Biophysical Analysis and Ecological Inventory

for

Marr Creek to Brothers Creek Old-Growth Forest

in the

Corporation of the District of West Vancouver, British Columbia

Geographic coordinates, UTM coordinates and elevational range: Latitude: 49.36667º N, Longitude: 123.16766º W; Northing 5468232, Easting 487827, Zone 10U; elevational range 540 to 840 metres.

NTS: 92G/6E

by

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1 Abstract:

An area of forest (~250 hectares; 618 acres) within land owned by the District of West Vancouver was characterised as old-growth forest based on vegetation and soil conditions, even though some of its first-growth veteran trees had been selectively logged. The boundaries of this area were defined both from satellite images and by checking on the ground. A plant/fungus species list was compiled. The species richness and biodiversity of the area was double that of old-growth areas at comparable elevations on the North Shore. About 400 first-growth veteran trees (both living and dead) were identified and mapped using a handheld outdoor GPS (Garmin Montana 680). There may be additional veteran trees in areas that were not traversed. For that reason, all Garmin survey tracks are shown (Figure 5). Further mapping of veteran trees is encouraged. It is recommended that because of its natural values, the information in this report be included in the Upper Lands Study and the area be protected as one continuous conservation area undissected by roads and other forms of development. The conservation area should be managed in a manner similar to the Old Growth Conservancy (see Figures 2 to 5).

2 Introduction

For decades, the presence of old-growth trees in West Vancouver had been recognized, appreciated and enjoyed by the Municipality, various natural history groups and the general public. Many of these trees and some groves had been recorded and some have been protected within parks, both Municipal and Provincial. However, the overall extent of old-growth forests and above all their ecology in West Vancouver was largely unknown. Some of the mature and veteran trees were removed during the pioneer logging era and there was little or no understanding of how the logging took place nor the ecology of the forest that remained; whether it be old-growth or second-growth. There was in fact a misconception that old-growth was just old veteran or first-growth trees, both alive and dead. There was no appreciation of old-growth ecology.

During twenty years of recreational hiking and plant studies in the forests of the North Shore, I became aware of many areas of forest that have had some of their first-growth veteran trees removed during the logging era, while retaining other aspects of old-growth ecology such as large coarse woody debris, multiple canopy layers, native understory flora, biodiversity and above all the preservation of intact soils with their mycorrhizal networks and associations. The importance of the latter in maintaining the health and ecology of an old-growth forest is brought out by Suzanne Simard in her book *Finding the mother tree* (Simard 2021).

For example, in the forest north of the Hollyburn Fir at the intersection of the Brewis and Crossover Trails, almost no veterans can be found, but that forest, has other old-growth attributes which clearly contrasts with the second-growth or even-aged forest to the south of the Hollyburn fir which was extensively logged. The satellite imagery shows this clearly in the differing pattern of tree canopies between the two types of forest. (See Figures 2, 3 and 5 and Section 3.3 and 4.0 for attributes that best describe the study area).

The primary intent of this study was to document the extent and record the biophysical characteristics of an area of original or old-growth forest that lies within the Corporation of the District West Vancouver (Figure 1) from Marr Creek to Brothers Creek, a distance west to east of approximately 2.4 km and a north/south extent of 540 to 840 metres approximately from the Skyline Trail to the Cypress Provincial Park boundary, an area of about 250 hectares (618 acres) referred to here as the study area (Figure 1 to 5). To my knowledge this area and the Mosquito Creek old-growth forest (Cook 2012a) and Roche Point Forest (Cook 2012b) in the District of North Vancouver are the largest remaining areas of unprotected forest with old-growth attributes lying within the Coastal Western Hemlock (CWH) Biogeoclimatic Zone on the North Shore of Burrard Inlet (Table 1). The information in this report focuses on the biophysical attributes of the study area and includes an inventory of the veteran trees and species and outlines a case for its protection and management. Those attributes are described in Section 4.0 of this report and the species list and veteran trees in Appendices 2 and 3 respectively.

For size comparison with other areas containing old-growth forest in the Vancouver and North Shore areas, the study area is ~250 hectares (618 acres), the Old Growth Conservancy is 54 hectares (133 acres), Lighthouse Park is 75 hectares (185 acres), Mosquito Creek old-growth forest is 52 hectares (128 acres), Roche Point Forest is 24 hectares (59 acres) and Stanley Park is 405 hectares (1001 acres).

Work in the study area was carried out over a seven-year period from 2015 to 2021 and has consisted of four parts; compiling of species lists along all trails within the study area, defining the boundaries of the forest with old-growth attributes, the mapping of locations of first-growth veteran trees and a preliminary study of soils within it.

The area defined as the study area is therefore a complex mosaic of intact undisturbed old-growth forest interspersed with areas that have had their first-growth veteran trees selectively logged without major disruption of the surrounding forest.

The term "first-growth veteran tree" as used in this report, applies primarily to western redcedars, yellow cedars, Douglas-firs and rarely western hemlock and amabilis fir of great size and obvious great age (both living and dead) that often show such features as candelabra tops (most common with redcedars), reiteration (Douglas-firs), dead limbs, sheared-off tops of emergent trees, extensive heart-rot (redcedars) and trunk splits (redcedars). The term "first-growth veteran trees" is defined elsewhere in this report (Section 4.1.2) and in the Glossary and the term reiteration is described in the Glossary.

The first-growth veteran trees have been plotted on to a base map (Figure 3 to 5) and Appendix 3 lists tag number, date surveyed, species, circumference and diameter at breast height, coordinates, elevation, whether living or dead and additional notes. Image 10 depicts the method of tagging a tree.

A limited number of soil profiles were completed. The soil profile from one of these, the selectively logged area north-west of the Hollyburn Fir at 680 metres elevation, is described under 5.6 and illustrated in Image 11.

3.0 Description of the study area:

3.1 Location, access, extent and elevation of the study area.

Location: The study area is located in the Municipality of the District of West Vancouver, British Columbia. National Topographic Series map index: 92G6E. Geographic coordinates, UTM coordinates and altitudes: Latitude: 49.36667º N, Longitude: 123.16766º W; Northing 5468232, Easting 487827, Zone 10U; from 540 to 840 metres elevation.

Access: Access to the trail network in the study area can be gained from three principal access points; West Lake Forest Access Road off Cypress Bowl Road and at both the west and east ends of Millstream Road in the British Properties.

Extent and elevation: The study area extends west to east from Marr Creek (500 metres east of the fourth switchback of Cypress Bowl Road) to approximately 500 metres east of Brothers Creek, a distance of approximately 2.4 kilometres and covering approximately 250 hectares (618 acres) on the Municipality of the District of West Vancouver land, not including the Capilano Watershed.
The southern boundary of the old-growth area (Figures 2, 3 and 5) was initially identified from satellite imagery by large-crowned trees and the pattern of canopy texture. This boundary was confirmed by ground truthing. Elevations for the southern boundary are 650 metres at Marr Creek and 540 metres at Brothers Creek which approximates to the Skyline Trail.
The northern boundary of the study area has been disrupted by the cabin area in which about 300 cabins were constructed over the last 100 years. Therefore, for political reasons the study stops at the approximate southern boundary of the cabin area. The northern boundary is also constrained in the eastern part by the Cypress Provincial Park boundary across which old-growth forest continues (Lertzman 1989).

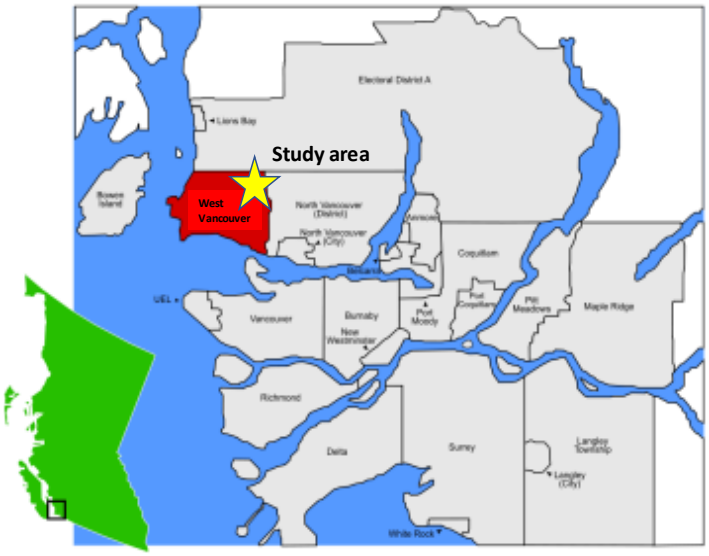

Figure 1: Regional map showing location of study area. The Municipality of the District of West Vancouver is indicated in red.

3.2 Climate

The study area lies mainly within the Coastal Western Hemlock Biogeoclimatic Zone of the Coastal Temperate Rainforest Belt of British Columbia but includes the transition zone (ecotone) with the higher elevation Mountain Hemlock Biogeoclimatic Zone, two zones of the 14 Biogeoclimatic Zones that make up British Columbia. In British Columbia the Coastal Temperate Rainforest Belt has average annual precipitation from 1500 mm (low elevation) to 3500 mm (high elevation). On the North Shore of Burrard Inlet, the Coastal Western Hemlock Zone extends to about 800 metres elevation. Mean annual precipitation in the study area is approximately 2300 mm with about 520 mm of this falling during the growing season from April to September. Mean annual temperature is about 9.0° C with the mean temperature of the warmest month being 16.8° C (Oikos 1991).
Rainfall is strongly seasonal in the Coastal Western Hemlock Zone of the North Shore of Burrard Inlet with relatively dry summers. The retention of moisture in the closed and well-developed canopy forest and large woody material dominates ecological processes.

3.3 Terrain and geology

The terrain is essentially gentle, south-facing slopes which include the southern end of Hollyburn Ridge. The bedrock is well-jointed granitic rocks of the Coast Belt, one of the five major geomorphological belts that make up British Columbia. The granitic rocks (as well as the coniferous trees) render the soils acidic. Soil profiles can be observed in cuts along the West Lake Forest Access Road and the Brothers Ck Trail where the bedrock is overlain by compacted basal till in turn overlain by uncompacted till, both of glacial origin. Overlying the bedrock and glacial deposits, particularly in topographic depressions, is a humus-enriched A, followed by E, B and C mineral soil horizons (humo-ferric podzol Great Group) which occurs at the drier end of the Podzolic range.

Localized peat deposits occur (Image 7). These soils developed since the ice receded about 12000 years ago. Image 11 shows a profile through a typical soil within the study area.

3.4 Attributes of old-growth forest and veteran trees in the study area

Wells *et al* (1998): State that "a single, precise definition of old-growth applicable to all forest types is neither possible nor desirable''. They further state that old-growth in coastal British Columbia is defined conceptually as a forest in which processes of gap dynamics rather than fire predominate. Their definition, which applies best to the study area, is a forest that "contains live and dead trees of various sizes (generations), species composition and age class structure that are part of a slowly changing but dynamic ecosystem."

Having a single definition for an old-growth forest is difficult because of varying interests and foci to old-growth forests such as conservation, exploitation, enjoyment and research. Many definitions can be found. Lund (2001) listed many definitions of the term "old-growth" that he had found in the literature.
The ecology of an old-growth forest, is a continuum without a beginning or end-point except where the cycle is reset by some catastrophic event such as glaciation or a stand-replacing fire.
There are many definitions of old-growth. These definitions can be divided into four main categories as follows (Wells *et al* 1998):

1. **Definitions that emphasize lack of disturbance by humans (at least post-colonization); there are abundant old trees some of which are approaching the maximum age for the species.**
2. **Definitions that use a minimum age since stand-replacing disturbance (typically around 150 years) combined with presence of characteristics such as large decaying logs, snags (standing dead trees), canopy gaps etc. Some human disturbance may be permitted.**
3. **Definitions that emphasize stage of stand development or succession, in particular climax forest – that is, the forest is in a stable state where trees are dying of old age and being replaced, and may continue to be stable for centuries.**
4. **Definitions that use an economic threshold. Old-growth stands are past the economic optimum for harvesting – usually between 80-150 years, depending on the species.**

As the focus for this study is on the biophysical aspects of the forest, its natural values with patchy human disturbance and its conservation, Category 2 is most applicable.

The term "first-growth veteran trees" as used in this study, applies to western redcedars, Douglas-firs, yellow cedars, amabilis fir and western hemlock of great size and/or great age (both living and dead). They are the remnants of the primary first-growth forest. Their determination as "veteran" is a subjective one which is assisted by the display of one or more of the following characteristics; candelabra tops of western redcedars, reiteration (see glossary) of Douglas-firs and western hemlocks (not to be confused with mistletoe parasitism in the case of western hemlock), partially dead trunks (redcedars), dead leaders (redcedars), broken or wind-sheared tops (both Douglas-firs and redcedars), emergent trees (see glossary), extensive heart-rot (redcedars) and trunk splits (redcedars). Girth is a useful guide to great age for redcedars but not always for Douglas-firs nor yellow cedars because of their rapid

growth in the case of the former and slow growth in the case of the latter. However, reiteration in Douglas-firs is a guide to their great age as well as the depth of bark splits.

3.6 Hydrology

The drainage within the study area is dominated by six streams that have cut deep ravines into the terrain. They are Marr Creek, Mc Donald Creek West Branch, Mc Donald Creek, McDonald Creek East Branch, Lawson Creek and Brothers Creek.

4.0 Materials and Methods:

Field observations were made by the author during numerous field trips into the area over many years, along with inspection of satellite imagery and review of relevant literature.

The first task was to ascertain the boundaries of the old-growth forest to see if it was one continuous patch or a number of disconnected patches. An examination of satellite imagery (Google Earth and Westmap 2019) showed that the boundary between the old-growth (first-growth) and the second-growth forest could be precisely identified by the difference in canopy textures on the imagery. It was seen that the forest with old-growth attributes was continuous between Marr Creek and Brothers Creek, a distance of about 2.4 kilometres. There was a difference in canopy widths seen between individual first-growth and second-growth trees on the satellite images. This was confirmed by ground truthing and so the study area was defined. In addition, when examined on the ground, the marked difference in multiple generations of trees on the one hand and the single generation on the other could be seen (see Figures 2, 3 and 5). For example, one well known and easily accessible location where the contrast between old-growth and second-growth forest can be seen is at the well-known Hollyburn Fir (Tag No. OGCS 011) which lies on the southern margin of the old-growth forest at 660 metres elevation on the Brewis Trail. By looking north and then south of this veteran tree, the two types of forest can be clearly observed

To define the perimeter of the old-growth forest in the study area, the following old-growth attributes were used:

1. **Trees within the study area are of many ages, sizes and generations (multi-aged) from saplings to ancient trees (veterans estimated to over 250 years and in the case of the two cedar species up to 1000 years and older). The second-growth forest beyond the boundaries of the study area consists primarily of trees of one generation and therefore of similar size (uniform or even-aged);**
2. **The differing heights for different generations of trees of the old-growth forest create a deeper canopy than the second-growth forest and an uneven canopy. This depth of canopy allows for a greater biodiversity of faunal species;**
3. **Canopy gaps occur where senescent or emergent wind-thrown trees have fallen and are common in the study area. These canopy gaps have allowed entry of sunlight, facilitating a well-developed but patchy understory (for a definition of patch dynamics and canopy gaps see Glossary). The second-growth forest has poor understory development due to absence of canopy gaps in turn due to low levels of tree fall;**

4. **Due to its great age, the old-growth forest has a higher proportion of dead standing trunks (snags) and a higher level of coarse woody debris (CWD) on the forest floor and this material is larger in diameter than CWD in younger forests;**
5. **The study area contains species only found in old-growth forests known as indicator species. An example of one of these indicator species is the fir clubmoss (*Huperzia miyoshiana; Syns: H. selago and H. chinensis*). I have identified this species in all old-growth forests on the North Shore that I have surveyed, including this survey, and have never found it in younger forests. Lesica (1991) noted that nitrogen-fixing foliose lichens were more common in old-growth forests. Goward (1994) describes 24 species of epiphytic microlichen that occur in very old forests and appear to be absent from younger forests.**

The next task was to investigate the species diversity of the study area. A plant and fungi (with one amphibian) list was compiled and comparisons made with two other old-growth areas at similar elevations on the North Shore i.e., the Mosquito Creek old-growth forest in North Vancouver and the Old Growth Conservancy. Completion of the species lists determined that the study area had a significantly higher biodiversity in terms of number of species than other old-growth forests at comparable elevations (Appendix 2 and Table 1). The species lists for all areas were compiled by Terry Taylor and the author. This programme was conducted over two summers (2014 and 2015). A second-growth area adjoining the study area to the east was used as a control for comparison purposes.

The next phase of the project was to locate and map the living and dead first-growth veteran trees using a Garmin Montana 680. This work was conducted over five summers (2016 to 2020). All the trees mapped are shown on Figure 3 and 5 to indicate areas not walked. The Garmin Montana tracks are shown in Figure 5 and was conducted by Alan Bardsley and the author.

4.1 Mapping:

4.1.1 Determining the boundary of the study area:

Satellite images published by Google Earth and Westmap 2019 (Figure 2, 3 and 5) were examined to determine if the boundary between old-growth forest and logged or disturbed (second-growth) forest could be distinguished. The imagery showed differences in canopy textures which appeared to identify old-growth and second-growth forest. These included primarily western hemlock, amabilis fir and western redcedar with some mountain hemlock and yellow cedar in the northern part of the study area. Ground truthing confirmed that satellite imagery was a useful guide for determining the boundary between old-growth forest and second-growth forest. Constraints to the northwest and north of the study area were the cabin area and the southern boundary of Cypress Provincial Park respectively. While it was known that old-growth continued into both, the study was not conducted there (see all Figures and

Lertzman 1989). The northern margin of the study area also corresponded with the transitional zone (ecotone) between the Coastal Western Hemlock Biogeoclimatic Zone and the Mountain Hemlock Biogeoclimatic Zone at approximately the 850-metre contour. A very few veteran western hemlocks, which were not infected by the dwarf mistletoe, but showed reiteration, were mapped in this transition zone. Although mountain hemlock did occur in the transition zone, none were veteran trees and were not mapped.

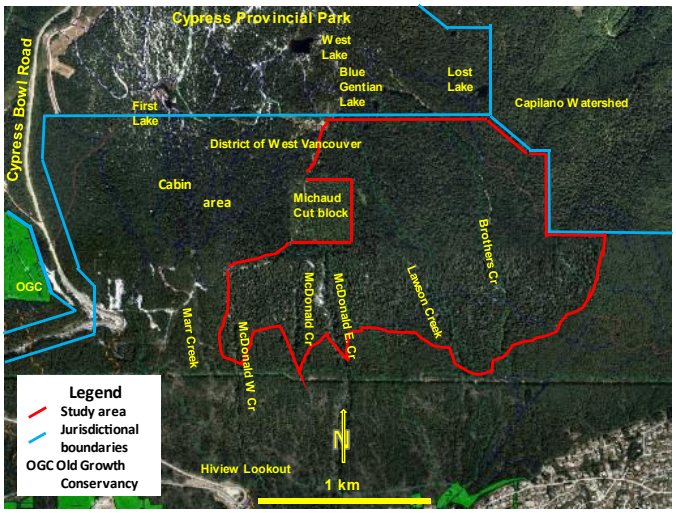

Figure 2: Satellite image from Google Earth of study area showing principal streams, boundary of study area, and jurisdictional boundaries

4.1.2 Mapping first-growth veteran trees

The locations of veteran trees were surveyed using a handheld outdoor GPS (Garmin Montana 680) which were then plotted onto the map (Figures 3 to 5). For details of these trees such as diameter, species, elevation and coordinates see Appendix 3. Veteran tree in this report is synonymous with old-growth and first-growth tree.
Veteran snags or dead veteran trees are included in Appendix 3 and Figures 3 to 5 as they are just as important as living trees in the ecology of an old-growth ecosystem. They are distinguished by different symbols in Figures 3 to 5. Veteran or old-growth trees have been selected on the basis of characteristics other than ring counts so that all trees mapped may in fact not be old-growth. This is not considered to be a significant number.

4.2 Species identifications:

Two summers were spent identifying and recording species. This study was conducted along all trails in the study area. The observed species are listed in Appendix 2 (List 1). As a control area, and for comparison, an area of second-growth forest east of the

boundary adjoining the study area was selected. The species observed in this control area are also listed in Appendix 2 (List 2).

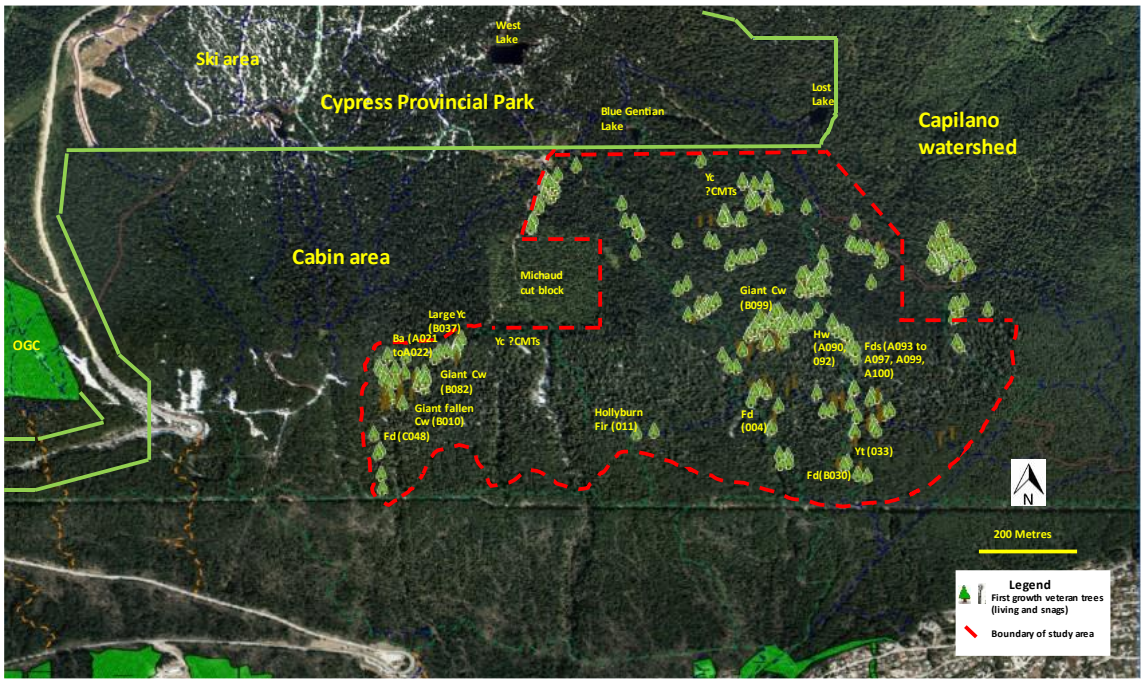

Figure 3: Satellite image from Google Earth showing primary-forest veteran tree plots, outline of study area and some veteran tree highlights. Cw = western redcedar; Fd = Douglas-fir; Hw = western hemlock; Ba = amabilis fir or Pacific silver fir; Yc = yellow cedar. CMT = culturally modified tree.

4.3 Biodiversity:

Biodiversity is a measure of ecosystem health (ecological integrity). Relative biodiversity of forests can be compared using the total number of vascular plant species identified, as these are the species lists most likely to be complete or near complete (Table 1). The species in a second-growth area adjoining the eastern margin of the study area was used for comparison. The species lists were compiled by the author with the assistance of Terry Taylor.

4.4 Biogeoclimatic Ecosystem Classification:

The Biogeoclimatic Ecosystem Classification (BEC) is a system designed in British Columbia and used widely by the Ministry of Forests for ecologically-based forest land management throughout the province. BEC classifies ecosystems at the regional and local level. Biogeoclimatic zones reflect changes in climate and vegetation at a regional scale. There are 16 biogeoclimatic zones in British Columbia. The study area lies entirely within the Coastal Western Hemlock Biogeoclimatic Zone (CWH) but transitional to the Mountain Hemlock Biogeoclimatic Zone on its northern margin. Biogeoclimatic Zones describe changes in climate at a regional scale.
The Coastal Western Hemlock zone is divided into subzones that reflect the effects of elevation and continentality on sub-regional climate. The Coastal Western Hemlock Very Wet Maritime subzone (CWHvm) and Coastal Western Hemlock Dry Maritime subzone (CWHdm). The former occurs in the upper elevation portions of the study area, and the latter the lower elevation portions.

These subzones are further divided into Site Series (Site Associations) which reflect the effects of local terrain and soil parent materials on soil moisture and nutrient regime. Site Series are named using one or two indicator tree species, followed by one or two understory species derived from the near-climax plant community on which they are based. Site Associations were not determined as it was beyond the scope of this report.

4.5 Soils and hydrology:

A number of pits were dug to determine:

1. **The preservation of the soil profiles in selectively logged area. This is thought to have implications for the preservation of soil mycorrhiza and soil microorganisms which in turn have implications for the health of the forest. For a typical soil profile in the study area see Image 11.**
2. **Incidence and preservation of piping which is a mechanism for the facilitation of drainage through the soils in the intervening ground between the major rivers draining the area. This would also have implications for the health of the forest. Piping is described in the Glossary, Jones (2010) and Wienhofer (2014). See Image 12 for an example of piping.**

Drainage within the high ground between the principal streams is considered to be primarily subsurface because of the mature soils, and is thought to take place in two ways.

1. **Soil water travels via piping left by decaying roots. Intact soils with their accompanying sub-soil drainage and well-developed piping networks ensure soil aeration and nutrient supply for the well-developed tree root systems and thus the continued health of the old-growth forest. A significant volume of the water in steep temperate forested catchments may enter the streams via preferential flow paths or macropores (Jones, 2010; Wienhofer 2014). Preferential flow may occur through fractures in the bedrock, locally saturated zones at the soil-bedrock interface, and soil pipes created by the rotting of tree roots. Piping in the glaciated British Columbia mountains is considered to occur mainly through the glacial deposits and subsoil resulting from rotting plant roots. Piping has been shown to be a major factor supporting the hypothesis that subsurface flow can be a significant contributor to quick-flow by field experiments in Canada and other countries (Jones 2010). Image 12 illustrates a possible example of soil piping.**
2. **Mycelia of mycorrhizal fungi are known to assist to a major extent in supplying water to vascular plants.**

4.6 Culturally modified trees:

Quite early in the study it was recognized that many of the smaller yellow cedars (although old-growth, as was determined by ring counts on a fallen and cut tree) showed an inordinate amount of very old scarring. These were assumed to be cultural scarring from First Nations traditional harvesting although an expert has not yet examined them. They were not included in the tree inventory of this study but the location of the main concentrations are indicated on Figure 3.

5.0 <u>Results</u>:

5.1 Disturbance history in the study area

Selective logging for western redcedar and Douglas-fir has occurred in parts of the study area, as can be determined from relict stumps and trees showing saw marks and springboard holes. This is thought to have occurred during the first of three principal phases of logging on the North Shore i.e., 1860 to 1890s, when methods of logging were relatively benign.

Kahrer (1985) writes that "From 1860s to 1890s human and animal power was used in the woods and lumber operations had relatively small impact on the forest ecosystem. After the turn of the century, steam power was adopted in the North Shore forests and lumbermen began to change the appearance of the land. By the 1920s several capital-intensive, larger-scale operations had emerged which employed logging railroads, trucks and high-lead-yarding. They pushed into steep, hitherto inaccessible slopes and left barren, slash-covered clear-cuts, prone to forest fires. Cutting regulations were virtually non-existent and the devastated hill sides were left to natural regeneration". There was no evidence of such intensive, larger-scale operations found in the study area.

While fire has played a part in the forests of coastal British Columbia, initiated mainly by lightning, logging, and by the influence of First Nations, the dominant disturbance regime in the coastal temperate rain forests of the North Shore has been by canopy gap dynamics rather than fire (Green *et al* 1998, Daniels *et al* 2006 and Lertzman *et al* 1991). See Glossary where "canopy gaps" and "gap dynamics" is defined. There have been forest fires in the area in the 1600s, 1840s and 1920s (Oikos 1991) possibly caused by both the indigenous population and logging operations. Based on the distribution, age and growth patterns of Douglas-fir in the Seymour Watershed, and the presence of charcoal in the soil, Daniels (1996) speculated that a number of Douglas-fir stands originated following partial to complete stand-replacing fires between 500 and 900 years ago. Green *et al* (1998) described the fire history of the nearby Capilano Watershed. They state that "Fire has played an important role in the ecology of British Columbia and Pacific Northwest temperate coastal forests since the retreat of the Fraser glaciation over 10,000 years ago. Pollen records from peat samples show that the climate from 10,000 to 7,000 B.P. (years before present-1997) was warmer than today, with charcoal peaks implying fire was much more prevalent". However, the more recent fire regime has been spasmodic and due primarily to localized lightning strikes. The principal influence for forest ecology has been by gap dynamics (explained in glossary).

5.2 Intact old-growth ecology

Field observations determined that while logging of mature and veteran trees had occurred in some areas, the old-growth forest ecology was generally intact and continuous. Invasive or introduced non-native species were almost entirely absent, the only non-native species identified were wall lettuce (*Lactuca muralis*), colonial bentgrass (*Agrostis vulgaris*) and English holly (*Ilex aquifolium*) brought in by wind, human, and bird dispersal respectively.

5.3 Biodiversity

The biodiversity of the vascular plants of the Marr/Brothers study area is double that observed in the Mosquito Creek Old-growth Forest and Old-growth Conservancy, which are at similar elevations to the study area (Table 1).

5.4 Living and dead primary-forest veteran trees

Living and dead (snags or wildlife trees) primary-forest veteran trees are shown on Figure 3 and are described in detail in Appendix 3. Table 1 compares the biodiversity of two other old-growth forests on the North Shore (Mosquito Creek old-growth forest and the Old Growth Conservancy) at comparable elevations as well as a second-growth control area adjoining the study area to the east.

5.5 Tree species

Western redcedar (*Thuja plicata*) is the dominant old-growth or veteran tree species. The largest redcedars found so far are B082 (south of West Lake Fire Access Road. 10.69 metres circumference) and known as Sasha's giant, B099 (east of Lawson Creek 10.65 metres circumference.) and the fallen giant B010 (south of West Lake Fire Access Road 8.40 metres circumference). The Hollyburn fir (011) and 10 other veteran Douglas-firs (*Pseudotsuga menziesii*) were included and all 11 occurred below 640 metres elevation (see Figure 3 for locations). One Pacific yew (*Taxus brevifolia*) (033) probably old-growth, is between the Brothers Cr Trail and Brothers Creek. Another yew, nearby, also possibly old-growth, overhangs the Brothers Creek canyon but was impossible to measure. Younger Pacific yew are scattered sparsely at various locations throughout the study area as would be expected due to their dispersal by birds. Yellow cedars (Alaska cypress or yellow-cypress) (*Chamaecyparis nootkatensis* also known as *Cupressis nootkatensis*) occurred in a west to east zone between 650 and 850 metres elevation, most of which showed possible cultural modification. Thirty-five of the larger yellow cedars were mapped. Many other smaller yellow cedars, showing possible cultural modification, were not mapped. Almost all yellow cedars observed are probably old-growth, as one of the smaller trees (1.58 metres in circumference) with possible cultural modification that was cut because it had fallen across a trail, was approximately 280 years old, although it had heart rot and was therefore impossible to age accurately. The locations of these possibly culturally scarred yellow cedars, where they cluster together, are labelled on Figure 3. No expert has examined these trees to verify their cultural modification. Two amabilis firs or Pacific silver fir (*Abies amabilis*), numbers AO21 and AO22, are probably old-growth and occur at 800 meters elevation near the West Lake Fire Access Road. Nine western hemlocks (*Tsuga heterophylla*), many showing reiteration, which was not dwarf mistletoe (*Arceuthobium campylopodium*) infection, were mapped. Most of these are south of the West Lake Fire Access Road at about 800 metres and the remainder are on the west side of Brothers Creek at about 660 metres elevation. These are all almost certainly old-growth and the higher elevation trees occur at the upper limit of the Coastal Western Hemlock Biogeoclimatic Zone where the dwarf mistletoe is not present and so has not reduced the lifespan of the tree as it has done at lower elevation. They are tag numbers A090 and A092 in the case of the Brothers Creek trees and tag numbers B040, B064, B066, B081, B097, C037 and C052 in the case of the West Lake Fire Access Road trees. Mountain hemlock (*Tsuga mertensiana*) were observed on the south side of the West Lake Fire Access Road but were not old-growth and therefore not mapped.

5.6 Ages of trees

Increment bore ages for six veteran trees and cut stumps in the Old Growth Conservancy, about 600 metres west of the study area, ranged from 650 to 900 years (Oikos 1991). These were all redcedars that did not have heart rot. Douglas-firs have not been recorded there and there is no mention of Douglas-firs in the Oikos report (Oikos 1991). No ages for veteran trees in the study area were determined by increment boring, but they are considered to be similar in age to the Old Growth Conservancy. One yellow cedar that was culturally modified, fell across a trail in the study area had slices cut from it and the growth rings were counted. An approximate count of 280 years was determined, although it had heart rot and therefore an accurate ring count was not possible.

5.7 Soils and hydrology:

A limited number of soil pits were dug to determine the survival of the soil profiles in the study area. Because the logging that has occurred does not seem to have caused disruption of the soil profile, the soil microbiota would not have been significantly compromised. In particular the mycorrhizal networks so vital for the healthy ecology of an old-growth forest would have been maintained. See Image 11 for a typical soil profile taken from an area north-west of the Hollyburn Fir where selective logging took place. Because the logging was selective and heavy machinery was not used, the soils have essentially been undisturbed, allowing preservation of the soil microbiota and the subsurface drainage.

Also, species only found in old-growth forests such as fir clubmoss (*Huperzia miyoshiana; Syn: H. selago and H. chinensis*) are found. Clubmosses are known to be rely on mycorrhizal fungi for their survival (Weakley, A.S. 2019).

A typical intact soil horizon profile is O (loose and partly decayed organic matter), A (mineral matter mixed with some humus), E (eluviation or leached horizon, quartz sand), B (subsoil and leachates) and C (glacial till) horizons (Image 11). The B horizon showed examples where drainage along channels left by rotten rootlets could have taken place. An example of a possible piping channel-way via a rotten rootlet is depicted in Image 12.

Evidence of a substantial peat deposit in the cut of the West Lake Fire Access Road (Image 7) attests to the varied history of the area since the ice left about 12,000 years ago.

5.8 Hub or “Mother” trees

The veteran trees that were mapped can be considered as hub or “Mother” trees. That is to say they are the biggest and oldest trees which are the most highly connected in terms of mycorrhiza. Selective logging in some areas have removed the veteran trees, but the largest trees that were left are still capable of functioning in the role of hub trees. Also known as legacy trees they have been used for mycorrhizal inoculum in the Forest Industry for promoting natural regeneration (Simard *et al* 2021).

5.9 Culturally modified trees:

Almost all yellow cedars, except the very largest, show what is thought to be cultural modification. Many trees exhibit multiple bark-strip scars. Lobe growth and scar-face obscure some of the key characteristics of a cultural scar, to the point where the initial cut for the bark strip is hidden by lobe growth or completely deteriorated. All those depicted (Image 1) are located on Old Brewis Trail near its intersection with West Lake Forest Access Road west of McDonald Creek East Branch (Image 13). Although all are old-growth trees, the Brewis Trail cluster of yellow cedars were not included in the inventory. We know they are old-growth because one tree which had fallen across the trail was cut to reveal about 400 closely-spaced growth rings. This cluster and other clusters are labelled on Figure 3. Larger yellow cedars elsewhere were included in the inventory. Yellow cedars occur between 650 and 850 metre elevation across the full breadth of the study area and almost all (except the largest) are Culturally Modified Trees (CMTs).

Image 1 (a to e): Yellow cedars showing possible culturally modified bark stripping by First Nations. Image 1a shows a typical single scar. Image 1b shows two adjacent trees with scars. Image 1c shows one tree with two scars. Image 1d shows a very old deceased tree with four possible scars that have deteriorated beyond recognition as cultural modifications. 1e is a cut through a yellow cedar that fell across the Old Brewis Trail showing the partly healed culturally modified scar. This tree, which was infected with heart rot, was estimated at 400 years. All trees depicted in Image 1 are the Old Brewis Trail cluster near the trail's intersection with the West Lake Fire Access Road, west of

McDonald Creek East Branch. For the First Nations culture, yellow-cedar bark was soaked and boiled, then pounded until soft. It was then woven into blankets and clothing and was preferred to red cedar due to its softness. Hats and capes made from yellow-cedar bark were water repellent.

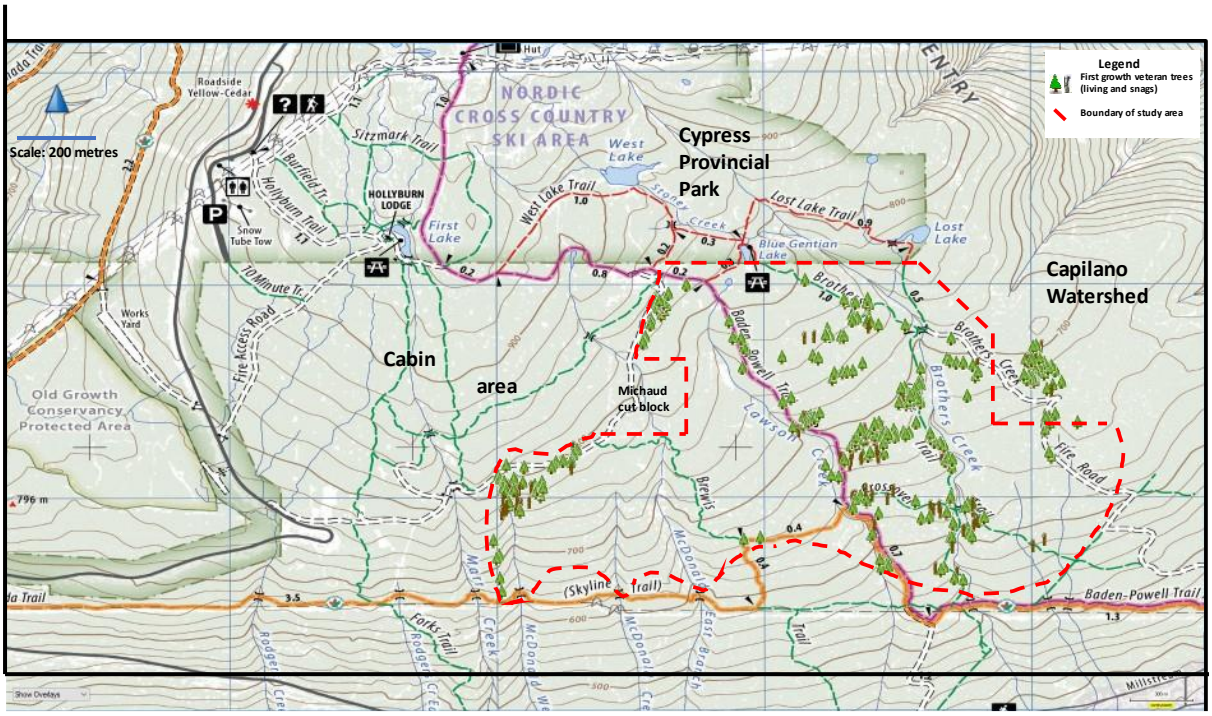

Figure 4: GPS plots of first-growth veteran trees and veteran snags plotted using the Garmin Montana 680. Base map courtesy of Clark Geomatics Corp. and Castle Cartographic.

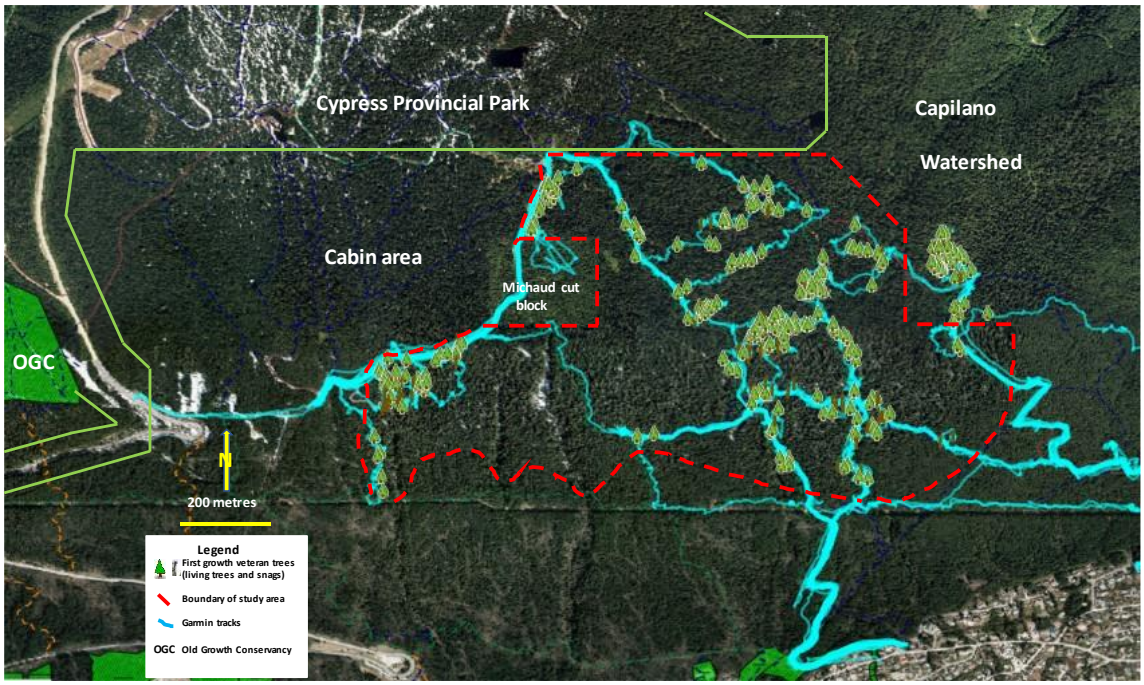

Figure 5: First growth veteran trees and snags with Garmin survey tracks shown in blue. The areas not surveyed could contain old-growth trees. The canopy configuration of the study area can be seen to be distinctly different from the adjacent second-growth forest.

Table 1 Biodiversity comparisons for forests at similar elevations with old-growth characteristics on the North Shore of Burrard Inlet. The vascular plants are used as these would be the most complete species lists. Species lists for all areas were compiled by Terry Taylor and David Cook.

Areas with old-growth characteristics	Number of vascular plant species	Elevation (m)	Approximate area (ha)	Biogeoclimatic Zone/s
Marr Creek/Brothers Creek old-growth	98	540-800	250	CWH (northern boundary transitional with MH)
Mosquito Creek old-growth forest	49	350-750	52	CWH
Old growth Conservancy	59	510-770	54	CWH (northern boundary transitional with MH)
Area of second-growth forest. Included as a control area				

Brothers Creek Fire Access Road	**28**	**380-640**	**Brothers Cr Forest Access Rd**	**CWH**

6.0 <u>Discussion</u>:

The results indicate that the study area has a mix of virgin old-growth forest and forest that has been selectively logged in such a way that old-growth attributes have been retained.

Trees old and large enough to function as hub trees (mycorrhizal inoculum) had survived the logging (Simard *et al* 2021).

The plant biodiversity (species richness) is considerably higher than two other old-growth areas studied by the author on the North Shore at similar elevations; the Mosquito Creek old-growth forest and the Old Growth Conservancy (Cook 2012a, Cook and Taylor 2012 to 2016 respectively). This may be due to the extent and continuity of the area and therefore the inclusion of additional micro-habitats and the protection afforded by the edge effect of the surrounding second-growth forest or by continuity of habitat which allows ease of gene flow and thus genetic health.

The ecotone between the Coastal Western Hemlock Biogeoclimatic Zone and the Mountain Hemlock Biogeoclimatic Zone has also been given as the explanation for the high biodiversity of the study area. The Old Growth Conservancy to the west of the study area lies within the same ecotone and does not have the high biodiversity of the study area (Taylor *et al* plant list 2005 to present) which supports the idea of size of the area. The study area is approximately five times greater in size than the Old Growth Conservancy.

Large areas such as the study area support keystone wildlife species. Bull & Meslow (1977) documented the foraging range of the Pileated Woodpecker, a keystone species in Oregon old-growth forests, at 200-480 ha (500-1200 ac). The Marr Creek/Brothers Creek old-growth area (the study area) is approximately 250 hectares, and could potentially support at least one breeding pair of this important local cavity excavating species.

Illegal trails occur throughout the area as the present survey discovered. Trail networks fragment natural habitat of the native species there. One of the effects of habitat fragmentation is the introduction of invasive species such as grasses, which create what is known as the edge effect surrounding ever-increasing numbers of habitat islands as trail networks proliferate. This leads to ecosystem decay and disrupts gene flow, particularly in the case of native plants (terms defined in Glossary). Fragmentation of habitat also destroys quiet areas for breeding in the case of fauna. A breeding area should be a quiet place with a minimum of sudden loud sound, particularly at the high end of the audible scale (ultrasound). Noise may also have widespread effects on wildlife, both near and far from its source (or sources), with negative effects on animal health, learning, predator detection, navigation, foraging, health, learning and

communication (Gill *et al* 2015; Radle 2007; Nagorsen *et al* 1993 and 1995). Monitoring for and decommissioning of illegal trails has been successful in the Old Growth Conservancy 600 metres to the west, but requires constant attention.

7.0 Conclusions and Recommendations:

I found that the study area was in fact a distinct unit with old-growth attributes unlike the surrounding second-growth forest. Field observations determined that while logging of mature and veteran trees had occurred in some areas, the old-growth forest ecology was otherwise intact and continuous.

The second-growth forest surrounding the study area acts as an effective buffer and protector to it.

Ecologically the study area compares favourably with the nearby Old Growth Conservancy except for its biodiversity and but for the Cabin Area and Cypress Bowl Road, would probably be continuous with it.

There are three good reasons to give formal protection to this area;

1. **to preserve the ecology of this functional old-growth forest for wildlife habitat and the biological services it provides and,**
2. **to preserve this representative of the ancient native forests for education, study and enjoyment of present and future generations and,**
3. **almost every yellow cedar within the study area and beyond is culturally modified (in the opinion of the author) and should be protected for this feature alone. However, this needs to be verified by an expert in culturally modified trees (CMTs). Almost all yellow cedars are old-growth which is the purpose of their inclusion within this report.**

It is recommended that the Marr Creek to Brothers Creek area (the study area) be protected as one continuous unit for the following reasons;

1. **the Marr Creek to Brothers Creek old-growth forest has definable boundaries and is the largest remaining middle-elevation area where old-growth ecology has been preserved on the North Shore of Burrard Inlet;**

2. **the species richness of the study area was found to be significantly higher (about twice) than other old-growth forest areas at similar elevations studied by the writer on the North Shore;**

3. **the old-growth forest in the study area is an optimum natural area size: For natural areas to retain biological and genetic sustainability (i.e., to maintain ecosystem function, integrity, health and resistance to human disturbance) size should be maximised and not fragmented into habitat islands by development, and the trail system should not be increased;**

4. **certain sectors of the study area may not contain their first-growth veteran trees because they have been selectively logged. Those areas should not be excluded from the area identified as old-growth forest because they contain other attributes of an old-growth ecosystem;**

5. **the cabin area forest and Cypress Provincial Park act as buffers for the north-west and northern margin of the area and the second-growth forest to the west, south and east also act as a buffer which will help to keep the ecology intact;**

6. **with the occasional occurrence of non-native species such as wall lettuce, English holly and colonial bentgrass, there is a lack of non-native species and those non-native species have not reached a point where they are invasive. Preservation of the area in its entirety without construction of further trails will limit the introduction of exotics;**

7. **a policy of subtle discouragement of user access should be similar to that used by the Old Growth Conservancy. The North Shore Mountain Bike Association (NSMBA) should be contacted for their assistance with monitoring and decommissioning of trails;**

8. **it is recommended that because of its natural values, this area be protected as one continuous conservation area;**

9. **management should be a public/municipal partnership managed similar to the Old Growth Conservancy;**

10. **selective logging of the first-growth veteran trees in parts of the study area appears not to have altered the ecology to any major extent and the soils are apparently intact. The old-growth forest can be clearly defined by the difference in canopy configuration seen in satellite imagery when compared with the canopy of the surrounding second-growth forest;**

11. **the study area appears to contain a large concentration of possible ancient Culturally Modified Trees on the North Shore. Almost all yellow cedars within the study area have this feature. Almost all are considered by definition to be old-growth trees;**

12. **it is recommended that the information in this report be included in the Upper Lands Study.**

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Fitz-Earle, Emeritus Professor, Department of Biology, Capilano University for an equally thorough review of this report. His summarizing comment was "The study leads to the inevitable conclusion that the area is ecologically unique and should be preserved as a Conservancy or similar protected area for future generations."

10.0. Statement of Author's qualifications:

I, David L. Cook, with address at 1788 Emerson Court, North Vancouver, British Columbia V7H-2Y6, do certify that:
1. I hold a double major Bachelor of Science degree (1962) from the University of Western Australia in Biology and Geology.
2. I have been active in the aforementioned fields since 1962.
3. I have no direct or indirect interest, nor do I expect to receive any remuneration directly or indirectly from this project.
4. I have based this report on my knowledge of the natural values of the area gained during numerous field visits to the region over the last 40 years. Other information has been derived from a review of published literature and maps some of which is included in the accompanying Bibliography.

Appendix 1:

Glossary: Definitions in the Glossary are taken where possible from the B.C. Ministry of Forests Glossary (www.for.gov.bc.ca/hfd/library/documents/glossary/) and B.C. Forest Practices Board Glossary (www.bcfpb.ca).

Biogeoclimatic Zone: The biogeoclimatic zones of British Columbia are a classification system used by the British Columbia Ministry of Forests for the Canadian province's fourteen different ecosystems. The classification system exists independently of other ecoregion systems, one created by the World Wildlife Fund and the other in use by Environment Canada, which is based on one created by the Commission for Environmental Cooperation (CEC) and also in use by the American Environmental Protection Agency (EPA). The system of biogeoclimatic zones was partly created for the purpose of managing forestry resources, but is also in use by the British Columbia Ministry of Environment and other provincial agencies. A biogeoclimatic zone is defined as "a geographic area having similar patterns of energy flow, vegetation and soils as a result of a broadly homogenous macroclimate."

Canopy closure: The progressive reduction of space between crowns as they spread laterally, increasing canopy cover. The point in time when crowns in a young stand begin to touch and interact resulting in crown shyness.

Canopy gaps, gap dynamics or gap-phase dynamics: Treefall gaps or canopy openings caused by the death of one or more trees, is the dominant form of disturbance in many forest systems worldwide, specifically west of the Coast Mountains of British Columbia. Gaps play an important role in forest ecology helping to preserve bio- and pedo-diversity, influencing nutrient cycles, and maintaining the complex structure of the late-successional forests. When one or few canopy trees die in a forest, mainly due to natural disturbance, this creates a hole in the canopy called a 'gap'. The term gap or canopy gap is generally used to refer to such empty areas within forest canopies. Spatial heterogeneity of canopy structure means that gaps of different size and shape exist

throughout a forest stand. Over time, these spaces are filled with other trees (Watt 1947; Whitmore 1989). Gaps, once formed, do not remain static but become localized sites of regeneration and subsequent growth where tree regeneration is usually a result of released advance regeneration or recruitment from buried or dispersed seed. This phenomenon is termed 'gap dynamics' or "gap-phase dynamics" (Daniels and Gray 2006; Lertzman 1989, 1992; Lertzman and Krebs 1991).

Culturally Modified Tree (CMT): A tree or a remnant of a tree with evidence of traditional aboriginal forest use.

Ecosystem decay: Is a term coined by Thomas Lovejoy to define the process of which species become extinct locally based on habitat fragmentation. This process is what led to the extinction of several species, including the Irish Elk. Ecosystem decay can be mainly attributed to population isolation, leading to inbreeding, leading to a decrease in the population of local species. Another factor is the absence of competition, preventing the mechanisms of natural selection to benefit the population. This leads to a lack of a skill set for the animal to adjust and adapt to a new environment. Although similar to forest fragmentation and island biogeography, ecosystem decay is what results in the event of forest fragmentation.

Ecotone: A transition area between two biological communities, where two communities meet and integrate.

Edge effect: In ecology, edge effects are changes in population or community structures that occur at the boundary of two or more habitats. Areas with small habitat fragments exhibit especially pronounced edge effects that may extend throughout the range. As the edge effects increase, the boundary habitat allows for greater biodiversity.

Emergent: The emergent layer of a forest contains a small number of the tallest trees called emergents, which grow above the general canopy. They are subjected to strong and desiccating winds which may damage the emergent crowns, shearing them off.

Epicormic branching: **Branches or shoots that grow from a dormant bud. They may appear for a variety of reasons, mostly on parts of a tree that are newly exposed to sunlight or they are a symptom of stress in a tree. The tree grows these sprouts first and foremost when there is a need to increase amounts of photosynthesis**

Even-aged: A forest stand or forest type in which relatively small (10 to 20 years) age differences exist between individual trees. See Multi-aged or Uneven-aged.

First-growth veteran tree: The term "first-growth veteran tree" is one that is not capable of precise definition but it encompasses trees defined by three guiding principles: Trees that are older than the trees around them, having survived some prior disturbance but may not have all of the following features. Those features can be of interest biologically, aesthetically or culturally because of their age; trees in the ancient stage of their life and trees that are old, relative to others of the same species. First-growth veteran trees may be characterized by large girth, but not necessarily so because of site suitability and competition with adjacent trees for nutrients; reiteration in the case of Douglas-firs (see "Reiteration" in Glossary); major trunk cavities or progressive

hollowing (redcedars); physical damage to trunk; bark loss; large quantities of dead wood in the canopy; sap runs due primarily to *Armillaria spp.* (honey mushroom) of Douglas-firs in our area; high number of interdependent wildlife species.

Fragmentation: See Habitat fragmentation.

Gap dynamics: See "Canopy gaps".

Gap phase: See "Canopy gaps".

Habitat fragmentation: Describes the emergence of discontinuities (fragmentation) in an organism's preferred environment (habitat), causing ecosystem decay. Causes of habitat fragmentation include geological processes that slowly alter the layout of the physical environment (suspected of being one of the major causes of speciation), and human activity such as logging, roads, trails, agriculture, utility corridors and subdivisions, which can alter the environment much faster and causes the extinction of many species. The forest is reduced to scattered, disconnected forest islands. Fragmentation leads to loss of biodiversity, increases in invasive plants, pests, and pathogens, and reduction in water quality. These wide-ranging effects all stem from two basic problems: fragmentation increases isolation between forest communities and increases edge effects. More specifically, habitat fragmentation is a process by which large and contiguous habitats get divided into smaller, isolated patches of habitats.

Keystone species: A species on which other species in an ecosystem largely depend, such that if it were removed, the ecosystem would change drastically.

Multi-aged or uneven-aged: A forest stand or forest type which has three or more age classes.

Mycorrhizal inoculum: Fungi that form a symbiotic relationship with the roots of most plants.

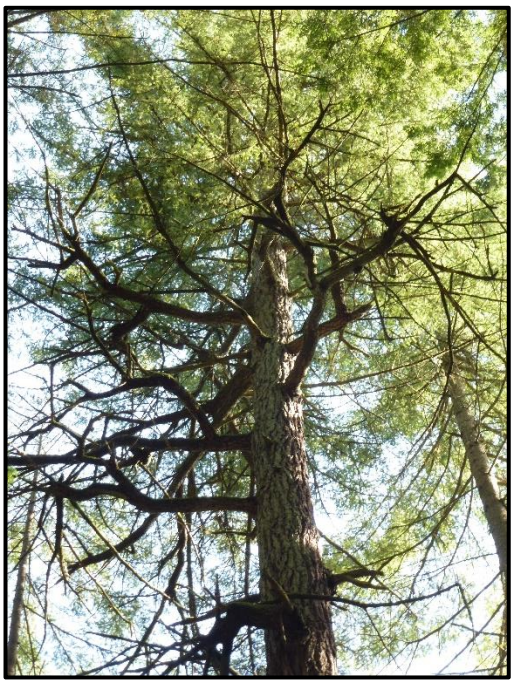
Old-growth: For the purpose of quantitative analysis, old-growth is defined as all Coast Region forests more than 250 years old, Interior forests dominated by lodgepole pine or deciduous species more than 120 years old, and all other Interior forests more than 140 years old. Old-growth tree and veteran tree are used interchangeably in this report.

Old-growth attributes: Structural features and other characteristics of old-growth forests, including: large trees for the species and site; wide variation in tree sizes and spacing; accumulations of large dead standing and fallen trees; multiple canopy layers; canopy gaps and understory patchiness; elements of decay such as broken or deformed tops or trunks and root decay; and the presence of species characteristic of old growth.

Old-growth Forest: A forest that contains live and dead trees of various sizes, species, composition, and age class structure. Old-growth forests, as part of a slowly changing but dynamic ecosystem, include climax forests but not sub-climax or mid-seral forests. The age and structure of old-growth varies significantly by forest type and from one biogeoclimatic zone to another.

Piping: Soil pipes are water-sculpted erosional features formed by concentration of subsurface flow along features such as decaying tree roots, fractures, or zones of locally higher hydraulic conductivity.

Reiteration: Old-growth Douglas-firs exhibit delayed adaptive reiteration (DAR) through epicormic production by which foliage is regenerated continuously within the existing crown structure by activation of dormant branch buds. This growth pattern has been proposed to provide a compensation for size constraints in large, old Douglas-fir trees that enables them to persist when annual growth increment is minimal (Kennedy M.C. *et al* 2009).



Old-growth Douglas-fir showing reiteration of branching

Mature Douglas-fir showing no reiteration of branching

Site Series: Are subdivisions of the biogeoclimatic subzone/variant, and describe sites capable of producing the same mature or climax vegetation unit (plant association or sometimes, subassociation). Site series are described in the Regional Field Guides to Site Identification. Site and soil conditions, and the vegetation community, are used to identify site series.

Succession: Changes in species composition in an ecosystem over time, often in a predictable order. The forest process follows a timeline of tree species replacement and in this order: from pioneer seedlings and saplings to transition forest to young growth forest to mature forest to old-growth forest.

Uneven-aged: See Multi-aged.

Veteran tree: See Old-growth.

<u>Appendix 2</u>:

The species lists that follow were compiled by Terry Taylor and David Cook along trails within the study area.

The first list is a compilation of numerous lists completed along all trails within the study area over a two-year period (2015 and 2016). The second list is from a second-growth forest adjoining the eastern margin of the study area and is given for biodiversity comparison purposes.

List 1: Entirely within the study area:

Conifers

Abies amabilis (Amabilis fir)
Pseudotsuga menziesii (Douglas-fir).
Taxus brevifolia (Pacific or western yew)
Thuja plicata (Western redcedar)
Tsuga heterophylla (Western hemlock)
Tsuga mertensiana (Mountain hemlock)
Xanthocyparis nootkatensis = Callitropsis nootkatensis = Cupressus nootkatensis = Chamaecyparis nootkatensis (Yellow cedar; Nootka cypress)

Flowering plants

- **Flowering trees**

Alnus rubra (Red alder)
Ilex aquifolium (English holly). Exotic
Populus balsamifera (Black cottonwood)
Sorbus sitchensis var *grayi* (Sitka mountain ash)

- **Flowering shrubs**

Aruncus dioicus (Goat'sbeard)
Gaultheria shallon (Salal)
Mahonia nervosa (Dull Oregon grape)
Menziesia ferruginea (False azalea)
Oplopanax horridus (Devil's club)
Ribes bracteosum (Stink currant)
Rubus leucodermis (Black raspberry)
Rubus parviflorus (Thimbleberry).
Rubus spectabilis (Salmonberry)
Sambucus racemosa (Red elderberry)
Vaccinium alaskaense (Alaskan blueberry)
Vaccinium ovalifolium (Oval-leaved blueberry)
Vaccinium parvifolium (Red huckleberry).

Dicot herbs

Actaea rubra (Baneberry)
Anaphalis margaritacea (Pearly everlasting)
Arceuthobium campylopodum (Western dwarf mistletoe)
Boykinia occidentalis = B. elata (Coast boykinia)
Caltha leptosepala var *biflora* (Marsh marigold)
Coptis asplenifolia (Fern-leaved goldthread)
Cornus canadensis (Bunchberry)
Digitalis purpurea (Common foxglove) Non-native
Epilobium anagallidifolium (Alpine willowherb)
Epilobium angustifolium (Fireweed)
Fauria crista-galli (Deer cabbage)
Galium triflorum (Sweet-scented bedstraw)
Geum macrophyllum (Large-leaved avens)
Lactuca biennis (Tall blue lettuce)
Lactuca muralis (Wall lettuce). Non-native
Linnaea borealis (Twin flower)
Lupinus polyphyllus (Large-leaved lupine)
Lysichiton americanum (Skunk cabbage)
Nuphar polysepalum (Yellow pond-lily)
Orthilia (=Pyrola) secunda (One-sided wintergreen)
Prenanthes alata (Western rattlesnake root)
Pyrola sp (Wintergreen)
Rubus pedatus (Five-leaved bramble; creeping raspberry)
Stellaria crispa (Crisp sandwort)
Tiarella trifoliata var *laciniata* (Foamflower)

Tiarella trifoliata var *trifoliata* (Three-leaved foamflower)
Tiarella trifoliata var *unifoliata* (Single-leaved foamflower)
Viola glabella (Stream violet)
Viola sempervirens (evergreen violet; trailing yellow violet)

- **Monocot herbs**

Agrostis capillaris (Colonial bentgrass). Exotic.
Bromus vulgaris (Columbia brome).
Calamagrostis canadensis (Canadian reedgrass)
Carex deweyana (Dewey's sedge)?
Carex laeviculmis (Smooth sedge)
Carex mertensii (Mertens' sedge)
Cinna latifolia (Wood reedgrass)
Clintonia uniflora (Queen's cup)
Glyceria elata (Tall mannagrass)
Goodyera oblongifolia (Rattlesnake plantain)
Juncus bulbosus (Bulbous rush)
Juncus effusus (Common rush)
Juncus ensifolius (Dagger-leaved rush)
Luzula fastigiata (Forked wood-rush)
Luzula parviflora (Small-flowered wood-rush).
Maianthemum dilatatum (False lily-of-the-valley)
Maianthemum racemosum (False Solomon's seal)
Maianthemum stellatum (Little false Solomon's seal)
Neottia banksiana = Listera caurina (Northwestern twayblade)
Platanthera stricta (Slender rein-orchid; slender bog-orchid)
Scirpus microcarpus (Small-flowered bulrush)
Streptopus amplexifolius (Clasping twisted-stalk)
Streptopus roseus (Rosy twisted-stalk)
Streptopus streptopoides (Small twisted-stalk)
Trisetum cernuum (Nodding trisetum)
Veratrum viride (Indian hellebore, corn lily)

Ferns & allies

Athyriun filix-femina (Lady fern)
Blechnum spicant (Deer fern)
Dryopteris expansa (Spiny wood fern)
Gymnocarpium dryopteris (Oak fern)
Huperzia miyoshiana = H. selago = H. chinensis (Fir clubmoss). Old-growth forest indicator.
Lycopodium clavatum (Running or staghorn clubmoss)
Polystichum munitum (Sword fern)

Mosses

Atrichum selwynii?
Brachythecium frigidum (Cold brachythecium moss)
Buckiella undulata = Plagiothecium undulatum (Wavy-leaved cotton moss)
Claopodium bolanderi
Claopodium crispifolium (Rough moss)
Dichodontium pellucidum (Wet rock moss)
Dicranella heteromalla
Dicranum fuscescens (Curly heron's-bill moss)
Dicranum scoparium (Broom moss; stork's bill moss)
Dicranum tauricum (Broken leaf moss)
Heterocladium procurrens (Tangle moss). Yellow cedar indicator.
Hylocomium splendens (Step moss)
Hypnum circinale (Coiled leaf moss)
Hypnum dieckii
Hypnum subimponens (Curly hypnum)
Isothecium stoloniferum = I. myosuroides (Cat-tail moss)
Kiaeria sp
Kindbergia oregana (Oregon beaked moss)
Kindbergia praelonga (Slender beaked moss)
Leucolepis acanthoneuron (Tree moss)
Mnium spinulosum (Menzies' red-mouthed mnium)
Neckera douglasii (Douglas' neckera)
Oligotrichum aligerum (Small hair moss)
Philonotis fontana (Fountain apple moss; spring moss)
Plagiomnium insigne (Badge moss)
Plagiothecium denticulatum
Pogonatum contortum
Pohlia longibracteata
Pohlia sp.
Polytrichum alpinum (Alpine haircap)
Polytrichum commune
Polytrichum juniperinum (Juniper hair-cap moss)
Pseudotaxiphyllum elegans (Small flat moss)
Pterigynandrum filiforme (Capillary wing moss)
Racomitrium heterostichum (Bristly fringe moss)
Rhizomnium glabrescens (Fan or large leafy moss)
Rhytidiadelphus loreus (Lanky moss)
Rhytidiopsis robusta (Pipecleaner moss)
Schistostega pennata (Goblin's gold)
Sphagnum girgensohnii
Sphagnum pacificum

Sphagnum palustre
Sphagnum squarrosum

Liverworts

Bazzania denudata (Naked bazzania)
Calypogeia muelleriana
Cephalozia bicuspidata (Two-horned pincerwort)
Diplophyllum albicans (Common fold-leaf or white earwort)
Douinia ovata (Waxy earwort)
Frullania nisquallensis (Hanging millipede liverwort)
Gyrothyra underwoodiana
Jungermannia rubra
Lepidozia reptans (Little hands liverwort)
Lophocolea heterophylla
Marsupella emarginata (Notched rustwort)
Pellia neesiana (Ring pellia)
Plagiochila porelloides (Cedar-shake liverwort)
Ptilidium californicum (Pacific fuzz wort)
Radula complanata (Flat-leaved liverwort)
Riccardia latifrons
Scapania bolanderi (Yellow-ladle liverwort)
Scapania undulata (Water earwort)

Algae

Trentepohlia sp.

Slime molds

Fuligo septica (Scrambled egg slime)
Stemonitis sp (Chocolate tube slime)
Trichia sp

Lichens

Baeomyces (Beret lichen)
Baeomyces rufus (Brown-beret lichen)
Baeomyces sp.
Cladonia macilenta (Lipstick powderhorn or pin lichen)
Cladonia sp
Hypogymnia physodes (Hooded bone; monk's-hood lichen; hooded tube lichen).
Hypogymnia sp
Icmadophila ericetorum (Candy lichen)
Lecidea sp

Lepraria sp. (Dust lichen)
Lichenomphalia umbellifera. Cook August 1st 2016
Lobaria linita (Cabbage lungwort)
Parmelia hygrophila
Parmelia saxatilis (Salted shield lichen)
Parmelia sp.
Parmeliopsis hyperopta (Gray starburst lichen)
Peltigera sp
Pilophorus clavatus (Tapered matchstick lichen)
Platismatia glauca (Ragbag)
Platismatia herrei = Cetraria herrei (Tattered rag; Herre's ragged lichen; tattered rag)
Porpidia crustullata (Concentric boulder lichen)
Sphaerophorus globosus (Common Christmas tree)
Thelotrema lepadinum (Bark barnacle; Barnacle lichen)
Usnea filipendula (Fishbone beard lichen)
Usnea subfloridana (Old man's beard)

Fungi: M = Mycorrhizal; D = Decomposer (saprobic); P = Pathogen (parasitic).

Amanita constricta (Constricted grisette) M.
Armillaria ostoyae or A mellea group (Honey mushroom). Rhizomorphs. P and D.
Bisporella citrina (Yellow fairy cups; lemon drops). D.
Calocera cornea. D.
Calocera viscosa (Staghorn jelly fungus). D.
Chalciporus (Boletus) piperatus (Peppery bolete). M.
Chroogomphus tomentosus (Woolly pine spike). M.
Clavulina ?cristata. M.
Coltricia perennis (Ground funnel). D.
Cordyceps capitata (Truffle eater). P.
Cortinarius violaceus (Violet cort). M.
Dacrymyces stillatus (Common jelly spot). D.
Elaphomyces granulatus (Common deer truffle). M.
Entoloma sp. M mostly, some D.
Exobasidium vaccinii (Leaf gall fungus). P.
Fomitopsis mounceae formerly *F. pinicola* (Red-belted conk). D.
Galerina sp. D.
Ganoderma applanatum (Artist's conk). D.
Ganoderma oregonense (Purple reishi; varnish shelf; *cf.* ling chih or ling zhi). D.
Haematostereum sanquinolentum (Bleeding stereum). D.
Heterobasidion annosum (Annosus root rot). P.
Hydnum umbilicatum (The sweet tooth). M.
Hygrocybe miniata (Miniature or Vermillion waxy cap). M (with mosses).
Hypholoma capnoides = Naematoloma capnoides (Smoky-gilled woodlover). D.
Hypholoma fasciculare = Naematoloma fasciculare (Sulphur top, sulphur tuft). D.

Inocybe sp. M (mostly).
Lactarius deliciosus (Delicious milk cap). M.
Lactarius scrobiculatus (Scrobiculate milk cap). M.
Laetiporus conifericola (Chicken-of-the-woods; sulphur shelf). D.
Lycoperdon pyriforme (Pear-shaped puffball). D.
Marasmius sp. D.
Mycena sp. D.
Naohidemyces vaccinii = Pucciniastrum vaccinii (Hemlock-blueberry rust). P.
Nidula candida (Jellied bird's nest fungus). D.
Paxillus involutus (Poison pax; inrolled pax). M.
Peziza sp. D.
Phellinus (Porodaedalia) pini (Pine conk). P.
Pleurotus porrigens (Angel wings). D.
Psathyrella sp. D.
Pucciniastrum goeppertianum (Fir-blueberry rust). P.
Pycnoporus cinnabarinus (Cinnabar polypore). D.
Rhytisma arbuti (Speckled tarspot) on false azalea. P.
Russula crasotunicata (Thick-shirted russula; rubber skin russula). M.
Russula sp. M.
Sarea resinae. D (feeds on resin).
Scutellinia scutellata (Eyelash pixy cup). D.
Stereum sp. D.
Suillus sp. M.
Tapinella atrotomentosa formerly *Paxillus atrotomentosus* (velvet pax). M.
Trichaptum abietinum (Violet-pored bracket fungus). D.
Truffle with smooth peridium & no odor. Not *Elaphomyces granulatus.*
Truncocolumella citrina (False truffle). M.
Xeromphalina campanella. D.

Amphibians

Ascaphus truei (Coastal tailed frog). Blue listed. Cook 2020.

List 2: Species list from a second-growth forest adjoining the study area to the east: East side of Brothers Creek 380 metres to ~640 metres. A heavily logged area used for biodiversity comparison with the study area.

Conifers

Abies amabilis (Amabilis fir)
Thuja plicata (Western redcedar)
Tsuga heterophylla (Western hemlock)

Flowering plants

- **Flowering shrubs**
  Menziesia ferruginea (False azalea)
  Oplopanax horridus (Devil's club)
  Rubus spectabilis (Salmonberry)
  Sambucus racemosa (Red elderberry)
  Vaccinium parvifolium (Red huckleberry). Including one plant with variegated leaves.

- **Dicot herbs**
  Arceuthobium campylopodum (Western dwarf mistletoe)
  Cornus canadensis (Bunchberry)
  Geum macrophyllum (Large-leaved avens)
  Lactuca muralis (Wall lettuce). Exotic.
  Lysichiton americanum (Skunk cabbage)
  Rubus pedatus (Five-leaved bramble; creeping raspberry)
  Tiarella trifoliata var *trifoliata* (Three-leaved foamflower)
  Viola glabella (Stream violet)
  Viola sempervirens (evergreen violet; trailing yellow violet)

- **Monocot herbs**
  Carex laeviculmis (Smooth sedge).
  Carex mertensii (Mertens' sedge)
  Clintonia uniflora (Queen's cup)
  Luzula fastigiata (Forked wood rush)
  Maianthemum racemosum (False Solomon's seal)
  Maianthemum stellatum (Star-flowered Solomon's-seal)
  Streptopus amplexifolius (Clasping twisted-stalk)

Ferns & allies

Athyrium filix-femina (Lady fern)
Blechnum spicant (Deer fern)
Dryopteris expansa (Spiny wood fern)
Gymnocarpium dryopteris (Oak fern)

Mosses

Buckiella undulata = Plagiothecium undulatum (Wavy-leaved cotton moss)
Dichodontium pellucidum
Dicranum fuscescens (Curly heron's-bill moss)
Hypnum circinale (Coiled leaf moss)
Isothecium myosuroides (Cat-tail moss)
Kindbergia oregana (Oregon beaked moss)

Kindbergia praelonga (Slender beaked moss)
Leucolepis acanthoneuron (Tree moss)
Pogonatum contortum
Pohlia sp.
Polytrichum juniperinum (Juniper hair-cap moss)
Plagiomnium insigne (Badge moss)
Pseudotaxiphyllum elegans (Small flat moss)
Racomitrium heterostichum (Bristly fringe moss)
Rhizomnium glabrescens (Fan or large leafy moss)
Rhytidiadelphus loreus (Lanky moss)
Sphagnum girgensohnii
Sphagnum squarrosum

Liverworts

Bazzania denudata (Naked bazzania)
Calypogeia muelleriana
Cephalozia bicuspidata
Lepidozia reptans (Little hands liverwort)
Pellia neesiana (Ring pellia)
Ptilidium californicum (Pacific fuzz wort)

Lichens

Baeomyces rufus (Brown beret lichen)
Cladonia macilenta (Lipstick powderhorn or pin lichen)
Cladonia sp
Lecidea sp
Lepraria sp. (Dust lichen)
Lobaria linita
Parmeliopsis hyperopta (Gray starburst lichen)
Platismatia glauca (Ragbag)
Platismatia herrei = Cetraria herrei (Herre's ragged lichen; tattered rag)
Porpidia crustullata (Concentric boulder lichen)
Thelotrema lepadinum (Bark barnacle)

Fungi

Fomitopsis mounceae formerly *F. pinicola* (Red-belted conk). D.
Nidula candida (Jellied bird's nest fungus). D.
Trichaptum abietinus (Violet-pored bracket fungus). D.

<u>Appendix 3</u>:

First-growth veteran trees and snags giving tag number, date surveyed, species, circumference and diameter at breast height, coordinates, elevation, whether living or snag (St = Status) and additional notes.

First-growth veteran trees									
Tag	**Date**	**Sp**	**CBH (m)**	**DBH (m)**	**Lat**	**Long**	**Elev (m)**	**St**	**Notes**
OGCS 001	20170907	Cw	8.05	2.56	49.36184728	-123.1588322	586	L	
OGCS 002	..	Cw	6.20	1.97	49.36165826	-123.1589143	605	L	Many Tws in area
OGCS 003	..	Cw	7.93	2.52	49.36158643	-123.1588038	602	L	
OGCS 004	..	Fd	7.93	2.52	49.36153195	-123.1592031	604	L	
OGCS 005	..	Cw	8.30	2.64	49.36188265	-123.1592731	611	L	
OGCS 006	..	Cw	6.10	1.94	49.36290742	-123.1597309	630	L	East bank Lawson Cr. Two unmeasured Cws nearby
OGCS 007	..	Cw	8.50	2.71	49.36300649	-123.1596348	639	L	
OGCS 009	..	Cw	8.37	2.66	49.36284548	-123.1654324	686	L	
OGCS 011	..	Fd	9.37	2.98	49.36275428	-123.1662722	691	L	Hollyburn fir
OGCS 012	20171008	Cw	6.62	2.11	49.36342944	-123.1595122	642	?S	
OGCS 013	..	Cw	4.00	1.27	49.36385248	-123.1593207	638	L	
OGCS 014	..	Cw	7.25	2.31	49.36438238	-123.1599147	642	L	S side Crossover Tr
OGCS 015	..	Cw	5.17	1.65	49.36458874	-123.1602459	640	L	N side crossover Tr
OGCS 016	..	Cw	5.66	1.80	49.36458816	-123.1606728	648	?S	
OGCS 017	..	Cw	5.63	1.79	49.36462437	-123.1605077	651	?S	
OGCS 018	..	Cw	4.77	1.52	49.36442647	-123.1605070	645	L	
OGCS 019	..	Cw	5.48	1.74	49.36407552	-123.1606574	643	L	
OGCS 020	..	Cw	6.16	1.96	49.36446327	-123.1599700	641	L	
OGCS 021	..	Cw	4.62	1.47	49.36464356	-123.1596538	645	S	
OGCS 022	..	Cw	6.32	2.01	49.36489502	-123.1599852	654	S	
OGCS 023	..	Cw	4.10	1.31	49.36451867	-123.1588822	637	?S	S side Crossover Tr
OGCS 024	..	Cw	5.14	1.64	49.36486099	-123.1585665	647	?S	N side Crossover Tr
OGCS 025	..	Cw	7.85	2.50	49.36436780	-123.1574218	636	L	
OGCS 026	..	Cw	4.72	1.50	49.36364863	-123.1571165	637	L	
OGCS 027	..	Cw	6.48	2.06	49.36418893	-123.1566499	644	S	S side Crossover Tr
OGCS 028	..	Cw	5.75	1.83	49.36403621	-123.1564842	644	S	
OGCS 029	..	Cw	5.56	1.77	49.36418951	-123.1561955	646	S	
OGCS 030	..	Cw	6.95	2.21	49.36392875	-123.1561533	639	S	
OGCS 031	..	Cw	6.80	2.16	49.36388425	-123.1557951	637	L	
OGCS 032	..	Cw	7.50	2.39	49.36369414	-123.1567035	637	L	
OGCS 034	20180606	Cw	6.53	2.08	49.36277004	-123.1507800	577	S	N side Crossover Tr
OGCS 035	..	Cw	8.08	2.57	49.36353665	-123.1541183	612	L	
OGCS 036	..	Cw	7.80	2.48	49.36357168	-123.1542750	612	S	S side Crossover Tr
OGCS 037	..	Cw	7.20	2.29	49.36339499	-123.1544200	606	S	
OGCS 038	..	Cw	4.32	1.38	49.36320665	-123.1547133	606	?L	
OGCS 039	..	Cw	7.58	2.41	49.36291496	-123.1546266	599	S	
OGCS 040	..	Cw	5.43	1.73	49.36298336	-123.1546450	599	L	
OGCS 041	..	Cw	4.80	1.53	49.36285503	-123.1545017	599	L	
OGCS 042	..	Cw	4.77	1.52	49.36314999	-123.1549400	599	S	
OGCS 043	..	Cw	4.82	1.53	49.36366003	-123.1538533	617	L	N side Crossover Trail
OGCS 044	..	Cw	5.62	1.79	49.36398500	-123.1544483	624	?S	
OGCS 045	..	Cw	8.98	2.86	49.36422665	-123.1544833	624	L	
OGCS 046	..	Cw	5.48	1.74	49.36428004	-123.1547333	624	L	S side Crossover Trail
OGCS 047	..	Cw	4.37	1.39	49.36409832	-123.1548483	624	L	N side Crossover Tr. E of Bros Cr. Skunk cabbage wetland
OGCS 048	20180618	Cw	6.23	1.98	49.36433829	-123.1544483	628	S	

OGCS 033	..	Tw	0.70	0.22	49.36158132	-123.1559255	568	L	W side Bros Cr. Other Tws in area.
OGCS 049	..	Cw	6.00	1.91	49.36624811	-123.1504172	653	L	Photo of skunk cabbage wetland in excellent OG forest with fir clubmoss.
OGCS 050	..	Yc	4.33	1.38	49.36738101	-123.1507375	655	L	W side of Bros Cr trail
OGCS 051	..	Cw	4.48	1.43	49.36765124	-123.1504904	657	L	E side Bros Cr trail
OGCS 052	..	Cw	4.27	1.36	49.36793002	-123.1505463	659	L	
OGCS 053	..	Cw?	7.10	2.26	49.36785802	-123.1505461	659	S	
OGCS 054	..	Cw?	5.64	1.80	49.36791175	-123.1507115	651	L	
OGCS 055	..	Cw	4.60	1.46	49.36771603	-123.1490581	676	L	
OGCS 056	20180720	Cw	6.10	1.94	49.36640980	-123.1505555	655	?L	W side Bros Cr FAR
OGCS 057	..	Cw	8.50	2.71	49.36807436	-123.1502162	663	L	Bros Cr FAR
OGCS 058	..	Cw	9.20	2.93	49.36942401	-123.1498898	670	L	
OGCS 059	..	Cw	5.62	1.79	49.36927951	-123.1503576	675	L	
OGCS 060	..	Cw	4.24	1.35	49.36912620	-123.1506601	672	L	Numerous unmapped veterans in area. Capilano watershed area
OGCS 061	..	Cw	7.80	2.48	49.36908153	-123.1504259	670	S	
OGCS 062	..	Cw	7.65	2.44	49.36975569	-123.1507723	678	L	Capilano watershed area
OGCS 063	..	Cw	7.43	2.37	49.36990933	-123.1502080	677	L	
OGCS 064	..	Cw	6.00	1.91	49.37009800	-123.1504014	681	L	
OGCS 065	..	Cw	4.65	1.48	49.36998979	-123.1505664	681	L	
OGCS 066	..	Cw	4.80	1.53	49.37023245	-123.1507875	686	L	
OGCS 067	..	Cw	5.33	1.70	49.37029506	-123.1510081	689	L	
OGCS 068	20181030	Cw	7.15	2.28	49.37031669	-123.1512000	698	L	
OGCS 069	..	Cw	6.86	2.18	49.37031669	-123.1512833	703	L	
OGCS 070	..	Cw	4.74	1.51	49.37031669	-123.1514000	697	L	
OGCS 071	..	Cw	5.81	1.85	49.37016665	-123.1514667	710	L	
OGCS 072	..	Cw	3.57	1.14	49.37006665	-123.1514000	708	L	
OGCS 073	..	Cw	3.72	1.18	49.37011669	-123.1513833	709	L	
OGCS 074	..	Cw	4.50	1.43	49.37021669	-123.1515334	712	L	
OGCS 075	..	Cw	5.47	1.74	49.37000002	-123.1513167	689	L	
OGCS 076	..	Cw	5.10	1.62	49.37003329	-123.1510833	696	L	Tw nearby
OGCS 077	..	Cw	5.10	1.62	49.36986666	-123.1512500	703	L	
OGCS 078	..	Cw	6.04	1.92	49.36960003	-123.1512500	704	L	
OGCS 079	..	Cw	4.68	1.49	49.36958335	-123.1511833	696	S	
OGCS 080	..	Cw	4.65	1.48	49.36953331	-123.1512500	696	L	Twinned
OGCS 081	..	Cw	6.30	2.01	49.36945000	-123.1512500	691	L	
OGCS 082	..	Cw	3.55	1.13	49.36945000	-123.1513000	686	L	
OGCS 083	..	Cw	3.92	1.25	49.36940004	-123.1514167	686	L	
OGCS 084	..	Cw	4.47	1.42	49.36943332	-123.1513167	691	L	
OGCS 085	..	Cw	3.50	1.11	49.36958335	-123.1514167	694	L	
OGCS 086	..	Cw	6.45	2.05	49.36964999	-123.1515500	695	L	
OGCS 087	..	Cw	6.30	2.01	49.36953331	-123.1516666	691	L	
OGCS 088	..	Cw	4.90	1.56	49.36971663	-123.1518167	697	L	
OGCS 089	20181106	Cw	8.40	2.67	49.36541595	-123.1789248	832	L	N side WLFAR
OGCS 090	..	Cw	6.31	2.01	49.36588434	-123.1784995	821	L	
OGCS 091	..	Cw	7.01	2.23	49.36601417	-123.1759520	804	L	S side WLFAR
OGCS 092	..	Cw	6.00	1.91	49.36638432	-123.1750718	800	L	N side WLFAR
OGCS 093	20190818	Cw	7.55	2.40	49.37040294	-123.1510497	700	L	
OGCS 094	..	Cw	10.30	3.28	49.37094281	-123.1509412	712	S	
OGCS 095	..	Cw	5.40	1.72	49.37087056	-123.1511751	712	L	
OGCS 096	..	Cw	7.75	2.47	49.37094248	-123.1512167	716	L	
OGCS 097	..	Cw	7.00	2.23	49.37077140	-123.1513539	710	L	
OGCS 098	..	Cw	5.10	1.62	49.37089730	-123.1513681	720	L	

OGCS 099	..	Cw	4.70	1.50	49.37034803	-123.1517659	704	L	
OGCS A001	..	Cw	8.90	2.83	49.37033026	-123.1516281	713	S	
OGCS A002	..	Cw	7.57	2.41	49.37039346	-123.1514630	712	L	
OGCS A003	..	Cw	8.70	2.77	49.37036673	-123.1512563	711	S	
OGCS A005	..	Cw	7.80	2.48	49.37030328	-123.1516004	709	S	
OGCS A006	..	Cw	5.10	1.62	49.37032146	-123.1514490	704	L	
OGCS A004	20190906	Cw	8.25	2.63	49.36518252	-123.1786072	871	L	
OGCS A007	..	Cw	8.00	2.55	49.36529014	-123.1788417	869	L	
OGCS A008	..	Cw	7.00	2.23	49.36515553	-123.1786346	860	L	
OGCS A009	..	Cw	7.00	2.23	49.36518252	-123.1786072	864	L	
OGCS A010	..	Cw	8.40	2.67	49.36505704	-123.1783450	865	S	
OGCS A011	..	Cw	6.50	2.07	49.36498513	-123.1782759	861	S	
OGCS A012	..	Cw	7.05	2.24	49.36491254	-123.1786751	864	L	
OGCS A013	..	Cw	6.70	2.13	49.36478689	-123.1784955	859	L	
OGCS A014	..	Cw	8.30	2.64	49.36414844	-123.1783693	848	L	
OGCS A015	..	Cw	9.70	3.09	49.36432832	-123.1783837	839	L	
OGCS A016	..	Cw	7.30	2.32	49.36405825	-123.1785204	842	S	
OGCS A017	..	Cw	8.80	2.80	49.36414828	-123.1785208	832	S	
OGCS A018	..	Cw	7.25	2.31	49.36401308	-123.1786718	843	S	
OGCS A020	..	Cw	7.52	2.39	49.36385105	-123.1787539	842	S	
OGCS A019	20191001	Yc	4.72	1.50	49.37372376	-123.1631133	807	L	
OGCS A021	..	Ba	3.40	1.08	49.37279119	-123.1610440	800	L	
OGCS A022	..	Ba	3.18	1.01	49.37288105	-123.1610994	803	L	
OGCS A023	..	?Cw	3.28	1.04	49.37265675	-123.1606578	793	S	
OGCS A024	..	Cw	5.28	1.68	49.37274694	-123.1605066	784	L	
OGCS A025	..	?Ba	5.17	1.65	49.37221594	-123.1606977	780	L	
OGCS A026	..	Yc	4.88	1.55	49.37206322	-123.1605595	770	L	
OGCS A027	..	Cw	5.20	1.66	49.37205417	-123.1606007	771	L	
OGCS A028	..	Cw	4.31	1.37	49.37211745	-123.1604081	773	L	
OGCS A029	..	Cw	6.65	2.12	49.37199114	-123.1606832	764	L	
OGCS A030	..	Cw	4.95	1.58	49.37212718	-123.1598296	768	L	
OGCS A031	..	Cw	5.08	1.62	49.37195619	-123.1599117	770	L	
OGCS A032	..	Yc	5.00	1.59	49.37192945	-123.1597188	758	L	
OGCS A033	..	?Cw	6.09	1.94	49.37176743	-123.1598422	751	S	
OGCS A034	..	?Cw	4.25	1.35	49.37183934	-123.1598563	748	S	
OGCS A035	..	Cw	4.20	1.34	49.37182208	-123.1593327	749	L	
OGCS A036	20191113	Cw	10.20	3.25	49.37125152	-123.1555704	727	L	
OGCS A037	..	Cw	5.53	1.76	49.37036966	-123.1558018	719	L	
OGCS A038	..	Cw	6.43	2.05	49.37030696	-123.1556363	715	L	
OGCS A039	..	Cw	5.95	1.89	49.37022641	-123.1553055	711	L	
OGCS A040	..	Cw	9.75	3.10	49.37021786	-123.1549611	716	L	
OGCS A041	..	Cw	7.12	2.27	49.37010161	-123.1544511	706	L	
OGCS A042	..	Cw	8.09	2.58	49.37020990	-123.1542310	714	S	
OGCS A043	..	Cw	7.61	2.42	49.36964303	-123.1543395	705	L	
OGCS A044	..	Cw	5.44	1.73	49.36881490	-123.1547638	676	L	
OGCS A045	..	Cw	6.71	2.14	49.36981419	-123.1541885	672	L	
OGCS A046	20191122	Cw			49.36951328	-123.1571765	693	L	Difficult access
OGCS A047	..	Cw	6.97	2.22	49.36917038	-123.1579881	699	L	
OGCS A048	..	Cw	5.58	1.78	49.36872949	-123.1580556	705	L	
OGCS A049	..	Cw	6.82	2.17	49.36910718	-123.1581807	705	L	
OGCS A050	..	Cw	6.60	2.10	49.36887391	-123.1577117	711	L	
OGCS A051	..	Cw	7.99	2.54	49.36905412	-123.1574781	721	L	
OGCS A052	..	Cw	6.36	2.02	49.36927054	-123.1571207	718	L	
OGCS A053	..	Cw	4.57	1.45	49.36930633	-123.1572310	713	L	
OGCS A054	..	Cw	7.09	2.26	49.36908119	-123.1574506	711	L	
OGCS A055	..	Cw	6.71	2.14	49.36873066	-123.1572291	710	L	
OGCS A056	..	Cw	5.66	1.80	49.36855087	-123.1571596	702	L	
OGCS A057	..	Cw	4.98	1.59	49.36868557	-123.1573253	704	L	
OGCS A058	..	Cw	5.88	1.87	49.36860418	-123.1576282	706	L	
OGCS A059	..	Cw			49.36855908	-123.1576968	702	L	Not measured due to fusing of adjacent trees
OGCS A060	..	Cw	4.93	1.57	49.36847795	-123.1578757	695	L	
OGCS A061	..	Cw	6.60	2.10	49.36856772	-123.1579586	689	L	

OGCS A062	..	Cw	6.73	2.14	49.36856789	-123.1578484	703	L	
OGCS A063	..	Cw	4.97	1.58	49.36879302	-123.1576838	707	L	
OGCS A064	..	Cw	8.46	2.69	49.36868456	-123.1580692	706	L	
OGCS A065	..	Cw	7.13	2.27	49.36850443	-123.1582201	704	L	
OGCS A066	..	Cw	7.45	2.37	49.36851332	-123.1582753	706	L	
OGCS No Tag	..	Cw			49.36996615	-123.1571447	682	L	Inaccessible. Coordinates & elevation estimated
OGCS A067	20200606	Cw	7.10	2.26	49.36448330	-123.1556500	640	L	
OGCS A068	..	Cw	7.73	2.46	49.36456670	-123.1556000	660	L	
OGCS A069	..	Cw	6.16	1.96	49.36621668	-123.1560666	670	S	
OGCS A070	..	Cw			49.36668330	-123.1560167	668	L	Difficult access
OGCS A071	..	Cw	5.50	1.75	49.36668330	-123.1559334	677	L	
OGCS A072	..	Cw	5.95	1.89	49.36681665	-123.1561500	676	L	
OGCS A073	..	Cw	5.45	1.73	49.36688337	-123.1564500	676	L	
OGCS A074	..	Cw	5.85	1.86	49.36703333	-123.1566167	682	L	
OGCS A075	..	Cw	5.03	1.60	49.36718336	-123.1566833	686	L	
OGCS A076	..	Cw	6.80	2.16	49.36723332	-123.1566667	682	L	
OGCS A077	..	Cw	6.35	2.02	49.36768334	-123.1574000	692	L	
OGCS A078	..	Cw	7.50	2.39	49.36725000	-123.1577667	710	L	
OGCS A079	..	Cw	5.77	1.84	49.36721664	-123.1579666	694	L	
OGCS A080	..	Cw	6.84	2.18	49.36728336	-123.1580334	689	L	
OGCS A081	..	Cw	6.53	2.08	49.36718336	-123.1579167	682	L	
OGCS A082	..	Cw	7.99	2.54	49.36740004	-123.1585333	684	L	
OGCS A083	..	Cw	7.86	2.50	49.36709996	-123.1584833	698	L	
OGCS A084	..	Cw	7.19	2.29	49.36726668	-123.1589333	702	L	
OGCS A085	..	Cw	7.23	2.30	49.36709996	-123.1587667	701	L	
OGCS A086	..	Cw	7.64	2.43	49.36746667	-123.1592166	703	L	
OGCS A087	..	Cw	6.65	2.12	49.36753331	-123.1591166	710	S	
OGCS A088	..	Cw	7.60	2.42	49.36768334	-123.1593000	709	L	
OGCS A089	20200617	Cw	5.53	1.76	4936608332	-123.1558833	655	L	
OGCS A090	..	Hw	3.31	1.05	49.36621668	-123.1557334	657	L	
OGCS A091	..	Cw	4.65	1.48	49.36580001	-123.1555333	659	L	
OGCS A092	..	Hw	3.64	1.16	49.36613336	-123.1555167	661	L	
OGCS A093	..	Fd	5.65	1.80	49.36343330	-123.1554667	628	L	W side Bros Cr A096 Difficult access
OGCS A094	..	Fd	4.14	1.32	49.36281664	-123.1556333	618	L	
OGCS A095	..	Fd	3.19	1.02	49.36279996	-123.1555500	623	L	
OGCS A096	..	Fd			49.36246670	-123.1555167	620	S	
OGCS A097	..	Fd	5.37	1.71	49.36146665	-123.1561167	587	L	
OGCS A098	..	Cw	7.34	2.34	49.36158333	-123.1564167	596	S	
OGCS A099	..	Fd	3.35	1.07	49.36138334	-123.1552834	596	S	W side Bros Cr
OGCS A100	..	Fd	5.63	1.79	49.36103331	-123.1549667	583	L	
OGCS B001	20200810	Cw	10.06	3.20	49.36505905	-123.1770366	850	L	Lifeline
OGCS B003	..	Cw	7.56	2.41	49.36505905	-123.1770366	844	S	
OGCS B005	..	Cw	7.63	2.43	49.36516601	-123.1776567	853	L	
OGCS B006	..	Cw	6.80	2.16	49.36489586	-123.1778624	845	S	CBH estimated due to adjoining stump
OGCS B007	..	Cw	6.75	2.15	49.36525536	-123.1780289	865	S	
OGCS B008	..	Cw	4.81	1.53	49.36532719	-123.1781256	861	L	
OGCS B009	..	Cw	5.71	1.82	49.36482352	-123.1781100	855	L	
OGCS B010	..	Cw	8.40	2.67	49.36448975	-123.1786873	847	Sf	Sasha's fallen giant (see image 1)
OGCS B011	..	Cw	6.11	1.94	49.36448196	-123.1779435	846	S	
OGCS B012	.	Cw	9.13	2.91	49.36434793	-123.1773232	839	S	
OGCS B013		Cw	8.52	2.71	49.36426638	-123.1777500	818	S	
OGCS B014	.	Cw	7.52	2.39	49.36401408	-123.1780245	834	S	
OGCS B017	..	Cw	5.53	1.76	49.36393353	-123.1777763	828	L	
OGCS B021	..	Cw	6.78	2.16	49.36459176	-123.1767181	838	L	
OGCS B022	..	Cw	5.55	1.77	49.36482570	-123.1766777	832	L	
OGCS B023	..	Cw	4.54	1.45	49.36471724	-123.1770078	833	L	
OGCS B024	..	Cw	6.01	1.91	49.36475328	-123.1769667	836	L	

OGCS B025	..	Cw	6.17	1.96	49.36489728	-123.1768983	832	L	
OGCS B026	..	Cw	7.98	2.54	49.36497867	-123.1766231	841	L	
OGCS B027	..	Cw	8.76	2.79	49.36519451	-123.1766790	846	L	
OGCS B028	..	Cw	5.48	1.74	49.36490675	-123.1766091	845	L	
OGCS B029	20200621	Cw	5.15	1.64	49.37203330	-123.1710500	838	L	
OGCS B031	20200825	Cw	6.47	2.06	49.37184127	-123.1710827	820	L	
OGCS B032	..	Yc	1.98	0.63	49.36966508	-123.1706344	800	L	N side WLFAR
OGCS B033	..	Yc	2.12	0.67	49.37131019	-123.1713426	821	L	
OGCS B034	..	Yc	3.49	1.11	49.37103116	-123.171438	823	L	Other Ycs in area
OGCS B035	..	Yc	3.00	0.95	49.37108514	-123.1714658	840	L	
OGCS B036	..	Yc	4.84	1.54	49.36651952	-123.1748657	806	L	
OGCS B037	..	Yc	5.37	1.71	49.3666631	-123.1750728	815	S	
OGCS B038	..	Cw	5.42	1.73	49.36630335	-123.1750715	809	L	
OGCS B039	..	Cw	6.67	2.12	49.36606932	-123.1751533	810	L	
OGCS B040	..	Hw	4.48	1.43	49.36599732	-123.1751806	798	L	
OGCS B041	..	Cw	8.28	2.64	49.36577252	-123.1751385	803	S	
OGCS B~~100~~ 030	20200617	Fd	4.46	1.42	49.36110003	-123.1554167	575	L	
OGCS B042	20200909	Cw			49.36538779	-123.1613779	669	L	On edge of bluff. Unable to measure
OGCS B043	..	Cw	6.15	1.96	49.36623336	-123.1613118	689	S	
OGCS B044	..	Cw	6.68	2.13	49.36619757	-123.1612152	685	S	
OGCS B045	..	Cw	4.56	1.42	49.36592826	-123.160815	676	S	
OGCS B046	..	Cw	4.60	1.46	49.36615323	-123.1607606	675	S	CBH estimated due to fused live tree
OGCS B047	..	Cw	5.35	1.70	49.36646814	-123.1606928	688	S	
OGCS B048	..	Cw	5.51	1.75	49.36632497	-123.1601138	685	L	Lifeline
OGCS B049	..	Cw	7.57	2.41	49.3662984	-123.1598521	693	L	
OGCS B050	..	Cw	5.73	1.82	49.36642447	-123.159756	696	S	
OGCS B051	..	Cw	6.12	1.95	49.36659579	-123.159426	693	S	
OGCS B052	..	Cw	5.64	1.80	49.36634408	-123.1593564	677	S	
OGCS B053	..	Cw	<5.85	<1.86	49.36626311	-123.1593285	675	S	Hw fused to a Cw. CBH estimated
OGCS B054	..	Cw	8.09	2.58	49.36640745	-123.1590398	677	L	Might be two trees
OGCS B055	..	Cw	7.11	2.26	49.36620796	-123.1602098	682	S	
OGCS B056	..	Cw	6.71	2.13	49.36252286	-123.1513837	591	S	Burnt interior
OGCS B057	20201003	Yc	4.67	1.49	49.37293913	-123.170783	844	L	Transition zone between Hw and Hm BGC zone. All Ycs are CMTs. Tw sapling near B057. South of WLFAR.
OGCS B058	..	Yc	3.96	1.26	49.37298414	-123.170756	849	L	
OGCS B059	..	Yc	4.51	1.44	49.37284039	-123.1706315	848	L	
OGCS B060	..	Yc	3.86	1.23	49.37284006	-123.1706315	845	L	
OGCS B061	..	Yc	4.20	1.34	49.37272313	-123.1708378	846	L	
OGCS B062	..	Yc	4.22	1.34	49.37258843	-123.170672	837	L	
OGCS B063	..	Yc	4.10	1.31	49.37258835	-123.1707409	841	L	
OGCS B064	..	Hw	4.39	1.40	49.37249841	-123.1707268	832	L	Giant tree. Reiteration. Not dwarf mistletoe. South of WLFAR.
OGCS B065	..	Cw	4.86	1.55	49.3722379	-123.1705055	827	L	South of WLFAR.
OGCS B066	..	Hw	4.93	1.25	49.37239104	-123.1703408	830	L	Reiteration. Not dwarf mistletoe. South of WLFAR.
OGCS B067	..	Yc	4.58	1.44	49.37259782	-123.1704103	832	L	South of WLFAR.
OGCS B068	..	Yc	4.17	1.33	49.37260704	-123.1702589	840	L	All CMTs B069 has bear claw marks.
OGCS B069	..	Yc	4.89	1.56	49.37266965	-123.1704932	844	L	
OGCS B070	..	Yc	3.57	1.14	49.3727238	-123.170397	834	L	
OGCS B071	..	Yc	4.72	1.50	49.37284039	-123.170604	839	L	

									South of WLFAR
OGCS B072	..	Yc	6.04	1.92	49.37311993	-123.1701642	838	L	No CM. South of WLFAR
OGCS B073	..	Yc	4.32	1.38	49.37349904	-123.1692426	827	L	CMT. Other smaller CMTs in area. South of WLFAR.
OGCS B074	..	Yc	3.86	1.23	49.37198209	-123.1670196	805	L	All CMTs. Two small Ycs with CM in area. Not measured. South of WLFAR.
OGCS B075	..	Yc	4.10	1.31	49.37128077	-123.1668381	782	L	
OGCS B076	..	Yc	4.50	1.43	49.37087702	-123.1661481	777	L	
OGCS B077	..	Yc	3.35	1.07	49.37084994	-123.1661617	783	L	
OGCS B078	..	Yc	3.02	0.96	49.37076906	-123.1661339	785	L	No CM. South of WLFAR.
OGCS B079	..	Yc	3.69	1.17	49.37085883	-123.1662582	783	L	
OGCS B080	..	Yc	3.96	1.26	49.37125445	-123.1663973	796	L	
OGCS B081	..	Hw	3.58	1.14	49.36581376	-123.1775902	822	L	Reiteration. Not dwarf mistletoe. South of WLFAR.
OGCS B082	20201015	Cw	10.69	3.40	49.36578895	-123.1761715	821	L	Giant tree (see image 3). Found by Sasha. Lifeline. South side WLFAR.
OGCS B083	..	Cw	7.75	2.47	49.36607762	-123.175594	804	L	
OGCS B084	..	Yc	3.84	1.22	49.37000421	-123.1663517	748	L	Yc close by
OGCS B085	..	Yc	3.46	1.10	49.36854098	-123.1642532	747	L	CMT
OGCS B086	..	Cw	4.71	1.50	49.36749827	-123.1637539	725	L	Candelabra
OGCS B087	..	Cw	4.60	1.46	49.36736374	-123.1634504	718	S	
OGCS B088	..	Cw	4.94	1.57	49.36759802	-123.1631757	715	L	Candelabra
OGCS B089	..	Cw	5.52	1.76	49.36774218	-123.1630385	715	L	
OGCS B090	..	Yc	4.24	1.35	49.36783204	-123.1630939	724	L	No CM
OGCS B091	..	Cw	4.75	1.51	49.36793983	-123.1632043	726	L	
OGCS B092	..	?Cw	5.67	1.80	49.36793991	-123.1631217	728	S	
OGCS B093	..	Cw	7.30	2.32	49.36797629	-123.1628326	726	L	
OGCS B094	..	Cw	5.09	1.62	49.36789524	-123.162915	725	L	
OGCS B095	..	Cw	5.84	1.86	49.36783221	-123.1629699	729	L	
OGCS B096	..	Cw	3.51	1.12	49.36770631	-123.1629143	734	L	
OGCS B097	..	Hw	4.16	1.32	49.36784151	-123.1627495	732	L	Reiteration. Not dwarf mistletoe. East side Lawson Cr.
OGCS B098	..	Cw	7.63	2.43	49.36791368	-123.162612	726	L	East side Lawson Cr.
OGCS B099	..	Cw	10.65	3.39	49.36809389	-123.1623647	731	L	Giant tree (see image 2). Much devil's club. East side Lawson Cr.
OGCS C001	20201021	Cw	5.38	1.71	49.36609883	-123.1610772	678	L	Split top
OGCS C002	..	Cw	6.21	1.98	49.36669285	-123.1607761	688	L	
OGCS C003	..	Cw	5.26	1.67	49.36675605	-123.1606111	693	S	
OGCS C004	..	Cw	5.40	1.72	49.36674725	-123.1604871	694	L	
OGCS C005	..	Cw	8.97	2.86	49.36691833	-123.1603912	690	S	Twin snags. Circ. Includes both snags
OGCS C006	..	Cw	5.43	1.73	49.36687298	-123.160639	706	L	Candelabra top
OGCS C007	..	Cw	4.62	1.47	49.36691816	-123.1605014	695	L	Candelabra top
OGCS C008	..	Cw	5.28	1.68	49.36707113	-123.1604743	688	L	
OGCS C009	..	Cw	5.85	1.86	49.3669547	-123.1600883	698	L	Candelabra top
OGCS C010	..	Cw	7.03	2.24	49.3670179	-123.159937	690	S	Fir club moss
OGCS C011	..	Cw	7.01	2.23	49.36718873	-123.1599789	695	L	
OGCS C012	..	Cw	7.43	2.37	49.36723374	-123.1599652	699	L	Spiral grain
OGCS C013	..	Cw	4.50	1.43	49.36718923	-123.1596208	702	L	

OGCS C014	..	Cw	5.92	1.88	49.36717129	-123.1595932	698	S	
OGCS C015	..	Cw	4.44	1.41	49.36705462	-123.1593862	696	L	
OGCS C016	..	Cw	4.92	1.57	49.36702738	-123.1595652	694	S	
OGCS C017	..	Cw	4.62	1.47	49.3671174	-123.1594966	701	L	
OGCS C018	..	Cw	4.73	1.51	49.36709996	-123.1591246	697	L	
OGCS C019	..	Cw	6.59	2.10	49.36679419	-123.1590685	693	L	3 cut stumps to south
OGCS C020	..	Cw	6.84	2.18	49.36716333	-123.1588493	687	L	Several other veterans east of here
OGCS C021	..	Cw	5.52	1.76	49.36746801	-123.1596355	696	L	
OGCS C022	..	Cw	5.75	1.83	49.36763012	-123.159512	705	L	Candelabra top
OGCS C023	..	Cw	5.81	1.85	49.36745846	-123.1600624	707	S	
OGCS C024	..	Cw	5.11	1.63	49.36742225	-123.1602413	694	L	
OGCS C025	20201022	Cw	5.00	1.59	49.37045692	-123.1642871	765	L	
OGCS C026	..	Cw	4.93	1.57	49.37051307	-123.1627308	768	L	
OGCS C027	..	Cw	5.08	1.62	49.3704145	-123.1624274	756	L	
OGCS C028	..	Cw	8.06	2.57	49.37130399	-123.1631467	779	S	
OGCS C029	..	Cw	8.30	2.64	49.37134976	-123.1626371	776	S	Difficult to measure
OGCS C030	..	Cw	5.56	1.77	49.37163851	-123.1619631	768	L	
OGCS C031	..	Cw	6.28	2.00	49.37135085	-123.1618244	768	L	
OGCS C032	..	Cw	4.77	1.52	49.37134154	-123.162031	767	L	Full length image
OGCS C033	..	Cw	5.90	1.88	49.37138647	-123.1620725	762	L	Several veterans south of this area. Not tagged. Many Yc.
OGCS C034	..	Cw	7.13	2.27	49.37132469	-123.1612596	767	L	
OGCS C035	..	Cw	6.52	2.28	49.37133383	-123.1611081	765	L	Much OG in area
OGCS C036	20201102	Cw	5.32	1.69	49.36874843	-123.163827	742	L	
OGCS C037	..	Hw	3.95	1.26	49.36955201	-123.161695	742	L	
OGCS C038	..	Cw	8.17	2.60	49.36978603	-123.161599	748	L	
OGCS C039	..	Cw	6.48	2.06	49.3698136	-123.161158	749	L	
OGCS C040	..	Cw	6.97	2.22	49.36983188	-123.160952	747	L	
OGCS C041	..	Cw	6.48	2.06	49.36985937	-123.160607	741	L	
OGCS C042	..	Cw	5.48	1.74	49.36985937	-123.160635	734	L	
OGCS C043	..	Cw	5.57	1.77	49.37018383	-123.160154	739	L	
OGCS C044	..	Yc	3.90	1.24	49.37182392	-123.157955	742	L	
OGCS C045	..	Yc	5.50	1.75	49.37266697	-123.159804	769	L	
OGCS C046	..	Cw	4.38	1.39	49.37272967	-123.159969	777	L	
OGCS C047	..	Cw	6.13	1.95	49.37292773	-123.159874	770	L	
OGCS C048	20201111	Fd	5.27	1.67	49.36207887	-123.178857	739	L	Reiteration. West of McDonald Cr (West Branch)
OGCS C049	..	Cw	4.60	1.46	49.36194375	-123.178994	735	L	Spiral
OGCS C050	..	Cw	4.74	1.50	49.36111646	-123.178826	664	L	Four Cws nearby
OGCS C051	..	Cw	4.52	1.43	49.36054087	-123.178741	674	L	
OGCS C052	..	Hw	3.34	1.06	49.36270801	-123.179176	767	L	Dwarf mistletoe infection
OGCS C053	20201119	Cw	6.89	2.19	49.36545921	-123.16175	702	L	
OGCS C054	20201120	Cw	6.50	2.07	49.36587252	-123.162068	689	S	

St = Status; L = Live; S = Snag; Sf = Fallen snag; Cw = western redcedar; Fd = Douglas-fir; Hw = western hemlock; Ba = amabilis fir or Pacific silver fir; Yc = yellow cedar; Tw = Pacific (western) yew; WLFAR = West L. Fire Access Rd.; BGC = Biogeoclimatic; CMT = Culturally Modified Tree.

Images

Image 1: Within text. See 5.8 "Culturally Modified Trees".

Image 2: Hollyburn Fir, Brewis Trail, GPS designation 011. Circumference 9.37m; Diameter 2.98m.

Image 3: Fallen giant redcedar McDonald Creek West Branch grove. GPS designation B010. Circumference 8.40 m. Diameter 2.67 m.

Image 4: Western redcedar giant, south of West Lake Fire Access Road (WLFAR). GPS designation B082. Circumference 10.69 m. Diameter 3.4 m. Sasha's redcedar.

Image 5: Western redcedar giant, Lawson Cr (east side). GPS designation B099. Circumference 10.65 m. Diameter 3.39 m.

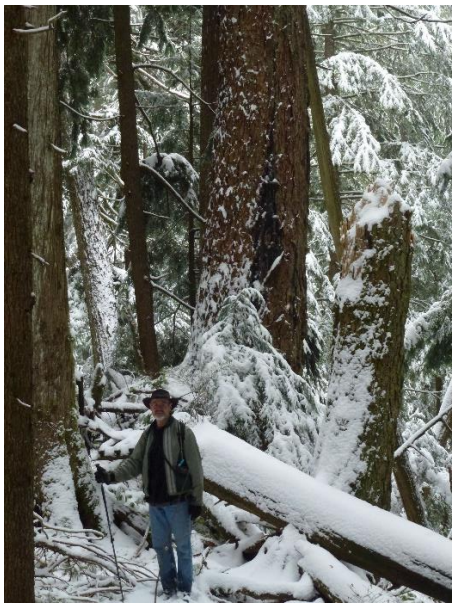


Image 6: Old-growth Douglas-fir west of McDonald Cr (West branch). GPS designation C048. Circumference 5.27. Diameter 1.67.

Image 7: Peat deposit overlying glacial deposit (till), West Lake Forest Access Road (WLFAR). Scale divided into seven one-centimetre sections.

Image 8: Typical old-growth forest showing multi-aged trees. South of West Lake Fire Access Road (WLFAR).

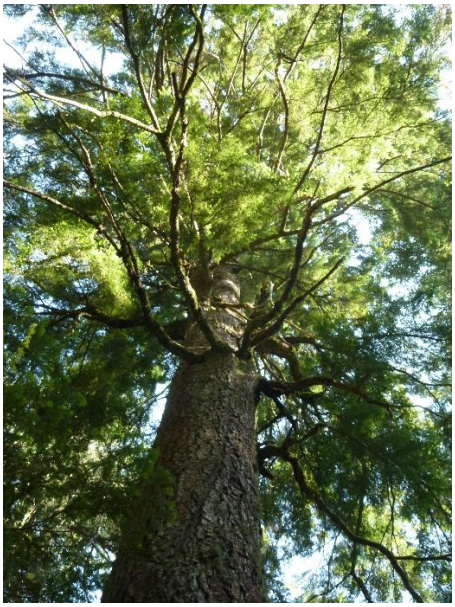


Image 9: Old-growth western hemlock showing reiteration of branching (probably not dwarf mistletoe), South of West Lake Fire Access Road (WLFAR).

Image 10: Method of tagging trees. Yellow cedar. Aluminium nail tag with number and OGCS (Old Growth Conservancy Society) marked on it. Note bear claw marks at tag and above tag in left image. South of West Lake Fire Access Road.

Image 11: Pit 2. Soil profile in the selectively logged area north of Hollyburn Fir showing horizons (from top): O (loose and partly decayed organic matter), A (mineral matter mixed with some humus), E (eluviation or leached horizon; entirely of quartz with some feldspars), B (subsoil with leachates of aluminium and iron). This is a typical soil profile in the study area.

Image 12: Pit 2. In selectively logged area north of Hollyburn Fir. Piping formed from rotted-out root in Horizon B (subsoil)