	Pink	Caging broken
40	Red alder	*Alnus rubra*	10N 465764 5419794	Remove	Pink	
41	Mock-orange	*Philadelphus lewisii*	10N 465762 5419817	Expand	Yellow	
42	Oso berry	*Oemleria cerasiformis*	10N 465762 5419799	Expand	Yellow	
43	Nootka rose	*Rosa nutkana*	10N 465767 5419791	Remove	Pink	
44	Douglas-fir	*Pseudotsuga menziesii*	10N 465774 5419833	Remove	Pink	
45	Unsuccessful	*N/A*	10N 465767 5419770	Remove	Pink	Cage is damaged; Himalayan blackberry overgrowth
46	Oceanspray	*Holodiscus discolor*	10N 465760 5419835	Expand	Yellow	
47	Unsuccessful	*N/A*	10N 465780 5419870	Remove	Pink	Not clear what was planted here
48	Unsuccessful	*N/A*	10N 465762 5419835	Remove	Pink	

49	Douglas-fir	*Pseudotsuga menziesii*	10N 465761 5419811	Remove	Pink	
50	Douglas-fir	*Pseudotsuga menziesii*	10N 465767 5419770	Remove	Pink	
51	Saskatoon berry	*Amelanchier alnifolia*	10N 465767 5419855	Expand	Yellow	
52	Arbutus	*Arbutus menzeisii*	10N 465771 5419838	Expand	Yellow	
53	Unsuccessful	*N/A*	10N 465774 5419818	Remove	Pink	
54	Oceanspray	*Holodiscus discolor*	10N 465768 5419828	Expand	Yellow	
55	Salal	*Gaultheria shallon*	10N 465762 5419813	Keep	Blue	
56	Nootka rose	*Rosa nutkana*	10N 465770 5419806	Remove	Pink	
57	Red alder	*Alnus rubra*	10N 465739 5419847	Remove	Pink	Heavily browsed at cage-level, but successful higher up
58	Saskatoon berry	*Amelanchier alnifolia*	10N 465774 5419824	Expand	Yellow	
59	Douglas-fir	*Pseudotsuga menziesii*	10N 465769 5419813	Remove	Pink	
60	Oceanspray	*Holodiscus discolor*	10N 465736 5419796	Remove	Pink	May wish to expand instead
61	Unsuccessful	*N/A*	10N 465773 5419821	Remove	Pink	Oregon-grape overgrowth
62	Douglas-fir	*Pseudotsuga menziesii*	10N 465790 5419819	Remove	Pink	
63	Douglas-fir	*Pseudotsuga menziesii*	10N 465772 5419810	Remove	Pink	
64	Salal	*Gaultheria shallon*	10N 465763 5419783	Remove	Pink	Honeysuckle growing around caging
65	Trailing blackberry	*Rubus ursinus*	10N 465783 5419811	Remove	Pink	
66	Western red cedar	*Thuja plicata*	10N 465798 5419817	Remove	Pink	
67	Red-osier dogwood	*Cornus sericea*	10N 465801 5419824	Expand	Yellow	
68	Unsuccessful	*N/A*	10N 465788 5419809	Remove	Pink	Unsure of what was growing here
69	Black hawthorn	*Crataegus douglasii*	10N 465799 5419807	Remove	Pink	
70	Unsuccessful	*N/A*	10N 465801 5419802	Remove	Pink	
71	Unsuccessful	*N/A*	10N 465792 5419807	Remove	Pink	
72	Trailing blackberry	*Rubus ursinus*	10N 465796 5419820	Remove	Pink	
73	Oso berry	*Oemleria cerasiformis*	10N 465815 5419797	Expand	Yellow	
74	Pacific willow	*Salix lucida*	10N 465800 5419805	Remove	Pink	Consider taping trunk in future
75	Pacific ninebark	*Physocarpus capitatus*	10N 465810 5419796	Expand	Yellow	Lots of herbivory present
76	Salmonberry	*Rubus spectabilis*	10N 465805 5419795	Expand	Yellow	
77	Red-osier dogwood	*Cornus sericea*	10N 465804 5419805	Expand	Yellow	
78	Salmonberry	*Rubus spectabilis*	10N 465808 5419796	Remove	Pink	
79	Grand fir	*Abies grandis*	10N 465813 5419792	Expand	Yellow	
80	Salmonberry	*Rubus spectabilis*	10N 465801 5419784	Remove	Pink	
81	Bigleaf maple	*Acer macrophyllum*	10N 465804 5419797	Expand	Yellow	

82	Salmonberry	*Rubus spectabilis*	10N 465804 5419798	Remove	Pink	
83	Horsetail overgrowth	*Equisetum arvense*	10N 465796 5419794	Remove	Pink	
84	Horsetail overgrowth	*Equisetum arvense*	10N 465800 5419809	Remove	Pink	
85	Salmonberry	*Rubus spectabilis*	10N 465796 5419791	Expand	Yellow	
86	Red-osier dogwood	*Cornus sericea*	10N 465791 5419789	Expand	Yellow	
87	Common snowberry	*Symphoricarpos albus*	10N 465778 5419749	Keep	Blue	*Beginning of small section on the other side of the parking lot
88	Western red cedar	*Thuja plicata*	10N 465776 5419755	Keep	Blue	
89	Baldhip rose	*Rosa gymnocarpa*	10N 465780 5419756	Remove	Pink	Not much larger than caging, but no clear herbivory present
90	Baldhip rose	*Rosa gymnocarpa*	10N 465777 5419764	Keep	Blue	
91	Evergreen huckleberry	*Vaccinium ovatum*	10N 465785 5419764	Expand	Yellow	
92	Grand fir	*Abies grandis*	10N 465770 5419779	Keep	Blue	Arbutus in caging as well
93	Grand fir	*Abies grandis*	10N 465749 5419778	Keep	Blue	Arbutus in caging as well
94	Western hemlock	*Tsuga heterophylla*	10N 465791 5419773	Expand	Yellow	
95	Douglas-fir	*Pseudotsuga menziesii*	10N 465787 5419775	Expand	Yellow	
96	Western hemlock	*Tsuga heterophylla*	10N 465783 5419760	Remove	Pink	
97	Black hawthorn	*Crataegus douglasii*	10N 465798 5419745	Keep	Blue	
98	Oceanspray	*Holodiscus discolor*	10N 465780 5419763	Expand	Yellow	
99	Oso berry	*Oemleria cerasiformis*	10N 465797 5419779	Keep	Blue	
100	Common snowberry	*Symphoricarpos albus*	10N 465790 5419767	Keep	Blue	Cage needs to be fixed
101	Evergreen huckleberry	*Vaccinium ovatum*	10N 465784 5419798	Expand	Yellow	
102	Baldhip rose	*Rosa gymnocarpa*	10N 465786 5419770	Expand	Yellow	
103	Common snowberry	*Symphoricarpos albus*	10N 465788 5419755	Keep	Blue	
104	Pacific ninebark	*Physocarpus capitatus*	10N 465806 5419693	Keep	Blue	Douglas-fir and western red cedar volunteers in caging
105	Trailing blackberry	*Rubus ursinus*	10N 465785 5419773	Remove	Pink	Douglas-fir and grand fir volunteers in caging
106	Western red cedar	*Thuja plicata*	10N 465788 5419752	Keep	Blue	
107	Mock-orange	*Philadelphus lewisii*	10N 465783 5419768	Keep	Blue	
108	Western red cedar	*Thuja plicata*	10N 465775 5419781	Expand	Yellow	Salal in caging
109	Oso berry	*Oemleria cerasiformis*	10N 465780 5419763	Keep	Blue	
110	Thimbleberry	*Rubus parviflorus*	10N 465786 5419765	Remove	Pink	May be red-flowering currant
111	Salal overgrowth	*Gaultheria shallon*	10N 465798 5419743	Remove	Pink	
112	Salmonberry	*Rubus spectabilis*	10N 465766 5419771	Keep	Blue	Vetch spp. and salal in caging
113	Oceanspray	*Holodiscus discolor*	10N 465796 5419754	Expand	Yellow	
114	Oceanspray	*Holodiscus discolor*	10N 465793 5419759	Expand	Yellow	

115	Common snowberry	*Symphoricarpos albus*	10N 465766 5419770	Expand	Yellow	
116	Western red cedar	*Thuja plicata*	10N 465806 5419758	Keep	Blue	
117	Grand fir	*Abies grandis*	10N 465799 5419760	Keep	Blue	Looks recently planted
118	Grand fir	*Abies grandis*	10N 465797 5419760	Remove	Pink	
119	Western red cedar	*Thuja plicata*	10N 465795 5419768	Keep	Blue	
120	Pacific ninebark	*Physocarpus capitatus*	10N 465794 5419765	Expand	Yellow	
121	Saskatoon berry	*Amelanchier alnifolia*	10N 465800 5419770	Keep	Blue	Volunteer western red cedar in cage
122	Common snowberry	*Symphoricarpos albus*	10N 465806 5419749	Expand	Yellow	
123	Oso berry	*Oemleria cerasiformis*	10N 465769 5419770	Expand	Yellow	With red alder takeover (this could have been the original plant)
124	Saskatoon berry	*Amelanchier alnifolia*	10N 465800 5419758	Keep	Blue	
125	Western red cedar	*Thuja plicata*	10N 465795 5419756	Keep	Blue	May want to leave as is
126	Red alder	*Alnus rubra*	10N 465775 5419761	Expand	Yellow	
127	Baldhip rose	*Rosa gymnocarpa*	10N 465800 5419762	Keep	Blue	*Small section on the other side of the parking lot ended
128	Grand fir	*Abies grandis*	10N 465767 5419770	Expand	Yellow	
129	Unsuccessful	*N/A*	10N 465766 5419770	Remove	Pink	Nothing in cage
130	Unsuccessful	*N/A*	10N 465801 5419792	Remove	Pink	
131	Salmonberry	*Rubus spectabilis*	10N 465830 5419797	Expand	Yellow	May want to use the same cage for 131 and 132
132	Salmonberry	*Rubus spectabilis*	10N 465830 5419797	Expand	Yellow	May want to use the same cage for 131 and 132
133	Salmonberry	*Rubus spectabilis*	10N 465820 5419810	Expand	Yellow	
134	Horsetail overgrowth	*Equisetum arvense*	10N 465800 5419798	Remove	Pink	
135	Western red cedar	*Thuja plicata*	10N 465805 5419787	Expand	Yellow	
136	Red alder	*Alnus rubra*	10N 465775 5419765	Expand	Yellow	Heavily browsed and broken caging
137	Thimbleberry	*Rubus parviflorus*	10N 465797 5419765	Remove	Pink	Trailing blackberry overgrowth
138	Western red cedar	*Thuja plicata*	10N 465809 5419796	Keep	Blue	
139	Mock-orange	*Philadelphus lewisii*	10N 465832 5419767	Expand	Yellow	
140	Unsuccessful	*N/A*	10N 465767 5419770	Remove	Pink	Blackberry overgrowth and cut woody stem with tape around the top
141	Unsuccessful	*N/A*	10N 465806 5419782	Remove	Pink	
142	Red-osier dogwood	*Cornus sericea*	10N 465826 5419793	Expand	Yellow	Hidden at wetter side of site
143	Unsuccessful	*N/A*	10N 465819 5419788	Remove	Pink	Just grass in cage
144	Saskatoon berry	*Amelanchier alnifolia*	10N 465815 5419804	Remove	Pink	Salmonberry also present
145	Unsuccessful	*N/A*	10N 465819 5419807	Remove	Pink	
146	Common snowberry	*Symphoricarpos albus*	10N 465831 5419798	Remove	Pink	Small, but covered in thistle spp.
147	Western red cedar	*Thuja plicata*	10N 465806 5419793	Remove	Pink	

148	Salal	*Gaultheria shallon*	10N 465802 5419792	Remove	Pink	Horsetail overgrowth
149	Western red cedar	*Thuja plicata*	10N 465789 5419812	Remove	Pink	Red-osier dogwood also present
150	Mock-orange	*Philadelphus lewisii*	10N 465797 5419797	Expand	Yellow	
151	Pacific ninebark	*Physocarpus capitatus*	10N 465796 5419804	Expand	Yellow	Heavily browsed
152	Western red cedar	*Thuja plicata*	10N 465805 5419793	Remove	Pink	Horsetail and thistle overgrowth
153	Black hawthorn	*Crataegus douglasii*	10N 465797 5419799	Remove	Pink	Very Successful
154	Thimbleberry	*Rubus parviflorus*	10N 465811 5419814	Remove	Pink	Outshaded by reed canary grass
155	Unsuccessful	*N/A*	10N 465784 5419818	Remove	Pink	Cage Trampled
156	Bigleaf maple	*Acer macrophyllum*	10N 465791 5419798	Expand	Yellow	Heavily browsed
157	Unsuccessful	*N/A*	10N 465794 5419804	Remove	Pink	Thistles everywhere
158	Unsuccessful	*N/A*	10N 465800 5419805	Remove	Pink	Covered in invasive grass
159	Unsuccessful	*N/A*	10N 465786 5419805	Remove	Pink	Reed canary grass
160	Unsuccessful	*N/A*	10N 465789 5419818	Remove	Pink	
161	Salmonberry	*Rubus spectabilis*	10N 465797 5419805	Expand	Yellow	
162	Unsuccessful	*N/A*	10N 465799 5419804	Remove	Pink	
163	Unsuccessful	*N/A*	10N 465780 5419809	Remove	Pink	
164	Red-osier dogwood	*Cornus sericea*	10N 465791 5419804	Expand	Yellow	
165	Salmonberry	*Rubus spectabilis*	10N 465783 5419795	Expand	Yellow	Heavily browsed
166	Red alder	*Alnus rubra*	10N 465795 5419803	Expand	Yellow	Heavily browsed
167	Unsuccessful	*N/A*	10N 465809 5419806	Remove	Pink	Thistle overgrowth
168	Red alder	*Alnus rubra*	10N 465781 5419777	Expand	Yellow	Hidden- located close to the main exclosure
169	Red alder	*Alnus rubra*	10N 465777 5419804	Expand	Yellow	Cage needs to be fixed
170	Unconfirmed	*N/A*	10N 465783 5419793	Keep	Blue	Remove if it ends up being invasive
171	Baldhip rose	*Rosa gymnocarpa*	10N 465789 5419794	Expand	Yellow	
172	Red alder	*Alnus rubra*	10N 465775 5419803	Expand	Yellow	Heavily browsed
173	Red alder	*Alnus rubra*	10N 465781 5419792	Expand	Yellow	
174	Western red cedar	*Thuja plicata*	10N 465786 5419805	Remove	Pink	Very Successful
175	Bigleaf maple	*Acer macrophyllum*	10N 465774 5419794	Keep	Blue	Fix cage
176	Grand Fir	*Abies grandis*	10N 465779 5419792	Remove	Pink	
177	Nootka rose	*Rosa nutkana*	10N 465768 5419784	Remove	Pink	Red alder also in cage
178	Nootka rose	*Rosa nutkana*	10N 465768 5419784	Remove	Pink	
179	Western red cedar	*Thuja plicata*	10N 465768 5419787	Remove	Pink	
180	Nootka rose	*Rosa nutkana*	10N 465785 5419787	Remove	Pink	

181	Baldhip rose	*Rosa gymnocarpa*	10N 465775 5419781	Expand	Yellow	
182	Nootka rose	*Rosa nutkana*	10N 465756 5419776	Expand	Yellow	
183	Mock-orange	*Philadelphus lewisii*	10N 465770 5419777	Remove	Pink	
184	Oceanspray	*Holodiscus discolor*	10N 465743 5419794	Expand	Yellow	
185	Baldhip rose	*Rosa gymnocarpa*	10N 465785 5419799	Keep	Blue	
186	Oceanspray	*Holodiscus discolor*	10N 465776 5419793	Expand	Yellow	
187	Baldhip rose	*Rosa gymnocarpa*	10N 465770 5419793	Keep	Blue	
188	Salmonberry	*Rubus spectabilis*	10N 465777 5419798	Keep	Blue	
189	Western red cedar	*Thuja plicata*	10N 465771 5419788	Expand	Yellow	
190	Salmonberry	*Rubus spectabilis*	10N 465771 5419799	Expand	Yellow	
191	Unsuccessful	*N/A*	10N 465773 5419802	Keep	Blue	
192	Grand fir	*Abies grandis*	10N 465783 5419811	Remove	Pink	Looks unhealthy
193	Red-osier dogwood	*Cornus sericea*	10N 465767 5419770	Expand	Yellow	
194	Black hawthorn	*Crataegus douglasii*	10N 465760 5419825	Expand	Yellow	
195	Red alder	*Alnus rubra*	10N 465772 5419800	Expand	Yellow	
196	Black hawthorn	*Crataegus douglasii*	10N 465767 5419807	Remove	Pink	
197	Red alder	*Alnus rubra*	10N 465768 5419801	Remove	Pink	
198	Bigleaf maple	*Acer macrophyllum*	10N 465780 5419801	Expand	Yellow	
199	Baldhip rose	*Rosa gymnocarpa*	10N 465750 5419784	Expand	Yellow	
200	Common snowberry	*Symphoricarpos albus*	10N 465745 5419763	Expand	Yellow	

Table 7. Species inventory data at the open and exclosure plots located on the Mill Site, collected by GCA student interns during the 2020 field season using a set template.

Species Composition					***Species Composition***			
Open Plot					**Exclosure Plot**			
Grass	**Herbs**	**Shrubs**	**Trees**		**Grass**	**Herbs**	**Shrubs**	**Trees**
Holcus lanatus	*Hypochaeris radicata*	*Cystisus scoparius*	*Alnus rubra*		*Holcus lanatus*	*Digitalis purpurea*	*Rubus spectablilis*	*Alnus rubra*
Agrostis spp.	*Leucanthemum vulgare*	*Gautheria shallon*	*Pseudotsuga mensiesii*		*Juncus effusus*	*Leucanthemum vulgare*	*Rubus ursinus*	*Thuja plicata*
Juncus effusus	*Trifolium repens*	*Rubus ursinus*	*Thuja plicata*		*Bromus vulgaris*	*Cirsium arvense*	*Gaultheria shallon*	*Pseudotsuga menziesii*
Phalaris arundinacea	*Cirsium arvense*	*Rubus laciniatus*	*Acer macrophyllum*		*Agrostis spp.*	*Lapsana communis*	*Polystichum munitum*	*Abies grandis*
Elymus glaucus	*Vicia villosa*	*Rosa gymnocarpa*			*Phalaris arundinacea*	*Ranunculus repens*	*Rubus parviflorus*	*Acer macrophyllum*
	Galium aparine	*Rubus spectabilis*				*Galium aparine*	*Rubus laciniatus*	
	Ranunculus repens					*Hypochaeris radicata*	*Rubus vestitus*	
	Madia sativa					*Vicia spp.*	*Symphoricarpos albus*	

	Plantago lanceolata		**Tree Recuits**			*Nemophila parviflora*		**Tree Recuits**
	Cirsium vulgare		*Acer macrophyllum*			*Plantago lanceolata*		Acer Macrophyllum
	Lapsana communis		*Pseudotsuga menziesii*			*Madia sativa*		
	Fragaria vesca		*Thuja plicata*			*Prunella vulgaris*		
	Digitalis purpurea					*Vicia sativa*		
						Rumex cf. crispus		
Percent Cover								
Open Plot					***Percent Cover***			
Grass		**Herbs**			**Exclosure Plot**			
Species	**Cover**	**Species**	**Cover**		**Grass**		**Herbs**	
Holcus lanatus	70%	*Hypochaeris radicata*	5%		**Species**	**Cover**	**Species**	**Cover**
Agrostis spp.	15%	*Leucanthemum vulgare*	15%		*Holcus lanatus*	30%	*Digitalis purpurea*	5%
Juncus effusus	10%	*Lapsana communis*	3%		*Agrostis spp.*	35%	*Cirsium arvense*	40%
Phalaris arundinacea	1%	Cirsium arvense	7%		Juncus effusus	2%	*Leucanthemum vulgare*	15%
		Cirsium vulgare	3%		*Phalaris arundinacea*	2%	*Lapsana communis*	10%
		Ranunculus repens	2%				*Vicia sativa*	5%
		Digitalis purpurea	7%				*Hypochaeris radicata*	5%
Shrubs		**Trees**					*Nemophila parviflora*	3%
Species	**Cover**	**Species**	**Cover**				*Ranunculus repens*	3%
Cystisus scoparius	3%	*Abies grandis*	1%				*Galium aparine*	4%
Gautheria shallon	1%	*Alnus rubra*	10%		**Shrubs**		**Trees**	
Rubus ursinus	1%	*Thuja plicata*	1%		**Species**	**Cover**	**Species**	**Cover**
Rubus laciniatus	2%				Rubus spectabilis	4%	Alnus rubra	40%
Rosa gymnocaropa	1%				*Symphoricarpos albus*	1%	*Acer macrophyllum*	5%
		Tree Recuits	**Count**		*Polystichum munitum*	1%	*Abies grandis*	1%
		Acer macrophyllum	2		*Rubus laciniatus*	5%	*Pseudotsuga menziesii*	3%
		Pseudotsuga menziesii	3		*Rubus vestitus*	3%		
		Thuja plicata	5		*Rubus ursinus*	8%		
					Gaultheria shallon	8%		
Browsing							**Tree Recuits**	**Count**
Open Plot							*Acer macrophyllum*	1
Shrubs		**Trees**						
Species	**Browsing**	**Species**	**Browsing**					
Rosa nutkana	1	Thuja plicata	0					
Rosa gymnocarpa (caged)	1	Alnus rubra (caged)	2					
Rubus spectabilis	1	Pseudotsuga menziesii (recruit)	1					

Table 8. Robust assessment scale used currently by the GCA that can be applied to future monitoring and species inventories at the Mill Site. Taken from the GCA Google Drive (2014).

Vigour	0 - **Dead** – no new growth, no buds alive 1 - **very poor** – dieback on leader and branches, poor condition/color of leaves 2 - **Poor** – significant dieback is observed in branching and/or leader, obvious discoloration, New growth is poor. 3 - **Medium** – some dieback in branches or leader is evident, discoloration is observed but new growth is observed, 4 - **Healthy** – plant looks generally healthy with some new growth but not vigorous. Dieback may be observed but is minimal, minor discoloration possible 5 - **very healthy** – robust, new growth, no dieback, no discoloration in new growth
Herbivory	1 - none 2 – observed but minor 3 – major (may threaten survival)
Height	1 – 0 to 0.3 m 2 – 0.3 to 0.6 m 3 – 0.6 to 1.0 m 4 – 1 to 2 m 5 – 2 to 10 m

Figure 3a. Initial 20m x 20m caging installed in 2014 to reduce browsing pressure, taken by a GCA staff member in 2014. Figure 3b. An image taken by a GCA staff member in 2020, when the original caging was removed. The current 10m x 10m caging is not visible but is located behind the successful tree growth.

Figure 5. Photos of first photopoint location on the eastern side of the rocky ledge. Photos taken using the app Theodolite.

Figure 6. Photos of the second photopoint location near the base of the western side of the rocky ledge. Photos taken using the app Theodolite.

Figure 7a. Suggested location for a second picnic table situated near the entrance and bike maintenance areas, located at 10N 465800 5419771. Figure 7b. Suggested location for a second picnic table situated near the trailhead, located at 10N 465758 5419784.