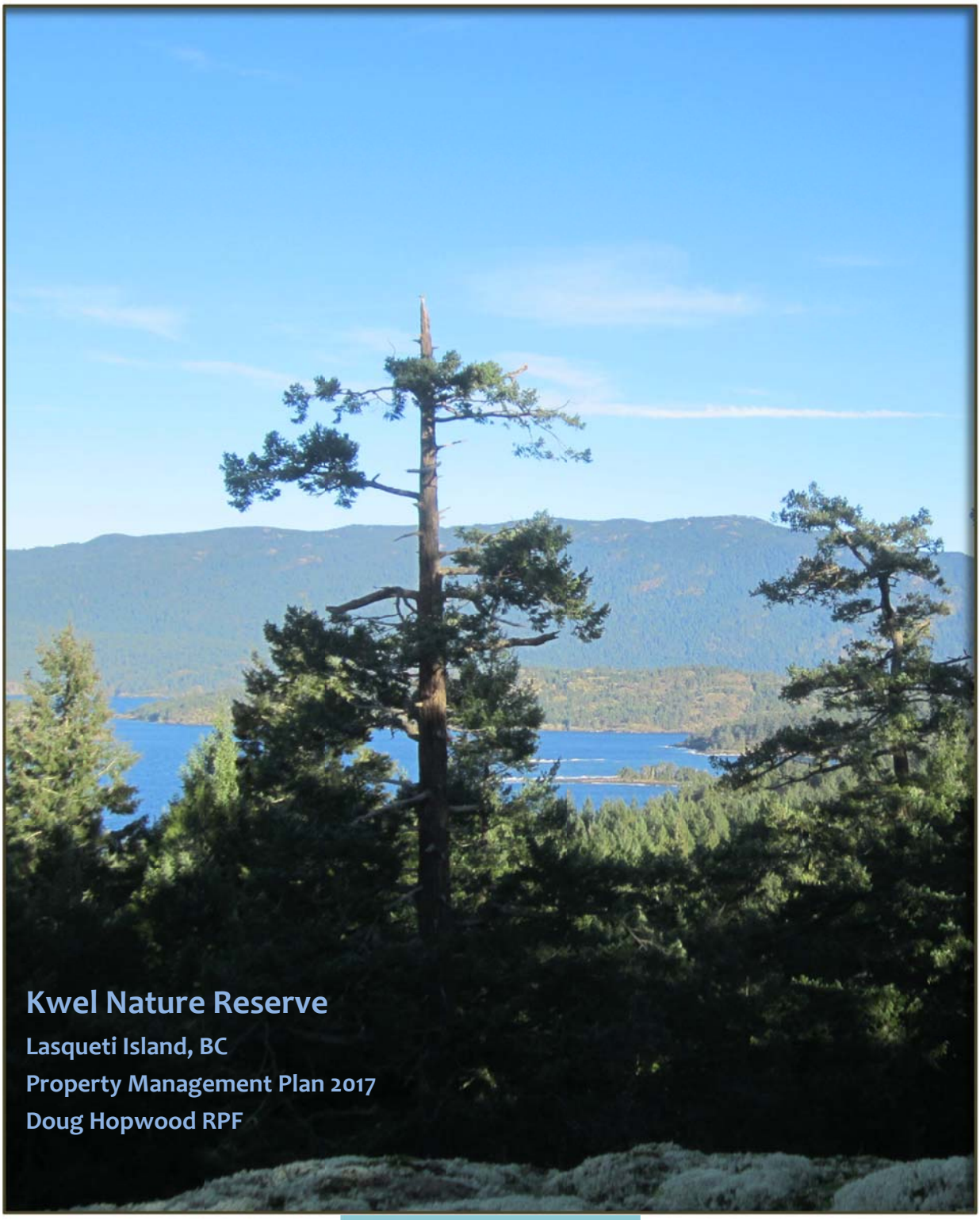

Kwel Nature Reserve

Lasqueti Island, BC

Property Management Plan 2017

Doug Hopwood RPF

ISLANDS TRUST FUND

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Kwel Nature Reserve
Lasqueti Island, BC
Property Management Plan 2017

Doug Hopwood RPF
603 Hemlock Street,
Qualicum Beach, BC V9K 1H8

Approved by:

- **Trust Fund Board - April 4, 2017**
- **Nanaimo and Area Land Trust (NALT) - May 15, 2017**
- **TLC The Land Conservancy of British Columbia – May 17, 2017**

Executive Summary

The Kwel Nature Reserve is a 21.6 hectare (53.4 acres) protected area at the northwest corner of Main Road and Tucker Bay Road on Lasqueti Island. The land was donated to the Islands Trust Fund in 1997 by Amelia Humphries. A Section 219 Conservation Covenant and Section 218 Statutory Right of Way Agreement, dated December 18, 2001, between the Trust Fund Board, TLC The Land Conservancy of British Columbia, and Nanaimo and Area Land Stewards Society prohibits any uses on the land which will impair or interfere with its natural state. Nanaimo and Area Land Stewards Society is now known as Nanaimo and Area Land Trust (NALT).

The Kwel Nature Reserve is within the asserted traditional territory of several First Nations and Treaty Groups. For over 10,000 years local First Nations have had an integral connection to the islands in the Trust area and the surrounding waters. The Islands Trust Fund has reached out to local First Nations to improve its understanding of the historical and current connection of First Nations with Lasqueti Island, and to learn how the Islands Trust Fund's management of protected areas can acknowledge and respect the cultural significance and traditional uses. While specific input has not been received to incorporate into this plan, the Islands Trust Fund will continue to research the cultural significance and traditional use/management of the property.

The objectives for management of the Kwel Nature Reserve are:

- to protect the natural character of the property and provide a place for quiet contemplation and nature appreciation;
- to protect the natural ecological, scenic, and human restorative values of the property;
- to allow natural ecological processes to function without human interference, except processes such as large-scale wildfire that may cause significant threat to ecosystem values or human life or property;
- to ensure that permitted uses will not significantly impair the natural condition of the land or interfere with natural processes on the land; and
- to allow minimal impact, non-consumptive human use of the property related to contemplation and nature appreciation and nature study.

The Kwel Nature Reserve is located within the Coastal Douglas-fir moist maritime (CDFmm) Biogeoclimatic subzone, an area where natural ecosystems have been heavily impacted by human development. One Blue-listed and eight Red-listed ecological comminutes occur in the Kwel Nature Reserve. Features of conservation note within the Reserve include mature and old growth forests, mossy rock outcrops, and a small wetland. Plant communities in the reserve generally have few non-native or invasive species.

The management issues identified for Kwel Nature Reserve are:

- Acceptable and Prohibited Public Uses
- Climate Change
- Wildfire Hazard Management
- First Nations Cultural Significance
- Impacts of Feral Sheep
- Western Screech-Owl Nest Boxes
- Signage
- Monitoring

The following activities by the public are prohibited:

- Use of motorized vehicles
- Bicycling or horseback riding
- Forestry, tree cutting or gathering of firewood
- Camping or fires
- Livestock grazing
- Trail development
- Collection of plants, animals or fungi
- Excavation or removal of soil or other materials
- Dumping of soil, fill or refuse of any kind

The following management actions or strategies are recommended, in order to achieve the management objectives, with respect to the identified management issues:

Acceptable and Prohibited Public Uses

- Continue annual monitoring.
- Assess need for a more pro-active approach to prohibited activities if needed in future.

First Nations Cultural Significance

- Consult, communicate and if possible collaborate with First Nations who have historical and/or current interest in the property.

Climate Change

- Islands Trust Fund may wish to undertake a more active and insistent program of advocating to senior governments and society in general for major reductions in greenhouse gas emissions.

Wildfire Hazard Management

- Contact local and/or provincial fire-fighters to make them aware of the Lasqueti Nature Reserves and to lay out the protocol that may be required to preserve these areas. The fire-fighters will have full control to fight the fires as they see fit to quickly extinguish any fires that occur in the Kwel Nature Reserve and to ensure the safety of the people and property of Lasqueti.
- The Lasqueti Island Volunteer Fire Department (LVFD) is supported by funding from the Powell River Regional District. For current contact numbers and information concerning the LVFD, contact Powell River Regional District.

Impacts of Feral Sheep

- Continue annual monitoring.
- Re-assess the state of forest regeneration at the time of the next management plan review.

Western Screech-Owl Nest Boxes

- Work with interested parties to install Western Screech-Owl nest boxes.

Signage

- Re-assess signage options if the need arises, or at the next management plan review.

Monitoring Program

- The routine monitoring process, along with the eyes of the community, will likely be sufficient to detect any impacts or issues that are likely to occur.
- The annual monitoring visit to Kwel Nature Reserve should include a traverse along the reserve frontage on Main and Tucker Bay roads and though the Reserve visiting the main Vegetation Types; an assessment of any increase in abundance or distribution of invasive plants and the impacts of feral sheep; and, at least once every five years, renewing the flagging or other markers indicating the corners and boundaries of the reserve.

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1 INTRODUCTION

This document is a management plan for the Kwel Nature Reserve[1], a 21.6 hectare (53.4 acre) ecologically significant area on Lasqueti Island that supports mature and old forest and habitat for a diversity of native species. The Kwel Nature Reserve is owned by the Trust Fund Board, who will work with the covenant holders, Nanaimo and Area Land Trust (NALT) and TLC The Land Conservancy of British Columbia to manage the property and protect its ecological values.

1.1 Islands Trust Fund and the Trust Fund Board

In 1974 the Province of British Columbia recognized the islands between Vancouver Island and the mainland as a unique area threatened by over-development. Through the *Islands Trust Act*, the province established the Islands Trust, a form of local government, with the following object:

> To preserve and protect the trust area and its unique amenities and environment for the benefit of the residents of the trust area and of British Columbia generally, in cooperation with municipalities, regional districts, improvement districts, other persons and organizations and the government of British Columbia.

The corporate status, responsibilities, and governance structure of the Trust Fund Board (TFB) are established under Part 6 of the *Islands Trust Act*. The TFB is charged to uphold the Object of the Islands Trust, and is responsible for administration of the Islands Trust Fund (ITF) and management of the properties of the ITF. The vision of the ITF is that:

> The islands and waters of Canada's Salish Sea will be a vibrant tapestry of culture and ecology where humans live and work in harmony with the natural world. A network of protected areas will preserve in perpetuity native species and natural systems of the islands. Engaged residents and conservation partners will work together to protect large natural areas and key wildlife habitat. Viable ecosystems will flourish alongside healthy island communities.

1.2 Islands Trust Fund Policies on Property Management

Under Trust Fund Board Policy 2.3 (2014) the following policies are relevant to this Management Plan:

10. The Board will prepare and approve a management plan for each property it acquires as a Nature Reserve. The Board will approve a management plan for its properties within one year of acquisition, and will update each management plan approximately every 10 years.

11. The Board will encourage input and involvement from interested community members, local First Nations and island conservation groups during the management planning process for its Nature Reserves.

12. The Board may negotiate management agreements with local conservation groups to assist with on-site property management, such as trail maintenance and invasive species removal.

13. Property management activities will focus on the preservation of the ecological integrity of the Nature Reserve. Low-impact recreational access will be accommodated only where the ecological integrity is not significantly compromised.

[1] The Kwel Nature Reserve was previously known as Kwel Nature Sanctuary.

14. The Board will monitor all Nature Reserves annually, and assess for potential management problems such as trespass, misuse or overuse, vandalism, safety hazards or other concerns or activities as listed in the management plan. The Board will take action to address any problems identified, within budget constraints.

15. Monitoring of Ecological Gifts will include confirmation that the present use of the property is consistent with the use at the time of the donation. Monitoring documentation relating to Ecological Gifts will be made available to Environment Canada upon request.

16. Management plans will indicate where signs should be placed on Nature Reserves. Signs will be kept to a minimum and be used only when necessary to provide visitors with essential information.

17. Generally, the following three types of signs may be used on Nature Reserves:

- *Management Signs*- describe permitted uses or activities that are not permitted, using international symbols where appropriate.
- *Safety Signs*- alert visitors to dangerous conditions or hazards that exist. Safety signs must be installed when a hazard or dangerous condition is identified on-site, using international symbols where appropriate.
- *Information Signs*- provide visitors with specific information such as the name of the property, management partners, site boundaries, identification or interpretation of features, provision of directions, and identification of facilities (e.g., trails).

18. The Board will seek appropriate conservation groups to hold conservation covenants on its lands and will work with these groups to negotiate appropriate covenant restrictions and obligations respecting the land.

1.3 Purpose of the Management Plan

ITF management plans provide background information and set out the direction of property management as follows:

- Provide general and descriptive information on the property, including location, legal description, history, and land use;
- Provide a process for consultation with First Nations, communities and conservation organizations in identifying management issues and articulating the conservation goals and objectives for the property;
- Identify the property's ecological and/or cultural values and features;
- Describe the management issues associated with the property; and,
- Provide short, medium and long-term management recommendations (action items or tasks) on issues such as protection of ecosystems and species at risk, ecological restoration, public access, educational and research opportunities, invasive species management, and signage.

Once the management plan process is complete, the ITF will work to carry out the management actions or strategies identified in the plan, as resources allow.

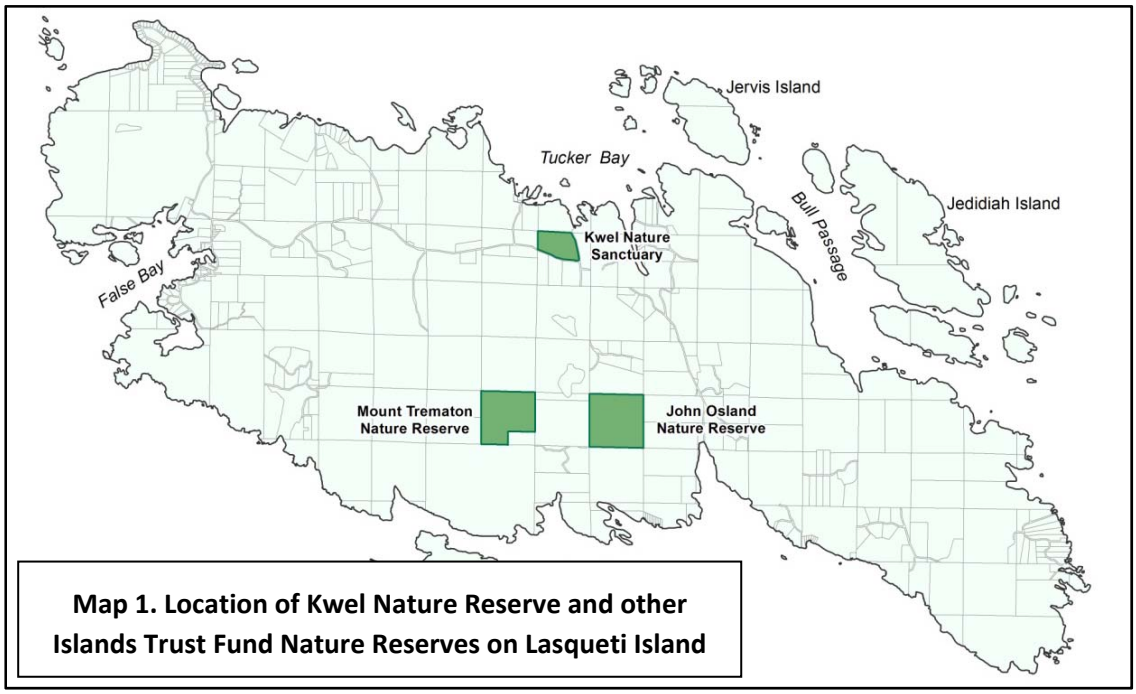
1.4 Previous Management Plan

A management plan for the Kwel Nature Reserve was written and approved in 1999 and revised in 2002. This plan is intended to replace that document. The wording of the Management Objectives (below) have been slightly revised to be more consistent with Islands Trust Fund policies, but are essentially the same as in the previous plan. The Vegetation Types in this plan are mostly the same, but have been refined to more fully account for the effects of disturbance history on plant communities. The "Old Vegetation Types" that correspond to the Vegetation Types in this plan are indicated by the numbers in parentheses in the top left hand cell of the vegetation tables in Appendix A. The mapping of Vegetation Types has also been slightly revised.

1.5 Management Objectives

The objectives for management of the Kwel Nature Reserve are:

- to protect the natural character of the property and provide a place for quiet contemplation and nature appreciation;
- to protect the natural ecological, scenic, and human restorative values of the property;
- to allow natural ecological processes to function without human interference, except processes such as large-scale wildfire that may cause significant threat to ecosystem values or human life or property;
- to ensure that permitted uses will not significantly impair the natural condition of the land or interfere with natural processes on the land; and
- to allow minimal impact, non-consumptive human use of the property related to contemplation and nature appreciation and nature study.

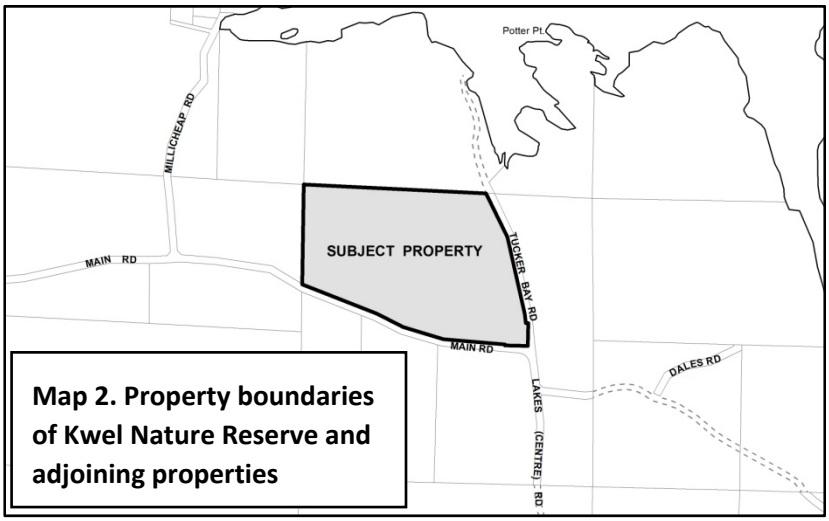


Map 1. Location of Kwel Nature Reserve and other Islands Trust Fund Nature Reserves on Lasqueti Island

2 PROPERTY INFORMATION

2.1 Location, Legal Description, and Access

The property is located at 49° 29’ 38” N, 124° 16’ 13” W, at the northwest corner of Main Road and Tucker Bay Road on Lasqueti Island. The legal description of the property is PID: 023-586-877, Lot 1 and District Lot 111, Section 14, Lasqueti Island, Nanaimo District, Plan VIP 64302. The property is 21.6 hectares (53.4 acres) in area. Access to the property is via foot passenger ferry from French Creek Harbour on Vancouver Island to False Bay on Lasqueti Island, then one kilometer north on Weldon Road (Conn Road), then six km east on Main Road to the corner of Tucker Bay Road. Legal access into the property is available along its frontage on Main Road and Tucker Bay Road. Map 1 shows the location of Kwel Nature Reserve and the Islands Trust Fund’s two other Nature Reserves on Lasqueti Island. Map 2 shows the boundaries of the Kwel Nature Reserve and adjacent properties.



Map 2. Property boundaries of Kwel Nature Reserve and adjoining properties

2.2 Land Use Regulation

The Property is within the Islands Trust Area and is subject to bylaws adopted by the Lasqueti Island Local Trust Committee. The property is within the “Land-Based” designation under the Lasqueti Island Official Community Plan, Bylaw No. 77, 2005. Objectives and policies under Bylaw No.77 that are relevant to the management plan include:

Objective 5: To promote the retention of native flora and fauna and areas of both typical and unique ecosystems.

Policy 5: Native flora and fauna should be retained to protect natural habitats of local significance.

Under the Lasqueti Island Land Use Zoning Bylaw No. 78, the property is within the “Land-Based” zone and Subdivision District “A’, in which the minimum subdivision parcel size is 9.88 ha and the maximum residential density is one dwelling per 9.88 ha.

Protection of riparian areas on Lasqueti Island, in keeping with the provincial *Riparian Areas Regulation*, is implemented under Bylaw No. 78. On Schedule “D” of Bylaw No. 78 (watershed designation map) the southeastern portion of the property is noted as falling within the watershed of Deane Creek, which is considered a “Watershed with Fish Habitat”. However, there are no streams or water bodies within the property that would be subject to setback or screening requirements for riparian areas.

2.3 Conservation Covenant and Statutory Right of Way

A Section 219 Conservation Covenant and Section 218 Statutory Right of Way Agreement, dated December 18, 2001, between the Trust Fund Board, TLC The Land Conservancy of British Columbia, and Nanaimo and Area Land Stewards Society prohibits any uses on the land which will impair or interfere with its natural state. Nanaimo and Area Land Stewards Society is now known as Nanaimo and Area Land Trust (NALT).

2.4 Land Use Context

The property is within an area of primarily private land properties ranging from 8 to 70 ha in area. Young to mature forest is the primary vegetation cover, with small areas of rocky outcrops, wetlands and residential clearings. There is a generally high level of forest habitat connectivity. The property abuts private land to the north and west, and public roads to the south and east. There are currently no activities on adjacent properties that pose significant risks to the ecological values of the property.

2.5 History

2.5.1 First Nations

Coast Salish First Nations have had a presence on Lasqueti Island and adjacent lands in the Salish Sea for thousands of years[2]. The Kwel Nature Reserve is located within the core traditional territory of several Coast Salish First Nations including Cowichan Tribes, Halalt First Nation, Lake Cowichan First Nation, Lyackson First Nation, Penelakut Tribe, Stz'uminus First Nation, Tl'amin Nation and Qualicum First Nation.

Local historian Elda Mason noted that one of the early European settlers on Lasqueti reported that there had been a "potlatch house on Lasqueti owned by the Pentlatch Indians" (Mason 1976). More recent archaeological work has shown that several permanent settlements were located on Lasqueti in coastal areas with high-value marine resources. Sophisticated structures such as fish traps and clam gardens provide evidence of a long history of settled occupation[3]. Smallpox and other epidemics which began in the 1770s or earlier had caused drastic population declines in First Nations in the Strait of Georgia by 1800, whereas the earliest recorded settlement on Lasqueti by Europeans did not occur until the 1860's, so it is likely that all permanent First Nations settlements had been abandoned before European settlers arrived, giving the false impression that Lasqueti had lacked ongoing First Nations settlements.

During the course of field work for this management plan, an archaeological feature was found that provides evidence of First Nations use and occupancy of the property.

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[2] The Trust Fund Board recognizes that the language commonly used to refer to land may be disrespectful to First Nations. For example, notions of 'private' and 'Crown' land do not appropriately recognize aboriginal title, and imply a belief in the concept of *terra nullius*, the idea that land was not owned prior to the assertion of European sovereignty. The Trust Fund Board acknowledges that *terra nullius* is a concept that doesn't apply to the Islands Trust Area. The words "provincially-managed public land" will be used in place of "Crown".

[3] For example, see http://www.lasqueti.ca/archaeological-heritage.

2.5.2 Forest History

Prior to arrival of European settlers, Lasqueti Island was covered primarily by natural forests. The age and size of the trees and the mix of species were controlled largely by site ecology factors (soil moisture and nutrients) and by patterns of natural disturbance. Douglas-fir was predominant across a wide range of sites. Shore pine and arbutus were most abundant on dry sites with sunny exposures and/or shallow stony soils. Western redcedar, grand fir and western hemlock were more common on moist fertile sites. Red alder and bigleaf ample were relatively minor species, on moist sites or disturbed areas. Western yew occurred as an uncommon species in the understory of mature stands. Wild fires occurred periodically during the pre-European settlement era. Many large Douglas-fir trees were able to survive forest fires, as evidenced by charcoal on the bark of many of the older Douglas-fir trees. Some fires may have been set by First Nations as part of indigenous land management strategies, or they may have been started by lightning strikes. First Nations may have stripped bark or cut trees within the property, but no evidence has been found of such activities.

Most of the more accessible and commercially valuable stands of large trees on the property were logged around 1915. Charring within the spring-board notches of stumps that date from this logging episode indicate that the slash was burned after logging, perhaps by accident, as noted under Section 2.5.4. These areas mostly regenerated naturally to a forest dominated by Douglas-fir with lesser amounts of cedar, grand fir, western hemlock, red alder and bigleaf maple (Vegetation Type 1.) A second round of logging occurred in about 1955, removing some of the smaller and less valuable trees from less productive growing sites. Most of these areas have also regenerated naturally (Vegetation Types 2, 4, 5, 6, 8, & 9).

A significant area with smaller trees on dry rocky sites remained unlogged, or subjected to very light selective logging (Vegetation Type 7). Three patches of old-growth forest with large, old Douglas-fir trees remain, with a combined area of about 2.0 ha (Vegetation Type 3).

The forest was cleared from the Tucker Bay School site, described under Section 2.5.4 below, probably around 1913. After the school was torn down in the 1960s, the site slowly regenerated with red alder (Vegetation Type 10).

A “borrow pit” was excavated next to Main Road near the western end of property during the mid 1970s to provide sand for fill during the construction of the Lasqueti Community Hall. This area has now regenerated naturally with red alder (Vegetation Type 10).

2.5.3 Property Ownership History

Lasqueti Island was surveyed into sections (lots measuring roughly one mile on each side) and quarter-sections in 1875. Initial ownership of the land was claimed by the Crown (the colonial government). No steps were taken to legally acquire title to the land from First Nations (although such measures had been taken in areas around Victoria, about twenty years earlier, during negotiation of the Douglas Treaties.) Land titles, in the form of Crown Grants, were made available to non-indigenous settlers, generally through pre-emption followed by completion of required improvements and residency, or by purchase.

The NW ¼ of Section 14 was preempted in 1912 by Norman Washburn, and was Crown granted in 1929 to Adda Washburn. Elda Mason records that “Norm” and “Addy” Washburn left Lasqueti in 1928. The next owner of the quarter-section was Chester Douglas, from the early 1930s until the 1950s, when it

was acquired by George Holland. In 1972, the NW ¼ of Section 14 was bought by Lasqueti Holdings, a company owned in part by Amelia and Michael Humphries, who moved to Lasqueti at that time.

The quarter-section was subdivided in 1975 and again in 1976, creating three lots on the south side of Main Road which were sold. In 1981, Amelia Humphries bought the remainder of the NW ¼ of Section 14 from Lasqueti Holdings, which included the land that is now the Kwel Nature Reserve. Also in 1981, the property that is now Kwel Nature Reserve was subdivided from the parent property, creating a 21.2 ha lot called Lot A.

2.5.4 Lot 111

A one-acre square lot (District Lot 111) at the corner of Main and Tucker Bay roads was a surveyed off from the rest of NW ¼ of Section 14 to accommodate Tucker Bay School in 1918. (By that time the school had already been built). Lot 111 was transferred by a free Crown grant in 1948 to Powell River School District "in trust for school purposes and as a school site". Some time prior to the Crown grant, likely in 1920, it was designated as a "school reserve".

In 1955, after Tucker Bay School was closed, the Provincial Government gave consent via an Order in Council for Lot 111 (the Tucker Bay School lot) to be sold by Powell River School District to the Lasqueti Women's Institute for $50.

In January, 1986, the Women's Institute, which had become largely inactive by the 1970's, sold Lot 111 to the Lasqueti Community Association (LCA) for one dollar. The LCA, in turn, sold Lot 111 to Amelia Humphries in August 1986, for $250.00, with the understanding that Amelia would amalgamate it back into the larger parcel of land, to be used for conservation purposes. In 1996, Amelia amalgamated Lot 111 with Lot A, to create the 21.6 ha property that is now the Kwel Nature Reserve.

2.5.5 Tucker Bay School

Tucker Bay was a centre of activity in the early settlement history of Lasqueti Island. A public dock was built at Tucker Bay in 1913, and it became the main route on and off the island, with the Union Steamships making a regular stop there until 1923. Also in 1913, the first public school on Lasqueti Island was built at the corner of Main Road and Tucker Bay Road, at the southeast corner of the property.

The original school building, made of logs, burnt down the next year in a fire caused by land-clearing associated with building Main Road. (It may be that this was the same fire that burnt nearby forest areas—then freshly logged—and helped create conditions for regeneration of the second-growth Douglas-fir stands now found near the old school site and along Main Road.)

After the fire, the school was replaced by a wood frame building with clapboard siding. School was held in this building until 1917. With the opening of the cannery in False Bay, the centre of population on Lasqueti shifted to the north end, and a new school was built in False Bay. The Tucker Bay school building then was used as a community hall, providing a meeting place for the Farmer's Institute, the Women's Institute, and the Agricultural Association, as well as various community functions. School classes were resumed at Tucker Bay in 1932, and were held there until 1950, when Charles Williams School (now called False Bay Elementary) was built in False Bay. A school bus service was begun at this time, making it feasible to have one school for the whole island. The Tucker Bay school house continued to be used as community building until it was dismantled in the mid 1960s.

Since the school building was demolished, red alder trees and a few conifers have seeded in naturally. The site shows very little evidence of its former use. In the course of 60 to 100 years, conifers will replace the alders. In the long run, the school site will probably develop a natural character difficult to distinguish from the rest of the property.

2.5.6 Amelia Humphries - Land Donation

Amelia Humphries and her husband Michael moved to Lasqueti Island in 1972, and built a house on a nearby property. For several years they operated an oyster farm in the sheltered waters of Tucker Bay, and Michael served on the islands Trust as a Local Trustee from Lasqueti Island from 1974 to 1986.

Amelia had previously been a high school teacher, and she brought a lively mind and an activist spirit to her life on Lasqueti. During the 1970s, many young people moved to Lasqueti to pursue a semi-self sufficient lifestyle involving home-made houses, homestead gardening and off-grid sources of energy. In the late 1970s, conflicts began to develop within the community over logging. While many in the community took polarized positions (either pro- or anti-logging) Amelia began seeking out information about the theory and a practice of ecologically sustainable forest management.

Thomas Ovanin, a lands officer with the BC Government, recommended that Amelia talk with Dr. Karel Klinka, a professor at the University of British Columbia (UBC) Faculty of Forestry and research scientist with the BC Ministry of Forests. Dr. Klinka was a former student of Dr. Vladimir Krajina, the originator of British Columbia's system of Biogoeclimatic Ecosystem Classification (BEC). At Amelia's invitation, Dr Klinka and his colleagues Bob Green, George Shishkov and Paul Courtin visited Lasqueti around 1986, and developed a pilot project demonstrating how the BEC system of site-level ecosystem, and classification could form a basis for a sustainable forest management plan for the parcel of land surrounding the Lasqueti Community Hall (Green *et al*. 1987). Amelia Humphries was inspired by the ecologically-based approach to forest management, and wanted to put a similar system into practice on her property. To that end and she hired Donald McLennnan (at that time a PhD student with Karel Klinka) to develop an ecologically based management plan for the remainder of the ¼ Section.

Amelia eventually left Lasqueti to live in Qualicum Beach. Her husband Michael died in a tragic airplane crash in August 1995. In October 1996, Amelia subdivided the remainder of the quarter section, creating the 21.6 ha lot that is now the Kwel Nature Reserve, which she donated to the Islands Trust Fund in 1997. Amelia died in 2011 at 80 years of age.

3 ECOLOGICAL INVENTORY

3.1 Geology, Landforms, and Soils

Geologically, most of Lasqueti Island is derived from Upper Triassic basalts and pillow lavas of the Karmutsen group, about 205 million years old. The underlying landforms of Lasqueti Island are rugged and irregular, dominated by many rocky hills (dome-shaped or oblong ridges) with steep sides, rounded tops, and many narrow, steep valleys between the rocky hills.

The Gulf (Strait) of Georgia region was covered by glaciers from about 29,000 to about 12,000 years ago. The weight of the ice depressed the land surface so that Lasqueti Island was below sea level. As the glaciers retreated and the land rebounded, marine and coastal processes eroded loose materials from the higher and steeper parts of the island and laid down finer-textured soil parent materials on many of the lower-lying and more gently sloping areas. Soils on the sides and tops of the hills vary from bare rock to morainal deposits (mixed material deposited by the glaciers), typically shallow and rapidly drained. Soils are somewhat deeper in the narrow steep valleys, and deepest, with the most water-holding capacity, in the broader lowland valleys and coastal plains. The Kwel Nature Reserve has both the rocky and steep landforms with shallow, coarse-textured soils, and the lower and gentler slopes with medium to deep marine soils of medium to fine texture.

3.2 Climate

Lasqueti Island lies within the Coastal Douglas-fir biogeoclimatic zone, an area of mild semi-Mediterranean climate in the southern Strait of Georgia, encompassing most of the Gulf Islands. The climate of this zone is strongly influenced by the rain shadow effect of the Vancouver Island Ranges. In the summer, periods of drought and high temperatures over four weeks long are common. Winters are typically rainy and mild. Snow rarely remains on the ground for more than a week, and some winters have no snow.

In winter the prevailing winds are from the southeast. Winter storms often involve winds up to 30 or 40 knots, which can blow for several days at a time. In summer, warm fair weather is usually associated with steady northwesterly winds, although southeasters can blow in summer too. The Kwel Nature Reserve, being located close to the Sabine Channel, is exposed to both northwest and southeast winds that blow along the axis of the Sabine Channel. Lasqueti is somewhat sheltered from the force of cold winter “outflow winds” by the mass of Texada Island to the northeast.

3.3 Climate Change

Due to human-caused emission of greenhouse gases, the climate on Lasqueti Island is expected to change significantly during coming decades. Figure 1 shows a comparison of two sets of monthly temperature and precipitation data for Kwel Nature Reserve, as generated by ClimateBC software (Wang *et al*. 2012):

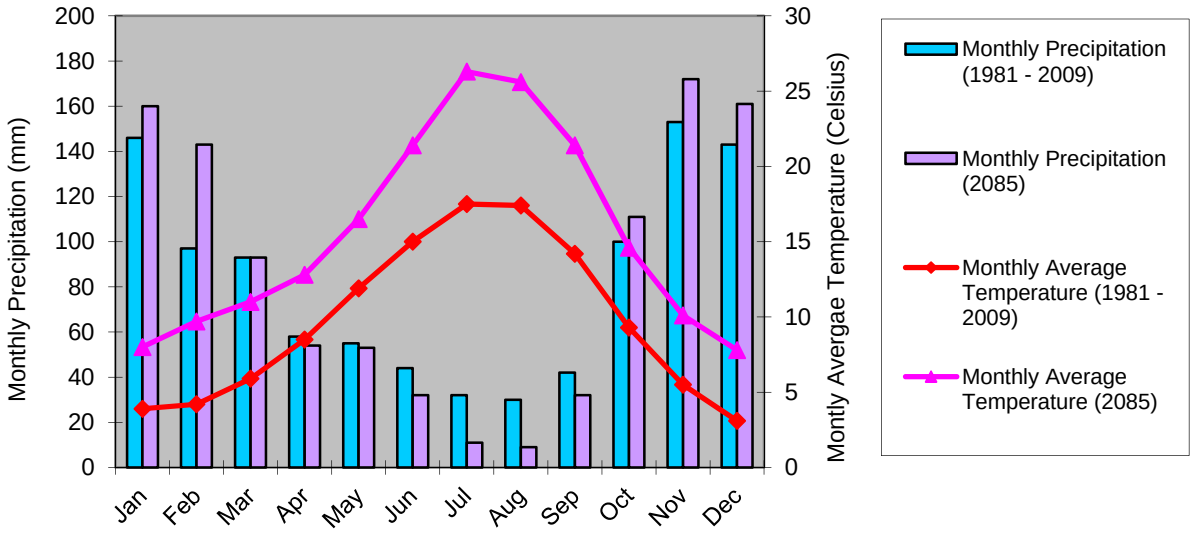
- the recent historical norm, represented by 1981 – 2010 averages; and
- the potential future climate, represented by results from the Canadian Earth System Model CanESM2 for the year 2085, using the Representative Concentration Pathway RCP 8.5.

The key predicted changes in climatic variables are:

- increases in average temperature of about 4° C in winter and 8° C in summer;
- up to 25 percent increase in winter precipitation (with less snow) and;
- a severe decrease in summer precipitation.

RCP 8.5 is a plausible scenario of future greenhouse gas emissions consistent with global emissions continuing along present trends. Under this scenario, the combination of higher temperatures and severe summer drought will most likely lead to the death of most trees and many other plants within the property, either directly due to extreme moisture stress, or indirectly due to wildfire, diseases, and epidemics of insects that attack trees.

Figure 1. Present and Future Climate of Kwel Nature Reserve



3.4 Hydrology

Most precipitation in the Kwel Nature Reserve occurs as rain that falls during the winter months. In areas of the reserve with shallow soils over bedrock, water is shed rapidly and little water penetrates into the ground. Lower areas receive water shed from higher areas, and the deeper, finer textured soils in these areas allows more absorption and storage of sub-surface water, so more moisture is available for growth of plants. There are no streams or lakes within the property. There is one seasonal pond, about 10 m across and by a small wetland, shown as Vegetation Type #12 on Map 3.

3.5 Ecological Classification

Two complementary systems of ecosystem classification are widely used in British Columbia. The Ecoregion Classification system is used to stratify British Columbia's terrestrial and marine ecosystem complexity into discrete geographical units at five levels. The three lowest levels, Ecoprovinces, Ecoregions and Ecosections, are progressively more detailed and narrow in scope. They describe areas of similar climate, physiography, vegetation and wildlife potential. Within each terrestrial ecoregion, climatic zones occur where specific soils, plant and animal communities and aquatic systems develop because of the interactions of climate with the land surface and surficial materials. These zones are best defined within the Biogeoclimatic Ecosystem Classification system.

3.5.1 Ecoregion Classification

Under the Ecoregion Classification System, the Kwel Nature Reserve is located in the Georgia Depression Ecoprovince, the Georgia-Puget Basin Ecoregion, and the Strait of Georgia Ecosection.

3.5.2 Biogeoclimatic Classification

Under the Biogeoclimatic Ecosystem Classification system, the Kwel Nature Reserve is located in the Coastal Douglas-fir moist maritime (CDFmm) biogeoclimatic subzone. Within that subzone, site series classification is used to recognize small-scale local differences in terrain, soils, aspect, etc. The predominant sites within the Kwel Nature Reserve are noted for each Vegetation type, as described in Section 3.7.

3.6 Red and Blue-listed Ecological Communities

The British Columbia Conservation Data Centre (CDC) has a system of ranking for species and ecological communities, and maintains two lists of species and ecological communities that are of conservation interest. The "Red list" includes species and ecological communities that have been legally designated as Endangered or Threatened under the *Wildlife Act of British Columbia*, are extirpated, or are candidates for such designation. The "Blue list" includes species and ecological communities not immediately threatened, but of concern because of characteristics that make them particularly sensitive to human activities or natural events.

BC Species and Ecosystem Explorer provides information on Red- and Blue-listed ecological communities in British Columbia. Table 1 lists the Red-listed and Blue-listed ecological comminutes that occur in the Kwel Nature Reserve.

Table 1. Red and Blue-listed Ecological Communities within the Kwel Nature Reserve

Ecological Community - English Name	BC List	Site Series	Type
grand fir / dull Oregon-grape	Red	CDFmm/04	Forest
grand fir / three-leaved foamflower	Red	CDFmm/06	Forest
Douglas-fir – arbutus	Red	CDFmm/02	Forest
Douglas-fir / dull Oregon-grape	Red	CDFmm/01	Forest
western redcedar - Douglas-fir / Oregon beaked-moss	Red	CDFmm/05	Forest
red alder / slough sedge [black cottonwood]	Red	CDFmm/14	Forest
lodgepole pine / peat-mosses CDFmm	Red	CDFmm/10	Wetland
sweet gale / Sitka sedge	Red	CDFmm/Wf52	Wetland
Wallace's selaginella / reindeer lichens	Blue	CDFmm/00	Grassland/Rock

3.7 Vegetation Types

Twelve distinct Vegetation Types were delineated within the Kwel Nature Reserve, primarily on the basis of site series and disturbance factors, which give rise to a unique plant community in terms of the species, age, or height of the dominant trees, and the species of understory plants. Table 2 summarizes the relationships between site series and disturbance factors for the twelve Vegetation Types.

Table 2. Site series and disturbance factors for the twelve Vegetation Types

	Site Series					
Disturbance Factors	Rock outcrops	CDFmm/02	CDFmm/01	CDFmm/04	CDFmm/06	Fresh and/or wet sites
Naturally non-forest	**VT 11** Moss, lichen A few Fd/Pl/Ra					**VT 12** Wetland Sedges and hardhack
Unlogged old or mature forest		**VT 7** Open Fd/Pl/Ra Moss (lichen)	**VT 3** Fd (Bg, Cw) Moss, shrubs, ferns			
Selectively logged circa 1955			**VT 4** Fd/Cw/Pl/Bg/Dr Moss, shrubs, ferns			
Heavy sheep browsing; Selectively logged circa 1955		**VT 6** Open Fd/Pl (Ra) Non-native grasses and herbs, moss				
Chronic wind disturbance; Selectively logged circa 1955		**VT 8** Open Fd/Pl (Ra) Moss				
Selectively logged circa 1955; Root disease			**VT 9** Open Fd/Dr/Cw/Dr Shrubs, ferns, moss			
Clear-cut circa 1915, naturally regenerated			**VT 1** Fd (Bg, Cw) Moss, ferns, shrubs			
Clear-cut circa 1955, naturally regenerated			**VT 2** Pl/Fd/Bg Moss, ferns, shrubs			**VT 5** Pl/Cw/Fd Dense salal & evergreen huckleberry
Cleared land regenerating with pioneer species				**VT 10** Red alder (a few young conifers) Ferns, grass, moss, sedge		

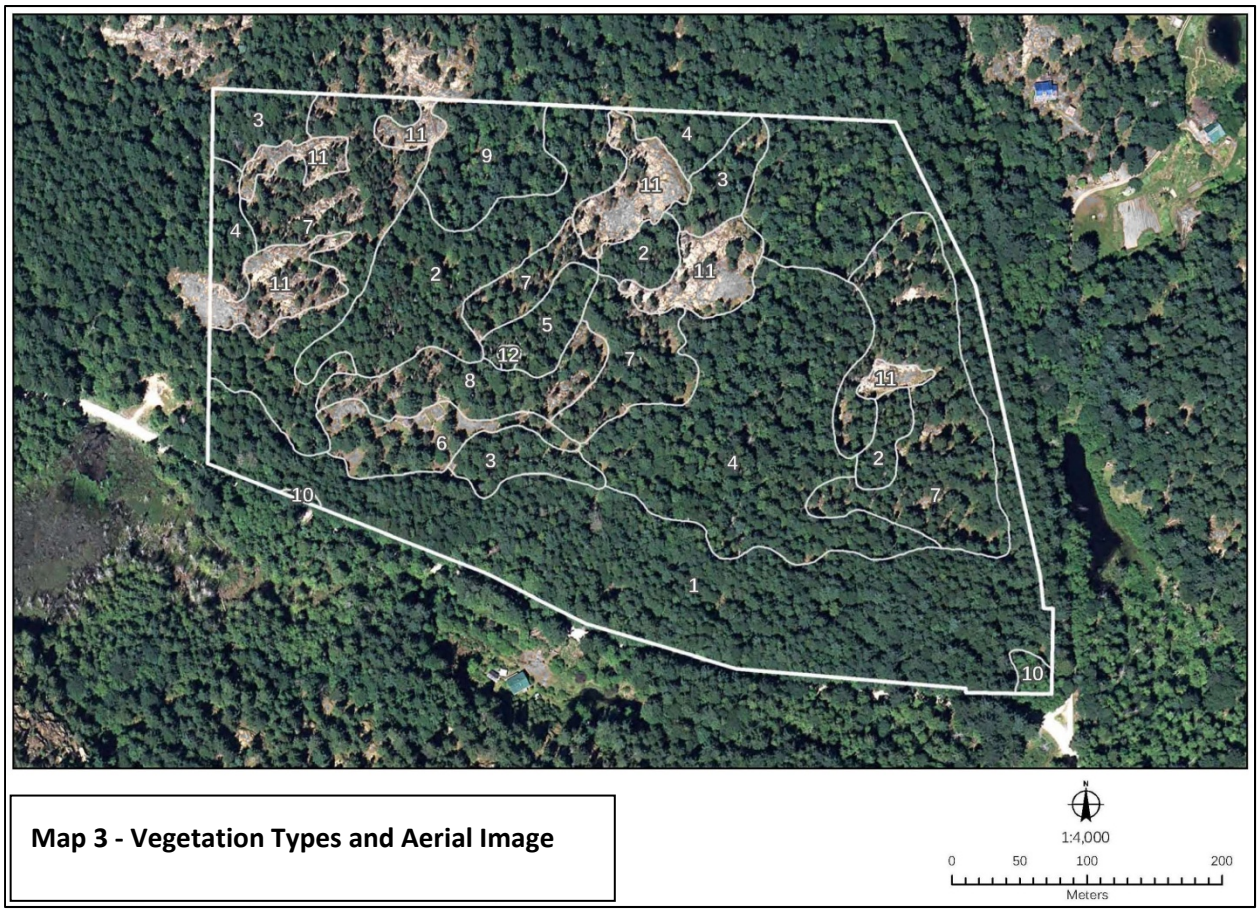
The abundance and vigour of plants is strongly affected by site factors (regional climate, soil moisture and nutrient regime, drainage, aspect, etc.) As a result, each Vegetation Type occurs on a limited range of site series. Site series within the Coastal Douglas-fir Biogeoclimatic zone are described in Green and Klinka (1994). Plant communities are also affected by the history of disturbance and recovery (logging, fire, windthrow, natural regeneration, browsing, etc.) Each Vegetation Type has a distinctive disturbance regime, and can be expected, in future, to follow a distinct path of changes, such as growth and succession. Because these processes will continue in the future, plant communities are not necessarily permanent, although they may be stable over periods of many centuries (or would be so in the absence of climate change).

Tree ring cores were taken from some of the second growth trees to establish stand ages. Cores were not taken from the larger and older trees, to avoid any risk of injuring them, so the age estimates given for the older stands are approximate.

Map 3 shows the Vegetation Types of the Kwel Nature Reserve. Photos and detailed descriptions of each Vegetation Type are provided in Table 4. The date, camera direction (azimuth) and location (UTM coordinates) of each Vegetation Type photo are shown in Table 3. The common and botanical (Latin) names of all plant species reference in this document are listed in Table 5.

Table 3. Date, camera direction and location of each Vegetation Type photo

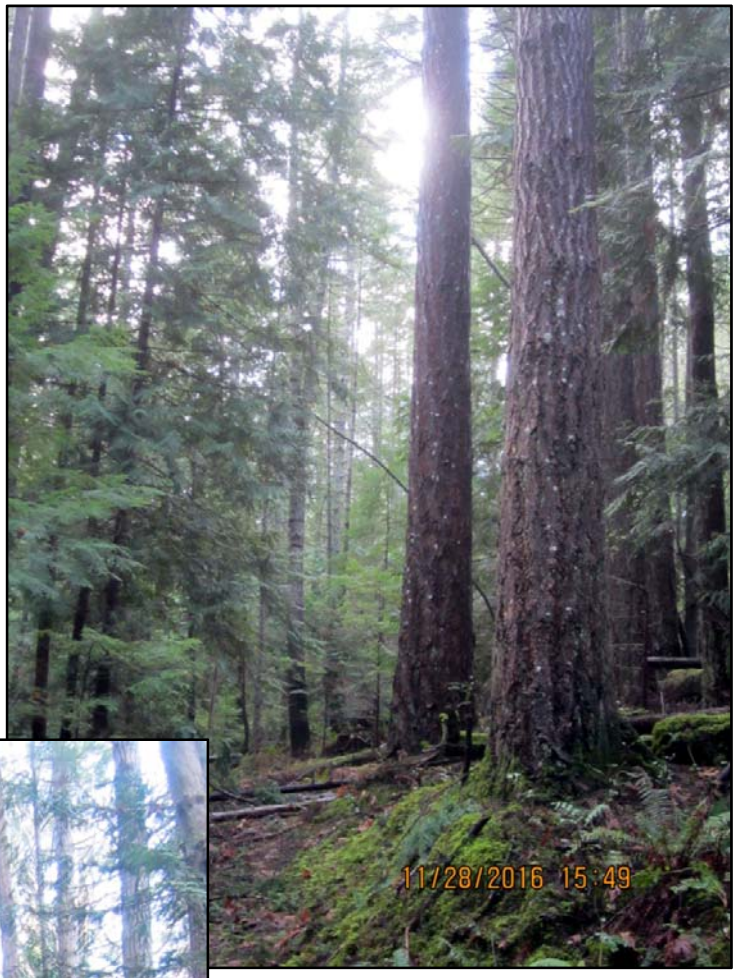
Photo Title	UTM - east	UTM - north	Azimuth	Date
Vegetation Type 1 , Photo 1	407913	5483239	246°	28-Nov-16
Vegetation Type 1 , Photo 2	407918	5483578	0°	4-Dec-16
Vegetation Type 2 , Photo 1	407529	5483479	158°	5-Nov-16
Vegetation Type 2 , Photo 2	407557	5483420	320°	28-Nov-16
Vegetation Type 3 , Photo 1	407460	5483582	250°	5-Nov-16
Vegetation Type 3 , Photo 2	407740	5483496	42°	28-Nov-16
Vegetation Type 4 , Photo 1	407416	5483471	40°	5-Nov-16
Vegetation Type 4 , Photo 2	407413	5483486	310°	5-Nov-16
Vegetation Type 5 , Photo 1	407626	5483408	120°	28-Nov-16
Vegetation Type 5 , Photo 2	407666	5483419	250°	28-Nov-16
Vegetation Type 6 , Photo 1	407559	5483356	278°	4-Dec-16
Vegetation Type 6 , Photo 2	407559	5483356	Close-up	4-Dec-16
Vegetation Type 7 , Photo 1	407970	5483339	260°	4-Dec-16
Vegetation Type 7 , Photo 2	407542	5483341	270°	28-Nov-16
Vegetation Type 8 , Photo 1	407572	5483389	0°	4-Dec-16
Vegetation Type 8 , Photo 2	407558	5483387	0°	4-Dec-16
Vegetation Type 9 , Photo 1	407636	5483546	320°	28-Nov-16
Vegetation Type 9 , Photo 2	407584	5483510	304°	5-Nov-16
Vegetation Type 10 , Photo 1	408039	5483135	330°	4-Dec-16
Vegetation Type 10 , Photo 2	407455	5483314	295°	28-Nov-16
Vegetation Type 11 , Photo 1	407745	5483450	110°	28-Nov-16
Vegetation Type 11 , Photo 2	407745	5483450	Close-up	28-Nov-16
Vegetation Type 12 , Photo 1	407618	5483399	50°	28-Nov-16
Vegetation Type 12 , Photo 2	407633	5483396	226°	28-Nov-16



Map 3 - Vegetation Types and Aerial Image

Table 4. Detailed descriptions of Vegetation Types

Vegetation Type # 1 (Old VT #1)	**Mature second growth conifer forest on moderately dry sites**
Main Tree Canopy	Douglas-fir, grand fir, (western redcedar, western hemlock, bigleaf maple)
• *Age range*	Even-age, 95 - 100 years
• *Height and dbh*	30 - 40 m; 30 – 100 cm
• *Canopy cover*	70 - 90 %
Secondary Layers	Western hemlock, western redcedar, grand fir
• *Age range*	10 – 40 years
• *Height and dbh*	2 – 15 m; 5 – 30 cm
• *Canopy cover*	1 – 5 %
Understory layers: • *Height, cover %, species*	Shrubs: 50 – 200 cm; 1 – 10 %; red huckleberry, evergreen huckleberry, Oregon grape, salal Ferns: 30 – 60 cm; 5 – 20 %; sword fern Moss: 20 - 80 %; *Eurhynchium oreganum, Hylocomium splendens, Leucolepis menziesii, Plagiomnium insigne*
Variability	Some small gaps, moderate vertical diversity. Veteran trees add structural complexity
Site series	CDFmm/04 (CDFmm/01, CDFmm/06)
Structural stage	Mature forest
Wildlife habitat features	Mature forest with well-developed understory, some large snags, CWD, a few large vets
History	Original old forest (mainly Douglas-fir and cedar) clear-cut, with a few trees left standing, around 1912. Post-logging fire, naturally regenerated.
Natural disturbance regime	Infrequent stand-replacing fire, leaving some live trees and abundant snags and CWD
Expected changes	Competition will continue to cause mortality of the smaller and more suppressed trees, leading to lower density and eventually some very large trees. Gaps may appear due to death of single trees or small groups from root disease or windthrow. Shade-tolerant understory conifers will continue to grow slowly and gradually occupy a larger portion of the canopy. Sheep browsing may suppress understory regeneration of cedar.
Conservation status	Red-listed ecological community “Douglas-fir / dull Oregon-grape” in good mid-seral condition, free of invasive plant species.
Comments	Visually attractive mature forest fronting Main and Tucker Bay Roads. Several “rings” of naturally coppice-regenerated bigleaf maple.



Vegetation Type 1, Photo 1

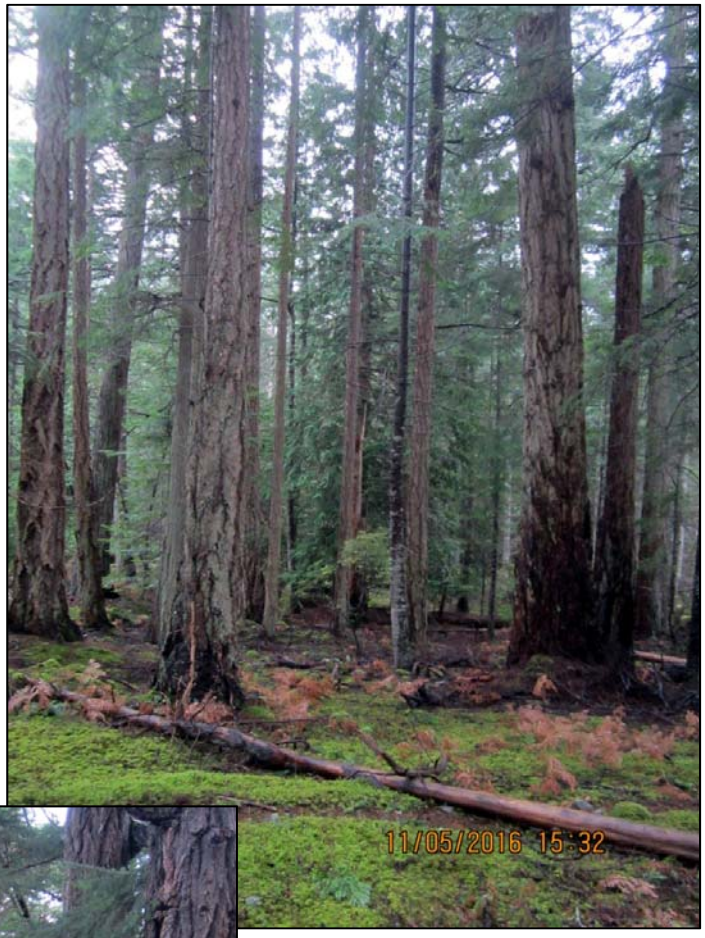
Vegetation Type 1, Photo 2

Vegetation Type # 2 (Old VTs #5 & #2)	**Young second growth conifer forest on moderately dry sites**
Main Tree Canopy	Shore pine (Douglas-fir, grand fir, western hemlock) OR Douglas-fir (shore pine, grand fir, western redcedar, western hemlock)
• *Age range*	Even-age, 55 - 65 years
• *Height and dbh*	30 – 45 m; 30 – 75 cm
• *Canopy cover*	70 – 90 %
Secondary Layers	Western hemlock
• *Age range*	10 – 30 years
• *Height and dbh*	2 – 5m; 5 – 10 cm
• *Canopy cover*	1 – 2 %
Understory layers: • *Height, cover %, species*	Shrubs: 50 – 200 cm; 1 – 5 %; red huckleberry, evergreen huckleberry, Oregon grape, salal Ferns: 30 – 60 cm; 5 – 10 %; sword fern Moss: 20 - 80 %; *Eurhynchium oreganum, Hylocomium splendens*
Variability	Fairly uniform even-age canopy. Species mix is variable; in some stands pine is
Site series	CDFmm/04, CDFmm/01
Structural stage	Young forest
Wildlife habitat features	Young conifer forest, some snags and CWD
History	Original forest clearcut (with a few trees left) around 1950 - 1955, naturally regenerated.
Natural disturbance regime	Infrequent stand-replacing fire, leaving some live trees and abundant snags and CWD.
Expected changes	Competition will continue to cause mortality of the smaller and more suppressed trees, leading to lower density and eventually some very large trees. Gaps may appear due to death of single trees or small groups from root disease or windthrow. Shade-tolerant understory conifers will continue to grow slowly and gradually occupy a larger portion of the canopy. Sheep browsing may suppress understory regeneration of cedar.
Conservation status	Red-listed ecological community “Douglas-fir / dull Oregon-grape” in good early to mid-seral condition, free of invasive non-native plant species.
Comments	

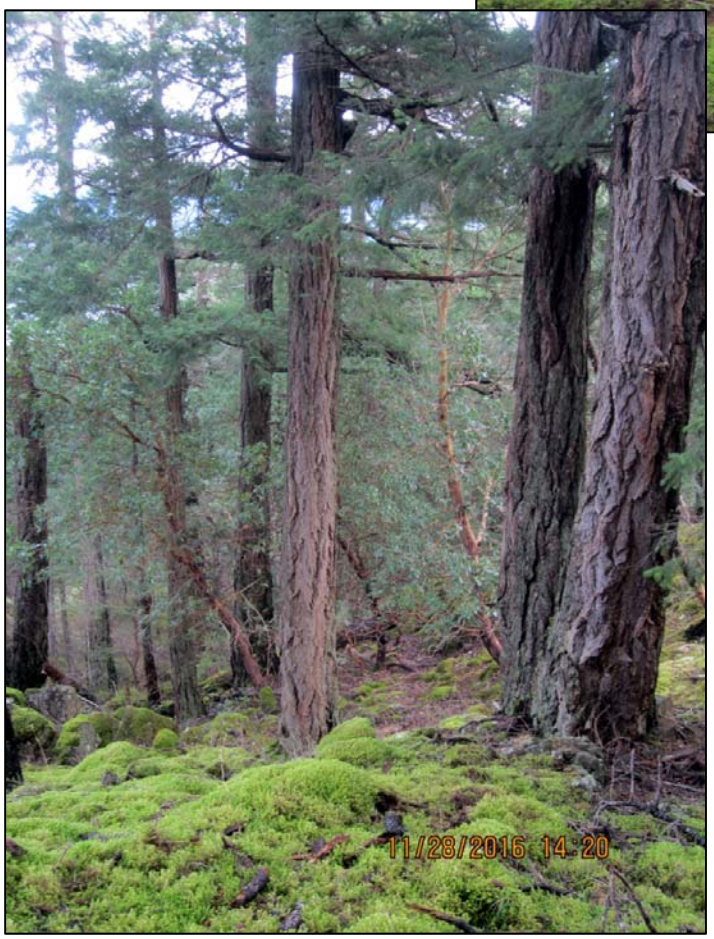
Vegetation Type 2, Photo 1

Vegetation Type 2, Photo 2

Vegetation Type # 3 (Old VT #3)	**Old coniferous forest on moderately dry sites**
Main Tree Canopy	Douglas-fir
• *Age range*	Uneven-age, mostly > 250 years
• *Height and dbh*	30 – 40 m, 60 – 150 cm
• *Canopy cover*	50 - 70 %
Secondary Layers	Grand fir, Douglas-fir
• *Age range*	20 – 60 years
• *Height and dbh*	3 – 20 m; 5 - 30 cm
• *Canopy cover*	1 – 5%
Understory layers: • *Height, cover %, species*	Shrubs: 50 – 300 cm; 1 – 5 %; red huckleberry, evergreen huckleberry, Oregon grape, salal Ferns: 30 – 60 cm; 5 – 10 %; sword fern, bracken Moss: 20 - 80 %; *Eurhynchium oreganum, Hylocomium splendens, Rhytidiadelphus triquetris*
Variability	Diversity of tree sizes
Site series	CDFmm/04, CDFmm/01
Structural stage	Old forest
Wildlife habitat features	Large, old trees with decay, broken tops, etc. Some large snags and large CWD.
History	Unlogged; charring on old trees indicates historical fire
Natural disturbance regime	Infrequent stand-replacing fire, leaving some live trees and abundant snags and CWD, minor gap formation due to individual tree death
Expected changes	Old Douglas-fir will continue to dominate the stand for a long time, in the absence of fire or other cause of sudden mortality. Gradual die-off of old trees, which will be replaced by a mix of Douglas-fir and grand fir.
Conservation status	Red-listed ecological community “Douglas-fir / dull Oregon-grape” in good late-seral condition, undisturbed, free of invasive non-native plant species.
Comments	Attractive old growth stand

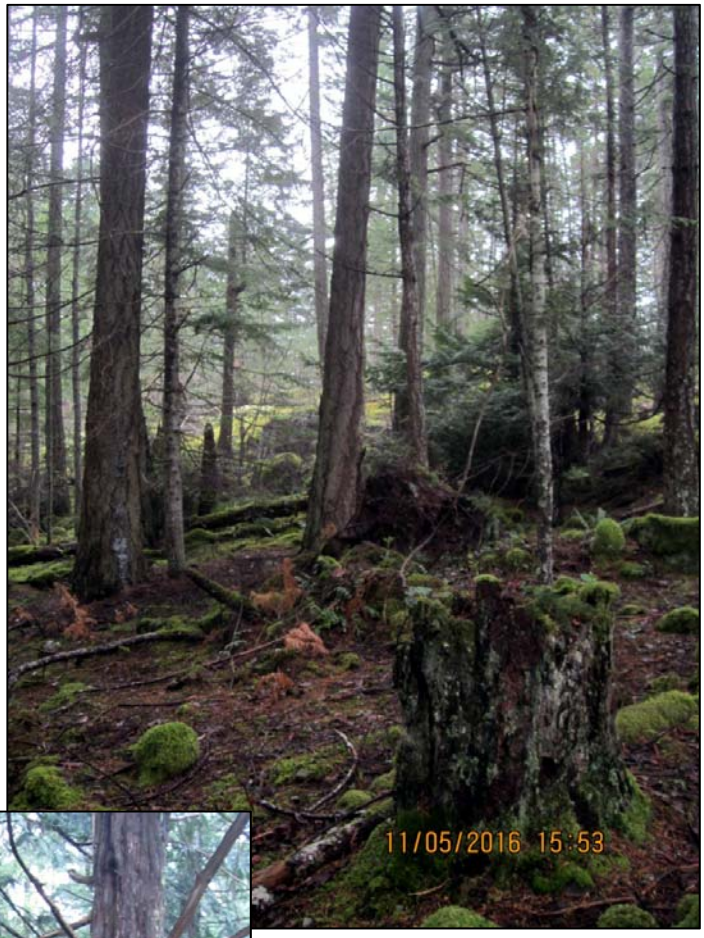


Vegetation Type 3, Photo 1



Vegetation Type3, Photo 2

Vegetation Type # 4 (Old VT # 4)	**Selectively logged old coniferous forest on moderately dry sites**
Main Tree Canopy	Douglas-fir, western redcedar, grand fir
• *Age range*	Uneven-age, mostly > 250 years
• *Height and dbh range*	30 – 40 m, 60 – 150 cm
• *Canopy cover*	50 - 70 %
Secondary Layers	Grand fir, Douglas-fir
• *Age range*	20 – 60 years
• *Height and dbh range*	3 – 20 m; 5 - 30 cm
• *Canopy cover*	1 – 5%
Understory layers: • *Height, cover %, species*	Shrubs: 50 – 300 cm; 1 – 5 %; red huckleberry, evergreen huckleberry, Oregon grape, salal Ferns: 30 – 60 cm; 5 – 10 %; sword fern, bracken Moss: 20 - 80 %; *Eurhynchium oreganum, Hylocomium splendens, Rhytidiadelphus triquetris*
Variability	Diversity of tree sizes
Site series	CDFmm/04, CDFmm/01
Structural stage	Old forest
Wildlife habitat features	Large, old trees with decay, broken tops, etc. Some large snags and large CWD pieces
History	Selectively logged around 1955, leaving many of the older trees
Natural disturbance regime	Infrequent stand-replacing fire, leaving some live trees and abundant snags and CWD, minor gap formation due to individual tree death
Expected changes	Old Douglas-fir and/or cedar will continue to dominate the stand for a long time, in the absence of fire or other cause of sudden mortality. Gradual die-off of old trees, which will be replaced by a mix of Douglas-fir and grand fir.
Conservation status	Red-listed ecological community “Douglas-fir / dull Oregon-grape” in fair late-seral condition, free of invasive non-native plant species.
Comments	Similar to Vegetation Type 3, except has more cedar and been lightly selectively logged.



Vegetation Type 4, Photo 1

Vegetation Type 4, Photo 2

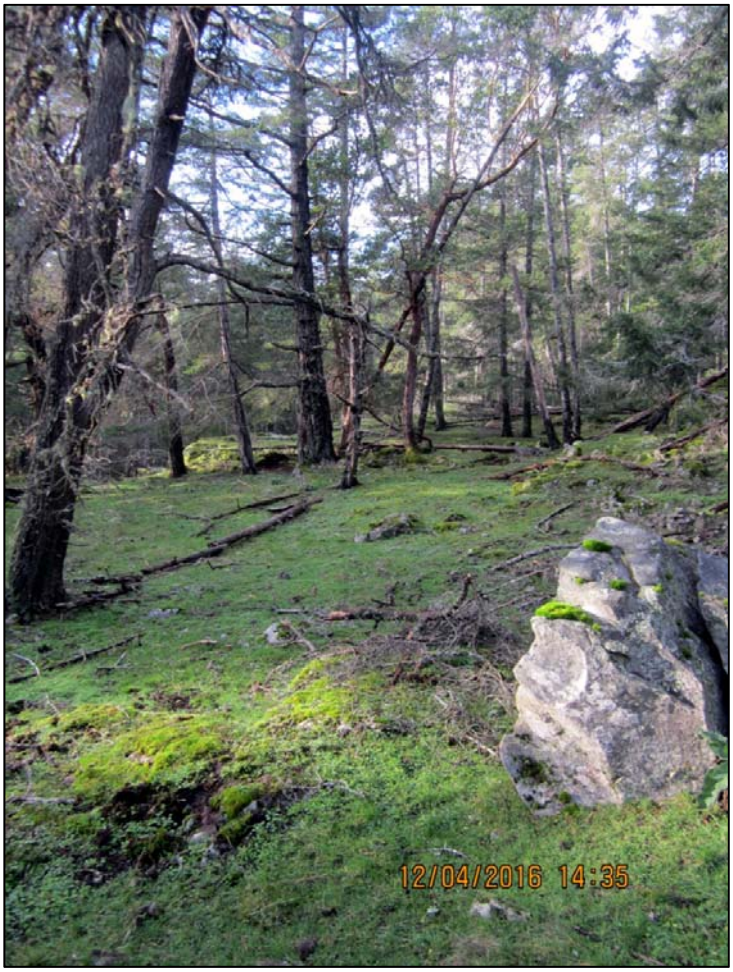
Vegetation Type # 5 (Old VT #5)	**Young conifer forest with dense ericaceous shrub understorey**
Main Tree Canopy	Douglas-fir, shore pine
• *Age range*	Even-age, 50 - 60 years
• *Height and dbh*	25 – 28 m; 20 – 70 cm
• *Canopy cover*	60 – 80 %
Secondary Layers	
• *Age range*	
• *Height and dbh*	
• *Canopy cover*	
Understory layers: • *Height, cover %, species*	Shrubs: 50 – 300 cm; 60 - 90%; salal, evergreen huckleberry Ferns: 30 – 60 cm; 1 - 2%; bracken Moss: 1- 20 %; *Eurhynchium oreganum, Hylocomium splendens, Sphagnum spp.*
Variability	Fairly uniform young forest, a few small patches of sphagnum moss
Site series	CDFmm/05, CDFmm/10 (CDFmm/01)
Structural stage	Young forest
Wildlife habitat features	Young conifer forest, some snags and CWD, dense shrub cover, berries
History	Original forest clearcut (with a few trees left) around 1950 - 1955, naturally regenerated.
Natural disturbance regime	Infrequent stand-replacing fire, leaving some live trees and abundant snags and CWD
Expected changes	Competition will continue to cause mortality of the smaller and more suppressed trees, leading to lower density and eventually some larger trees. Gaps may appear due to death of single trees or small groups from root disease or windthrow. Shade-tolerant understory conifers may gradually occupy a larger portion of the canopy. Sheep browsing may suppress understory regeneration of cedar.
Conservation status	This ecosystem has elements of the Red-listed “western redcedar - Douglas-fir / Oregon beaked-moss” community and the Red-listed “lodgepole pine / peat-mosses CDFmm” community, in early to mid-seral condition, free of invasive non-native plant species.
Comments	This is an unusual and intriguing ecosystem. Small patches of sphagnum moss indicate a bog-like environment with year-round available moisture. However, the site is not in a water-receiving slope position. Perhaps sub-surface water is trapped in bedrock formation beneath the soil. The very high coverage of ericaceous shrubs, salal and evergreen huckleberry, is also unusual on Lasqueti island.

Vegetation Type 5, Photo 1

Vegetation Type 5, Photo 2

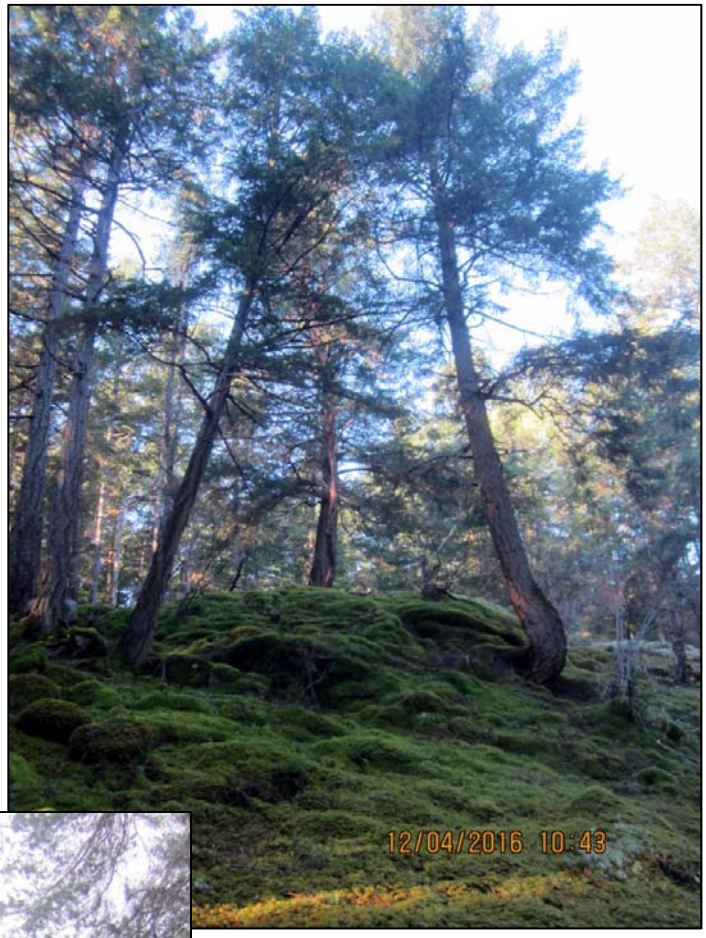
Vegetation Type # 6 (Old VT # 6 on 01 site; Old VT # 7 on 02 site)	**Open coniferous forest, heavily browsed by feral sheep**
Main Tree Canopy	Douglas-fir, shore pine (arbutus)
• *Age range*	Uneven-age, up to 250 years
• *Height and dbh*	1 – 20 m; 20 – 120 cm
• *Canopy cover*	10 – 50 %
Secondary Layers	
• *Age range*	
• *Height and dbh*	
• *Canopy cover*	
Understory layers: • *Height, cover %, species*	Shrubs: 30 – 50 cm; 1 – 5 %; salal Herbs & Grasses: 2 – 20 cm; 20 – 100%; Dense low carpet of herbs & grasses, many non-native, including *Geranium molle, Geranium robertianum, Bellis perennis, Cerastium arvense* & *Rumex acetosella* Moss: 1 - 20%; *Hylocomium splendens, Rhytidiadelphus triquetris; Polytrichum junperinum*
Variability	Significant variability in site productivity, logging history and tree cover.
Site series	CDFmm/01, CDFmm/02, CDFmm/04
Structural stage	A mosaic of Herb, Young forest, and Mature forest stages
Wildlife habitat features	Some large old trees; very open canopy, snags, CWD
History	Chronic heavy browsing by feral sheep has prevented forest regeneration, resulting in a very open stand with patchy tree cover. Non-native herbs and grasses (presumably introduced via sheep droppings) have over time formed a dense, closely-cropped carpet. Some areas were selectively logged around 1955.
Natural disturbance	Infrequent fire leaving many trees alive, as well as ongoing episodic windthrow.
Expected changes	Tree cover will probably diminish over time as trees die and regeneration is prevented by sheep browsing.
Conservation status	Red-listed ecological community “Douglas-fir / dull Oregon-grape” in poor early to mid-seral condition, with significant presence of non-native plant species.
Comments	This vegetation type could be a candidate for restoration (planting and protecting seedlings of native tree species). Fencing would be desirable but probably not feasible, due to the cost of installation and maintenance.

Vegetation Type 6, Photo 1



Vegetation Type 6, Photo 2

Vegetation Type # 7 (Old VT #7)	**Mature forest on very dry sites with shallow soil over bedrock**
Main Tree Canopy	Douglas-fir, shore pine, arbutus
• *Age range*	Uneven-age, up to 250 years
• *Height and dbh*	1 – 20 m; 5 – 60 cm
• *Canopy cover*	20 – 50 %
Secondary Layers	
• *Age range*	
• *Height and dbh*	
• *Canopy cover*	
Understory layers: • *Height; cover %; species*	Shrubs: 20 – 100 cm; 1 – 5 %; salal, ocean spray, Oregon grape Ferns: 10 - 40 cm; < 1%; sword fern Moss & lichens: 50 - 100%; *Hylocomium splendens, Rhytidiadelphus triquetris, Polytrichum junperinum, Dicranum spp., Cladina portentosa*
Variability	Some variability in tree cover, due to site factors and logging history.
Site series	CDFmm/02, (rock outcrops, CDFmm/01)
Structural stage	Mostly mature forest, with some attributes of Old forest, or Young forest where logging has occurred
Wildlife habitat features	Some large old trees; very open canopy, snags, CWD
History	Some areas were selectively logged around 1955.
Natural disturbance regime	Gap dynamics due to individual tree death (usually due to moisture stress). Infrequent fire leaving many trees alive, as well as ongoing episodic windthrow.
Expected changes	Tree cover may diminish over time as trees die and regeneration is prevented by sheep browsing.
Conservation status	Red-listed ecological community “Douglas-fir - arbutus” community in fair to good mid- or late-seral condition, mostly free of invasive non-native plant species.
Comments	Attractive open forest with some large old trees and a diverse moss/lichen forest floor.



Vegetation Type 7, Photo 1

Vegetation Type 7, Photo 2

Vegetation Type # 8 (Old VT # 6 on 01 site; Old VT # 7 on 02 site)	**Mature coniferous forest with chronic wind-throw disturbance regime**
Main Tree Canopy	Douglas-fir, shore pine (arbutus)
• *Age range*	Uneven-age, up to 200 years
• *Height and dbh*	1 – 20 m ; 5 – 60 cm
• *Canopy cover*	20 – 60 %
Secondary Layers	
• *Age range*	
• *Height and dbh*	
• *Canopy cover*	
Understory layers: • *Height, cover %, species*	Shrubs: 30 – 50 cm; 1 – 5 %; salal Moss: 20 - 80 %; *Hylocomium splendens, Rhytidiadelphus triquetris, Polytrichum junperinum, Dicranum spp.*
Variability	Somewhat variable canopy cover depending on site factors and logging history
Site series	CDFmm/01, CDFmm/02
Structural stage	Mature forest
Wildlife habitat features	Some large old trees; open canopy, snags, CWD
History	This vegetation type occurs on areas with shallow soils over bedrock. Because rooting is severely restricted, trees blow over easily, in single trees or small groups, becoming more susceptible as they grow taller. Mineral soil exposed by windthrow provides a seed-bed for trees and other plants to regenerate.
Natural disturbance regime	Infrequent fire leaving many trees alive, as well as ongoing episodic windthrow as described above under “History”.
Expected changes	Trees will probably continue to grow up and blow over, creating openings for new trees to come up. The species mix will likely remain stable (Douglas-fir and shore pine) and large trees (over 25 m tall) will be uncommon. Browsing by feral sheep may inhibit tree regeneration.
Conservation status	Red-listed ecological community “Douglas-fir / dull Oregon-grape” in good mid- or late-seral condition, mostly free of invasive non-native plant species.
Comments	This community appears to be subject to an unusual natural disturbance regime of chronic windthrow of individual trees or small groups of trees, giving rise to an uneven-age stand.

Vegetation Type 8, Photo 1

Vegetation Type 8, Photo 2

Vegetation Type # 9 (Old VT #9, Fd leading; Old VT #9 Dr leading)	**Selectively logged forest with root disease**
Main Tree Canopy	Douglas-fir, western redcedar, red alder, (grand fir)
• *Age range*	Uneven-age, mostly in the 60 or 100 year age ranges
• *Height and dbh*	Mostly 20- 30 m; 30 – 90 cm
• *Canopy cover*	20 - 40%
Secondary Layers	Douglas-fir, grand fir, red alder, Western hemlock
• *Age range*	Up to 30
• *Height and dbh*	Up to 10 m; 2 - 15 cm
• *Canopy cover*	1 -2 %
Understory layers: • *Height, cover %, species*	Shrubs: 30 – 150 cm; 5 – 15 %; salal, ocean spray, red huckleberry Ferns: 20 – 100 cm; bracken, sword ferm Moss: 50 - 80 %; *Hylocomium splendens, Rhytidiadelphus triquetris, Polytrichum junperinum, Dicranum spp.*
Variability	Variable species mix and canopy cover
Site series	CDFmm/01, CDFmm/04, CDFmm/06
Structural stage	Young forest
Wildlife habitat features	Open canopy, well developed understorey, wildlife trees, CWD
History	The original old forest was lightly selectively logged around 1915 and more heavily around 1955, then naturally regenerated with red alder and conifers. Shoestring root disease (*Armillaria ostoyae*) has killed many conifers. Some have died standing; some are fallen over). This mortality, along with age-related die-off of red alder, has led to an open stand with well-developed understorey.
Natural disturbance regime	Infrequent fire leaving many trees alive, as well as ongoing mortality due to root disease.
Expected changes	This stand will likely continue to have a very open canopy with a brushy understory, as conifers succumb to root disease. Red alder will likely be mostly absent from the stand within another 20 years, although other deciduous species such as bitter cherry or bigleaf maple may occupy sites made available by death of conifers.
Conservation status	Red-listed ecological community “Douglas-fir / dull Oregon-grape” in fair mid-seral condition, free of invasive non-native plant species.
Comments	Interesting example of the role of root disease in promoting diversity in forest structure and composition.

Vegetation Type 9, Photo 1

Vegetation Type 9, Photo 2

Vegetation Type # 10 (Old VT# 10)	**Pioneer red alder forest regenerating on cleared land**
Main Tree Canopy	Red alder
• *Age range*	Even-age patches ranging from 20 to 40 years
• *Height and dbh*	10 – 25 m; 15 – 50 cm
• *Canopy cover*	60 – 80 %
Secondary Layers	Douglas-fir, grand fir, cedar
• *Age range*	Up to 25 years
• *Height and dbh*	Up to 10 m, 2 – 8 cm
• *Canopy cover*	1 – 2 %
Understory layers: • *Height, cover %, species*	Ferns: 15 – 50 cm; 1 – 10 %; sword fern, deer fern Grasses and sedges: 10 – 40 cm; 0 – 60 %, slough sedge, non-native grasses
Variability	There are two distinct patches of this type, quite different but each internally quite homogeneous. The patch at the old school site is older and has a drier soil. The patch at the old sand pit is younger and wetter.
Site series	CDFmm/04, CDFmm/06 (school site) CDFmm/06, CDFmm/14 (old sand pit)
Structural stage	Pole-sapling
Wildlife habitat	Deciduous trees, seasonal pool at old sand pit
History	The forest was cleared from the Tucker Bay School site, as described under Section 2.5.4 of the Management Plan. A “borrow pit” was excavated next to Main Road near the western end of property during the mid 1970s, to provide sand for fill during the construction of the Lasqueti Community Hall. Both these deforested area have regenerated naturally with red alder.
Natural disturbance	N.A
Expected changes	The pioneer stands of red alder will gradually be replaced by an irregular stand of coniferous trees that grow up under the alder canopy.
Conservation status	Disturbed sites, early seral stage. Some presence of non-native plant species.
Comments	

Vegetation Type 10, Photo 1

Vegetation Type 10, Photo 2

Vegetation Type # 11 (Old VT # 11)	**Moss/lichen/herb community on shallow soils and bedrock outcrops**
Main Tree Canopy	No trees
Understory layers: • *Height, cover %, species*	Moss & lichens: 80 - 100%; *Hylocomium splendens, Rhytidiadelphus triquetris, Pleurozium shreberii, Racomitrium canescens, Polytrichum junperinum, Selaginella wallaceii, Dicranum spp., Cladina portentosa* Herbs and grasses: 1 -5%: small-flowered blue-eyed Mary, death camas, native and non-native drought-resistant grasses
Variability	Relatively uniform, with small scale mosaic of varying species
Site series	Rocky outcrops, CDFmm/02
Structural stage	Bryoid
Wildlife habitat features	Open mossy areas, grasses
History	Relatively unchanged over time
Natural disturbance regime	"
Expected changes	"
Conservation status	Blue-listed CDFmm/Wallace's selaginella/reindeer lichens community in good condition, mostly free of invasive non-native plant species. "This sparsely-distributed, highly vulnerable and ecologically sensitive community is threatened by trampling that commonly occurs with recreational activities (trails, foot traffic, bicycles and all-terrain vehicles). The long-term impacts of increased summer drought, as predicted for the range of this community, may result in loss of the vegetation community and erosion of the thin, sensitive soils." (BC Conservation Status Report)
Comments	Open mossy areas are attractive and offer views. "The lichen, forb and moss cover is highly sensitive to disturbance as it may be easily separated from the underlying rock surface and shallow layers of humus. The lichen layer is particularly vulnerable as the lichen requires very long periods to recover and never recovers unless disturbance is ended." (BC Conservation Status Report)

Vegetation Type 11, Photo 1

Vegetation Type 11, Photo 2

Vegetation Type # 12 (Old VT # 12)	**Slough sedge/hardhack/salal wetland**
Main Tree Canopy	No trees
• *Age range*	
• *Height and dbh*	
• *Canopy cover*	
Secondary Layers	
• *Age range*	
• *Height and dbh*	
• *Canopy cover*	
Understory layers: • *Height, cover %, species*	Shrubs: 50 – 150 cm; 0 - 80%; hardhack, salal Sedges: 20 – 50 c, 0 – 50%; slough sedge
Variability	Patches of shrubs, sedges, and open water
Site series	CDFmm/ CDFmm/14, CDFmm/Wf52, shallow open water
Structural stage	Shrub/herb
Wildlife habitat features	Shallow water, dense brush cover
History	Relatively unchanged over time
Natural disturbance regime	"
Expected changes	"
Conservation status	This small wetland has elements of the Red-listed "sweet gale / Sitka sedge" community and the Red-listed "red alder / slough sedge" community, in good condition, mostly free of non-native plants.
Comments	An unusual small wetland.

Vegetation Type 12, Photo 1

Vegetation Type 12, Photo 2

3.8 Special Vegetation Features

3.8.1 Bigleaf Maple Coppice Rings

Bigleaf maple (*Acer macrophyllum*) trees occur at low densities in the Kwel Nature Reserve, particularly in Vegetation Type 1. There are at least two large clusters or "rings" of Bigleaf maple stem, growing close together in a rough circle. These are an interesting feature, although not especially rare or unusual. The following is a description of how these maple clumps probably came to be. Bigleaf maple can reproduce by seeds, or by coppicing (sprouting from a stump). The wood of bigleaf maple is brittle, so the trees often break rather than uprooting when subject to extreme winds. When a large maple tree breaks, the stump will often produce sprouts close to the ground, around all sides of the stump. Over time, the stump will die and rot away while the new sprouts grow up into separate trunks. Competition will eliminate many of the new stems, and the final number will usually be between one and half a dozen. One of these coppiced clumps on the Kwel Nature Reserve has ten stems, measuring between 30 and 60 cm dbh (diameter at breast height) individually. The circumference measured around the entire clump is roughly 10 m. The space inside this clump is so large, that perhaps the present trees sprouted from a number of trees, these predecessor trees being themselves the products of an earlier coppicing event. Bigleaf maple supports many species of epiphytic mosses, liverworts, lichens, and even ferns—more than any other local tree species—so its presence is very valuable for maintaining biological diversity.

3.8.2 Western yew

Western yew is a rather uncommon tree of coastal forests. Because of its relative scarcity, very slow rate of growth, and adaptation to the shady conditions in the understory of mature conifer stands, its abundance is likely to be reduced in future by logging, land-clearing and the effects of climate change. Therefore, yew trees should be considered an important conservation feature. There are at least six yew trees over 30 cm dbh on the property, and more of smaller diameters. The largest is 107 cm dbh. For Lasqueti Island, this an above-average density of yew trees, especially the larger ones.

3.8.3 Wetlands

Vegetation Type 5 contains small patches where the ground cover is dominated by sphagnum moss, which is typical of nutrient-poor bog ecosystems. Vegetation Type 12 is a small wetland with a shrub layer of sedges and hardhack. Sphagnum bogs are quite uncommon in the dry climate of the CDF zone, and any wetland in natural undisturbed condition such as this should be considered an important conservation feature.

3.8.4 Douglas-fir old growth

There are three small patches (approximately 1.5 ha total) of old-growth Douglas-fir forest (Vegetation Type 3). The extent of old growth forest in the CDF zone is now reduced to less than 1% of its former extent, so even small patches such as these are important conservation features.

3.9 Wildlife and Habitats

The main wildlife mammal species occurring on the Kwel Nature Reserve include Black-tailed Deer (*Odocoileus hemionus*), Raccoon (*Procyon lotor*), Mink (*Neovison vison*), River Otter (*Lontra canadensis*), and a number of small rodent species. Numerous bird species, migratory and resident, also occur. Four species of cavity excavators nest in the area: Pileated Woodpecker (*Dryocopus pileatus*), Hairy Woodpecker (*Dryocopus villosus)*, Downy Woodpecker (*Dryocopus pubescens)* and Northern Flicker (*Colatpes auratus*). These species excavate holes that may be used by secondary cavity nesters, such as the Western Screech Owl (*Megascops kennicottii*). The continued presence of these species depends on an ongoing supply of standing dead trees (snags) of sufficient diameter for their use.

Large veteran Douglas-fir trees are a valuable habitat feature in the forest and may be selected for nest or perch trees by Osprey (*Pandion haliaetus*), Bald Eagle (*Haliaeetus leucocephalus*), Red-tailed Hawk (*Buteo jamaicensis*), and other species. Mature and old growth conifer stands are valuable habitat for resident songbirds including Golden-crowned Kinglet (*Regulus satrapa*) and Chestnut-backed Chickadee (*Parus rufescens*).

Appendix A provides notes on specific wildlife habitat features in each Vegetation Type.

3.10 Red and Blue-listed Species

The BC Species and Ecosystem Explorer tool (http://a100.gov.bc.ca/pub/eswp/) lists thirty Blue-listed species and twenty-six Red-listed species of vertebrate and invertebrate animals that may occur in terrestrial habitats in the CDFmm subzone. Of these, the Blue-listed Northern Red-legged Frog (*Rana aurora*) and Western Toad (*Anaxyrus boreas*) have been observed in the Kwel Nature Reserve.

The Blue-listed Western Screech-Owl, *kennicottii* subspecies (*Megascops kennicottii kennicottii*) was detected in the near vicinity of the Kwel Nature Reserve in a nocturnal owl survey in 2001 but has not been reported since. The last report of a Western Screech-Owl on Lasqueti was in 2004 (Peter Johnston, pers. comm.) Installation of Western Screech-Owl nest boxes on the Kwel Nature Reserve has been suggested, given that Western Screech-Owl have been recorded immediately west of the property recently, and that much of the forest is generally suitable habitat for Western Screech-Owl (mature mixed second growth) but lacks an abundance of cavities, a critical habitat feature for these owls.

3.11 Invasive and Non-native Species

Most of the plant communities of the Kwel Nature Reserve have very little presence of invasive and/or non-native plants. Vegetation Type 6 is an exception, with a significant presence of non-native herbs, including dovefoot geranium (*Geranium molle*), English daisy (*Bellis perennis*) and sheep sorrel (*Rumex acetosella*) as well as non-native pasture grasses (not identifiable due to heavily browsed condition). These species probably were introduced via seeds in the droppings of feral sheep, which browse heavily in certain areas of the property, especially in Vegetation Type 6. A few plants of foxglove (*Digitalis pupurea*) occur in Vegetation Types 6, 7 and 11.

Domestic sheep (*Ovis aries*) were first introduced to Lasqueti over a hundred years ago by the early settlers. Since that time various flocks have been abandoned and there is now a feral population, estimated at about 500 animals. Their preferred foods are grasses and herbs, but there is inadequate pasture available, so the sheep also browse shrubs and tree seedlings. The long-term impacts of browsing by sheep can be very significant, including severe reduction of understory vegetation. Tree regeneration is inhibited, especially arbutus, cedar, and Douglas-fir. Some species of flowering plants have been reduced in abundance or eliminated altogether by the many decades of sheep browsing, as has occurred in many areas on Lasqueti.

The density of sheep populations is unevenly distributed on Lasqueti. Some local areas have high populations that cause severe impacts on vegetation. At present, the impacts of sheep in the Kwel Nature Reserve are concentrated in Vegetation Type 6, but are noticeable through the property.

Table 5. Common and botanical names of plant and lichen species

Common Name	Botanical Name
Trees	
Arbutus	*Arbutus menziesii*
Bigleaf maple	*Acer macrophyllum*
Bitter cherry	*Prunus emarginata*
Douglas-fir	*Pseudotsuga menziesii*
Grand fir	*Abies grandis*
Red alder	*Alnus rubra*
Western redcedar	*Thuja plicata*
Western hemlock	*Tsuga heterophylla*
Western yew	*Taxus brevifolia*
Shrubs	
Dull Oregon-grape	*Mahonia nervosa*
Evergreen huckleberry	*Vaccinium ovatum*
Hardhack	*Spiraea douglasii*
Oceanspray	*Holodiscus discolor*
Red huckleberry	*Vaccinium parvifolium*
Salal	*Gaultheria shallon*
Forbs and Graminoids	
Dovefoot geranium	*Geranium molle*
English daisy	*Bellis perennis*
Field chickweed	*Cerastium arvense*
Robert's geranium (Herb-Robert)	*Geranium robertianum*
Sheep sorrel	*Rumex acetosella*
Slough sedge	*Carex obnupta*
Ferns	
Bracken fern	*Pteridium aquilinum*
Swordfern	*Polystichum munitum*
Mosses & Clubmosses	
Coastal leafy moss	*Plagiomnium insigne*
Electrified cat's-tail moss	*Rhytidiadelphus triquestrus*
Juniper hair-cap moss	*Polytrichum juniperinum*
Menzies' tree moss	*Leucolepis menziesii*
Oregon beaked-moss	*Eurhynchium oreganum*
Red-stemmed feather moss	*Pleurozium schreberi*
Roadside rock moss	*Racomitrium canescens*
Step moss	*Hylocomium spendens*
Wallace's selaginella	*Selaginella wallacei*
Lichens	
Coastal reindeer lichen	*Cladina portentosa*

4 CONSULTATION

4.1 First Nations Consultation

A consultation process was undertaken by Islands Trust Fund staff to reach out to First Nations. An outreach letter was sent to each of twelve First Nations whose areas of interest, as per the BC First Nations Consultative Areas Database (http://maps.gov.bc.ca/ess/sv/cadb/), includes areas on Lasqueti Island. The letter invited First Nations to help the Trust Fund understand the historical and current connection of First Nations with Lasqueti Island, and to learn how the Islands Trust Fund's management of protected areas on Lasqueti can acknowledge and respect the cultural significance and traditional uses. The letter also invited First Nations to participate in a walking tour of the Kwel Nature Reserve as described below.

4.2 Community and Covenant Holders Consultation

In cooperation with Islands Trust Fund staff, the author undertook a consultation process to encourage the Lasqueti community and covenant holders to participate in setting objectives, identifying issues, and proposing strategies for inclusion in this Management Plan. Input was sought from the following groups:

- Lasqueti Island community in general
- Owners of neighbouring properties
- Covenant holders: Nanaimo and Area Land Trust (NALT) and TLC The Land Conservancy of British Columbia
- Lasqueti Island Nature Conservancy (LINC)

The methods used to gather input for the management plan were as follows:

- A walking tour of the reserve was held on November 19, 2016, led by the author of this plan, which provided a good opportunity for participants to see the diversity of ecosystems within the reserve and discuss management of the reserve.
- A notice was posted on the Lasqueti email list-serve, inviting community members to attend the walking tour or to contact the contractor by telephone or email to provide their comments or concerns.
- A two-page questionnaire to gather input for the management plan was developed by Islands Trust Fund staff.
- Outreach letters, including the questionnaire, were sent to the registered owners of nearby properties.
- An email notice of the walking tour was sent to TLC, NALT and LINC.
- A draft version of the Management Plan, for review, has been made available to TLC, NALT and LINC.

4.3 Results of Consultation

One reply was received from First Nations. Lyackson First Nation stated that "Should Lyackson First Nation identify greater interests in the future we retain the right to revise this assessment. However, at this time, we defer to the Local First Nations' whose title and governing authorities are directly affected."

No responses were received from owners of neighboring properties.

The walking tour on November 19, 2016 was attended by five Lasqueti Island residents and a representative from NALT. Comments submitted verbally were as follows:

- The reserve is remarkably free from invasive plant species, and has a good diversity of ecosystems as well as some interesting features, such as several large yew trees.
- There is no need to post signs, build trails, or undertake other active management programs on the reserve.
- Ongoing annual monitoring is important and should include monitoring for invasive species and the impacts of browsing by feral sheep.

Contributions from TLC, NALT and LINC were incorporated into this plan. There was a general consensus to keep human impact on the site low and to look into strategies to mitigate negative climate changes on the property. Restoration of the areas degraded by sheep grazing was also discussed.

4.4 Cultural Significance

The cultural significance of the property for First Nations is not known at this time, although the presence of an archaeological feature provides evidence of past use by First Nations.

The property has cultural significance for the Lasqueti Island community as the site of the historic Tucker Bay School and as a memorial for the late Amelia Humphries, who is fondly remembered by many members of the community.

4.5 Recreational and Amenity Values

Although the main purpose of the Kwel Nature Reserve is nature conservation, it is also well suited for low impact use for quiet appreciation of nature. The exposed rock bluffs have fine views out over the Sabine Channel with its many small islets and Texada Island in the distance. Because these areas have few trees, they are pleasantly sunny in fair weather. These areas are sensitive—heavy traffic can damage the mosses and lichens on the rocks—but are sufficiently robust to withstand occasional use. The small patches of old growth forest are an exceptional feature for nature appreciation and can withstand low levels of foot traffic. There are no built trails in the Nature Reserve, but the forest is open enough to allow easy walking in most areas.

5 MANAGEMENT PLAN

5.1 General Management Approach

In general, the approach to management for the Kwel Nature Reserve is one of passive conservation through protection, and allowing natural processes to operate with minimal interference. An exception is that wild fires should be suppressed. Low impact human use, such as hiking or bird-watching are allowed but not promoted. At present, there is no need for active restoration measures, but active management may be needed in the future to ensure regeneration of desired wildflowers and tree species such as Western yew and western redcedar, and to address the suppression of tree regeneration and other impacts of browsing by feral sheep.

5.2 Management Issues

The management issues identified for Kwel Nature Reserve are:

- Acceptable and Prohibited Public Uses
- First Nations Cultural Significance
- Climate Change
- Wildfire Hazard Management
- Impacts of Feral Sheep
- Western Screech-Owl Nest Boxes
- Signage
- Monitoring

5.2.1 Acceptable and Prohibited Public Uses

Public access to the Kwel Nature Reserve for low-impact use is acceptable but not promoted or encouraged. The following activities by the public are prohibited:

- Use of motorized vehicles
- Bicycling or horseback riding
- Forestry, tree cutting or gathering of firewood
- Camping or fires
- Livestock grazing
- Trail development
- Collection of plants, animals or fungi
- Excavation or removal of soil or other materials
- Dumping of soil, fill or refuse of any kind

To date, only minor instances of prohibited uses have occurred in the Kwel Nature Reserve, and these have been effectively noted and remedied through the routine annual monitoring process.

Although the above listed activities are prohibited, if in the future they are deemed necessary for research, restoration and management activities, some of these activities may be permitted provided they are consistent with the covenant agreement and do not cause harm to Species at Risk and their habitat. For example, study of archeology sites or beneficial restoration activities may be permitted provided they are agreed to by the ITF and the covenant holders prior to implementation.

<u>Recommended Management Actions or Strategies</u>

- Continue annual monitoring program.
- Assess need for a more pro-active approach to prohibited activities if needed in future.

5.2.2 First Nations Cultural Significance

The Islands Trust Fund will welcome information from First Nations on the cultural significance or management of the property at any time. Guidance from First Nations concerning the management and ecological restoration of the property will be considered provide that:

- proposed management actions are permitted under the covenant,
- species at risk and their habitats are not negatively impacted, and
- the Islands Trust Fund and the covenant holders approve of the proposed actions.

Recommended Management Actions or Strategies

That the ITF consult, communicate and if possible collaborate with First Nations who have historical and/or current interest in the property.

5.2.3 Climate Change

Forest ecosystems in the Coastal Douglas-fir zone are highly vulnerable to climate change impacts, because the CDF zone is already subject to summer drought that limits the growth and health of plant communities. Tools are being developed to assist with adaptation to climate change in managed forests, for example, by planting more drought-tolerant tree species after logging. Such tools will be of limited value in protected areas, where there is no intent to harvest trees. In any case the degree of climate change that is expected to result if the human community continues on the current trajectory of emission of greenhouse gases will be extremely disruptive to ecosystems of the CDF zone regardless of any possible management interventions.

Climate change poses an extreme long-term threat to the ecological integrity of the Kwel Nature Reserve, and all natural ecosystems within the Islands Trust area—to say nothing of the future prosperity and existence of the human species. However, due to the global nature of the problem, it is beyond the capacity of the Islands Trust Fund to unilaterally mitigate or adapt to this threat.

Recommended Management Actions or Strategies

- Islands Trust Fund may wish to consider undertaking a more active and insistent program of advocating to senior governments, and to society in general, for major reductions in greenhouse gas emissions.

5.2.4 Wildfire Hazard Management

As in all forested areas of Lasqueti Island, there is a risk of wildfire within the Kwel Nature Reserve. Some stands have moderately high fuel loads on the ground (small branches, needles, etc.) and moderately high vertical and horizontal fuel continuity, indicating the potential for a high severity ground and crown fire during hot dry weather. There are also significant natural fire-breaks (features that may slow or stop the spread of fires) such as the non-forested rock bluffs, so it is unlikely that a single fire would affect the whole Kwel Nature Reserve area. Access for fire-fighting is available from Main and Tucker Bay Roads.

According to ecological principles, it might be a desirable policy to allow a fire that occurs naturally in the Reserve to burn. However, such a policy would not be practical because there are homes in the area, so property and personal safety of community members would be at risk if the fire spread. Also, the old growth forest in the nature reserve is now a rare ecosystem, and should be protected from disturbance.

Recommended Management Actions or Strategies

- Islands Trust Fund may wish to contact local and/or provincial fire-fighters to make them aware of the Lasqueti Nature Reserves and to lay out the protocol that may be required to preserve these areas. The fire-fighters will have full control to fight the fires as they see fit to quickly extinguish any fires that occur in the Kwel Nature Reserve and to ensure the safety of the people and property of Lasqueti.
- The Lasqueti Island Volunteer Fire Department (LVFD) is supported by funding from the Powell River Regional District. For current contact numbers and information concerning The LVFD, contact Powell River Regional District.

5.2.5 Impacts of Feral Sheep

Browsing by feral sheep inhibits regeneration of trees, especially western redcedar, and reduces the diversity and cover of a broad range of understory plant species. The options to reduce the impacts of feral sheep are limited. Fences can work, but are expensive to build and require frequent inspection and diligent maintenance. Some private landowners protect the forest and plants on their properties by hunting the sheep to keep their numbers down to levels where their impact is not excessive. However, the Islands Trust Fund is not well equipped to implement a program of this kind.

Programs to plant and/or protect tree seedlings can help to mitigate the impacts of feral sheep. At this time, most areas are well stocked with trees. Over time, as mature trees die off, gaps in the forest canopy will likely develop, and may require planting and protection of new tree seedlings, or protection of existing seedlings that are being heavily browsed.

Recommended Management Actions or Strategies

- Continue annual monitoring.
- Re-assess the state of forest regeneration at the time of the next management plan review.

5.2.6 Western Screech-Owl Nest Boxes

Installation of Western Screech-Owl nest boxes on the Kwel Nature Reserve has been suggested, given that Western Screech-Owl have been recorded immediately west of the property recently, and that much of the forest is generally suitable habitat for Western Screech-Owl (mature mixed second growth) but lacks an abundance of cavities, a critical habitat feature for these owls.

Recommended Management Actions or Strategies

- Work with interested parties to install Western Screech-Owl nest boxes.

5.2.7 Signage

Input from community members and the covenant holders indicate there is no need or support for a sign or signs at this time, in keeping with the management approach of not encouraging public use of the Kwel Nature Reserve.

Recommended Management Actions or Strategies

- Re-assess signage options if the need arises, or at the next management plan review.

5.2.8 Monitoring Program

The ITF undertakes a program of annual monitoring on all of its properties, including Kwel Nature Reserve. A monitoring map, with 100-metre UTM grid and the boundaries of the Vegetation Types is provided on Page 49.

Recommended Management Actions or Strategies

- The routine monitoring process will be sufficient to detect any impacts or issues that are likely to occur.
- The annual monitoring visit to Kwel Nature Reserve should include a traverse along the reserve frontage on Main and Tucker Bay roads and though the Reserve visiting the main Vegetation Types; assessment of any increase in abundance or distribution of invasive plants and the impacts of feral sheep; and, at least once every five years, renewing the flagging or other markers indicating the corners and boundaries of the reserve.

6 REFERENCES

Green, R.N., and K. Klinka. 1994. A Field Guide for Site Identification and Interpretation for the Vancouver Forest Region. BC Ministry of Forests, Research Branch, Land Management Handbook No. 28. Victoria, BC.

Green, R. N., G. Shishkov, K. Klinka, and P.J. Courtin. June 1987. An Ecological Approach to Organizing Forests for Woodlot Management – Lasqueti Island Pilot Study. B.C. Min. For. Lands, Research Report RR87003-VA.

Mason, E.C. 1976. Lasqueti Island: History and Memory. Bryon Mason, Lantzville, B.C.

Wang, T., A. Hamann, D.L. Spittlehouse, and S.N. Aitken. 2006. Development of scalefree climate data for western Canada for use in resource management. Intl. J. Climatology 26(3): 383–397.

7 MONITORING MAP