Imagining restoration of the Galiano Conservancy Association's Project Centre Site

ER412
Fern Yip V00020676
For Professor Eric Higgs
August, 2018

Introduction

1.1 Background

In Fall 2018, construction for a Project Centre at the entrance to the Galiano Conservancy Association's District Lot 57 (10825 Porlier Pass Road) will begin. Architectural plans exist for the building and attached patio and deck areas. The Project Centre will house staff offices and includes basic bathroom and kitchen facilities for staff use (see Appendix A). The location of the area is within one of the multi-use facility zones as defined by the GCA's management plan and lies adjacent to a current parking area and across the dirt road from the restored mill site. The larger surrounding area (including the Project Centre site) was historically disturbed due to the previous owner's logging and milling activities, which resulted in forest clearings and soil compaction. Further disturbance to the area has occurred and continues to occur due to ongoing construction of the Project Centre and placement of below surface utility lines. The degraded nature of the Project Centre site makes it a good candidate for restoration.

1.2 Project Site and Description

The restoration site comprises a sloped area with a southwest aspect. The site is bounded by a dirt road on its northwest side, the Project Centre on its east side, and coniferous forest dominated by Western redcedar (*Thuja plicata*) on its south side. Currently, the dominant vegetation colonizing the logged site consists of a variety of non-native grasses and both native and non-native weedy species (see section 2.1 for more details). The area comprises a total of approximately 735m^2 or 0.18 acres. A wooden post in the northeast corner of the site is located at UTM 0465748, 5419767 (Figure 1.2.1).

The excavation of the Project Centre area has resulted in the removal of top layers of soil that now exist as a single large pile on the site. Next to this soil pile is a pile of coarse woody debris (Figure 1.2.2). Another disturbance feature caused by large machinery is a linear feature where utility lines for the GCA facilities are buried. This linear feature of exposed earth runs northeast from the southwest corner of the coarse woody debris pile into the coniferous forest on the eastern side of the site. Together these disturbances will impact the soil composition of the site with increased compaction in some areas and mixed soils in others.

An important consideration for restoration of the site is the nearby proximity of the future solar panel module, which will be located directly west across the dirt road from the site.

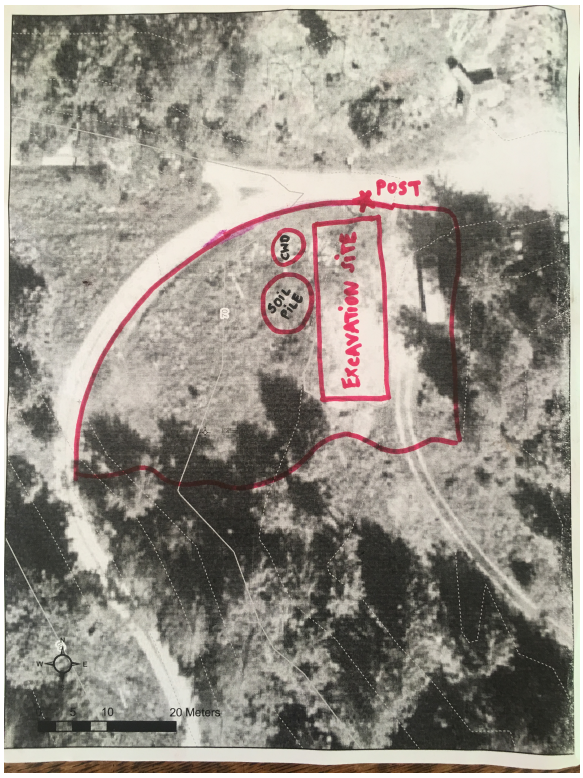


Figure 1.2.1 Satellite image of restoration site. Boundaries of site, marking post, soil pile, and coarse woody debris pile outlined in red.


Figure 1.2.2 View of the restoration site from the solar panel site (courtesy of Lauren Goforth and Christophe Boyer's repeat photography project from ER412, 2018)

1.3 Legal and management obligations

Restoration of the site must be consistent with the following management guidelines and bylaws:

- Rural zoning bylaws set by the Island Trust
- Guidelines for integrated management areas as described in the 2013 Galiano Learning Centre Management Plan (see pg. 22)
- Bylaws as set by the Galiano Island Local Trust Committee in the 1995 Official Community Plan Bylaw No.108.

1.4 Scope and Project Objectives

My work focuses on conceptualizing and making recommendations for restoration to the degraded land southwest of the Project Centre site. Central are goals for the site as described by Keith Erickson:

- Increasing ecological integrity of the site through some forest restoration
- Ensuring that any restoration plan does not interfere significantly with solar panel energy production
- Creating landscape features that appeal to staff use
- Demonstrating the possibilities of restoration to visitors of the GCA

This last goal highlights the unique opportunity that restoration of the site presents due to the centrality of its location. The Project Centre will serve as the first point of entry for visitors to the GCA, which increases the educational and experiential value of restoration to the site.

2.0 Methods

Site observations and assessments were made from August 21st – August 28th, 2018 to gather information that may be valuable for future restoration efforts. This initial assessment is intended to provide a basic foundation of knowledge but future assessments will be necessary before any restoration actually begins.

2.1 Flora

The most common plants found on the site were ones that thrive in disturbed, open areas such as common rush (*Juncus effucus*), Canada thistle (*Cirsium vulgare*), bracken fern (*Pteridium aquilinum*), stinging nettle (*Utica dioica*), *Rubus spp.* and several species of non-native grasses. Several less common species and individual plants that may be of salvage value were also found and marked with GPS coordinates (Table 2.1-1).

Table 2.1-1 Uncommon or salvage value plants of the Project Centre restoration site and their GPS coordinates (Aug. 22, 2018)

Latin name	Common name	Coordinates	Description
Satureja douglasii	Yerba buena	0465707, 5419736	Small patch
Mahonia aquilifolium	Tall Oregon grape	0465711, 5419735	1 individual
Gnaphalium thermale	Slender cudweed	0465727, 5419766	1 individual
Rubus spectabilis, R. ursinus, R. discolor	Salmonberry, trailing blackberry, Himalayan blackberry	0465723, 5419759	Patch of *Rubus spp*. growing on an old stump
Pseudotsuga menziesii	Douglas-fir	0465705, 5419742	6 saplings (<0.5m height)

Pseudotsuga menziesii	Douglas-fir	0465735, 5419743	2 saplings (1-1.5m height)
Thuja plicata	Western red cedar	0465711, 5419741	7 saplings (<0.5m height)

There is also a bigleaf maple (*Acer macrophyllum*) sapling that grows on a nursery stump adjacent to the soil pile. This maple was purposefully left untouched by the excavator who died of a heart attack in the GCA parking lot shortly after finishing excavation work (per Keith Erickson). Due to the maple's sentimental value, effort should be made to salvage or incorporate its growth in the building and restoration plans. One possibility would be to incorporate the big leaf maple in the patio design.

2.2 Soil assessment

Field determination of soil texture from the large soil pile was completed following field test procedures from the forest service of British Columbia (Appendix B). The results of the field test indicate that the large soil pile (ie. a mixture of soil layers from the excavation work) is loamy as summarized below in Table 2.2-1.

Table 2.2-1 Soil pile sample- field determination results (Aug 28, 2018)

Test method (in order conducted)	Result
Graininess	Not grainy in texture
Moist cast	Moderate cast
Stickiness	Not sticky to slightly sticky
Worm	None
Taste	Slightly gritty
Soil classification	Loam

Two soil pit attempts were made on August 24, 2018 but there was insufficient time to complete a full pit. The first soil pit attempt encountered a top layer of decaying wood up to 30cm deep and the second one encountered gravelly soil up to 30cm deep. The excavation pit of the Project Centre shows a soil profile containing a layer of organic matter. These initial assessments indicate that the organic matter currently present in the soil may be sufficient for restoration purposes. However, more complete assessments are needed to determine the quality of soil.

2.3 Hydrology of site

The slope of the site directs water to the northwest corner as indicated by the presence of common rush aggregating in this area. The common rush presence also suggests areas that are more seasonally moist than the rest of the site. The ditch adjacent to the dirt road on the north side of the site also directs water flow to a culvert that travels underneath the road. There are no visible water inputs to the site, and the site was very dry when I conducted my work. The lack of water except

during the rainy season should be considered in determining which plant species will be used in restoration plans. The GCA could also consider harvesting water from the roof to help irrigate plants (see section 3.3).

2.4 Solar panel restrictions

To determine how different canopy heights on the site may impact the output of the nearby solar panels, an online solar panel installation tool called Helioscope was used. Helioscope calculates how much shade loss trees on a particular site will cause based on their height, radius and distance from the solar panels. Multiple scenarios were generated representing a north-south tree canopy (5 -75m in height and 3.6-4.0m in radius) located at 10, 20, 30, and 40 meter intervals 180 degrees south from a reference rock at UTM 0455721, 5419771 (see Appendix C). The results are shown below in graphs alongside their corresponding scenario (Figures 2.4-1, 2.4-2, 2.4-3, and 2.4-4)

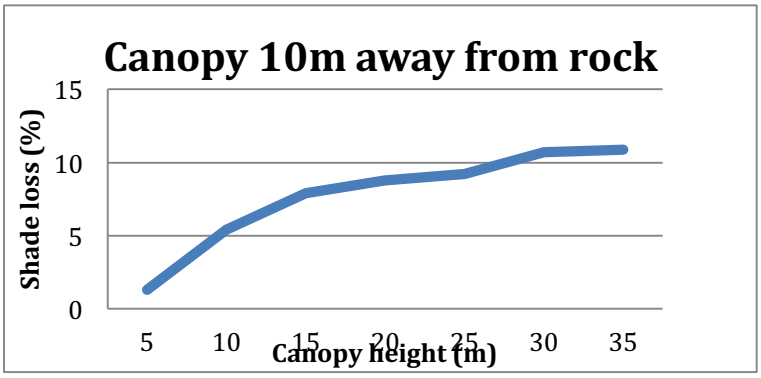


Figure 2.4-1 Shade losses of a north-south tree canopy (4 individuals of 3.6m radius)10 meters from reference rock at 5-35m heights

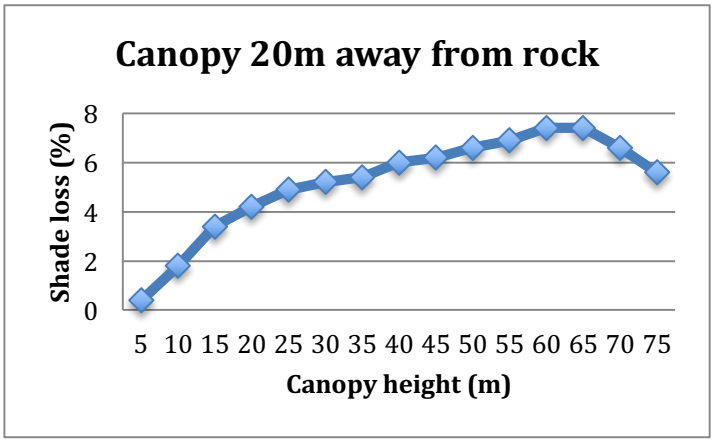
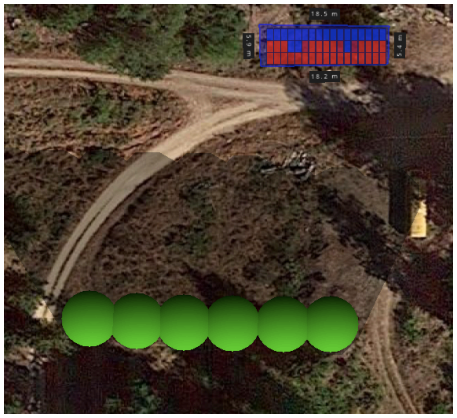


Figure 2.4-2 Shade losses of a north-south tree canopy (4 individuals of 3.8m radius) 20 meters from reference rock at 5-75m heights



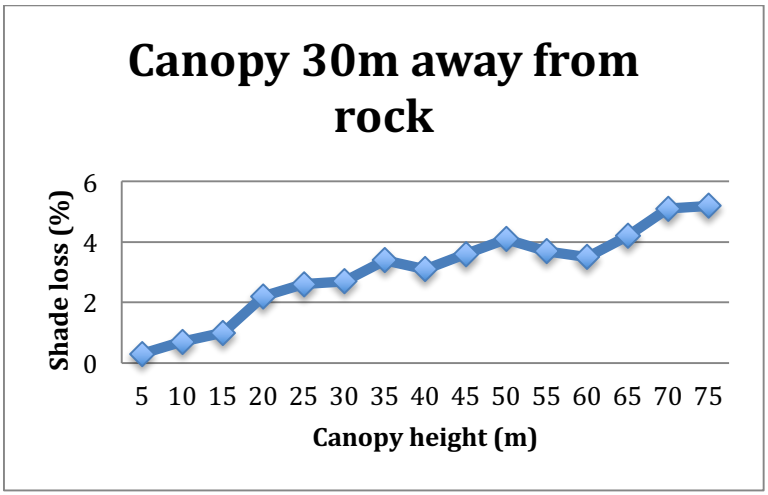
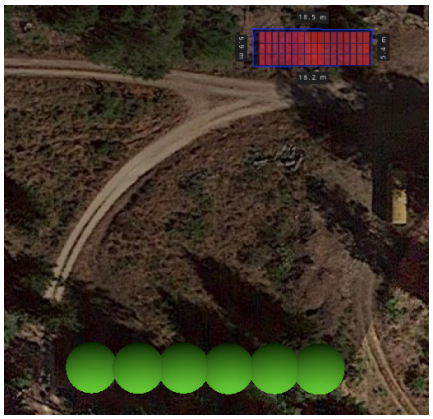


Figure 2.4-3 Shade losses of a north-south tree canopy (6 individuals of 4m radius) 30 meters from reference rock at 5-75m heights



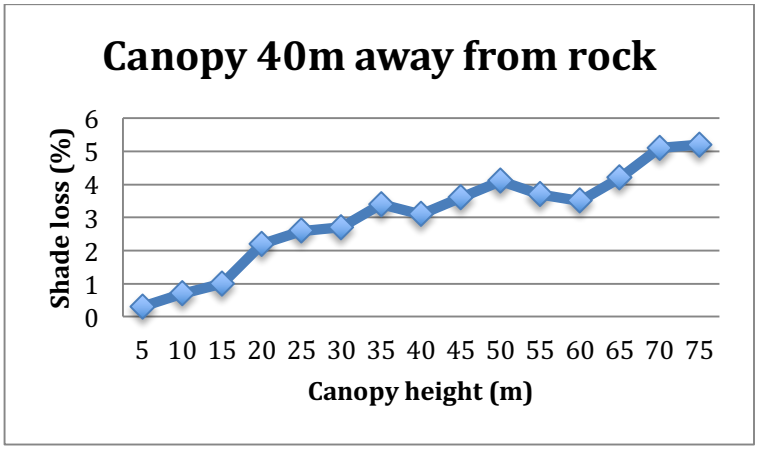
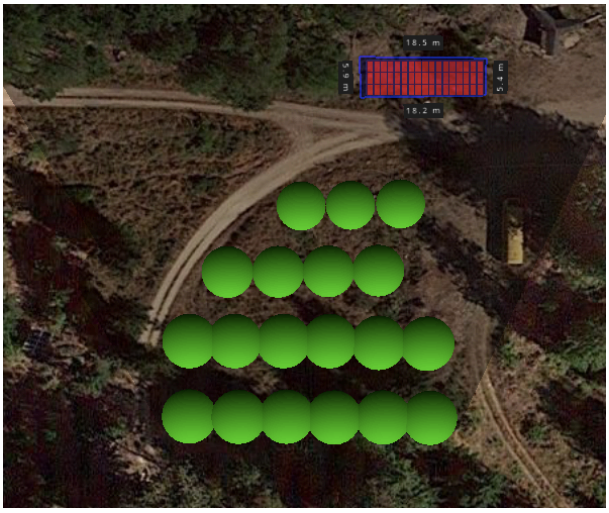


Figure 2.4-4 Shade losses of a north-south tree canopy (6 individuals of 4m radius) 40 meters from reference rock at 5-75m heights

Scenarios were also generated with combined tree canopies at the 10, 20, 30, and 40 meter intervals to predict resulting shade losses (Figure 2.4-5 and Table 2.4-1)

Table 2.4-1 and Figure 2.4-5 Shade losses from three scenarios of combined tree canopies

Scenario 1	Distance from rock	Tree height	Total loss
	10	10	
	20	30	
	30	35	
	40	75	15.4
Scenario 2	10	5	
	20	10	
	30	15	
	40	30	7
Scenario 3	10	2	
	20	5	
	30	15	
	40	30	6.4



The Helioscope models can provide a general guideline for what species of trees to plant at different places on the restored site. If the GCA would like to keep solar output shade loss to less than 7.5%, tree species chosen should have a maximum height of ~30m and taller trees should be placed furthest south from the solar panels. The Helioscope tool will be very useful once more detailed restoration plans are created to ensure that solar panel output is not significantly compromised.

3.0 Prescription

To accomplish the goals of the GCA in restoring the Project Centre site, a hybrid approach to restoration that uses a designed ecosystem and forest restoration is recommended. The designed ecosystem would involve creation of a native garden with six different themed plant communities (section 3.1). A native garden capitalizes on the site's location to demonstrate an important part of restoration—connecting visitors and community to the flora of the Coastal Douglas-fir ecoregion. The forest regeneration aspect would involve accelerating the forest succession process on the southern edge of the site by planting predominantly deciduous trees. Other restoration aspects discussed include considerations for soil and coarse woody debris piles (3.2), water design (3.3), human use features (3.4), deer fence and staffing (3.5). As the final site conditions cannot be known until after construction is completed this prescription aims to give conceptual direction and early recommendations for restoration planning.

3.1 Native garden design

The objectives of the native garden at this site would be to:

- enable demonstration of a large diversity of native plants in a small area
- facilitate awareness and learning experiences of native plants
- showcase plants that are uncommon to rare which grow in the Coastal Douglas-fir ecoregion

A native garden at this location has the benefit of being close to staff offices and a water source, which will make ongoing maintenance possible. A possible native garden landscape design is shown below (Figure 3.1-1)

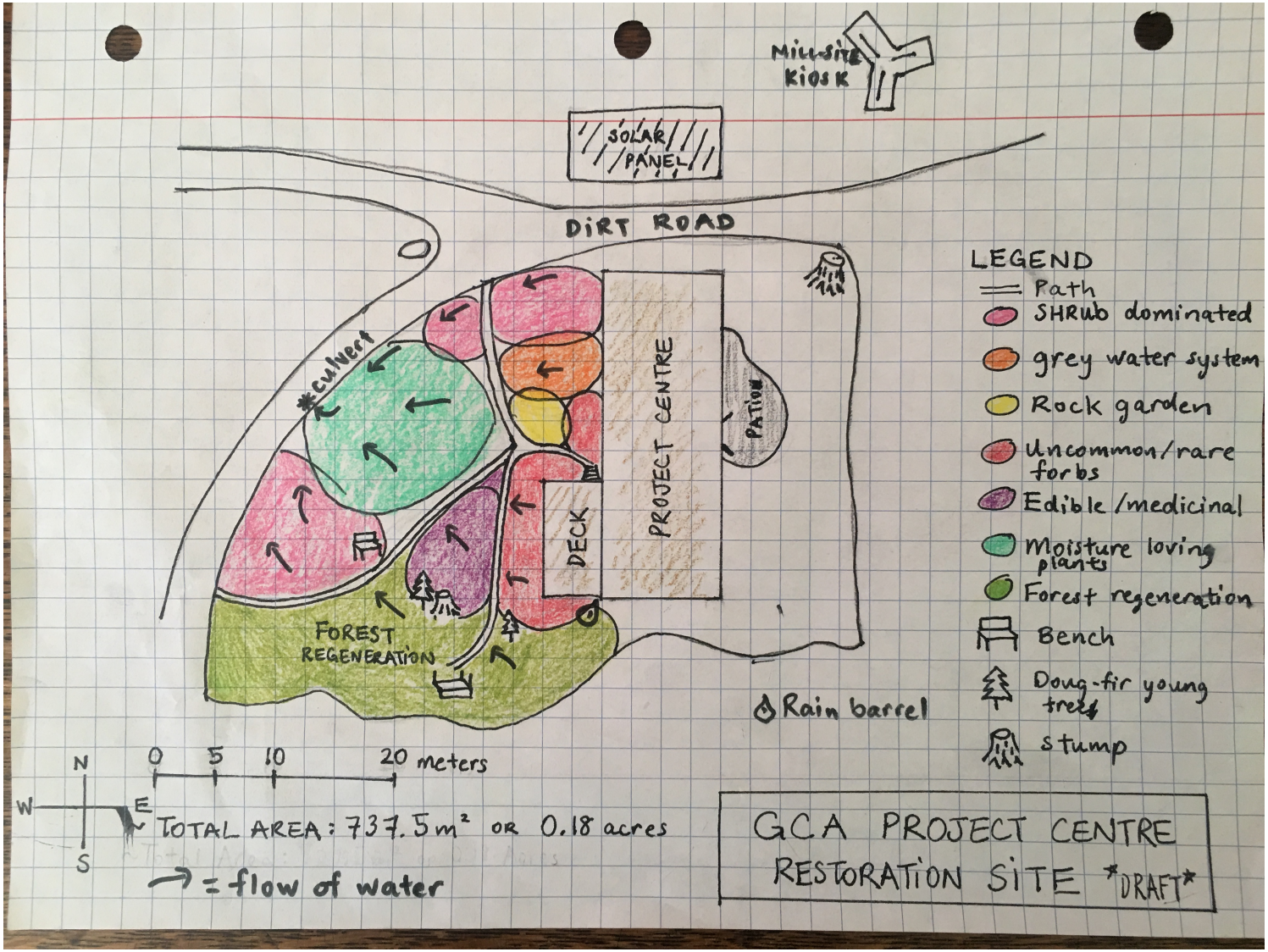


Figure 3.1-1 Restoration design illustrating location of native garden beds, forest regeneration site, human use features, and water flow

Tables below indicate some recommended species for each native garden bed based on its theme. The lists are not exhaustive and will need to be further refined to match the specific microclimate of each bed's location at later restoration stages. The intent of these lists is an exercise in imagination to see what species can be represented in a native garden. Future native garden designs would benefit from using the helioscope tool to ensure that the solar panel output is not compromised. The lists were compiled from sources that give information on creating native gardens representative of the Coastal Douglas-fir ecosystem: GOERT's The Garry Oak Gardener's Handbook, Habitat Acquisition Trust's Gardening with Native Plants, Pojar and MacKinnon's Plants of Coastal British Columbia, and Gardening with Native Plants of the Pacific Northwest by Arthur R. Kruckberg.

FOREST REGENERATION AREA (selection of trees include those that will not grow too high)

COMMON NAME	LATIN NAME	MAX HEIGHT	SOIL (Mosit; Dry; Well drained)	LIGHT (SHade; Sun; Partial Shade)
Western yew	*Taxus brevifolia*	15m	M	SH
Western flowering dogwood	*Cornus nutallii*	20m	M, WD	PS
Red alder	*Alnus rubra*	25m	M	SU
Western redcedar	*Thuja plicata*	60m	M	SH
Douglas-fir	*Pseudotsuga menziesii*	70m	D, M	PS, S
Big-leaf maple	*Acer macrophyllum*	35m	D, M	SU, PS

EDIBLE/MEDICINAL (plants that have harvest value)

COMMON NAME	LATIN NAME	MAX HEIGHT	SOIL	LIGHT
Oval-leaved blueberry	*Vaccinium ovalifolium*	2m	M	S
Alaskan blueberry	*Vaccinium alaskaense*	2m	M	S
Black Huckleberry	*Vaccinium membranaceum*	1.5m	D, M	PS
Indian-plum	*Oemeleria cerasiformis*	1.5-5m	D, M	PS
Blue elderberry	*Sambucus cerula*	6m	D, M	S
Red elderberry	*Sambucus racemosa*	2-4m	M	PS
Woodland strawberry	Fragaria vesca			
Black hawthorn	Crataegus douglasii	10m	M	S

Saskatoon	Amelanchier alnifolia	1-5m	D, M	S
Highbush-cranberry	Viburnum edule	0.5-3.5m	M	PS

ROCK OUTCROP GARDEN (all these like rocky sites)

COMMON NAME	LATIN NAME	MAX HEIGHT	SOIL	LIGHT
Broad-leaved stonecrop	Sedum spathulifolium	20cm	D	S
Oregon stonecrop	Sedum oreganum	15cm	D	S
Lance-leaved stonecrop	Sedum lanceolatum	5-25cm	D, M	S
Entire-leaved Gumweed	Grindelia integrifolia	15-80cm	D	S
Yerba buena	Satureja douglasii	1m long	WD	PS
Nodding onion	Allium cernuum	50cm	D, sandy	S
Harsh Paintbrush	Castilleja hispida	20-60cm	D	S
Spring-gold	Lomatium utriculatum	10-60cm	D	S
Common woolly sunflower	Eriophyllum lanatum	25-60cm	D, WD	S
Harvest brodiaea	Brodiaea coronaria	30cm	D	S

SHRUB DOMINATED

COMMON NAME	LATIN NAME	MAX HEIGHT	SOIL	LIGHT
Scouler's willow	Salix sitchensis	1-8m	D, M	S
Saskatoon	Amelanchier alnifolia	1-5m	D, M	S
Nootka rose	Rosa nutkana	3m	D, M	S
Snowberry	Symphoricarpos albus	0.5-2m	D, M	S

UNCOMMON/RARE FORBS

COMMON NAME	LATIN NAME	MAX HEIGHT	SOIL	LIGHT
Broad-leaved shootingstar	Dodecatheon hendersonii	5-50cm	M	S
Menzies' larkspur	Delphinium menziesii	50cm		S
White fawn lily	Erythronium coronaria	30cm	D, WD	S, PS
Chocolate lily	Fritillaria affinis	80cm	D, M	S

Tiger lily	Lilium columbianum	1.2m	D, M	S, PS
Red columbine	Aquilegia formosa	40-80cm	WD	S, PS
Common camas	Camassia quamash	70cm	D, M	S, PS
Harsh Indian paintbrush	Castilleja hispida	20-60cm	D	S

MOIST-SOIL GARDENS

COMMON NAME	LATIN NAME	MAX HEIGHT	SOIL	LIGHT
Red-flowering currant	*Ribes sanguineum*	1-3m	D, M	SH, PS
Black Twinberry	*Lonicera involucrata*	0.5-3m	M	S
Pacific ninebark	*Physocarpus capitatus*	4m	M, D	S, PS
Red-osier dogwood	*Cornus sericea*	10m	M	S
Thyme-leaved speedwell	*Veronica serpyllifolia*	10-30cm	M	S
Foamflower	*Tiarella trifoliata*	15-60cm	M	PS, S

3.2 Soil and coarse woody debris piles

The coarse woody debris (CWD) pile could be incorporated into the native garden design as nursery log and stump planting materials. The remaining CWD could be redistributed across the site as valuable organic material.

The soil pile consists of valuable loamy soil and could be used to either recontour parts of the native garden or simply be redistributed across the site.

3.3 Water design

The generally dry conditions of the site make water design important. Increasing available water will help establish and maintain the native garden and allow for the inclusion of a greater variety of native plants. Installing a rain barrel system that utilizes water run-off from the roof would accomplish this. An additional option would be to incorporate a greywater system that connects to the Project Centre's plumbing lines and funnels it through a native plant filtration system. The Galiano Island Local Trust Committee's Official Community Plan, 1995 supports implementation of grey water systems on Galiano Island as stated in bylaw 216:

BL216 Water Borne Waste Disposal Advocacy Policies
a) Vancouver Island Health Authority shall be requested to:
vi)permit the use and separate disposal of grey water.

To allow for future installation of a grey water system, design plans for the Project Centre must have separate grey water and black water plumbing lines. The inclusion of a rain barrel and grey water system as part of the site's restoration also promotes sustainable use of water resources to GCA visitors.

3.4 Human use features

Trails that wind to the different garden beds and benches placed in different locations will facilitate visitation to and staff maintenance of the native garden. Another human use feature would be to designate a place in the native garden for GCA nursery plant sales.

3.4 Deer fence and staffing

The creation of a native garden hinges on two things: a deer fence and sufficient staffing. Due to the voracious appetite of deer on Galiano island the native garden would need to be completely enclosed by a fence to ensure the establishment and continued existence of its plants. A design similar to the native forage forest could be used or if aesthetics are particularly important, other designs could be explored. The establishment of a thriving native garden requires continued attention and care for at least one year (better two) by an experienced gardener familiar with maintaining native plants. If the GCA chooses to restore the site with a native

garden, enough funding should be set aside to allocate staff time to native garden care duties.

4.0 Conclusion

At this conceptual stage of restoration, the next step would be to determine if the restoration trajectory outlined is desirable and plausible for the GCA. Once a trajectory is agreed upon, the specific methods and design details restoration will need to be worked out. A restoration project of this magnitude will likely take a full year or more to begin implementing on the ground. It could be tackled as part of a final project for a student completing their Restoration of Natural Systems Diploma. Hopefully, this restoration prescription provides some valuable information and a useful imaginary process for what is possible in the restoration of the Project Centre site

5.0 References

Kruckeberg, A.R. (2001). Gardening with Native Plants of the Pacific Northwest: Revised and Enlarged. University of Washington Press.

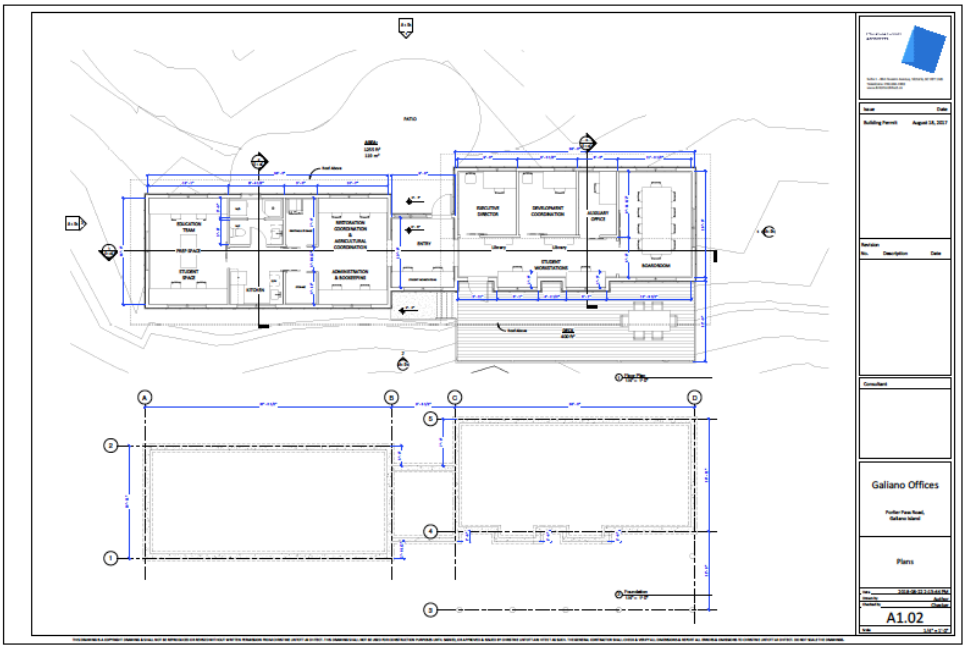
Pojar, J., & MacKinnon, A. (2004). Plants of the Pacific Northwest coast. Partners Publishing Group.

Team, G.O.E.R. (2007). Garry Oak gardener's handbook: Nuturing native plant habitat in Garry Oak communities.

Team, Habitat Acquisition Trust. (D.U.). Gardening with Native Plants.

Appendix A

Project Centre Architectural plans (August 2018)

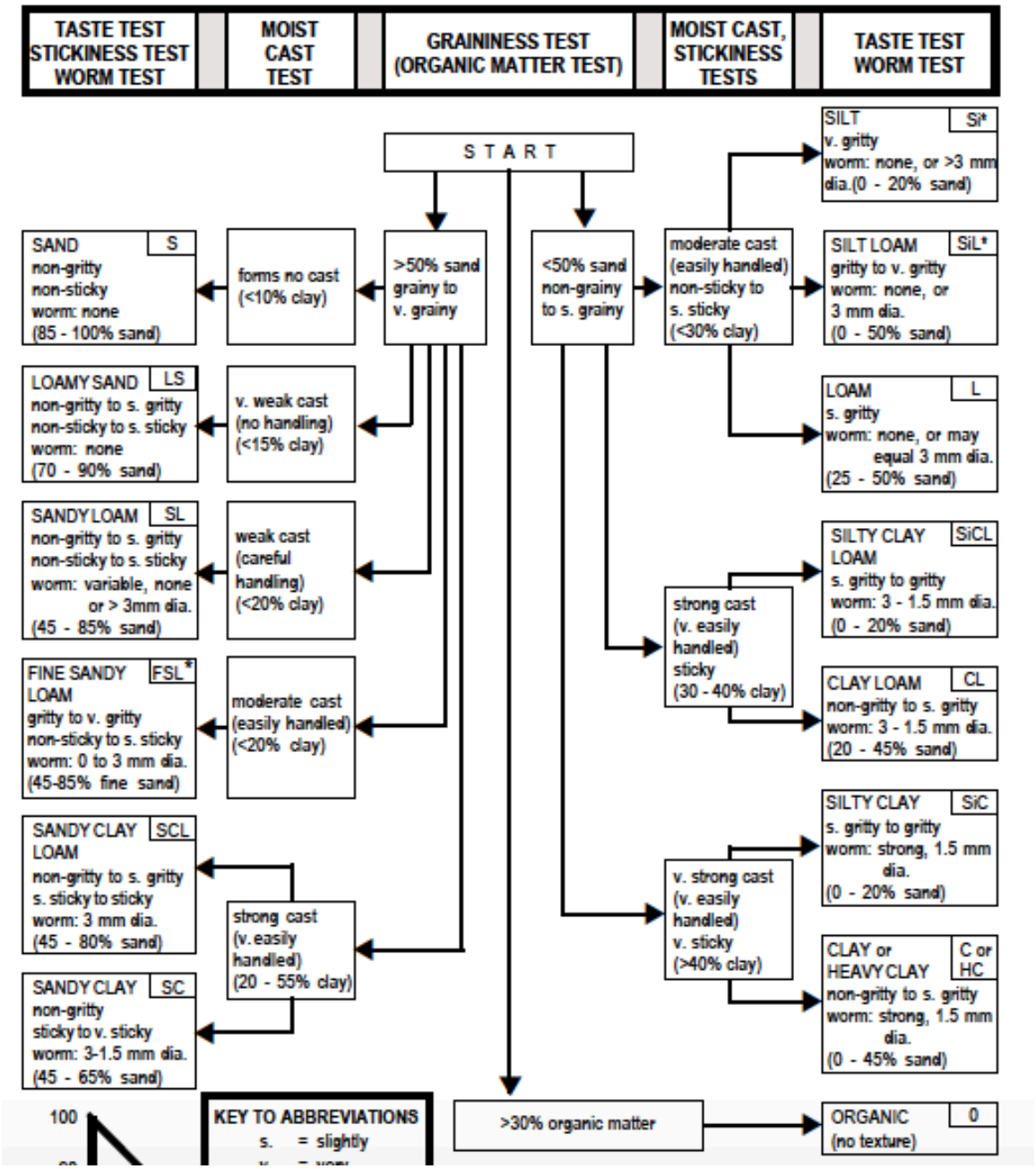


Appendix B

BRITISH COLUMBIA

ESTIMATING SOIL TEXTURE IN THE FIELD

- The field determination of soil texture is subjective and can only be done consistently with training and experience. The field tests, outlined below, are used in sequence with the accompanying flow chart to assist in the field determination of soil texture:
  1) **Graininess Test:** Rub the soil between your fingers. If sand is present, it will feel "grainy". Determine whether sand comprises more or less than 50% of the sample.
  2) **Moist Cast Test:** Compress some moist soil by clenching it in your hand. If the soil holds together (i.e., forms a "cast"), then test the durability of the cast by tossing it from hand to hand. The more durable it is, the more clay is present.
  3) **Stickiness Test:** Wet the soil thoroughly and compress between thumb and forefinger. Degree of stickiness is determined by noting how strongly the soil adheres to the thumb and forefinger upon the release of pressure, and how much it stretches. Stickiness increases with clay content.
  4) **Worm Test:** Roll some moist soil between the palms of your hands to form the longest, thinnest worm possible. The more clay there is in the soil, the longer, thinner and more durable the worm will be.
  5) **Taste Test:** Work a small amount of soil between your front teeth. Silt particles are distinguished as fine "grittiness", unlike sand which is distinguished as individual grains (i.e., graininess). Clay has no grittiness at all.


TASTE TEST STICKINESS TEST WORM TEST
MOIST CAST TEST
GRAININESS TEST (ORGANIC MATTER TEST)
MOIST CAST, STICKINESS TESTS
TASTE TEST WORM TEST
START
>50% sand grainy to v. grainy
<50% sand non-grainy to s. grainy
forms no cast (<10% clay)
v. weak cast (no handling) (<15% clay)
weak cast (careful handling) (<20% clay)
moderate cast (easily handled) (<20% clay)
strong cast (v. easily handled) (20 - 55% clay)
moderate cast (easily handled) non-sticky to s. sticky (<30% clay)
strong cast (v. easily handled) sticky (30 - 40% clay)
v. strong cast (v. easily handled) v. sticky (>40% clay)
SAND S non-gritty non-sticky worm: none (85 - 100% sand)
LOAMY SAND LS non-gritty to s. gritty non-sticky to s. sticky worm: none (70 - 90% sand)
SANDY LOAM SL non-gritty to s. gritty non-sticky to s. sticky worm: variable, none or > 3mm dia. (45 - 85% sand)
FINE SANDY LOAM FSL* gritty to v. gritty non-sticky to s. sticky worm: 0 to 3 mm dia. (45-85% fine sand)
SANDY CLAY LOAM SCL non-gritty to s. gritty s. sticky to sticky worm: 3 mm dia. (45 - 80% sand)
SANDY CLAY SC non-gritty sticky to v. sticky worm: 3-1.5 mm dia. (45 - 65% sand)
SILT Si* v. gritty worm: none, or >3 mm dia.(0 - 20% sand)
SILT LOAM SiL* gritty to v. gritty worm: none, or 3 mm dia. (0 - 50% sand)
LOAM L s. gritty worm: none, or may equal 3 mm dia. (25 - 50% sand)
SILTY CLAY LOAM SiCL s. gritty to gritty worm: 3 - 1.5 mm dia. (0 - 20% sand)
CLAY LOAM CL non-gritty to s. gritty worm: 3 - 1.5 mm dia. (20 - 45% sand)
SILTY CLAY SiC s. gritty to gritty worm: strong, 1.5 mm dia. (0 - 20% sand)
CLAY or HEAVY CLAY C or HC non-gritty to s. gritty worm: strong, 1.5 mm dia. (0 - 45% sand)
KEY TO ABBREVIATIONS
s. = slightly
>30% organic matter
ORGANIC O (no texture)
100

Appendix C

Heliotrope values for different canopy scenarios

Distance from rock (m)	Canopy height (m)	Shade losses (%)
10 (3.6m radius trees)	5	1.3
	10	5.4
	15	7.9
	20	8.8
	25	9.2
	30	10.7
	35	10.9
20 (3.8 radius trees)	5	0.4
	10	1.8
	15	3.4
	20	4.2
	25	4.9
	30	5.2
	35	5.4
	40	6.0
	45	6.2
	50	6.6
	55	6.9
	60	7.4
	65	7.4
	70	6.6
	75	5.6
30 (4.0m radius trees)	5	0.4
	10	1.2
	15	2.5
	20	3.6
	25	4.1
	30	4.5
	35	4.9
	40	5.5
	45	5.1
	50	5.1
	55	6.2
	60	6.2
	65	6.2
	70	6.4
	75	7.1

40 (4m radius trees)	5	0.3
	10	0.7
	15	1.0
	20	2.2
	25	2.6
	30	2.7
	35	3.4
	40	3.1
	45	3.6
	50	4.1
	55	3.7
	60	3.5
	65	4.2
	70	5.1
	75	5.2