Native Forage Forest

Implementation and Management Plan

A proposal for the design, implementation, and management of a native plant foraging forest on the Galiano Conservancy Association's District Lot 57.

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1.0 Introduction

Located on the traditional lands of the Coast Salish people, the Galiano Conservancy Association's District Lot 57, Galiano Learning Centre, is midway along the west coast of Galiano Island, British Columbia. This Crown grant property of 188 acres teems with ecological complexities, historical legacies, and learning opportunities. Old growth forests, wetlands, streams, farms, and a variety of human structures are found throughout the property. Additionally, the western border of the property boasts stunning waterfront views and almost two kilometers of protected shoreline ecosystems. An extensive amount of research, dedication, and hard work has been put into protecting and restoring these ecosystems whilst providing learning opportunities for members of the Galiano Island community and beyond.

Ecological restoration is most widely defined as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" (SER, 2004), and involves deliberate human intervention within ecosystems in various forms. Throughout District Lot 57, there are several sites that can be identified as requiring various degrees of intervention, with some interventions involving higher levels of follow-up human presence than others. During a 9 day intensive field course, our group of three directed our attention to one such area, located directly behind and to the northwest of the Galiano Conservancy Association's new Learning Centre classroom building. This is the location of the "Grandmother Cedar", a single tree that stands alone amongst several logged Western red cedar (*Thuja plicata*) stumps. This area is heavily disturbed, having undergone extensive logging approximately 10 years ago. As a result, issues including soil compaction and the presence of several exotic species have arisen. Despite this, the site continues to demonstrate diversity in ecological composition and is home to over a dozen native species; these species include vanilla leaf (*Achlys triphylla*), salal (*Gualtheria shallon*), dull oregon grape (*Mahonia nervosa*), and western Hemlock (*Tsuga heterophylla*), among others.. The Galiano Conservancy originally chose this site with the intention of establishing a permaculture-based food forest; however, certain ecological characteristics, such as the presence of large stumps and soil acidity have caused the vision for the site to evolve. The Conservancy is now considering the establishment of a native forage forest as a means of assisting ecological recovery on this site. For the purposes of this document, the term 'native forage forest' refers to a woodland ecosystem, comprised of a variety of native plant species, which demonstrate edible or medicinal qualities and can be foraged for such uses. The site is envisioned to become a semi-open canopy woodland ecosystem, which will be actively maintained and interacted with in varying levels over time (Erickson, K., personal communication, July 13th, 2015).

Based on the knowledge we have gathered from community members and staff at the Galiano Conservancy Association, we have compiled a document, which should act as a guideline for making this vision a reality. If implemented, this design proposal has the potential to result in a project that provides ample opportunities for food production, learning, and a better coexistence of humans and thriving ecosystems. While these efforts do not reflect traditional forms of ecological restoration, we believe that the foraging forest presents an exciting opportunity to restore ecological, as well as human health, in such a way as will foster mutually beneficial human-nature relationships and heightened levels of ecosystem stewardship.

We have chosen to focus our design proposal on a smaller area within the 2.5 acre site designated by the Conservancy for this project (See Figure 1 below for a map of our chosen area). This is an ideal location for the placement of a food forest if the Galiano Conservancy Association is aiming to create an educational space that may be interacted with on a regular basis, as it is adjacent to the Learning Centre; this is the area of the property that likely sees the greatest amount of foot traffic.

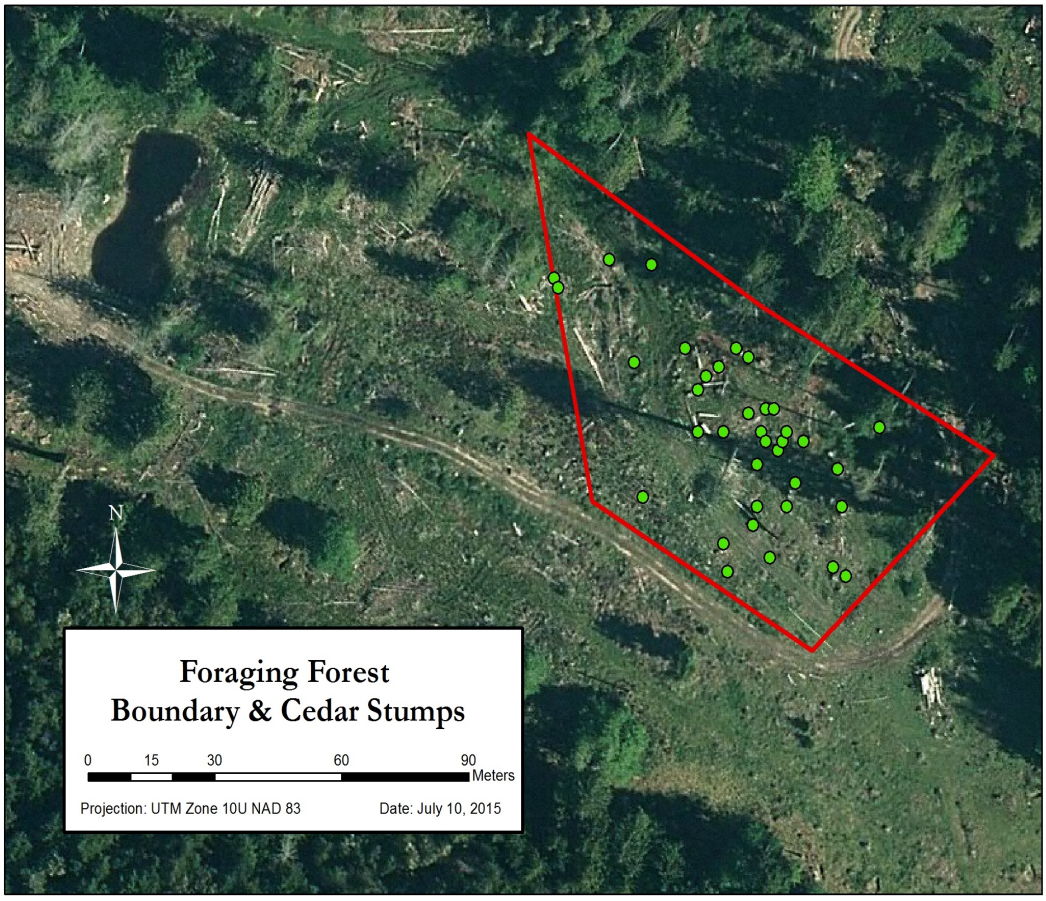

Figure 1: Foraging Forest Boundary and Cedar Stumps Visualized boundaries for the forage forest, along with the locations of the cedar stumps that may be used as nurse stumps for small floral species.

Three ecological communities occupy this space. These include a mosaic of young stands of Douglas fir (*Pseudotsuga menziesii*), red alder (*Alnus rubra*), and Western red cedar (*Thuja plicata*), and graminoid dominated spaces; a marsh area; and a large, thistle and graminoid-dominated, logged area, within which several Western red cedar stumps remain (Galiano Conservancy Association, 2015). For a more detailed description of each ecological community, see Table 1 of the Appendix. In incorporating these ecological communities, and through the collaboration of the Galiano Conservancy Association, the local community, and local First Nations, a diverse system of foraging species can be established and maintained over time. We would like to acknowledge that such an endeavor cannot be carried out without the proper consultation and participation of local First Nations, as their traditional knowledge systems play an integral role in the continued health of ecosystems and especially a project such as this one.

As our economy, knowledge of indigenous rights, and need for food security grows, our interests toward foraging plants comes to light (Keefer et al, 2010). In this paper, we will outline the proposed design for this foraging forest, and the considerations necessary for its implementation and continued management.

2.0 Design Prescription

2.1 Overview

This document discusses the possible plans and actions that can be taken to establish the foraging forest; however, we wish to emphasize that the following information should act not as a template, but as a guide for future action. Establishing the forage forest will involve the on going interaction of people and ecosystems, and will require adaptive management in order to achieve success. Therefore, this proposal should act as a foundation upon which more knowledge can be built and changes made; it should signify the beginning of a continuous, dynamic, and creative process.

The Galiano Conservancy Association has already conducted surveys within the site, in order to identify existing species composition, soil properties, hydrology patterns, ecosystem types, and potential interventions the site may support. We have directed our attention toward a smaller section within the area, which is divided into three different ecological communities (indicated as polygons 24, 25a, and 27a in the Appendix tables, and seen in Figure 2 below). We have used the available information on these ecological communities to determine the plant species that already do, or will, in the future, thrive best within each area. This system of division is crucial to ensuring the proper intervention in and management of areas with slightly different needs, and in turn, optimal levels of health and function of the entire

system. Three different ecological communities demonstrating different growing conditions have deliberately been incorporated into the chosen site, as a means of maximizing the diverse foraging species that can be grown in the area. This design prescription will discuss key considerations to be accounted for in the design process (Section 2.2), and will provide an indepth outline of what each ecological community currently supports or has the potential to support. This is not an exhaustive list of all possible species, and our focus is on species demonstrating edible or medicinal qualities. Many species, whether they are included in this design prescription or not, have several other uses that the Galiano Conservancy Association may choose to incorporate into its long term plan.

2.2 Considerations

In order to create a functional and sustained forage forest that will be useful to the Conservancy year-round, many things must be considered, including forage time of plant species, height of plants and ecosystem structure, aesthetics, watering systems, pathways, management, and signage.

2.2.1 Foraging Times and Seasons

The Galiano Conservancy's land is located in the Coastal Douglas Fir biogeoclimatic zone (British Columbia Minstry of Environment, 1990), a region that is home to a diverse array of floral species, which allow for food and medicine to be gathered year-round. We plan to embrace this potential for diversity in the forage forest by suggesting plant species that flower, fruit, and are otherwise useful at different times of year (for specific harvest periods for each species, see Tables 6, 7, and 8 in the Appendix). This will be important in not only ensuring that the Conservancy and the community may access food and medicinal resources during all seasons, but also to ensure year-round opportunities for learning and visitor interaction with the area.

2.2.2 Ecosystem Structure and Diversity

In order for the forage forest to be most useful and diverse, plant species must vary in their heights and preferred growing environments. The species of plants that we have chosen for each polygon represent an array of structures and preferred growing conditions, which can be accommodated and encouraged to thrive through the establishment of specific, positive species relationships. For example, shade-loving species can be planted next to taller, shade providing species, with open areas reserved for sun-loving species. Another example is nurse stumps; old stumps on the property that can provide a raised habitat (and nutrients) for species planted on them. Certain plants, such as salal and red huckleberry, are known to grow well on decaying tree stumps, and creating raised beds from the stumps

already present on the property will allow for the retention of existing structural characteristics and the provision of more structural complexity.

2.2.3 Educational Signage

For the purpose of maximizing the educational value of the site, and in turn aligning closely with the Galiano Conservancy Association's devotion to environmental education (Galiano Conservancy Association, 2015), we recommend that educational signage be placed in several locations within the native forage forest. Signs should be placed in front of an individual of each species to inform visitors of their food or medicinal use, and harvest times. Signage placed around nurse stumps could discuss the history of logging on the site and the restoration efforts that have been implemented since; signs could also discuss the Grandmother Cedar and its significance to the site, as the last tree to have been cut into on the property. Additionally, signage can be placed around plants to inform visitors of what parts of a plant are not edible, or parts that should not be used or touched because of their defense mechanisms, such as with stinging nettles. An introductory sign at the entrance to the food forest would also be beneficial, and could discuss harvesting rules and guidelines. This would be especially important in encouraging visitors to practice caution and avoid harvesting any plant they see without the necessary knowledge, and informing visitors of acceptable harvest volume.

2.2.4 Movement through the Site

Other important decisions regard the placement of pathways throughout the forage forest. It is important that pathways allow for all three ecological communities and the optimal amount of resources to be easily accessed, while ensuring minimal trampling in the area. We have designed a potential plan for the pathways where the major paths follow historical forestry skid roads that are already on the property, and smaller pathways stem from the main ones. Keeping the main paths along the skid roads that are already present reduces any negative effects on the ecosystem that could occur from building other paths in the area, and reduces the work that would need to be put into restoring the old skid roads in order to plant the species for the forest. The "finger" pathways that stem from the main paths allow access to plants spanning a large area, which are not on the main trail, and which may be smaller and see less human traffic. Members from the Conservancy also expressed a desire to establish a wider pathway around the Grandmother Cedar, which could act as a primary gathering place on the site. Our initial design visual for the site, demonstrating the above-discussed factors, is shown in Figure 2 below.

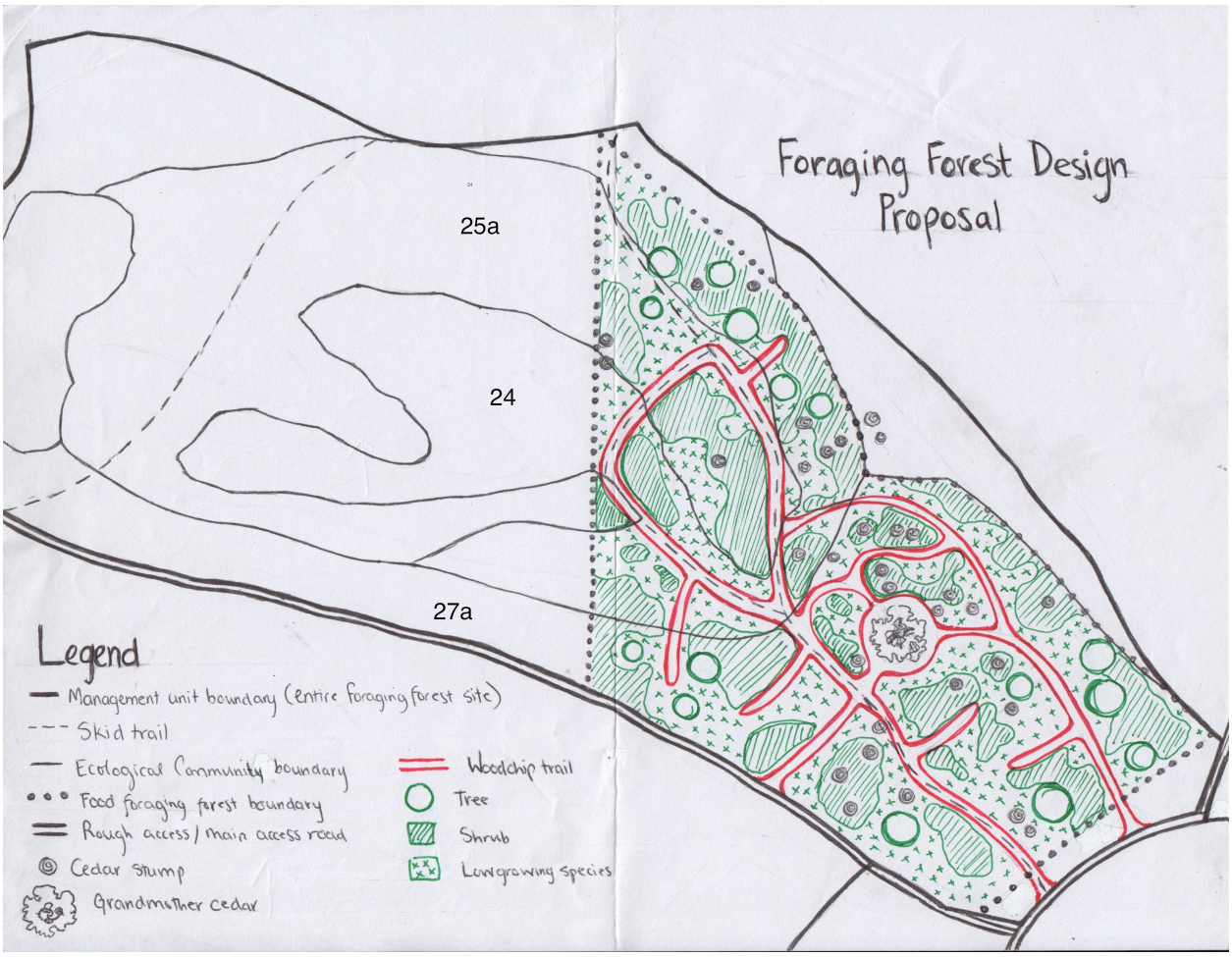

Figure 2. Design of proposed area for the native plant forage forest outlining ecological community polygons 24, 25a, and 27a, the possible layout of path structures, and the multilevel scheme that would create ideal habitats for a variety of species.

2.2.5 The Grandmother Cedar

As mentioned previously, the Grandmother Cedar is a tall Western red cedar (*Thuja plicata*) tree behind the Learning Centre, which stands alone, surrounded by logged cedar stumps. This is the last tree of a former cedar grove, and was in the process of being felled when the formal sale of the property was announced in February 2012. Thus, it holds great symbolic significance for the Galiano Conservancy and greater community as a representation of the site's cultural and ecological history. As such, it provides an ideal location for visitors to gather in the forage forest to learn, discuss, or ponder; this is why we propose the integration of a small gathering space around this tree. It has also been recommended that a buffer be created around the base of the tree to protect visitors from the unlikely, but potential hazard of a falling branch. Thus, while there will be a gathering space around the tree, the immediate area surrounding the base of the tree will be occupied by low growing native species.

2.2.6 Pollinators

Pollinators provide ecosystem services by increasing the reproduction of plant species (Kreman et al., 2007, p.299-300). Having a healthy population of pollinators in the area, and attracting pollinators to the site will be important for encouraging the healthy growth and reproduction of the plants in the forage forest; thus, planting species which are known to attract pollinators (particularly at different times of the year) is desirable. We considered this when choosing plant species for each ecosystem polygon; this is indicated by our encouragement of the presence of salal (*Gualtheria shallon*), nodding onion (*Allium cernuum*), red flowering currant (*Ribes sanguineum*), evergreen huckleberry (*Vaccinium ovatum*), fireweed (*Epilobium angustifolium*), and Nootka rose (*Rosa nutkana*), which attract hummingbirds and butterflies (Pettinger and Costanzo, 1996, p.98). By encouraging a diversity of plants, we hope to ensure the attraction of pollinators and therefore the continued pollination and success of the plants species. The conservancy may also consider introducing additional pollinator species to the site if they so desire.

2.2.7 Irrigation

During establishment of the food forage site, it is critical to consider options for irrigation, both for the initial establishment of newly planted species, and in the long term. Newly planted species require extra care and regular watering if they are to successfully establish themselves within a new environment (Anonymous participant, personal communication, July 9th, 2015) Irrigation may also be necessary over a longer period of time to ensure optimal growth and productivity of already established plants. There may be a desire to implement as little long term management as possible, allowing this system to take its course and sustain itself. However, a long term irrigation system should be considered as an option, which will be carried out based on the ultimate goals decided upon by the Conservancy. Gravity-fed irrigation from the spring north of the foraging forest site has been suggested as a viable option in previous studies of the property (Stevens, 2013). Another option that may merit further research is the use of the nearby pond as an irrigation source. As discussed by JJ Ford, a panelist who presented on food forestry during our field course, the Bullocks Permaculture Homestead on Orcas Island utilizes water from a nearby marsh through the use of solar powered horizontal piston pumps, with cisterns that collect the water (Food Forest Panel, personal communication, July 9th, 2015).

2.3 Data and Results of on Site Analysis

Through our research, we have found a variety of plants that are well suited to grow on the site and benefit the forage forest through food or medicinal uses. A full list of desirable species for each ecological community present with the site can be found in the Appendix (Tables 2-4). Many of these plant species have multiple uses, which depend on the part of the plant used and how it is prepared; species such as these may require more knowledge to be held by the user, whereas other plants species are easily utilized (such as berry proving plants, whose berries can be harvested and eaten immediately). The wide variety of uses and preparations of each species increases the educational purpose of the forage forest, as any individual—whether old or young—who enters the forest has the opportunity to increase their knowledge of the native plants and ecosystems. Additionally, we listed plants whose harvesting times vary throughout the year so that the forest will provide food and medicine year long. Harvesting times, uses, and some information on preparation for desirable species in each ecological community can be found in the Appendix (Tables 6-8).

3.0 Implementation

In the implementation of a final design for the food foraging forest, steps must be taken to remove existing exotic species on site, source native foraging species, and provide the conditions for newly planted species to properly establish. All interventions in this system should be carried out in a manner that is least harmful to the integrity of the ecosystem, as suggested by the IUCN's second guideline: "Do No Harm" (IUCN 2012, p.17) That is to say, interventions should be carried out such that the lowest possible impact is had on ecological processes (nutrient cycling and energy flows), function (ie. least disturbance to the functional roles played within the system), and structure (as discussed above, we wish to have existing structural variations in the site retained). This is an especially important consideration in decision making regarding species removal from the site. While the vision for this site sees a future of abundance for human use, plants that do not demonstrate foraging qualities, but which play an important functional role in the ecosystem, should be retained. This is of particular importance in polygon 25a, which is indicated as an area of particularly high ecological value. Table 5 in the Appendix provides a brief list of the exotic species present within each ecological community; it is important that these species be prioritized for removal in order to provide more desirable conditions for existing foraging plants in the area, as well as to make room for new native plants to be brought in. As also recommend by the IUCN (2012, p. 37), the impacts of this, and all restoration efforts, should be measured pertaining to conservation, social, equity, and other environmental goals. We recommend that native species with

foraging qualities be sourced from local nurseries, in order to ensure that species brought into the site are adapted to local climatic and environmental conditions. That being said, the Galiano Conservancy may also be advised to consider options for ensuring resilience in an increasingly variable climate. As climatic conditions begin to vary increasingly over time, the ability of the foraging forest system to bounce back in the face of disturbance (ie. drought, extreme weather conditions, extreme temperatures) will increase with heightened genetic diversity within species. Individuals within a species could be sourced from a variety of areas in the Pacific Northwest to ensure a greater rate of individual survival in the event of any sort of perturbation. Additionally, in allowing for the successful establishment of new plantings, watering is highly recommended; therefore, as previously mentioned, the Galiano Conservancy Association must consider its options for irrigating the site.

4.0 Management

While the proposed plant communities outlined above are inherently well suited to thrive in the conditions available on this site, we acknowledge that continued active management of the entire site, and of individual plants, will likely be necessary to ensure the continued success of this project. Traditional food systems of First Nations people, which involved all of the plant species we have discussed here, involve active management of the landscape – management activities could include pruning, weeding, and other activities geared towards ensuring the survival of select species (Turner, 2014). An understanding of this fact, and an acknowledgement of the need to develop strong, mutual relationships in which humans and environments ensure each others' survival, is crucial in sustaining this forage forest.

Several management considerations, both general and specific to this site, must be kept in mind. First, we must consider the reality of heavy deer browsing in the area, and the impact this may have on species we wish to forage. As seen in a study carried out by Martin et al. (2011), intense deer browsing can simplify understory vegetation, reducing the overall quality of vegetative structure in an ecosystem. The Galiano Conservancy Association may consider fencing the area in question to prevent browsing on the site in the first place; although this is a costly option, it may be one of the best options to ensure the continued productivity of forage plants in the site. The Conservancy may also consider strategic vegetation placement, and could look into methods by which vegetation structure can be utilized to create a natural fence around a specific area. In the long term, it is important to remember that we have chosen a smaller site than was originally outlined for the location of the foraging forest. The possibility of expanding the forage forest into surrounding areas must be taken into account if the Conservancy is considering fencing as an option for browsing control.

The collaborative uses of First Nations traditional knowledge systems, and the knowledge of experienced community members, are critical components of an effective long-term management system for this site. Strength in cultural and spiritual connections to the land plays an integral role in resource management and the way that individuals continue to relate to and work with the land (Keefer et al., 2010). We have gathered information regarding management considerations for specific plants in Tables 6, 7, and 8 of the Appendix (this table also indicates typical harvest periods for each plant, and demonstrates the variety of time periods throughout the year when food and medicine may be harvested).

Finally, the manner in which this site is managed into the future will ultimately be left up to the Galiano Conservancy Association and the surrounding community. Whether the site requires continued active management, or will be left to self-sustain, will depend on the desires and needs of the Conservancy, the community, and other stakeholders. If the conservancy chooses to allow the site to sustain itself over time, certain native species may tend to dominate others, successional processes may change the system's composition and structure, and exotic species may continue to enter the area. While most desired species should fare well on this site, as they have been selected for suitability to the site's conditions, and are well adapted to local conditions, some watering, weeding, and pruning may be required to ensure optimal productivity and foraging value of the site. Management activities will be species dependent and may evolve over time; species composition, interactions between species, and other factors may change as the forage forest becomes more well established. The Conservancy will have to consider whether certain successional processes should be allowed over time, as well. If a semi-open canopy is to be maintained, tree species will need to be managed, for example. We acknowledge that there are several potential trajectories that this site may embark on, and wish for our comments merely to outline the possibilities to be conscious of when carrying out such an initiative as the native food foraging forest.

5.0 Conclusion

After spending time on the site of the forage forest and conducting additional research on the area, it has become clear that a significant amount of time and energy will be required to implement this project. The potential benefits of such a project, however, to ecological and social systems are substantial. While much of the work in studying ecological communities and species lists has been carried out, this document is by no means exhaustive. Much more effort, research, and collaboration in the future are inevitable if this vision is to arrive at a realized, functional state.

The purpose of this document has been to outline a starting point from which the design, implementation, and management of a forage forest on District Lot 57 can be further explored. We have focused in on a smaller portion of the entire possible area to be transformed, simply to allow for a smaller level of effort, finance, and planning for what is already a very ambitious project. We have not covered all of the elements of this project, but we hope to have provided insight as to the ways in which native plants can be utilized for regenerative purposes in an area that has been heavily impacted by human use in the past. Finally, we want to emphasize once more the need to acknowledge historical, cultural, and spiritual connections between humans, the land, and other species involved in this process; we acknowledge, in addition, the vital need to continually cultivate these connections into the future. Such connections will ultimately allow for this system to thrive.

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Appendix

Table 1. Ecosystems Found in the Forage Food Forest

**All information on polygon characteristics obtained from previous studies carried out by the Galiano Conservancy Association*

Ecological Community	Ecosystem Description
Polygon 24	Present in this ecosystem is a combination of Douglas-fir, red alder, western red cedar and sword fern. Slopes, depressions and moister soils comprise an ecosystem in which common rush, horsetail, and sedges can be found. Due to the abundance of the invasive grasses and common rush, soil compaction can be observed on this site.
Polygon 25a	Polygon 25a represents a marsh wetland primarily dominated by small-flowered bulrush, slough sedge, Sitka sedge and common rush. Present further along the site is a small pond. Due to the diversity created by micro-sites, sword fern, young alder trees, and western red cedar can be found throughout the polygon.
Polygon 27a	This polygon represents the most disturbed area on the site in which we analyzed. Due to the high intensity of previous logging, this polygon is largely dominated by Western red cedar stumps, with one cedar, the Grandmother Cedar, left standing in the centre. Soils in this area are highly disturbed and very little conifer regeneration can be seen. Plants that thrive in acidic soils and disturbed sites will be best suited to this area.

Table 2. Desired native foraging species for polygon #24 including present and absent species that will be included into the area

Species Name	Foraging Properties
Vanilla leaf *Achlys triphylla*	● Vanilla substitute (when the leaf is crushed into batter) ● Pleasant aroma (Moore, 1993, p.252-253) ● **Present**
Red alder *Alnus rubra*	● Edible cambium (Turner, 1995, p.64; Pojar & MacKinnon, 1994, p.44); bark can aid with respiratory ailments when used as a tonic or in tea (Pojar & MacKinnon, 1994, p.44; MacKinnon et al., 2009, p.151) ● Attracts many insects and birds, especially during winter (Pettinger p.149) ● **Present**

Black Hawthorn *Crataegus douglasii*	● Edible berries, called haws; high pectin content, useful in jellies, jams, pies (Turner, 1981, p.2336); berries should not be over-consumed, as this may cause nausea and diarrhea (MacKinnon et al., 2009, p.80-81) ● Bark acts as anti-inflammatory; many medicinal uses, refer to Tarn 2015, p.18 ● Flowers attract pollinators (Hansen's Northwest Native Plant Database, 2012a); attracts hummingbirds (Pettinger p.98) ● **Absent**
Fireweed *Epilobium angustifolium*	● Nectar can be used to make honey (Sierra Club B.C., n.d.) ● Leaves used to make tea and in salads (MacKinnon et al., 2009, p.232) ● In the spring, fireweed shoots can be eaten fresh or cooked ● Young roots can be used as an anti-inflammatory (Wild Foods and Medicines, 2012b) ● Leaf and flower tea useful for a variety of medicinal purposes (MacKinnon et al., 2009, p.232) ● Attracts hummingbirds (Pettinger p.98) ● **Absent**
Common horsetail *Equisetum arvense*	● Edible young shoot and rhizome, fresh or boiled (Turner, 1995, p.24); should not be over-consumed, and should not be consumed when growing in contaminated soils or by individuals experiencing high blood pressure ● When consumed as a tea, has several medicinal properties (MacKinnon et al., 2009, p.388) ● **Present**
Salal *Gualtheria shallon*	● Edible berries, often used in jams and in baking (Turner, 1995, p.77; MacKinnon et al., 2009, p.122) ● Tea from leaves act as anti-inflammatory, aids diarrhea and coughs, and acts as a pain reliever when applied to irritated skin (Moore, 1993, p.223) ● Provides food for butterfly larva and attracts hummingbirds (p.98-108) ● **Present**
Dull Oregon Grape *Mahonia nervosa*	● Edible berries; relatively bitter; good for making jams, especially when combined with salal berries (Turner, 1993, p. 63; D. Fitzgerald, personal communication, July 9th, 2015) ● **Absent**
Yerba Buena *Mentha spicata*	● Small amount of the tincture can be added to flavour yogurt for fruit salads, lemonade, fruit punch, and apple cider ● Aids stomach and digestive problems (Moore, 1993, p.232) ● **Absent**
Douglas fir *Psuedotsuga menziesii*	● New growth used for tea (Wild Foods and Medicines, 2012a) and high in vitamin C ● Pitch and inner bark have antibiotic properties (MacKinnon et al., 2009, p.42) ● **Present**

Coastal black gooseberry *Ribes divaricatum*	● Edible berry is a source of Vitamin C and A (First Nations Health council, n.d.); high pectin content and useful in making jams and jellies ● Commonly eaten to aid with cold and sore throat (MacKinnon et al., 2009, p.106) ● **Absent**
Red Flowering Currant *Ribes sanguineum*	● Early food source for pollinators ● Edible berries; better for jams as they are quite tart (Gonzalves and Darris, 2008), high pectin content (MacKinnon et al., 2009, p.105) ● Attracts hummingbirds (Pettinger p.98) ● **Absent**
Baldhip rose *Rosa gymnocarpa*	● Edible hips, very high in vitamin C and rich in vitamins A, B, E, and K; often used in jams or eaten fresh; only the outer flesh should be eaten as seeds are fibrous and irritating when ingested (MacKinnon et al., 2009, p.84) ● Pain reliever and anti-inflammatory (Jennings, 2008, p.59) ● Edible flower petals (Hansen's NorthWest Native Plant Database, 2012b). ● **Absent**
Nootka rose *Rosa nutkana*	● Edible hips, very high in vitamin C and rich in vitamins A, B, E, and K; often used in jams or eaten fresh; only the outer flesh should be eaten as seeds are fibrous and irritating when ingested (MacKinnon et al., 2009, p.84) ● Help immune responses (O et al., 2007). ● **Absent**
Black-capped raspberry *Rubus occidentalis*	● Edible berries, high in antioxidants (Artemio et al., 2008) ● Young shoots can be eaten with outer layer peeled off (MacKinnon et al., 2009, p.94) ● **Absent**
Trailing blackberry *Rubus ursinus*	● Edible berries ● Old red leaves can be used for tea (Turner, 1995, p.127) with medicinal qualities; wilted leaves should not be eaten due to high toxicity levels (MacKinnon et al., 2009, p.93) ● **Present**
Soopolallie, or Soapberry *Shepherdia canadensis*	● Edible berries, high in vitamin C; traditionally whipped to make 'Indian ice-cream' (Pojar, p.94; MacKinnon et al., 2006, p.129); can cause diarrhea and vomiting when consumed in large amounts (MacKinnon et al., 1996, p.129) ● **Absent**
Western hemlock *Tsuga heterophylla*	● Edible cambium and secondary phloem tissue (Turner, 1995, p.33); needle tea is high in vitamin C (MacKinnon et al., 2009 p.40) ● Bark can be used as a medicinal wash for external injuries and skin conditions; bark tea traditionally used to treat flu, coughs, colds, abdominal pain; several other parts of the plant have been used for various medicinal purposes (MacKinnon et al., 2009, p.40) ● **Present**

Red huckleberry *Vaccinium parvifolium*	● Edible berries (Turner, 1995, p.88), high in vitamin C. Slightly sour, can be dried or eaten fresh (Pojar and Mackinnon, 1994, p.57) ● Dried leaves used in tea have medicinal properties (MacKinnon et al., 2009, p.113) ● **Present in trace amounts**

Table 3. Desired native foraging species for polygon #25a including present and absent species that will be included into the area

Species Name	Foraging Properties
Red alder *Alnus rubra*	Refer to Table 2 (Polygon 24)
Common horsetail *Equisetum arvense*	Refer to Table 2 (Polygon 24)
Field mint *Mentha arvensis*	● Edible raw, usually eaten cooked in soups or as flavouring in other dishes (MacKinnon et al., 2009, p.286) ● Beneficial for digestion, colds, fevers when steeped in tea (Pojar & MacKinnon, 1994, p.244; MacKinnon et al., 2009, p.286) ● **Present**
Devil's club *Oplopanax horridus*	● Medicinally important; cambium can be used to create a tonic or tea to treat diabetes, arthritis, general aches and pains, and ulcers (Anon., personal communication, July 9th, 2015; Pojar & MacKinnon, 1994, p.82) ● Berries are not edible ● Roots and young stems can be eaten when cooked and with spines removed ● Caution should be taken when handling this plant, as spines are sharp and can cause infection (MacKinnon et al., 2009, p.92) ● **Absent**
Thimbleberry *Rubus parviflorus*	● Edible berries, traditionally often dried ● Young shoots can be eaten raw if peeled (Pojar & MacKinnon, 1994, p.77) ● **Absent**
Salmonberry *Rubus spectabilis*	● Edible berries ● Young stem shoots traditionally peeled, eaten raw (Pojar & MacKinnon, 1994, p.76) ● **Present, trace amounts**
Trailing blackberry *Rubus ursiuns*	Refer to Table 2 (Polygon 24)

Mexican hedge-nettle *Stachys mexicana*	● May demonstrate some medicinal qualities when made into tonic; not traditionally considered edible by all indigenous peoples (Pojar & MacKinnon, 1994, p.247) ● **Present**
American brooklime *Veronica beccabunga ssp. americana*	● Leaves edible, often used in salad ● Useful as a blood purifier, for urinary and kidney issues (Pojar & MacKinnon, 1994, p.261) ● **Present**
High bush-cranberry (Also, Squashberry & Mooseberry) *Viburnum edule*	● Edible berries, high in vitamin C (Pojar & MacKinnon, 1994, p.68) ● Traditionally widely used to treat muscle cramping (MacKinnon et al., 2009, p.116) ● **Absent**

Table 4. Desired native foraging species for polygon #27a including present and absent species that will be included into the area

Species Name	Foraging Properties
Nodding onion *Allium cernuum*	● Edible ● Has antibacterial, antiviral, and antifungal properties; can be used to treat cuts, burns, insect bites, and various internal ailments (MacKinnon et al., 2009, p.192) ● Attracts butterflies and hummingbirds (Pettinger p.98,108) ● **Absent**
Saskatoon Berry *Amerlanchier alnifolia*	● Edible sweet fruit (Pojar); high in antioxidants (Keefer et al., 2010) ● Berries and roots can be used in juices or teas for various medicinal uses (MacKinnon et al., 2009, p.109) ● **Absent**
Fireweed *Epilobium angustifolium*	Refer to Table 2 (Polygon 24)
Woodland Strawberry *Fragaria vesca*	● Edible berries eaten raw; bruised berries and leaves used in tea ● Leaf tea widely used to treat diarrhea and other ailments; most parts of the plant have a wide variety of medicinal uses (MacKinnon et al., 2009, p.178) ● **Absent**
Salal *Gaultheria shallon*	Refer to Table 2 (Polygon 24)
Dull Oregon Grape *Mahonia aquifolium*	Refer to Table 2 (Polygon 24)

Yerba Buena *Mentha spicata*	Refer to Table 2 (Polygon 24)
Red Flowering Currant *Ribes sanguineum*	Refer to Table 2 (Polygon 24)
Baldhip Rose *Rosa Gymnocarpa*	Refer to Table 2 (Polygon 24)
Evergreen Huckleberry *Vaccinium ovatum*	● Edible berries; sweet/musky in taste (Pojar & MacKinnon, 1994, p. 59) ● **Absent**
Red Huckleberry *Vaccinium parvifolium*	Refer to Table 2 (Polygon 24)

Table 5. Exotic species present in each representative polygon located on the site for the forage forest in which attention should be taken in either removal or maintenance.

Ecological Community	Exotic species
Polygon 24	*Argostis capillaries* (Colonial Bentgrass)
	Cirsium arvense (Canada Thistle)
	Holcus lanatus (Common velvet-grass)
	Urtica dioca (Stinging Nettle)
Polygon 25	*Agrostis tenuis* (Colonial bentgrass)
	Cirsium sp. (Thistle)
	Digitalis purpurea (Common foxglove)
	Holcus lanatus (Common velvet-grass)
	Vicia sp. (Vetch)
Polygon 27a	*Agrostis tenuis* (Colonial bentgrass)
	Anthoxanthum odoratum (Sweet vernal grass)
	Crepis capillaries (Smooth hawksbeard)
	Dactylis glomerata (Orchard Grass)
	Digitalis purpureai (Common foxglove)
	Holcus lanatus (Common velvet-grass)

	Hypochaeris radicata (Hairy cat's-ear)
	Lactuca muralis (wall lettuce)
	Lychnis coronaria (rose campion)
	Madia sativa (Chilean tarweed)
	Taraxacum officinale (dandelion)
	Urtica dioica (stinging nettle)

Table 6. Management conditions for native forage plants found in Polygon 24 including times of harvest, and particular growing conditions

Species	Growing Conditions/Harvest Period	Management Considerations
Achlys triphylla Vanilla leaf	· Moist, shady forests · Along stream banks, forest edges (Pojar & Mackinnon, 2004, p.312) · Plant w/sword fern (Pettinger & Costanzo, 1996, p.149) · Leaves harvested year round (Moore, 1993, p.251)	Unknown
Alnus rubra Red alder	· Moist conditions; disturbed sites; clear cut areas (Pojar & MacKinnon, 1994, p.44) · Cambium harvested in spring (Pojar & MacKinnon, 1994 p.44)	· Can shade out other species. May be useful in areas with high levels of soil disturbance, as this is a nitrogen fixing species (Pojar & MacKinnon, 1994, p.44)
Crataegus douglasii Black Hawthorn	· Grows in moist sites but is drought tolerant · Part-full shade. grows well with sword fern, conifers (Pettinger, p.145-146) · Flower from May to June; fruit may persist into winter (MacKinnon et al., 2009, p.80; Tarn, 2015, p.18)	- May shade out or provide shade for other species. Has potential to be utilized for natural fencing around the site, providing feed for deer but a physical barrier (this species has long thorns) (Pojar & MacKinnon, 1994)

Epilobium angustifolium Fireweed	· Grows well in open, disturbed sites (MacKinnon et al., 2009, p.232); tolerates acidic soil · Flower from June to September (MacKinnon et al., 2009, p.232)	· Despite being native, can become very invasive. Cut it back after flowering and before going to seed (Pettinger and Costanzo, 1996, p.160); can be especially weedy in previously logged and disturbed areas (Mitich, 1999)
Equisetum arvense Common Horsetail	· Grows in moist and disturbed sites (MacKinnon et al., 2009, p.388) · Harvested in the summer (Patterson, 2015)	· Can spread rapidly. To prevent this, sink them in bottomless containers (Patterson, 2015)
Gualtheria shallon Salal	· Tolerate dry to moist conditions, open to closed canopy (MacKinnon et al., 2009, p.122); · dry conditions (Anon., personal communication, July 9th, 2015) · Branches gathered in late-spring to early fall · Berries; early to mid fall, when they are fully mature on that plant (Moore, 1993, p.222)	· In the winter, prune old stems to encourage new growth (Pettinger and Costanzo, 1996, p.134) · Berries are more easily harvested by the bunch (Fitzgerald, D., personal communication, July 9th, 2015); this is said to increase productivity of the plant (Turner, 2014, p.187) · Spreads rapidly once established - this may require active management (Pettinger p.134)
Mahonia nervosa Dull Oregon Grape	· Moist to dry closed or open areas (MacKinnon et al., 2009, p.100); common in second growth, closed-canopy Douglas fir forests (Pojar, p.95); prefers shade but is drought tolerant (Pettinger, p.145) · Gather leaves from May-Mid fall (Moore, 1993, p.192) · Flowers in April, May, and June. Berries follow shortly after (Pettinger and Costanzo, 1996, p.145)	· Deer do not browse this species; grows back readily from disturbances once established (Anon., personal communication, July 9th, 2015)
Mentha spicata Yerba Buena	· Grows well in dry conditions, semi-open to open canopy (MacKinnon et al., 2009, p.284) · Leaves can be harvested year-round; flower in early summer (MacKinnon et al., 2009, p.284)	Unknown

Psuedotsuga menziesii Douglas Fir	· From dry to moist sites · Grows well after fires (Pojar and Mackinnon, 1994, p.32) · Young tips: harvested when bright green/tender (wild food and medicine, 2012a)	· Successional processes; may shade out other species
Ribes divarcatum Coastal black gooseberry	· Moist conditions, open canopy (MacKinnon et al., 2009, p.107) · Flower from May to June; if berries picked too soon, can be very sour (MacKinnon et al., 2009, p.107)	- Ts'msyen Peoples traditionally pruned and cleaned gooseberry bushes to increase productivity (Turner, 2014, p.190)
Ribes sanguineum Red Flowering Currant	· Grows well in dry to moist open forests (MacKinnon et al., 2009, p.105); grows in disturbed sites · Blooms in June and July (Pettinger, p. 158)	Unknown
Rosa Gymnocarpa Baldhip Rose	· Sunlight (MacKinnon et al., 2009, p.85) · Flower from June to August; rose hips often remain through winter (MacKinnon et al., 2009, p.84)	Unknown
Rosa nutkana Nootka Rose	· Moist, open areas (MacKinnon et al., 2009, p.85); requires full sun (pettinger, p.157) · Flower from June to August; rose hips often remain through winter (MacKinnon et al., 2009, p.84)	· Remove dead stems. For young plants, prune ⅔ of the years growth in the fall/winter to increase the plant's density (Pettinger and Costanzo, 1996, p.157)
Rubus occidentalis Black-capped raspberry	· Disturbed sites · Open forests and thickets (Pojar and Mackinnon, 1994, p.77) · Flowers from June to July (MacKinnon et al., 2009, p.95)	· Can behave like a weed given the right conditions and level of abundance (Anon., personal communication, July 9th, 2015); Requires pruning (Moore, 1993, p.232)
Rubus ursinus Trailing Blackberry	· Grows well in dry, open sites (MacKinnon et al., 2009, p.93) · Berries can be harvested in July (Pojar & MacKinnon, 1994, p.78)	· Grows quickly and can behave like a weed; the spread of this plant should be managed (Anon., personal communication, July 9th, 2015)

Shepherdia canadensis Soopalallie, or Soapberry	· Dry to moist conditions; open sites (MacKinnon et al., 1996, p. 129) · Berries can be harvested in mid-summer; traditionally harvested by shaking bushes over a mat (Pojar, p.94) · Traditionally pruned, berries scattered to encourage and new growth and sustained productivity (Turner, 2014, p.191)	
Tsuga heterophylla Western Hemlock	· Dry to wet sites · Shade tolerant · Grows well on decaying wood (Pojar and Mackinnon, 1994, p.30)	· Succession processes; may shade out other species
Vaccinium parvifolium Red Huckleberry	- Commonly grows out of Western red cedar or other decaying tree stumps in sun or shade (Anon., personal communication, July 9th, 2015; Pojar and Mackinnon, 1994, p.57); tolerates dry to moist conditions and semi-open canopy (MacKinnon et al., 2009, p.113) · Gather leaves in summer and early fall while still green (Moore, 1993, p. 82) · Flower from April to June? (MacKinnon et al., 2009, p.113)	- Bushes traditionally pruned by several First Nations (Turner, 2014, p.192)

Table 7. Management conditions for native forage plants found in Polygon 25a including times of harvest, and particular growing conditions

Species Name	Growing Conditions/Harvest Period	Management Considerations
Alnus rubra Red alder	· Refer to polygon 24, table 6	
Equisetum arvense Common horsetail	- Refer to polygon 24 table 6	
Mentha arvensis Field mint	· Grows well in moist, open conditions (MacKinnon et al., 2009, p.287) · Leaves can be harvested year-round (MacKinnon et al., 2009, p.287)	Unknown

Oplopanax horridus Devil's club	· Requires moist, shady conditions (D. Fitgerald, personal communication, July 9th, 2015; MacKinnon et al., 2009, p.92) and well-drained soils · Flowers from May to July MacKinnon et al., 2006, p.82) · Stems traditionally harvested only from "daughter" shoots, while "mother" shoots were left to continue growing (Turner, 2014, p.189)	Unknown
Rubus spectabilis Salmonberry	· Grows in wet conditions (Anon., personal communication, July 9th, 2015) · Flowers from June to July (MacKinnon et al., 2009, p.95); young shoots can be harvested from early spring to early summer (Pojar and Mackinnon, 1994, p.76)	- Green shoots can be cut from the plant to regenerate later; can be pruned after harvest to increase production (Turner, 2014, p.190)
Rubus parviflorus Thimbleberry	· Grows in moist conditions (Anon., personal communication, July 9th, 2015) most often in open sites (MacKinnon et al., 2009, p.95) · Flowers from June to July (MacKinnon et al., 2009, p.95)	- Green shoots can be cut from plant to regenerate later (Turner, 2014, p.190)
Stachys Mexicana Mexican hedge-nettle	· Moist clearings · Thickets, forest edges (Pojar and Mackinnon, 1994, p.247) · Can likely be harvested year-round	Unknown
Veronica beccabunga ssp. Americana American brooklime	· Wet ground or shallow water · Seepage areas, along streams, or near springs · Wet clearings and ditches (Pojar and Mackinnon, 1994, p.261) - Requires moist conditions (Anon., personal communication, July 9th, 2015) - Can likely be harvested year-round	Unknown
Viburnum edule High bush-cranberry (Also, Squashberry & Mooseberry)	· Moist forest, forest edges, margins of wetlands, rocky slopes (Pojar and Mackinnon, 1994, p.68) · Berries can be harvested from late summer to early fall (Pojar and Mackinnon, 1994, p.68)	- Traditionally pruned to renew growth (Turner, 2014, p.192)

Table 8. Management conditions for native forage plants found in Polygon 27a including times of harvest, and particular growing conditions

Species Name	Growing Conditions/Harvest Period	Management Considerations
Allium cernuum Nodding onion	· Requires full sun; common in Garry oak meadows (Patty; MacKinnon et al., 2009, p.193) · Tolerates dry conditions and drought tolerant once established (Pettinger p.135) · Bulbs are dug up in August (pojar and Mackinnon, 1994, 106)	· Be careful not to confuse with death camas as it grows in the same area (Pojar and Mackinnon, 1994, p.106)
Amerlanchier alnifolia Saskatoon berry	· grows in dry conditions (Anon., personal communication, July 9th, 2015); dry, open conditions (MacKinnon et al., 2009, p.109) · Flower from April to July (MacKinnon et al., 2009, p.109); berries ready to harvest from June to August (Pojar and Mackinnon, 1994, p.72; Keefer, 2010)	· Provides important winter browse for ungulates (Pojar and Mackinnon, 1994, p.72) · Traditionally pruned (Turner, 2014, p.185)
Fragaria vesca Woodland strawberry	· Dry to moist conditions, partial to open canopy (MacKinnon et al., 2009, p.179) · Flower from May to August (MacKinnon et al., 2009, p.179)	Unknown
Gaultheria shallon Salal	Refer to polygon 24, table 6	
Mahonia nervosa Dull Oregon Grape	Refer to polygon 24, table 6	
Vaccinium ovatum Evergreen huckleberry	· Requires shade/sun so partial tree cover is good (Anon., personal communication, July 9th, 2015) · Coniferous forests especially on edges and openings (partial canopy) (Pojar & MacKinnon, 1994, p.59) · Begin to ripen in early autumn and remain on bushes until December (Pojar and Mackinnon, 1994, p.59)	· May shade out or provide shade for other species - should be planted accordingly.
Vaccinium parvifolium Red huckleberry	· Refer to polygon 25a, table 7	

Epilobium angustifolium Fireweed	- Refer to polygon 24, table 6
Rosa gymnocarpa Baldhip Rose	See polygon 24, table 6
Mentha spicata Yerba Buena	Refer to polygon 24, table 6
Ribes sanguineum Red Flowering Currant	See polygon 24, table 6
Rubus ursinus Trailing Blackberry	See polygon 24, table 6