

**A CONSERVATION REVIEW
of the
ELPHINSTONE PROVINCIAL PARK
EXPANSION PROPOSAL
BC SUNSHINE COAST**



5 June 2015

Report for: Elphinstone Logging Focus
Box 85, Roberts Creek, BC V0N 2W0

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Research has shown that land size is a vital factor in the number of species any designated area can support. As habitats become more fragmented by human encroachment over time, animal and plant populations were left marooned and their long-term survival became untenable. Critical thresholds were reached and passed – life forms were pushed into local, then global extinction. [From Environmental Village, GETAWAY 2002]

DISCLAIMER

As the study area is within the traditional territories of the Sechelt (Shíshálh) and Squamish (Skwxwú7mesh) First Nations, who have never signed treaties, the land is recognised as subject to traditional and legal interpretation of First Nations aboriginal rights and land title, especially in light of the June 26, 2014 Supreme Court of Canada (SCC) ruling on aboriginal title (*Tsilhqot'in Nation v British Columbia*). The Sechelt (Shíshálh) and Squamish (Skwxwú7mesh) First Nations are currently engaged in the BC Treaty process and are also involved in other government-to-government (G2G) discussions associated with land and resource use in their traditional territories outside the treaty process. *Nothing in this report shall abrogate or derogate from any aboriginal title or aboriginal rights of the Shíshálh and Skwxwú7mesh First Nations or any Shíshálh and Skwxwú7mesh members.*

PROFESSIONAL BACKGROUND, QUALIFICATIONS RELEVANT TO THIS PROJECT, AND DISCLAIMER INFORMATION

PROFESSIONAL BACKGROUND

This report was prepared by myself, conservation biologist Wayne McCrory. I am a Registered Professional Biologist (RPBio) in the province of British Columbia. I have an Honours Zoology degree from the University of British Columbia (1966) and have more than 40 years of professional experience. My extensive wildlife and bear work has been published in ten proceedings, in peer-reviewed journals, and in government publications. I have produced 85 professional reports, some peer-reviewed, many involving environmental impacts, faunal species inventories, ecosystem analyses, cumulative effects reviews, bear habitat and bear hazard assessments, and bear-people conflict prevention/management plans. My curriculum vitae (CV) is available upon request.

I have been doing ecological field research on the BC coast for 30 years. I have compiled general inventories and reports on mammals, birds, amphibians, salmonids, and other aspects of island and mainland areas on the BC central and north coasts, including the Khutzeymateen, Kitlope, Princess Royal Island, Green Inlet and Valley, and other areas. My research includes a review of the potential impacts of logging on marbled murrelet and Sitka black-tailed deer old-growth potential habitat on the BC central coast. I have done a detailed report on the coastal predator-prey Sitka deer-grey wolf ecosystem, including detailed Sitka deer winter range GIS modeling for Princess Royal Island and adjacent areas. I also oversaw a report on Carabid forest beetles and an ecosystem landscape analysis by Silva Forest Foundation on Princess Royal Island.

I have also done extensive grizzly and black bear habitat work on the BC coast since 1987, including for the Khutzeymateen, Kitlope, Koeye Spirit Bear Conservancy Proposal Area, Mussel-Poison Cove bear-viewing areas, Atnarko River-South Tweedsmuir Park, Phillips River, Metro Vancouver parks, and other areas. Many of these studies involved ground-truthing and mapping bear habitats, including salmon areas. I have also been instrumental in developing a draft coastal grizzly and black bear GIS den habitat model. A number of these studies included professional reviews of coastal grizzly and black bear logging guidelines. As part of that work, I was one of the peer reviewers of the grizzly bear capability maps and logging guidelines for the Central and North Coast LRMPs, as well as a peer reviewer of the Ecosystem-Based Management (EBM) draft guidelines for the province of BC. I am a member of the Coastal Bear-Viewing Association (CBVA), and am one of three certified trainers.

Elsewhere in western Canada, the Yukon, and Canadian Arctic, I have done numerous environmental impact studies, cumulative effects assessments, mammal inventories (in Yoho National Park), waterfowl studies, and am currently overseeing a pilot project on impacts of traffic levels on a BC interior highway on migrations of the endangered western toad.

I was assisted in Geographical Information System (GIS) maps and analyses by Baden Cross, who has 30 years of experience in this field, particularly with mapping projects on the BC coast. All work on GIS maps used in this report was supervised and approved by me.

FINDINGS DISCLAIMER

The findings contained in this report were compiled from four days of on-site field investigations of the Elphinstone Slope and a review of all background information and studies available for the *Elphinstone 1500* park expansion proposal area. All background information provided to me that related to the proposal area was double-checked to ensure accuracy. Extensive GIS map modeling had to be carried out to ascertain current forest ages of the Elphinstone study area and amount of clearcut/logged versus native generally unlogged forests. The scientific literature was also reviewed for relevant materials.

Although the study was constrained by a limited budget, I feel I have provided an accurate and authoritative analysis with regard to the subject matter covered herein. The conclusions and recommendations expressed herein are entirely my own and have not been subjected to outside peer review. I take full responsibility for any errors or omissions on my part, but not for any errors or omissions in the data provided by outside sources. Where possible, I identify where I have relied on my own professional opinion.

While best efforts have been made to ensure the validity of this review, no liability is assumed with respect to the use or application of the information contained herein.

ACKNOWLEDGEMENT

The main funding for this report has been provided by Laurie Bloom and John Davies. We thank them for their support.

Cover Photo: Elphinstone Health Trail. Ross Muirhead

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PART 1

CONCLUSIONS AND RECOMMENDATIONS

This preliminary report examines the conservation values of the Elphinstone area located on the Sunshine Coast of British Columbia and known locally as the “Elphinstone park expansion proposal,” the “Mount Elphinstone park proposal,” “Elphinstone 1500” (referring to the assumed 1500 hectare size), the “Elphinstone slope,” and other names. In my analysis for this report, I have referred to it as the Elphinstone park proposal study area, Elphinstone study area, study area, or Elphinstone slope.

The current proponents for full protection of the expanded provincial park proposal are known as Elphinstone Logging Focus (ELF) and are generally mentioned throughout this report as “ELF” or “the client group.”

Despite some 29% of the study area having been logged over the past 80 years or so, the Elphinstone study area was found to be 2,137 ha in size, considerably larger than the 1,500 hectares originally estimated, and still has some 1,514 of pristine or near-pristine semi-mature to older forests up to 150-155 years of age, with scattered old-growth trees and downed structures. Biodiversity values are very high, including numerous old-growth Douglas-fir (*Pseudotsuga menziesii*) trees, critical old forest winter range for Roosevelt elk (*Cervus elaphus roosevelti*), rare plant communities of snow bramble (*Rubus nivalis*) and Pacific rhododendron (*Rhododendron macrophyllum*), significant macrofungi (mushroom) diversity of some 165 species (including the rare scented night mushroom or *Tricholoma apium*), and eight amphibian species whose life cycles and habitat needs are not well understood.

The study area is within the traditional territories of the Sechelt (Shíshálh) and Squamish (S̕kw̕xwú7mesh) First Nations. Keystone cultural species include Roosevelt elk and western redcedar. A background study by Dr. Nancy Turner demonstrated that in terms of overall biodiversity values to First Peoples across the province, some 400-500 species are named and utilized or have had specific cultural importance. Certainly loss of these biodiversity values to First Nations on the Sunshine Coast has already been significant. Protection of places like the Elphinstone study area will be important to help preserve what is left.

Further clearcut logging and associated roading is the greatest threat to the rich biodiversity of the Elphinstone study area and should not be allowed to continue.

Recommendations

1. This conservation analysis was preliminary; further study and documentation of biodiversity and First Nations values is highly recommended as time and budget permit. Priorities should be set in this regard.
2. A top priority for ELF and other community groups should be to work closely with the Sechelt (Shíshálh) and Squamish (S̕kw̕xwú7mesh) First Nations to document cultural/heritage and traditional use of the study area. This should also include immediate consultation of protection options, such as a provincial Class A Park.

3. The very high biodiversity values support my recommendation that the Elphinstone study area be fully protected as a core benchmark area. This is consistent with conservation biology principles that core protected areas are the *cornerstone of conservation* (Noss 2000, p. 197).
4. Although there is a range of protection options available for the 2,137 ha Elphinstone study area, I would strongly recommend that the entire area be legislatively protected as a provincial Class A park, which would also encompass the three existing small parks. Although Tribal Parks have been declared by several First Nations in a few areas of the province, such as in Clayoquot Sound and the Chilcotin, unfortunately, these are not recognised by the provincial or federal governments and are, therefore, still susceptible to resource development sanctioned by the province. The one exception was the Stein, which was first declared a Tribal Park and then (largely due to extreme pressure from the First Nation and the public) ended up being legislatively protected as a Class A provincial park while retaining reference in the name as a Tribal Park.
5. Besides fully protecting the core 2,137 ha Elphinstone provincial park proposal, additional older forests and old-growth in the Chapman Landscape Unit should also receive far greater protection than offered from logging plan leave strips, such as old-growth management areas (OGMAs, wildlife tree patches [WTPs]), and other weak and unproven biodiversity protection classifications. Other select older forest and old-growth areas in the Elphinstone map area should be identified and connected to the core protected 2,137 ha by permanently protected and adequate biodiversity corridors. Such areas on the Elphinstone slope should be connected to the core protected 2,137 ha by biodiversity corridors.
6. Although the width of such corridors is still being scientifically debated due to lack of hard data on animal movements and functionality, I strongly recommend Elphinstone biodiversity corridors connecting older and old-growth forests to the core 2,137 ha study area be at least 0.5 km in width, if not wider. (I am basing this on my recent research and design of black bear/biodiversity corridors for the City of Coquitlam). GIS corridor modeling techniques will greatly help define such biodiversity corridors for the Elphinstone map area. As some of the potential biodiversity corridors have been logged and thus occur in different age forest cover classes, they should be regarded as “biodiversity recovery corridors” so that over a long period of time the mature forests and old-growth that better favour animal and plant connectivity will be allowed to return.

SUMMARY OF KEY FINDINGS

1. ELPHINSTONE PROVINCIAL PARK EXPANSION PROPOSAL STUDY AREA

1a. The Study Area

Locally, the Elphinstone study area is a fairly large and partially clearcut area of low-mid elevation (129-702 metres) coastal forest up to 150-155 years of age with a small mix of old “veteran” trees likely up to 500-800 years or older that survived a large wildfire in about the 1860s.

The study area is located on the Sunshine Coast in an area near the community of Roberts Creek between the towns of Gibson’s Landing and Sechelt. It is situated on a mountainside known locally as the Elphinstone slope. It is within the traditional territories of the Sechelt (Shíshálh) and Squamish (Skw̱xwú7mesh) First Nations and is, therefore, subject to aboriginal rights and title claims.

The study was first proposed as a provincial park some 20 years ago, known as the “Elphinstone 1500” due to an estimation that it was 1500 hectares in size (Map 1). In response, the provincial government protected three small provincial parks in 2000, widely separated from each other. These comprise 139 ha and do not adequately protect the rich forest biodiversity that still remains in the unlogged older forests of the study area. Since the area was first proposed for protection, the government has allowed, mostly through its own timber allocation company, BC Timber Sales, the clearcutting of some 475 ha or about 22% of the study area. A small portion of the logging included an attempt at smaller-scale experimental logging with a monitoring program that has since been discontinued. The continuous clearcut logging has been and continues to be highly controversial because so little of the lower elevation older coastal forests with their rich biodiversity still survive on the Sunshine Coast. Elphinstone Logging Focus (ELF), the Sechelt First Nation, and many others support protection of the whole area. The Sunshine Coast Regional District (SCRD) recently supported a conservation study to examine the area’s biodiversity values, which is what my report is all about. As will be outlined in greater detail, my study found that if the government allows clearcutting to continue in the park expansion proposal area, the three small provincial Elphinstone parks would become “islands of extinction.”



Map 1. Red and white outline shows the original “Elphinstone 1500” park proposal, which has only been slightly modified but actually comprises about 2,137 ha. The three small Elphinstone provincial park areas created in 2000 are shown as a darker green (yellow outline).

1b. Redefining the proposal study area and size

An important first step of my conservation analysis was to use Geographical Information System (GIS) mapping to evaluate the boundaries and size of the study area and look at adding adjacent older forest areas to the original boundaries. Minor revisions were made to streamline the original boundary, but ELF decided not to include adjacent older forests to the east and towards Gibsons. One large old-growth polygon indicated on the forest cover map along the north boundary was found to have been all clearcut in the past and was not included. The study area was found to include four parcels of privately owned lands (DLs 1505, 2674, 2439, and 2387), some of which have been heavily logged and in total comprise approximately 75 ha. For purposes of discussion, these private lands were excluded from the study area but should be considered for protection at some point within the larger context of the full protective provincial status my report recommends for the whole study area. The three small widely separated provincial Class A parks were included in the study area.

Minor boundary revisions were made in discussions with the client group to streamline the boundaries. Several options were looked at, potentially to expand the current boundaries to include adjacent large areas of older native forest. After some map review of other native forested areas, such as extensive older forest to the east and including the Dakota community watershed, the client group chose to continue with the near-original core proposal area. An

old-growth area indicated on the government's forest cover map just to the northwest of the study area was found to be clearcut, so was not added.

The GIS map review showed that the slightly revised study area (Map 2) is somewhat larger than originally estimated. The “Elphinstone 1500” actually comprises about 2,137 hectares of public land, with only 6.5% (139 ha) permanently protected in the three small provincial parks.

2. STATE OF THE ELPHINSTONE STUDY AREA FORESTS

Because biodiversity of forested landscapes is affected by a complex interaction of age, structure, composition, connectivity, and man-made and/or natural disturbance events, such as wildfire and windfalls, the next step in this conservation analysis was to determine the state of the forest in the study area.

2a. Ages of forests in the Elphinstone study area

Ministry forest age class maps and associated digital data (updated to 2014) were used to prepare a preliminary map (Map 2) showing the different age class polygons of the forests in the Elphinstone study area. While there are different and often confusing definitions of forest ages, I used the Ministry's age class categories for the Elphinstone map but used my own interpretations in describing some of the various forest ages.

No forest cover map polygons considered to be old-growth (age class 9, 250+ years) were found in the Elphinstone study area, although the area has many scattered old Douglas-fir and some western redcedar (*Thuja plicata*) that could be upwards of 400-500+ years old, adding considerable biodiversity value. Some of the veteran Douglas-fir are of very large stature (3-4+ m diameter). The study area was burned by a large wildfire, apparently in the 1860s. Although some old-growth trees, predominantly Douglas-fir, survived the fire, and are to be found scattered throughout the study area, none occur in patches large enough to be classed on the Ministry's maps as old-growth polygons. However, the Ministry determined there was still 364 ha of old-growth forest left on the Elphinstone slope in 2011, but outside of the park proposal study area.

Overall, some 1,322 ha or 62% of the 2,137 ha study area was found to be in the early-mature to older forest state (age classes 5-8) that has never been logged except for some small salvage logging. This is considerably more than the average (48%) for the same cover types that the Ministry found in 2011 for the overall Elphinstone slope map area, a subset of the Chapman Landscape Unit (LU).

Age class 4 (61-80 years) comprises some 340 ha, or a fair share (16%) of the study area. As will be noted, some of this has been clearcut while some is still native forest.

Age classes 0-3 (recently logged to 60 years), which represent mostly clearcut areas, comprise some 475 ha or 22% of the study area.

Due to the wildfire, the oldest forests in the study area were found to be in age class 8 (141-250 years), but would only actually be 150-155 years of age. There were 252 ha of this forest in the Elphinstone study area, accounting for 11.7 % of the total 2,137 ha size. While there are different definitions of forest ages, I arbitrarily called these “older” forests or “emerging



Figure 1. Large Douglas-fir in Roberts Creek ravine within the proposed Elphinstone park expansion area.
Photo: Ross Muirhead.

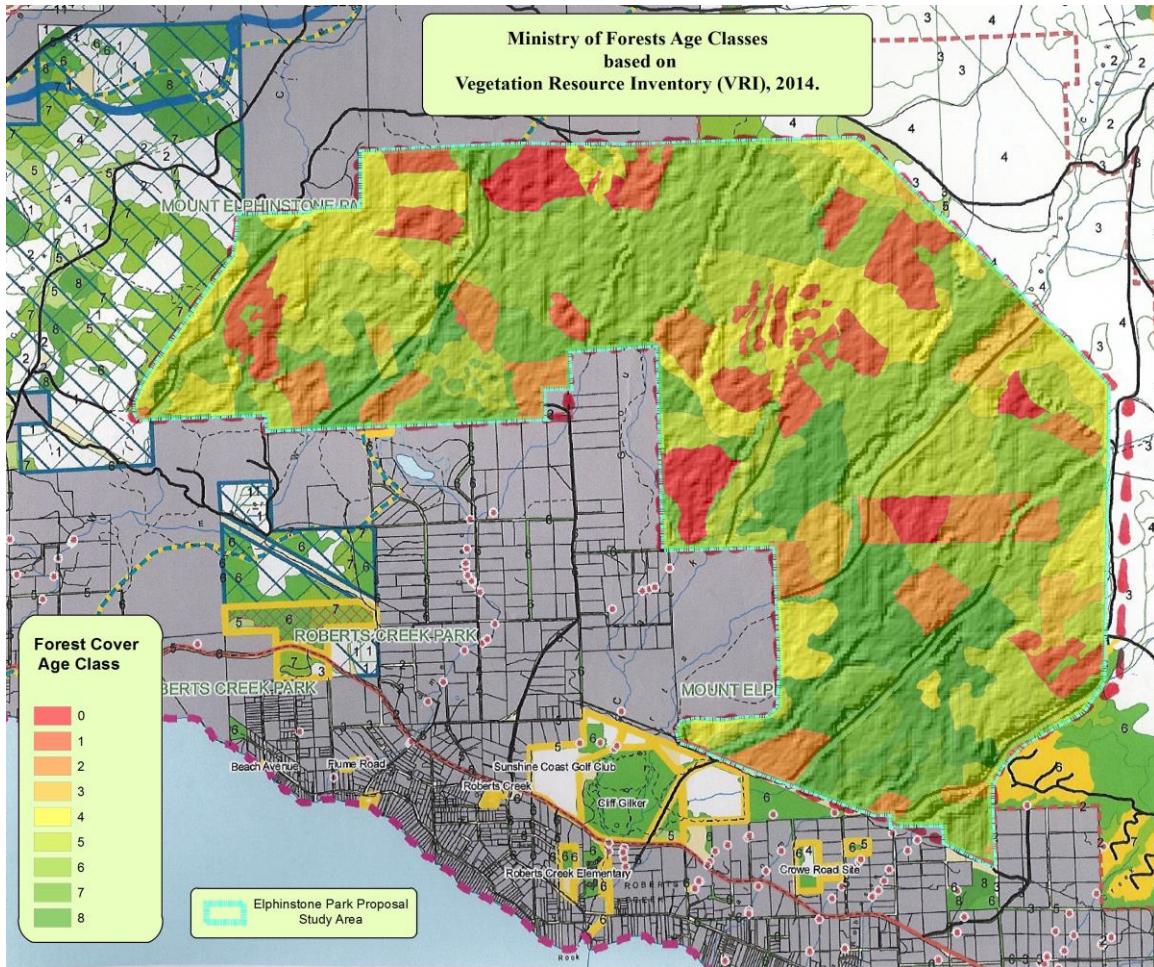
old-growth” since some had small amounts of understorey typical of the first stages of old-growth based on a detailed study in Alaska.

Age classes 5, 6, and 7 (81-140 years) were considered to be early-mature to mature forests for purposes of discussion. Some ground-truthing indicated that most or all of these had never been clearcut.

2b. How much of the Elphinstone study area has been roaded and clearcut?

Considerable time was spent ground-truthing some of the forest cover polygons on the draft GIS forest cover map for the study area, particularly age class 4, to better refine which areas had actually been clearcut and which had not. What we learned was:

- An estimated 148 ha of age class 4 had been clearcut, while 192 ha appears to be native forests on poor growing sites.
- Of the 2,137 ha study area, some 623 ha (29%) has been logged (mostly clearcut) while some 1,514 ha (71%) has remained native forest and in a pristine or near-pristine state (Map 3).
- This total aerial extent of the surviving uncut native forest of the study area approximates the size of the original “Elphinstone 1500” hectare park proposal.
- The majority, about 1,322 ha or 62% of the overall 1,514 ha native forest, is in an early-mature to older forest state (80-155 years).
- The older forest types in the study area have scattered or clustered old-growth Douglas-fir, western redcedar, and other species that survived the major 1860s wildfire. Some are very old tree structures up to 3-4 m diameter, living or dead, and are considered important contributors to the biological functioning of the surviving Elphinstone ecosystem.
- Since the Elphinstone Forest was first proposed for protection around 20 years ago, an estimated 267 ha involving age classes 0 to 1 (recent to 20 years) have been clearcut. This represents 12.5% of the study area. Of this, 73 ha were logged during 2011-2013, representing 3.4% of the study area.
- Recent logging of the study area has been under the auspices of BC Timber Sales and the Sunshine Coast Community Forest. No effort was made to separate how much of the study area has been clearcut by each, but the majority, including planned new clearcuts, appears to be BC Timber Sales, a government-sponsored subsidiary.
- The network of open logging roads or the lineal motorised disturbance GIS layer in the study area amounted to 36 km.
- No effort was made to quantify the extensive network of hiking and mountain bike trails that crisscross the study area, but it appears fairly extensive and a map inventory should be done.

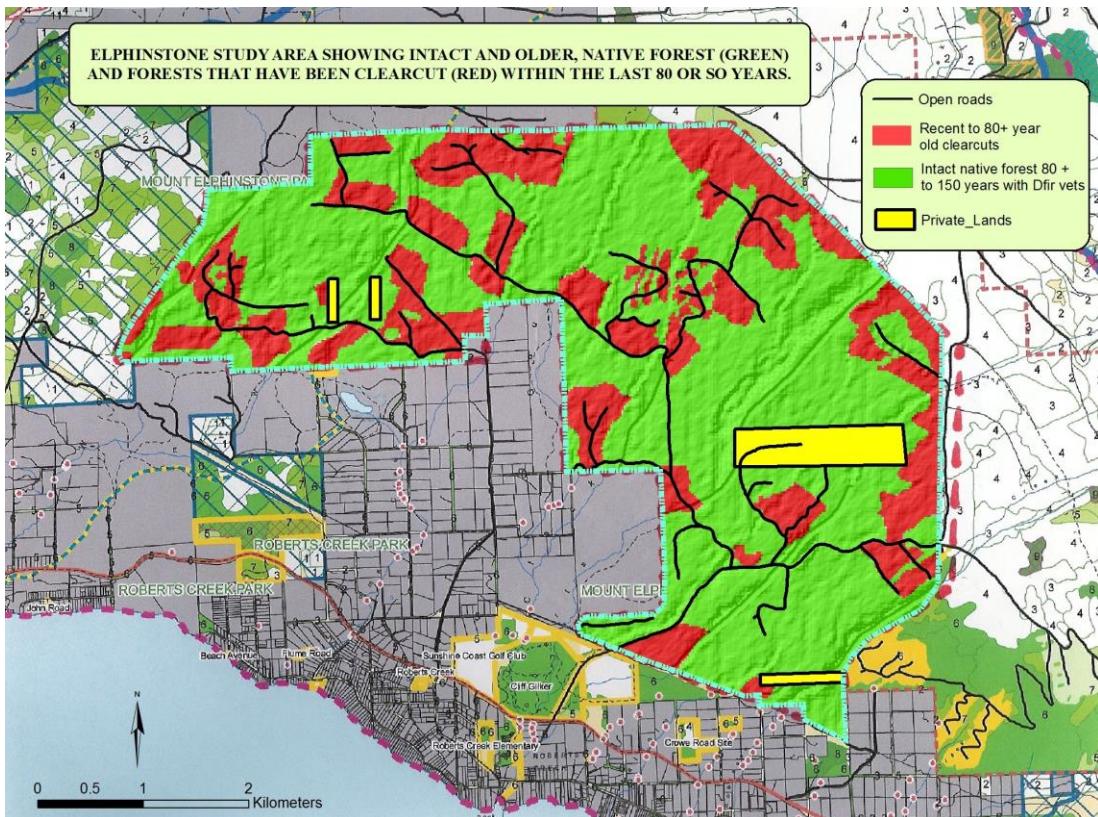


Map 2. Preliminary map showing the different ages of the forests in the Elphinstone study area. Age classes 0 to 3 (red to orange) are younger age classes that have been mostly clearcut logged in recent times. Age class 4 (yellow polygons, 61-80 years) has only been partially clearcut while some is native forest. Age classes 5-8 (light to darker green) represent native, unclearcut forests.

2c. Contribution of Elphinstone study area older forests (age classes 7 & 8) to surviving older forests in the Chapman Landscape Unit (LU)

The Elphinstone study area makes an important contribution to older forests surviving in the Chapman LU: age class 7 contributes 173 ha (17.4%) of what is left, and age class 8 contributes 252 ha (14.7%) of what is left. In terms of old-growth forest cover polygons (age class 9), the study area makes no contribution. However, a partial map review and data analysis indicates that there is in fact very little old-growth left in the Chapman LU within the low-mid elevation range similar to the Elphinstone study area (129-702 m). Some 5,757 ha or 93% of the surviving old-growth in the LU is above 800 m, most of it obviously in marginal areas not considered merchantable timber and having somewhat different forest types and biodiversity values than low-mid elevation old-growth.

For the Chapman LU land area (34,119 ha), about 705 ha or 2.1% of the LU land area is in age class 7 (121-140 yrs), some 1,714 ha or 4.4% is in age class 8 (141-250 yrs), and 6,209 ha (18.2%) is left in age class 9 (250+ yrs.).

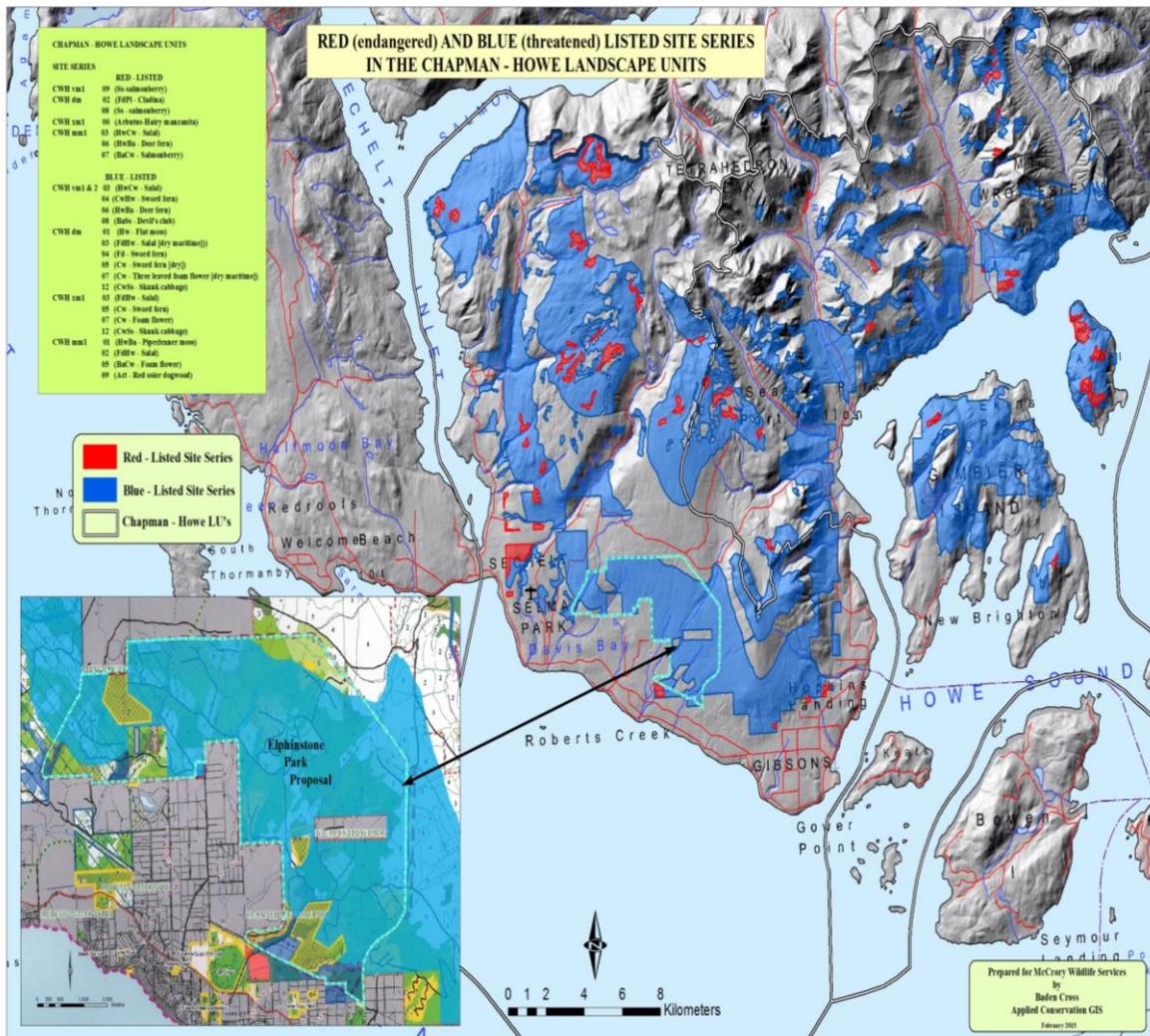


Map 3. Red areas show that some 623 ha (29%) of the 2,137 ha study area has been logged (mostly clearcut) while light green shows the 1,514 ha (71%) that has remained native forest and is in a pristine or near-pristine state. Since the Elphinstone Forest was first proposed for protection about 20 years ago, some 12.5 % of the study area has been logged, mostly in large clearcuts. The black lines show the 36 km network of active roads built for logging. The map shows that most of the pristine forested area is still interconnected, with some fragmentation. Such large enclaves of remaining low elevation pristine or near-pristine older-aged forests on the Sunshine Coast are now very rare and are in need of immediate protection for their intrinsically high biodiversity values.

2d. Biogeoclimatic characteristics of the Elphinstone study area, including provincially at-risk biogeoclimatic site series as ecosystem health indicators & vectors for protection

Geospatial analysis

The forests of the Mt. Elphinstone provincial park expansion study area fall largely within the broad Coastal Western Hemlock (CWH) biogeoclimatic zone, with most being within the CWHdm subzone variant (Coastal Western Hemlock, Dry Maritime) at low to mid elevations. The study area lies between 129-702 metres above sea level (ASL). This subzone variant is greatly under-represented in terms of overall protection (5.89%) of the Strait of Georgia Lowlands Ecosection. A small portion of the study area is within the CWHxm1 subzone (Coastal Western Hemlock, Eastern Very Dry Maritime), which is also considered to be highly under-represented.



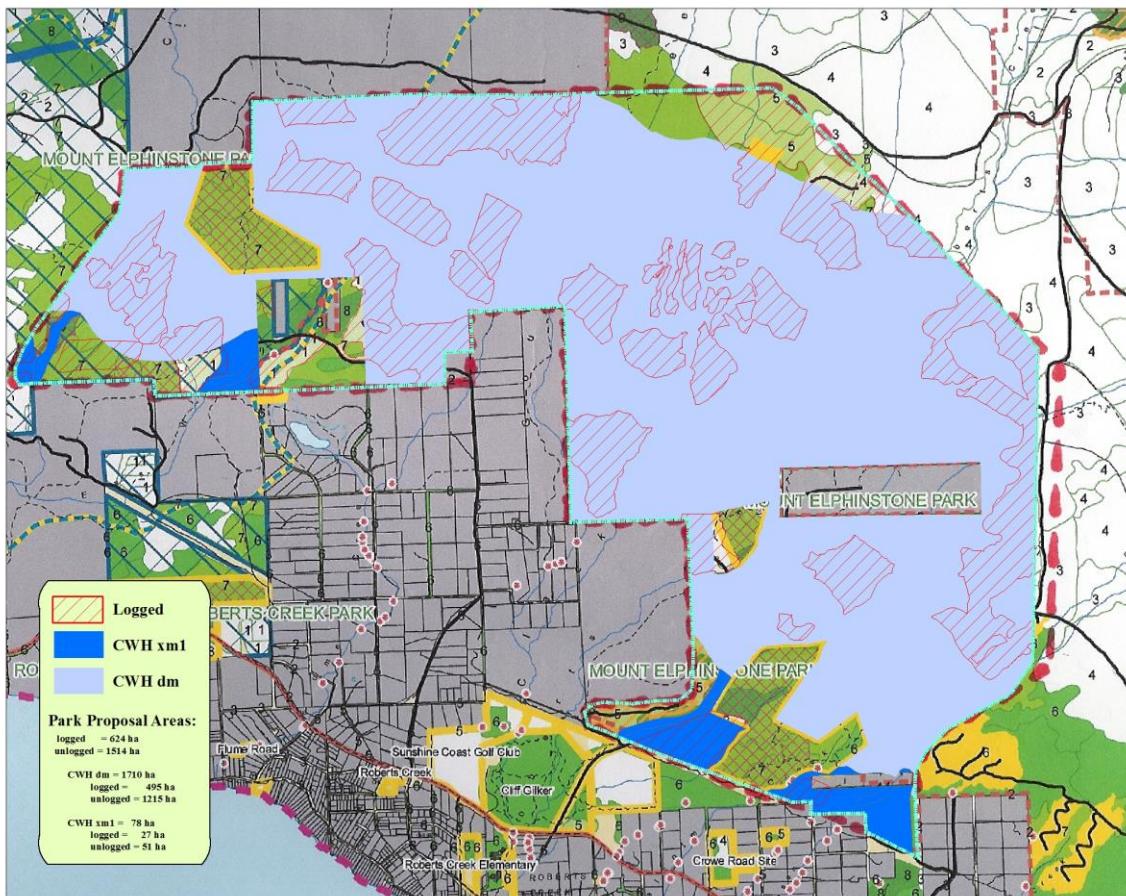
Map 4. Shows that a high proportion of biogeoclimatic subzones of the Chapman-Howe Landscape Units (LUs) have plant communities or site series that are provincially of conservation concern (blue-listed), while smaller areas (red) are considered imperiled or critically imperiled. Continued clearcutting of the mature and older forests within which are situated these endangered site series plant communities is contributing to a growing extinction debt on the South Coast.

Endangered biogeoclimatic site series plant communities

A map review (Map 4) found that large forested areas of the three biogeoclimatic subzones of the Chapman and Howe landscape units (LUs) between Howe Sound and Sechelt Inlet have zonal site series that are provincially at risk (blue-listed), and smaller areas that are considered imperiled or critically imperiled (red-listed). Site series refers to what type of plant community would be growing in an area at the mature/older forest stage. Thus, the more that mature and older forests are subjected to ongoing clearcut logging, the more endangered the site series representation becomes since coastal industrial forestry logging patterns of a harvest every 80-100+ years means most of the site series will never reach more advanced age characteristics that are so critical to biodiversity preservation.

The Elphinstone study area was found to have nine site series based on the province's biogeoclimatic ecosystem classification (BEC) system using Terrestrial Ecosystem Mapping

(TEM). The government database showed that the majority (83.7%) of the Elphinstone study area has forest cover polygons that have blue-listed (species of concern) site series, while no site series were found to be red-listed or imperiled (Map 5).



Map 5. Elphinstone study area showing most (80%) is comprised of blue listed (species of concern) plant communities or site series within the CWHdm type (light blue). The darker blue shows the small amount (3.7 %) of species of concern site series in the CWHxm1. No site series data was available for the three small park areas (green), but it was assumed they are also blue-listed CWHdm.

Map 4 (and inset) and Map 5 illustrate that a total of 83.7 % of the Elphinstone study area includes forest cover polygons that have provincially at-risk (blue-listed) site series. No red-listed site series were found in the study area. The high proportion of the study area with blue-listed site series potential is another measure that the Elphinstone study area is a core very productive ecosystem with high biodiversity values.

Unfortunately, the Chapman-Howe Landscape Units and Elphinstone study area are outside of the south coast ecosystem-based management (EBM) process under the government's South Central Coast Consolidated Orders (2009 and 2013) to protect 70% of blue-listed site series in forest cover polygons, particularly those in mature to older-aged forest types. Red-listed site series would be nearly 100% protected. I am uncertain as to how the Ministry addresses protection of red- and blue-listed site series outside of the coastal EBM area. However, by applying current EBM proposed 70% protection measures, much more of the Elphinstone study area would need to be protected. Overall, since such low elevation and

very productive older forest ecosystems are so rare on the Sunshine Coast, and blue-listed site series plant communities in these mature and older forests on Mt. Elphinstone contribute significantly to the rich biodiversity of the Elphinstone study area, the best overall protection would be to forego logging and establish the whole area as a provincial park.

3. IMPORTANCE OF THE BIODIVERSITY OF THE ELPHINSTONE FORESTS TO FIRST NATIONS



Figure 2. Western redcedar with bark stripped for traditional uses, also known as a “Culturally Modified Tree” or CMT. Photo: Ross Muirhead.

In a study of the importance of biodiversity to the First Peoples of British Columbia, Dr. Nancy Turner concluded that, in total, some 400-500 plant species are named and utilised, or have had specific cultural importance to First Peoples across the province. Turner also notes that *erosion of biodiversity in various parts of the province has severely impacted First Peoples and their traditional food systems.*

During field surveys in the study area during December 2014, small numbers of culturally modified trees (CMTs) were observed. These involved recent stripping of bark from young western redcedar trees, as well as older cedar bark stripping scars estimated to be least 100-200 years old. My review also indicates that some elk survive in the area and are dependent on old forests during periods of inclement weather. Elk, like redcedar, are recognised as cultural keystone species for First Nations on the BC coast.

Undoubtedly, harvest of mushrooms and other wild plant foods are also still important to the local First Nations.

While it was beyond the budget and scope of my study to measure the importance of the biodiversity of the study area, past and present, to the Sechelt (Shíshálh) and Squamish (Skwxwú7mesh) First Nations, this should be a priority.

4. BIODIVERSITY & BIOLOGICAL FEATURES OF FOREST HABITATS IN THE ELPHINSTONE STUDY AREA

Considerable biological inventory, some of it quantified and some of it observational and anecdotal, has been gathered over time for the Elphinstone study area. This information, combined with a technical background review, shows the study area's forests, despite some fragmentation from logging roads and clearcutting, still has very high biodiversity values urgently in need of full protection.

Although coastal black bears (*Ursus americanus*) have been used elsewhere as old-growth ecosystem health indicators, I found very little feeding habitat values in the early mature-old forest habitats surveyed. If these forests are allowed to evolve towards the old-growth state, they will have much better foraging values for black bears. Clearcut areas would provide moderate plant forage value for the first 30 years or so, until second-growth forests reach the closed-canopy stage, and then the sites turn into what we call bear "deserts," because the forage availability becomes so impoverished. However, in the unlogged forests of the study area, numerous surviving standing and downed old-growth structures were noted that would be suitable for winter denning, and this value should not be overlooked. No actual dens were located during the four survey days in December 2014.

4a. Roosevelt Elk as an indicator species

Currently, Roosevelt elk (*Cervus elaphus roosevelti*) are blue-listed (threatened) provincially and, because they are a subspecies that has uniquely evolved and adapted to coastal temperate rainforests over millennia and are partially dependent in winter on mature and old-growth forests, they were considered a good indicator species for the study area. The Roosevelt elk is also widely known as an important cultural heritage and subsistence species for many coastal First Nations; for this reason they are also referred to herein as a "keystone cultural species." Further documentation of their historic and current importance to local Sechelt (Shíshálh) and Squamish (S̱kwx̱wú7mesh) Nations should be a priority.

Studies have demonstrated that this coastal elk subspecies is partially dependent on old forests during periods of severe winter snowfall, and probably severe rainstorm-wind events as well. Extensive logging of older-aged forested winter range on Vancouver Island has been blamed for severe elk declines in the 1960s. Elk were extirpated from the Sunshine Coast prior to 1900, but were later successfully reintroduced by the BC Wildlife Branch. Today, an estimated 60 elk range in Rainy-Gray Elk Population Unit (EPU), which includes the Elphinstone forest area. During field surveys of the core study area (December 2014), a small amount of elk sign was observed in old forest habitat.

Protection of and recovering mature and old forest values in the 2,137 ha Elphinstone study area, rather than further clearcutting of important elk winter survival habitats, would greatly benefit the local elk population, establish a significant old forest ecological benchmark for habitat for the subspecies, and help sustain local numbers for subsistence and cultural/heritage uses. Preservation action would also help the Ministry meet the proposed provincial Roosevelt elk recovery objective to maintain or restore the contribution of Roosevelt elk to natural biodiversity and ecosystem function. The goal is to see these coastal elk provincially de-listed. Such restoration of ungulate natural biodiversity can't really be accomplished on

the Sunshine Coast in my professional opinion if most of the Roosevelt elk's mature and old forest winter range continues to be clearcut at a time when so little is left.

4b. Rare plant communities in the Elphinstone proposal area as biodiversity indicator species

A number of rare plants were identified on Mt. Elphinstone in 2000 during mushroom surveys for BC Parks. My report focuses on several rare plant communities identified in the Elphinstone study area, including snow bramble and large-leaved rhododendron. By their very nature, rare plant communities are more vulnerable to being extirpated by man-made disturbances, such as roads and clearcuts, and are also susceptible to natural destructive causes, such as blowdowns or large intensive wildfires. In the instance of the Elphinstone study area, clearcut logging and roading has been and continues to be the largest threat to several species of rare plant communities. Snow bramble appears somehow to have survived the 1860s wildfire.

These rare plant communities are analysed separately from the blue-listed site series plant communities, although they would also be found in forest cover polygons that have the blue-listed components.

Snow bramble

This species was reported in the study area during surveys in 2000 for BC Parks. Despite snow bramble being red-listed, it was reported at the time that BCTS allowed a road to be built in the Elphinstone proposal area through one of these rare plant communities. After a follow-up study, BCTS adopted an interim management protocol in an attempt to protect snow bramble sites by leaving small (0.25 ha) wildlife tree patches (WTPs). However, when more of these plant communities were reported to the Conservation Data Centre (CDC), the status of snow bramble was down-listed from red to blue. Surveys in the Elphinstone study area by Strathcona Forestry Consultants showed that some snow bramble in WTPs showed evidence of leaf burn at the edge of cutblocks; one community of snow bramble supposedly protected by a small BCTS WTP, appeared to have disappeared altogether, apparently a result of a blowdown. Blowdowns are a common problem with WTPs. The study area, being south-west and thus facing towards the coast, appears to be subject to severe wind storms, exacerbating the common coastal blowdown problems.

My review found that an independent international study recommended reserve sizes of about 1,000 ha for rare plant communities of 50 or more plants. This number of plants was considered necessary for minimum population viability (MVP). Although further quantification is needed, field surveys suggest that at least the largest of three snow bramble patches located in the study area within the BCTS proposed clearcut 87126 has a minimum of 50 adult plants. Based on this, and observations of damage to plant communities within small WTPs, reserve sizes for larger snow bramble communities need to be at least 1,000 hectares.



Figure 3. Large, healthy community of blue-listed snow bramble (darker leafed plant amidst moss) in proposed BCTS cutblock 87126 in Elphinstone study area (Photo: W. McCrory).

Pacific rhododendron

The study area has the northernmost known wild colony of Pacific rhododendron (*Rhododendron macrophyllum*), a pink-flowering shrub, on the whole Pacific Coast of North America. A 2006 genetic study determined that the isolated Mt. Elphinstone subpopulation is part of a unique genetic strain or clad “1” (variation) of the haplotype (in RPB2-i) that prefers to live near saltwater (Map 6). The large patch of this rare rhododendron is situated within the west end of the park proposal study area at a low elevation. It is within the tenure area held by the Sunshine Coast Community Forest. Theoretically this subpopulation is protected by a small WTP, surrounded by a rope barrier. The adjacent areas have been extensively clearcut and roaded. Field surveys by ELF (under my direction) determined that there are 84 individual plants in this large patch, more than enough to qualify for a minimum viable population and a recommended reserve size of about 1,000 ha. Remedial steps should be taken to recognise that a much larger, viable reserve needs to be established to adequately protect this rare and unique genetic rhododendron site.

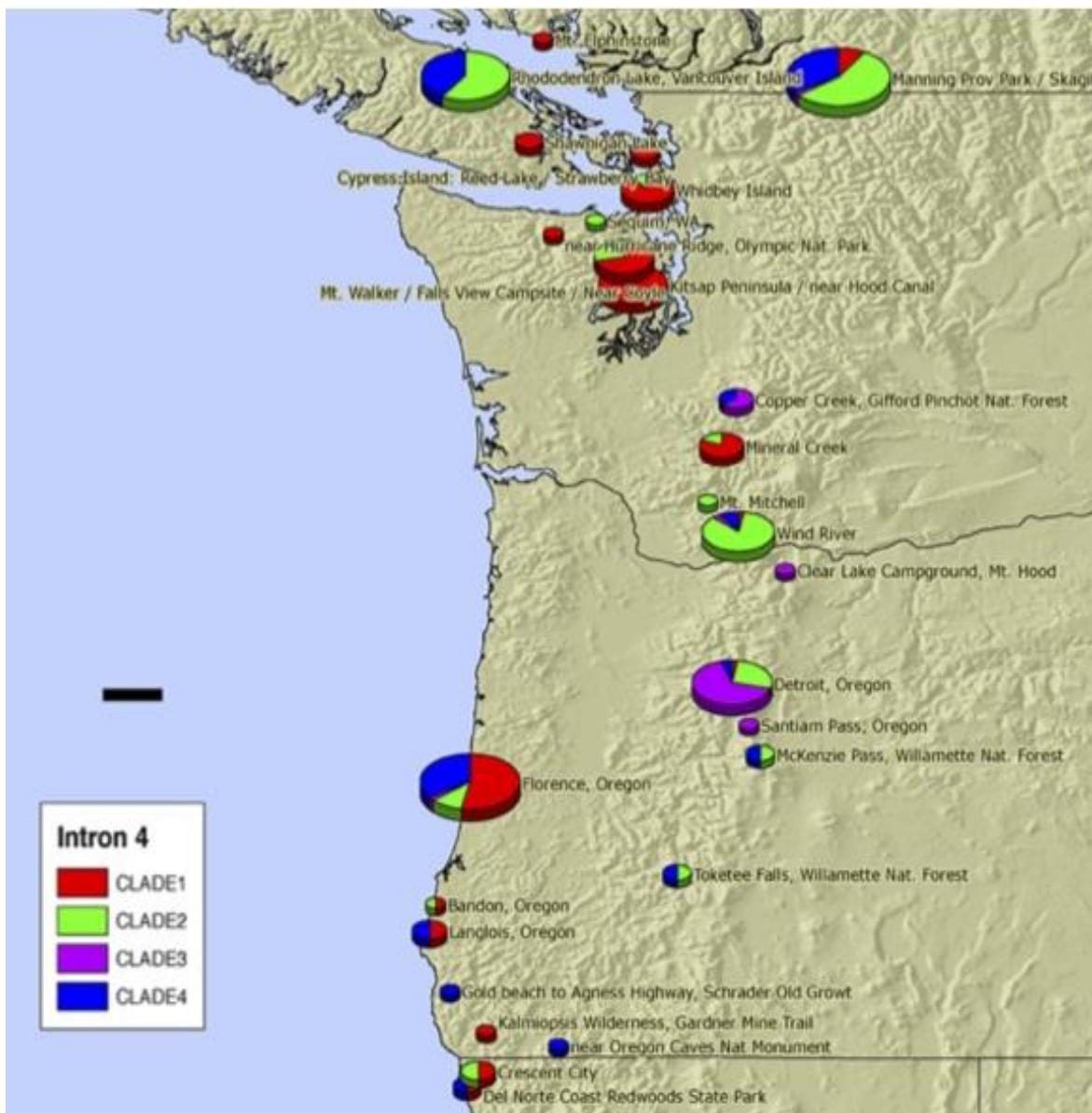


Figure 4. This rare and genetically unique wild rhododendron colony within the western boundaries of the Elphinstone study area needs much greater protection than the small WTP that currently exists (Photo by Hans Penner).

4c. Macrofungi (mushrooms) as biodiversity indicator species

Biodiversity of the Elphinstone forests is perhaps best known by the documentation of the large assemblage of mushroom species found in the older forests of the study area. Surveys in the late 1990s by well-known mycologist Paul Kroeger (2000) identified 152 taxa of fungi with the conclusion that the Elphinstone forest appears to be especially diverse in mycota compared with other South Coast sites. The information was then used to help select three small older forested areas that today comprise the 139 ha Mt. Elphinstone provincial park.

Although the BC Conservation Data Centre (CDC) does not include tracking lists of mushroom species-at-risk, an independent researcher prepared a provisional list of 65 rare or notable macrofungi for BC. I did not attempt to identify which of the known mushrooms on Mt. Elphinstone would be considered rare or endangered. However, in his 2000 report for BC Parks, Kroeger stated that the rare scented night forest mushroom (*Tricholoma apium*) especially influenced the choice of one of the provincial park areas. This species is considered rare in North America and was only known from six other locations in British Columbia. On Mt. Elphinstone, *Tricholoma* is considered to favour old-growth habitats; in 1996, clearcut logging done in association with the Roberts Creek Research Forest apparently destroyed a significant portion of the known habitat at that time.



Map 6. Shows Mt. Elphinstone rhododendron subpopulation (small red circle at top of map) as part of CLADE 1 (red), a genetic strain that prefers to live near salt water. Genetic studies were done by the University of Washington. <http://faculty.washington.edu/benhall/outreach.html>

The Kroeger study concluded that the great diversity and abundance of mushrooms and other large fleshy fungi on Mt. Elphinstone depends upon “late-successional;” i.e., old forest conditions. The mycologist concluded that: *Conservation of the organisms associated with the forests of Mount Elphinstone hinges upon the retention of their habitat with its late-successional characteristics intact.* This is especially important since it is widely accepted that the diversity of mushrooms increases with the age of the forest and is greatest in older forests.

Recommendation

Given the documented destruction of old forest habitat of the rare scented night mushroom on Mt. Elphinstone, and other rare or endangered species, it is very likely that protection of this exceptional macrofungi biodiversity in three small provincial parks will be grossly inadequate. In my professional opinion, all of the remaining intact forest in the study area should be protected to safeguard the loss of this well-documented biodiversity.



Figure 5. Scented night forest mushroom (*Tricholoma apium*) is considered rare in North America and in 2000 was only known from six other locations in British Columbia. On Mt. Elphinstone, *Tricholoma* is considered to favour older forest habitats. In 1996, clearcut logging done in association with the Roberts Creek Research Forest apparently destroyed a significant portion of the known habitat (Photo: Paul Kroeger).

4d. Amphibians as biodiversity indicator species

The Elphinstone study area has a high biodiversity representation of south coast rainforest amphibians (eight species) and, as with the diverse mushroom representation, is likely the result of so much of the area still being intact with semi-mature to older forests with ample old-growth structures left over from the 1860s burn. For this reason, including the partial or complete dependence of amphibians for all or parts of



Figure 6. Blue listed juvenile coastal tailed frog observed on Dec. 6, 2014, along the Elphinstone health trail, 20 m from a running creek and in near-freezing temperatures (Photo: W. McCrory)

their life cycles on older or old-growth forests, coastal amphibians were considered an excellent biodiversity indicator for the Elphinstone study area. Unfortunately, a complete field inventory has not been done and a more detailed review of impacts of logging is recommended.



Figure 7. *Ensatina escholtzii*, one of two lungless types of salamander that breathes through its skin and does not migrate to wetlands to breed, but lives in the forest year-round.

Photo: Rick O'Neill.

Amphibians include three frog species: the Pacific tree (chorus) frog (*Hyla regilla*), coastal tailed frog (*Ascaphus truei*) and red-legged frog (*Rana aurora*). The two latter species are provincially blue listed. The five salamander/newt species are: Ensatina salamander (*Ensatina escholtzii*), northwest

salamander (*Ambystoma gracile*), long-toed salamander (*Ambystoma macrodactylum*), western red-backed salamander (*Plethodon cinereus*) and rough-skinned newt (*Taricha granulosa*).

The overall distribution and habitats of each of the eight coastal amphibian species in the Elphinstone study area, including the two that are provincially blue listed, is poorly understood. Each has somewhat different but over-lapping life cycles and habitats required for breeding, feeding, hiding, resting and hibernating. Interestingly, two of the salamander species, the western red-backed and Ensatina, are lungless, breath through their skin, and do not migrate to wetlands to breed as do the other species. They live in older forests year round and breed during the winter.

According to one local study, the only wetland-breeding habitat for the blue listed red-legged frog is in a well-kept pond on private land that is outside of the Elphinstone study area. Some studies show that decaying downed trees including old-growth structures on the forest floor are very important for many of these amphibian species. However, since so little is known of the life cycles and habitats needed for the overall life cycle of all eight species, including hibernation habitat, current logging guidelines such as buffers around small wetlands and along streams are extremely speculative and will likely cause, over the long run, subpopulation declines, semi-isolation and genetic in-breeding leading to a high risk of local extinction. Further amphibian inventory and a more detailed background review of cumulative effects of roading and clearcut logging are thus measures urgently needed. Protection of the whole study area would go a long ways to preserve the high amphibian biodiversity values.

5. COMMENTS ON SUFFICIENCY OF EXISTING MINISTRY LOGGING PROTECTION MEASURES – MANAGEMENT IMPLICATIONS & THREATS TO PROTECTION OF THE BIODIVERSITY OF THE ELPHINSTONE FOREST

My partial sufficiency review concludes that current provincial protection measures for the Elphinstone study area will not adequately protect the outstanding biodiversity values if clearcutting (or any logging) and roading continue. Current protection measures provided by the creation of three very small provincial parks in combination with Ministry logging reserves, such as wildlife tree patches (WTPs), old-growth management areas (OGMAs), stream buffers, and other small logging concessions are grossly inadequate. No wildlife habitat areas (WHAs) for endangered species have been set aside in the study area.

In my background review, it was interesting that a comprehensive international study recommends reserve sizes in the order of 1,000 ha to adequately protect rare plant communities, which contain 50 or more adult plants (needed for minimum viable population (MVP) genetic size). On the other hand, I found that in the Elphinstone study area only small wildlife tree patches (WTPs) of 0.25 ha were still being recommended under Ministry guidelines to protect the rare snow bramble sites, despite evidence that WTPs were causing some bramble die-off; a blowdown of one WTP apparently caused the rare bramble plants it was meant to protect to disappear altogether. A December 2014 field survey indicated that at least one of three snow bramble plant communities found in a proposed BCTS cutblock would have over 50 adult plants and would warrant a 1,000 ha reserve, not a 0.25 ha reserve.

Additionally, a small WTP appears to be the only protection provided by the Sunshine Coast Community Forest for the genetically rare colony of wild rhododendron in the study area. A field survey found there were over 80 adult rhododendron plants, enough to warrant a 1,000 ha reserve, as recommended by the scientifically rigorous international study.

Although in-depth GIS mapping of the combined Ministry reserves was not done, it was concluded that the existing protection approach would lead to eventual loss of the rich biodiversity of the Elphinstone study area if logging is allowed to continue, including not just eventual loss of the rare snow bramble and rhododendron plant communities but the very prolific mushroom and amphibian biodiversity. It was no surprise that a GIS analysis showed 83.7% of the study area is comprised of biogeoclimatic site series/plant communities considered to be blue-listed (of conservation concern) provincially, particularly older forest types.

Since much is still not known about all the biodiversity values of the Elphinstone study area and the associated cumulative effects of clearcut logging, Ministry guidelines intended to protect biodiversity can be regarded as speculative and misleading, and will only increase the extinction crisis and extinction debt. The findings from a recent international study, using long-term measurements of global habitat fragmentation of a variety of different ecosystems, support my conclusion that forest fragmentation caused by clearcut logging on Mt. Elphinstone is a far greater threat to biodiversity than the timber tenure holders would have us believe.

PART 2

1.0 INTRODUCTION & STUDY APPROACH

In November 2014, McCrory Wildlife Services Ltd. was commissioned by a conservation group called Elphinstone Logging Focus (ELF) to carry out a preliminary conservation review of the proposed Elphinstone provincial park expansion study area near Roberts Creek on the BC Sunshine Coast. The study area has been called the *Elphinstone 1500* in reference to its assumed size of 1500 hectares.

The study approach, using Geographic Information System (GIS) map modeling and modern concepts and principles of conservation biology, included a review and double-checking of all available background information provided by ELF and others, interviews of the client group ELF and others, and a technical background review of relevant studies and other information including existing plant and mycorrhizal inventories and species at risk. The consultant, Wayne McCrory, RPBio. also drew on his 30 years of research on the biology of coastal and interior temperate rainforests. Analyst Baden Cross who also has 30 years experience in research and GIS mapping of BC's temperate rainforests carried out GIS mapping.

Due to the limited budget and short-term time frame, this report is considered a preliminary analysis. The author is responsible for his professional interpretations and opinions where they were necessary in the face of a paucity of sound biological inventory, and weak and scientifically unsupported government protection guidelines related to industrial forest management.

2.0 RESULTS & DISCUSSION

2.1 STUDY AREA

The Elphinstone protection proposal area (Map 1) on the Sunshine Coast of British Columbia is known locally as the “Elphinstone park expansion proposal,” “Mount Elphinstone park proposal,” “Elphinstone 1500” (referring to the assumed 1500 hectare size), “Elphinstone slope,” and other names. For the purpose of this analysis, I have referred to it as the Elphinstone park proposal study area or the Elphinstone study area.

As will be noted, during the study, the boundaries were slightly modified and the proposal area was found to be considerably larger in area than estimated by the original proponents.

The current proponents for full protection of the original Elphinstone 1500 park proposal are known as the Elphinstone Logging Focus or ELF and are generally mentioned throughout this report as the “client group” or “proponents.”

2.1.1 General site description

Map 1 shows the original Elphinstone park proposal study area.

The following comprehensive site description for the Elphinstone forest area has been modified slightly from the BC Federation of Naturalists (BCFN) 1998 report:

Environmentally important sites and streams on the Sunshine Coast. The following site

description was provided to BCFN researchers by mycologist Paul Kroeger. Rather than write a separate description, after verifying the BCFN site description during four days of field surveys, I decided it was well written and appropriate and have only made a few small editorial changes:

The Elphinstone Forest is most representative of the ecology of the Sunshine Coast. Gentle slopes, typically around 10% to 15%, a south-west aspect, low to middle elevations and well to moderately drained soils, combine here to grow almost uninterrupted coniferous forest.

What is exceptional about the Elphinstone slope is that a serendipitous combination of fire and logging history has left intact a large area of natural low-elevation forest. In the 1860's, before logging had begun, a catastrophic fire burned almost the entire slope, leaving alive only large fire-resistant Douglas-fir. Some of these fire veterans were later felled by hand-loggers, especially lower on the slope, but most live on, centuries old, and in places in dense concentrations. At several different times through the twentieth century the area has been selectively logged for the old-growth red cedar that was killed in the fire. This was done with relatively little disturbance because the wood was cut to shake-block size on site and taken out by flume or on minimal roads. The regenerating fir and cedar were not quite large enough to be cut in early power-logging days, especially as there was still older growth available. So it is only recently that clear-cut logging has started in this area.

The forest that has regenerated naturally after the fire is dominated by Douglas-fir well over 100 years old, with many trees on better sites now approaching a metre in diameter. Red cedar and western hemlock are also major and unlike Douglas-fir are everywhere present as seedlings and juveniles under the forest canopy. Old-growth cedar that survived the fire are widely scattered but are much less common than the old growth Douglas-fir. Old growth western hemlock is very rare, so far reported from just two small areas that apparently were not burned. Less common tree species include grand fir and western white pine that grow as widely scattered individuals now generally of canopy height, and western yew, always growing in the understory. A few large rock outcrops support shore pine but no arbutus. Some wetter areas have Sitka spruce, sometimes in small stands. One site with old growth Sitka spruce is known.....

Under the trees, the shrub and herb layers are generally sparse and monotonous. In the dry summer the biodiversity on the forest floor is not apparent, but in autumn mushrooms appear in great variety....

2.1.2 History of the Elphinstone park proposal

Efforts to protect the older forests on Mt. Elphinstone have been ongoing for the past 25 years, with only a small portion ending up being protected in three separated parcels as the Class A Elphinstone Provincial Park. The following background is from a Forest Practices

Board report (2000) that was written in response to a citizen's complaint about logging impacts on a rare mushroom species on Mt. Elphinstone:

In the early 1990s, the district established a study forest in the Mount Elphinstone area to research timber harvesting strategies. Nine cutblocks were to be harvested under the Small Business Forest Enterprise Program (SBFEP): three cutblocks by clearcut, three by shelterwood, and three by extended rotation. The effects of the three types of silvicultural systems on various components of the ecosystem would then be studied. At the same time, local residents asked that 1,500 hectares of Mount Elphinstone, including areas proposed for the harvesting research, be made a protected area.

Clearcutting of the first research cut block was approved in 1995 and was controversial because it failed to protect the habitat of a rare mushroom (see section on mushrooms).

According to the Forest Practices Board (2000), an attempt at a Local Resource Use Plan (LRUP) for Mt. Elphinstone was unsuccessful due to public opposition. This is not surprising since at the time the LRUP process was a failed government strategy to involve the public in a planning process intended to subvert legitimate proposals for new parks across the province. In retrospect, this was a very ill-conceived planning approach by the government of the day to minimise the threat of proposed parks to logging and mining resource tenures by engaging conservation groups, the public, logging and mining companies, and other interests in a multi-stakeholder collaborative approach to resource management. Not surprisingly, the informed public saw through the façade of the LRUP process, as was the case for the Mt. Elphinstone LRUP as summarised technically by the Forest Practices Board (2000):

In late 1996, Ministry of Forests district and regional staff wrote a Mount Elphinstone Forest Management Plan. A draft was presented at a Local Resource Use Plan (LRUP) meeting in February 1997, and the forest management plan was completed in December. There was strong and divided public response to the plan. Local residents formed a committee to develop their own forest management plan, one that proposed 'low impact' forest management. Low impact meant using techniques that avoided gullies and areas of high erosion potential, using existing roads only, removing less than 12 percent of the forest canopy at each pass, and using high-line timber removal methods to minimize surface disturbance.

In early 1998, cabinet designated 150 hectares of land on Mount Elphinstone as a protected area. This was much less than the 1,500 hectares requested by local residents. The district manager approved a forest development plan in June 1998, and silviculture prescriptions for several research cutblocks in December 1998. When clearing of the road right-of-way to one cutblock began in early August 1999, local residents set up a blockade. In late August, two residents filed a complaint about the approval of the road construction and harvesting of the cutblock. They maintained that anything smaller than the 1,500-hectare reserve could not adequately protect the habitat of mushrooms in mature forests. As of the release of this report in July 2000, no further road construction or timber harvesting has occurred.

According to the 1998 BCFN report, after termination of the LRUP plan by the Ministry of Forests in 1997, the Landscape Unit Plan for Mt. Elphinstone was instead done internally in February 1997 by the Ministry with a “biodiversity emphasis” set for intermediate, with a possibility to drop to low (which was later done). At the time, 9% of the timber harvesting land base was recommended to be designated as old-growth retention areas (OGMAs).

The public campaign for further protection continued, particularly for adequate protection of the mushroom biodiversity of Mt. Elphinstone. The campaign was headed by World Wildlife Fund and the BC Environmental Network (BCEN 1998).

The actual size of the LRUP for Mt. Elphinstone was 8,400 ha, so protection in 1998 of only 137 ha, or 1.6%, of the LRUP area in three small provincial park areas was obviously not going to come even close to meeting public demands for biodiversity protection.

Before, during, and after the failed 1997 LRUP public plan activities, there was a considerable amount of background inventory of plants and animals within the study area. The most comprehensive were the macrofungi inventory by Paul Kroeger (2000) and the 1998 site description and cataloguing of biological resources in the Land for Nature report by FNBC (1998).

Over time, as the Ministry of Forests implemented their internal LRUP that facilitated further roading and clearcutting of the older forest types in the Elphinstone 1500 park proposal area, a new organization called the Elphinstone Logging Focus (ELF) was formed to continue active biodiversity research and campaigning to protect the Elphinstone 1500 area. Further information is available on the history of the Elphinstone protection initiative on the ELF website (<http://www.loggingfocus.org/#>).

2.1.3 Assessing the core “Elphinstone 1500” park proposal study area, minor boundary adjustments

Considerable time and effort was spent inventorying and better defining the boundaries, size, and status of the forests of the original Elphinstone 1500 proposal.

After discussions with the client group, some small boundary revisions were made to streamline the boundary while at the same time retain the core of the original “Elphinstone 1500” that had been mapped originally and nominated for a provincial park about 20 years ago. As near as I could determine, 1500 hectares was a rough estimate of the proposal size at the time, although no documentation was available as to how this size had originally been estimated (Rick O’Neill, pers. comm.). Since then, the proposal boundaries have remained more or less constant with those that were originally mapped. The study area boundaries include the three parcels that comprise the 139 ha Elphinstone Provincial Park.

The original study area was also found to include four parcels of privately owned lands (DLs 1505, 2674, 2439, and 2387), some of which have been heavily logged. These were crudely estimated to total about 75 ha and were excluded from the current study area; although eventually they should be considered as part of an overall protection package.

2.1.4 Assessing the core “Elphinstone 1500” park proposal study area; review of adding adjacent old forests

Given the highly diminished and fragmented state of the original old-growth coastal rainforest ecosystems on the Sunshine Coast, a second step in defining the core Elphinstone study area involved reviewing maps with the client group to explore the possibility of expanding the core proposal area boundaries to include adjacent older or old-growth forests. These were identified using the preliminary GIS forest cover class map prepared for the study area from the government vegetation resource inventory (VRI) database. As follow-up to the map review, on December 8, 2014, we did a field survey on the north-central boundary of the proposal where the map showed a large forested polygon that was indicated as older forest (age Class 8). However, field inspection showed that it had all been previously clearcut some 60-80 years ago and no native forest was left. We then examined the possibility of adding to the core Elphinstone study area an extensive area of low elevation and largely intact older forest to the southeast that lies partially within the Gibson’s community watershed. While this appeared to have some conservation merit, after consideration, the client group advised me that for purposes of expediency they preferred to stay more or less with the original boundaries of the core proposal area.

2.1.5 Evaluation of the size of the final core study area

After the above-mentioned boundary review was completed, the next step was to re-examine the size of the final “Elphinstone 1500” core study area. The GIS map measurement showed that the slight revision to the original boundaries could not account for a significant discrepancy between the actual (revised) size and the size estimated 20 years ago. The “Elphinstone 1500” minus the private lands but including the three small provincial park areas was found to comprise some 2,137 hectares of public land, considerably more than the proponents had estimated originally. It is strongly recommended that the proponents not reduce the size to fit the original area estimate but revise the name of the proposal and no longer refer to it as the “1500.” As will be noted later, the remaining uncut original forest in the proposal is approximately 1500 ha in areal extent.

2.2 STATE OF THE FORESTS IN THE STUDY AREA

Prior to doing a review of biodiversity values, an important first step was to determine how much of the 2,137 ha Elphinstone study area had been clearcut and roaded. We began by using Ministry data to determine the relative proportion of the different forest cover age classes ranging from age class 0 (or recently clearcut) to the uncut second oldest age class 8 (141-250 years). As will be noted, no age class 9 or old-growth was evident on the forest cover map. This process provided a good overview of what appeared to have been clearcut and what was still relatively pristine forest in terms of age structure. However, following this analysis, we then used the forest cover map combined with Google Earth maps and some ground-truthing to more accurately determine areas that have been clearcut versus native forests.



Figure 8. Older-aged western redcedar in study area representative of mixed-age forests of high biodiversity values typical of the Elphinstone proposed park expansion area.
Photo: Rolef Von Swedenborg.

2.2.1 Analysis of ages (age classes) of the forests in the Elphinstone study area

Determination of age classes

For the Elphinstone study, GIS analyst Baden Cross obtained digital base maps, including Shapefiles, from a variety of sources but primarily from DataBC (<http://pub.data.gov.bc.ca/datasets/173885/>).

Using the government's Vegetation Resource Inventory (VRI) database, a preliminary base map of forest cover age classes was generated for the Elphinstone study area. The VRI database resulted from a 1991 Forest Resources Commission recommendation to redesign the provincial resource inventory process. The VRI is a photo-based, two-phased vegetation inventory design involving, first, photo interpretation, followed by ground sampling. The VRI is continuously updated to show changes in the forest, such as timber harvesting, fire, and other catastrophic events. This is done through electronic data submissions from timber licensees and through a combination of mapping from satellite imagery, aerial photography, and Global Positioning System (GPS) mapping. The VRI is housed on the Land and Resource Data Warehouse (LRDW) where the data can be viewed and downloaded (<http://geobc.gov.bc.ca/>). The VRI database for the area encompassed by the Elphinstone proposal was last updated in 2014. As experienced elsewhere in my coastal research, I found that age classes for forest cover polygons generated by the VRI database are not always accurate.

Age classes included Class 0 (0-1 yr.), Class 1 (1-20 yrs.), Class 2 (21-40), Class 3 (41-60), Class 4 (61-80), Class 5 (81-100), Class 6 (101-120), Class 7 (121-140), Class 8 (141-250), and Class 9 (251+). I did not attempt to correct any of the age classes from errors detected during the field surveys under my guidance of some of the map polygons that were done for the study area (see next section). The age class computations in Table 1 were considered to be accurate enough for a general overview of the age structure of the forests of the study area and surrounding Elphinstone slope.

Although there are different definitions of what constitutes coastal old-growth, the Ministry used class 9 as 250+ years.

As to age class 8 (141-250 years) for the study area, for purposes of discussion, it is assumed that any age class 8 in the study area is what grew back soon after the 1860s burn and therefore would be no older than 150-155 years; although as will be discussed, the Elphinstone forests have many old-growth trees, especially Douglas-fir vets, that survived the 1860s fire. There are different interpretations as to whether forests in age class 8 should be called "emerging old-growth." According to one forest ecologist, the upper end of an age class 8 might be considered emerging old-growth (depending on your definition of old-growth) but the lower end (say 141-200 years) might not be (Andy McKinnon e-mail to Ross Muirhead, Feb. 10, 2015). However, a comparative study of plant species density and composition of similar coastal rainforests in southeastern Alaska after clearcutting suggests that the older forests in the Elphinstone study area are now reaching some of the earlier stages of understorey plant growth that characterise old-growth forests. Alaback (1982) found that understorey shrubs and herbs start coming back in logged coastal western redcedar and western hemlock forests some 140-160 years after logging, and continue to increase in density as the forest evolves back to an old-growth state. During some of my field surveys in the age class 8 older Elphinstone forests, I noted very patchy and very low densities of salal, salmonberry, and other understorey plants that I consider likely characteristic of the first stages of old-growth as described by Alaback (1982) and therefore could be considered from this point of view to be "emerging old-growth." Therefore, for purposes of discussion, I refer to these age class 8 forests in this report as "older forests."

As already noted, another very significant feature of the older forest types in the study area is the presence of old-growth trees that survived the 1860s burn.

Field surveys and photo-documentation by myself, other researchers, and ELF indicate scattered or clustered live old-growth trees and downed or standing old-growth structures, including Douglas-fir, western redcedar, and western hemlock (*Tsuga heterophylla*). The 1860s wildfire on Mount Elphinstone appears to have been intense enough to have burned off most of the old-growth forest that existed at the time such that the scattered old-growth veterans that survived were too small in areal extent to show up on the Ministry's forest cover maps as actual old-growth polygons. These very old tree structures are up to 3-4 m in diameter, now living or dead, and are important contributors to old-growth biological functions of the Elphinstone forests. Although ages have not been obtained, from past experience in assisting with timber cruises on the coast, I am guessing some of the larger trees are likely to be 1,000 years or older.

A limited attempt has been made to inventory some of the old-growth trees in the study area. On January 15, 2015, members of ELF and volunteers counted what they considered to be 98 old-growth Douglas-fir veterans in about 50 ha of older forest in a zone bordered by the two easterly tributaries to the main Roberts Creek channel and north of the B & K Logging Rd. The survey included the proposed BC Timber Sales cutblock A87125. On March 5, 2015, ELF and four groups of trained volunteers tallied a total of 116 larger western redcedars in an approximate 20 ha area of the Roberts-Flume Forest Service Road (FSR). These ranged in diameter-at-breast height (DBH) from 0.8 m-2.6 m. However, it was uncertain how many of these could be considered old-growth since no age data was available to relate to DBH; and also they were growing on what was considered moist, and therefore favourable, growing sites for this species.

A limited number of these old-growth relic tree structures have also been selection logged. Most were for the harvest of parts of dead and/or downed western redcedar trees for cedar shake blocks and a small amount of other small commercial uses. Small amounts of First Nations traditional harvest for western redcedar bark (i.e., bark stripping) and other possible traditional uses were observed during field surveys, including some looking over a century old and some recent. This needs to be further inventoried.

Analysis of age classes in the Elphinstone study area and on the Elphinstone slope

Table 1 shows the approximate areal extent of each of the Ministry's age classes that we computed for the 2,137 ha study area, as well as what the Ministry computed in 2011 for the Mt. Elphinstone slope. Age classes generated by the government's VRI database are not always accurate. I did not attempt to correct any of the age classes from errors detected during field surveys done under my guidance using some of the draft map polygons (see next section). The age class computations in Table 1 were considered to be accurate enough for a general overview of the age structure of the forests of the study area and surrounding Elphinstone slope.

No forest cover polygons in the study area were found to be in age class 9, which is commonly considered "old-growth". In 2011, the Ministry determined there were 364 ha of old-growth forest on the Elphinstone slope—obviously outside of the park proposal study

area. This amount of old-growth may not be very accurate since one of the large old-growth polygons we ground-truthed on the slope (outside of the study area) was discovered to have been completely clearcut about 60 years or so in the past.

The oldest forest age types in the study area are the 252 ha of age class 8 (141-250 years) that account for some 11.7 % of the study area; although, because they re-grew from the 1860s burn, the oldest forests would assumed to be approximately 150-155 years.

As for age classes 5, 6, and 7, for purposes of discussion I refer to these as young-mature to mature forests. Field surveys by ELF directors Ross Muirhead (pers. comm.) and Hans Penner (pers. comm.), under my guidance, indicate that areas of forests of these age classes represent what they consider to be natural re-growth sites from the 1860s wildfire that have never before been clearcut. As well, they have only very small amounts of earlier salvage logging for cedar shake blocks.

Table 1. Comparison of forest age classes

Mt. Elphinstone provincial park expansion study area: 2,137 ha (exclusive of private lands). Based on 2014 VRI data.			Mt. Elphinstone slope total area: 5,870 ha. Based on 2010 or 2011 data. (BC Timber Sales Manager R. Hudson, March 21, 2011 letter to ELF).		
Age Class	Total ha	% of total area	Age Class	Total ha	% of total area
Ac 0	73	3.4 %	Ac 0	0	0
Ac 1 (1-20 yrs.)	194	9.1%	Ac 1	1034	17.6%
Ac 2 (21-40 yrs.)	141	6.6%	Ac 2	501	8.5%
Ac 3 (41-60 yrs.)	67	3.1%	Ac 3	685	11.7%
Ac 4 (61-80 yrs.)	340	15.9%	Ac 4	847	14.4%
Ac 5 (81-100 yrs.)	343	16.1%	Ac 5	260	4.4%
Ac 6 (101-120 yrs.)	554	25.9%	Ac 6	929	15.8%
Ac 7 (121-140 yrs.)	173	8.1%	Ac 7	1009	17.2%
Ac 8 (141-250 yrs.)	252	11.7%	Ac 8	241	4.1%
Ac 9 (251+ yrs.)	0	0	Ac 9	364	6.2%
ACs 5-8: Total	1,322	61.8%	ACs 5-8: Total	2,803	47.7%

If we consider age classes 5-8 (81 to 150-155 years) as unclearcut and near-mature, mature and older forests, then our GIS analysis showed that some 1,322 ha or 62% of the overall 2,137 ha study area is comprised of this type of intact, near-pristine forest. This amount is considerably more in proportion to the total study area than is the proportion of these same cover types (48%) in the larger Elphinstone slope MOF operating area of some 5,870 ha (which includes the study area). In other words, as to be expected, more mature and older forest is found within the study area than the mountainous hillsides outside of it, which show evidence of considerably more clearcutting. However, my age class review of the study area indicates that the 364 ha of old-growth (age class 9) identified by the Ministry for the Elphinstone slope would occur outside of the study area boundaries since no age class 9 was found within the study area.



Figure 9. Example of older selection logging of old-growth redcedar for shake wood. NE corner of Elphinstone study area. (Photo: Ross Muirhead).

In terms of recent logging, the age classes from 0 to 3 (recent clearcut to 60 years) were considered to have been clearcut except for a small area where experimental smaller cutblocks with leave strips were done. In total, these younger-aged clearcut areas comprise some 475 ha, or 22% of the study area.

Since the Elphinstone Forest was first proposed for protection some 20 years ago, an estimated 267 ha involving age classes 0 to 1 (recent to 20 years) have been clearcut. This represents 12.5% of the study area. Of this, 73 ha were logged over the past year or two, representing 3.4% of the study area.

The majority of this recent logging was done by BC Timber Sales (BCTS), while some was done by the Sunshine Coast Community Forest. No effort was made to determine how much has been done by each. Currently, BCTS is proposing two cutblocks (A87125 and A87126) in 2016 and 2017. A map review shows this proposed clearcutting is again targeting the older, biologically rich forests in the study area.

As will be discussed further, all available evidence indicates that the older forests logged in recent times have been of high biological significance. Such logging of the last remaining low-elevation older forests in a temperate coastal landscape, where most older-aged native forests are now almost gone, has, and will continue to be, highly controversial with the public and First Nations. Proposed controversial clearcut (A87126), recently advertised for sale by BCTS, was recently deferred for a year pending further input from the Sechelt First Nation.

2.2.2 Current clearcut/ altered versus native/undisturbed state of the forests of the Elphinstone study area

Although this forest age class review gave us a good approximation of how much of the study area has been logged, age class 4 (61-80 years) proved problematic. This age class comprises some 340 ha or a fair share (16%) of the study area. From just comparing forest cover maps to Google Earth maps, it was uncertain how much of this forest cover type had been clearcut and how much involved still-native forests growing on poor sites. In order to sort this out, the following step was taken: The draft forest cover map was compared to logged areas on a Google Earth map. Some forest cover polygons were then demarcated where the forest cover map might be in error or where it was not clear that the sites had been previously clearcut or represented natural forests on poor growing sites. Notes were made and a printed copy made of the draft forest cover map. Ground-truthing was then done involving a team effort by RPBio Wayne McCrory, Ross Muirhead, Hans Penner, and Rick O'Neill; other field surveys were done in 2015 by Ross Muirhead and Hans Penner under the direction of Wayne McCrory. Field notes were kept of the different polygons checked and the data was used to correct errors found on the government's forest cover map as well as more accurately verify clearcut versus native forest areas on poorer growing sites. This field data (available upon request) was then used to correct and produce a GIS map of the final approximation of clearcut/logged areas versus unlogged native forest areas.

As noted earlier, some 475 ha or 22% of the study area are in age classes 0 to 3 (recent clearcut to 60 years) that have been largely clearcut. As a result of the field surveys, we made a few small adjustments to some of these age classes on the final map that did not change our overall computations. However, our final map analysis of clearcut areas, adjusted mainly from field surveys of age class 4 polygons, showed that 148 ha have been clearcut, while 192 ha appear to be native forests on poor growing sites. Again, these are still approximate.

This final map analysis showed that of the 2,137 ha study area, some 623 ha (29%) has been logged, while about 1,514 ha (71%) remains native forest and in a pristine or near-pristine state. The total area of the surviving unclearcut native forest of the study area approximates the size of the original “Elphinstone 1500.”

Of the core study area, only 6.5% is fully protected by three small, disconnected provincial Class A parks (139 ha); an additional small but unquantified amount in small old-growth management areas (OGMAs), wildlife tree patches (WTPs), and streamside buffers has been set aside in small leave reserves in the past 20 years and where clearcutting and roading has advanced into the pristine older forest areas remaining in the study area.

Such logging-type reserves are set aside under various government policy mandates and guidelines that have never been independently evaluated in terms of their sufficiency to protect biodiversity related to old-growth values; nor have they been subject to any assessment of cumulative effects of environmental impact. Some of these smaller reserves are often subject to blowdowns due the severity of coastal storms and the small and poorly designed size of the reserves.

It is of interest that when the three small-protected areas comprising Elphinstone Provincial Park were established in 2000, a clearcut was included in the smallest part (#2) and an

important area of older Douglas-fir that was supposed to be protected was left outside of the boundaries. This was documented during macrofungi surveys for BC Parks and noted by Paul Kroeger (2000) as follows:

Site #2: Roberts Creek. This is the smallest of the three sites constituting Mount Elphinstone Park. Despite its small size (16.1 hectares), this area contains several important features and rare fungi. Upon ground-proofing of boundaries, it was found that a sizeable area of young plantation was erroneously included and a stand of old-growth Douglas-fir trees intended to be protected was not.

According to the Mount Elphinstone provincial park purpose statement and zoning plan (BC Parks 2003), BC's Environmental Stewardship department was discussing a boundary adjustment with the Ministry of Forests, including working towards a legislative change. Although I sent an email query to BC Parks to see if the boundary had been adjusted, I received no response. For purposes of this analysis, I assumed that it has.

2.2.3 How much old-growth and older forest is left in the Chapman Landscape Unit (LU) and how much would protection of the Elphinstone proposal contribute?

Government GIS shapefiles were used to first estimate the amount of old-growth (age class 9) and older (age classes 7 & 8) forests left in the Chapman-Howe Landscape Units (LUs). Although the total combined size of the LUs is 122,371 ha, this includes ocean. In fact, there is only 34,119 ha of land in the Chapman LU and only 34,515 ha in the Howe LU.

For the Chapman LU land area (34,119 ha), 705 ha or 2.1% of the LU land area is in age class 7 (121-140 yrs.), 1,714 ha or 4.4% is in age class 8 (141-250 yrs.), and 6,209 ha (18.2%) is left in age class 9 (250+ yrs.). The Elphinstone study area makes an important contribution to older forests surviving in the LU: age class 7 contributes 173 ha (17.4%) of what is left and age class 8 contributes 252 ha (14.7%) of what is left. In terms of old-growth forest cover polygons (age class 9), the study area makes no contribution. However, a partial map review and data analysis indicates that there is in fact very little old-growth left in the Chapman LU within the low-mid-elevation range typical of the Elphinstone study area (129-702 m). Some 5,757 ha or 93% of the surviving old-growth in the LU is above 800 m, most of it obviously in marginal areas not considered merchantable timber and having somewhat different forest types and biodiversity values than low-mid-elevation old-growth.

[http://www.thescca.ca/index.php?option=com_content&view=article&id=324&Itemid=251]

It is physically impossible to protect the natural diversity of plant communities and ecological processes on such a small land base as that currently provided by the LU Plans and Provincial Parks of our forest districts.

2.2.4 Biogeoclimatic characteristics of the Elphinstone forest, including provincially-at-risk biogeoclimatic site series or plant communities

Biogeoclimatic zone and subzone representation

Where do the older surviving forests of Elphinstone provincial park proposal study area fit in terms of biogeoclimatic zones, subzones, and classification of site series, including those that are considered by the province's Conservation Data Centre (CDC) to be at risk?

This is important since one approach to evaluate conservation values related to coastal temperate rainforests involves analysing how representative they are of different forest types as classified provincially under a rather complicated and highly technical regional, zonal, and local ecosystem classification system. This is determined by Terrestrial Ecosystem Mapping (TEM). The classification includes ecoprovinces, ecoregions, and ecosections (Demarchi 1993); biogeoclimatic zones, subzones, variants, and phases (Meidinger and Pojar 1991), and broad ecosystem units and site series units (Resources Inventory Committee 1998). The zonal and local site series classifications are collectively referred to as the biogeoclimatic ecosystem classification (BEC) system.

The smallest unit of classification in BEC is the site series. These are defined as ecosystems that have similar soil nutrient and soil moisture and, along with plants species, are indicative of the potential vegetation community that can occupy a site at maturity. The description of site series in the field manuals always represents mature site conditions.

A review shows that the Elphinstone study area is in the CWH (Coastal Western Hemlock) zone that covers much of the low elevation areas of the BC coast and within the Strait of Georgia Lowland (GEL) Ecosection. The Chapman Landscape Unit, in which the study area is to be found, includes three biogeoclimatic subzone variants: Coastal Western Hemlock: CWHxm1 (Coastal Western Hemlock, Eastern Very Dry Maritime), CWHdm (Coastal Western Hemlock, Dry Maritime), and CWHvm2 (Coastal Western Hemlock, Montane Very Wet Maritime).

Most of the forests of the Mt. Elphinstone study area fall within the CWHdm subzone variant, with a small portion of CWHxm1 (Map 5). Elevation of the CWHdm subzone variant ranges from sea level to about 650 m. The Elphinstone study area falls within an elevational range of 129-702 m. Forests on zonal sites are generally dominated by Douglas-fir (Fd), western redcedar (Cw), and western hemlock (Hw).

Implications for protection

In terms of protection, the Strait of Georgia Lowland (GEL) Ecosection is only 8.44% protected and therefore considered by the province to be under-represented. The CWHdm is only 5.89% protected and therefore also considered under-represented (BC Parks 2003). Since BC Parks acknowledges that the current 139 ha Elphinstone provincial park complex, within the CWHdm subzone variant, makes a negligible contribution to representation, it is difficult to understand why the province does not have a program to increase representation to biologically acceptable levels, including full protection of the diminishing older forests, such as the Elphinstone study area.

Provincially at risk plant communities/site series

The following analysis is separate from my discussion of the rare and distinctive snow bramble and wild rhododendron plant communities identified in the Elphinstone study area. Although each of these plant species appear to occur within forest cover polygons in the study area that were identified from the CDC database as blue-listed site series, they are not specifically segregated by this database for site series.

The study area was found to have ten TEM BEC plant community site series. A first step was to use the government TEM database to map the red-(imperiled or very imperiled) and blue-listed (of concern) plant communities (i.e., TEM BEC site series) in all of the biogeoclimatic subzones of the Chapman and Howe landscape units (LUs) between Howe Sound and Sechelt Inlet (Map 4). This was inclusive of the Elphinstone study area (inset, Map 4). A previous analysis by another researcher found 137 forest cover polygons in the Chapman and Howe LUs that contained red-listed and blue-listed site series using just the first decile (highest percentage above 50%) for each forest cover polygon. We employed a broader approach by using the three deciles (a complicated GIS term referring to the amount each forest cover polygon would have in terms of percentage of at risk site series). Our analysis (Map 4) found some 1,637 polygons in the Chapman-Howe LUs with red- and blue-listed site series plant communities.

For the Elphinstone study area, there are 10 site series plant communities. For some reason, no site series TEM data was available for the three small areas in he Elphinstone Provincial Park. However, as the park areas are surrounded by polygons with at-risk site series (Map 5), we assumed they have the same at-risk site series plant communities identified in the CWHdm subzone. In the study area, there are six blue-listed site series within the CWHdm site series (light blue), including: types j, k, and w of 01 HM (Hw-Flat moss), types J and K of 05 RS (Cw-Sword fern), and 07 RF (Cw-Foamflower). These total 1,712 ha or 80% of the study area. There are two blue-listed site series in the CWH xm1 (darker blue). These are 05 RS (Cw-Sword fern) and 07 RF (Cw-Foam flower). These total 80 ha or 3.7% of the study area.

Actually, there may be one or more plant communities within one site series, but this information is not contained in the TEM database. It must also be kept in mind that the site series are those that represent mature to older forests, regardless of current age class.

Map 4 (and inset) and Map 5 illustrate that a total of 83.7% of the Elphinstone study area includes forest cover polygons that have provincially at-risk (blue-listed) site series. No red-listed site series were found in the study area.

The high proportion of the study area with blue-listed site series potential is another measure of a very productive ecosystem with high biodiversity values.

Implications for protection

The implications of these results, in terms of protection values, were difficult to evaluate since the process is still being worked out in other areas of the South Coast, to the north of Elphinstone, through the ecosystem-based management (EBM) process by the Coastal Information Team (CIT) of the Great Bear Rainforest. The development of these new logging guidelines has been at least 12 years in the making and still are not finalised.

The Chapman-Howe LUs that include the Elphinstone study area are south of and outside the landscape units that come under the proposed new EBM guidelines. As near as I could determine, there appear to be no provincial guidelines developed yet, outside of the coastal ecosystem-based management (EBM) study area, for protection of blue-listed and red-listed

site series/plant communities, despite the widespread mapping database available by the Conservation Data Centre (CDC).

I loosely applied the principles being used for EBM and the revised 2013 South Central Coast Order-Consolidated version (Crown Lands 2013) to the Elphinstone situational analysis as another important ecological yardstick for my conservation review. As will be noted, this is rather confusing and complicated and, according to one representative (anon.), working on the EBM blue- and red-listed site series plant community protection guidelines is presenting challenges that need to be worked out on the ground. One of the difficulties is the small size of some of the at-risk forest cover polygons.

According to the original South Central Coast Order, Consolidated version (BC Minister of Agriculture and Lands 2009) and the 2013 revised order (Crown Lands 2013), the objectives for red-listed plant communities are to fully protect them, except that 5% can be modified such as if there are no suitable alternatives for an access road. For blue-listed:

Protect at least 70% of each occurrence of a blue-listed plant community, as set out in Schedule 6, during a primary forest activity or protect at least 70% of each type of blue-listed plant community, as set out in Schedule 6, that occurs in a landscape unit.

The intent of EBM in terms of red- and blue-listed site series is to set aside mature and older forests.

For the Elphinstone study area, this is rather complicated to apply since it does not infer that all of the 83.7% of the study area that has blue-listed forest cover polygons be protected since usually only a portion of each polygon has blue-listed site series, and only 70% of each of the blue-listed portion needs to be protected.

Overall, however, the take-home message is that the Elphinstone study area has representative at-risk site series found in the majority of the semi-mature to older forests that are indicative of a very productive ecosystem representing very high biodiversity values, and the best conservation approach would be to not do any further logging but rather to protect the whole area and let site series that have been impacted by logging recover and the remaining 80-155 year old native forests evolve to old-growth stature (250+ years).

2.3 IMPORTANCE OF ELPHINSTONE FORESTS & THEIR BIODIVERSITY TO FIRST NATIONS

Ethnobotanist Dr. Nancy Turner (2007) provides a good summary of the importance of biodiversity to First Nations of British Columbia, including food species that comprise at least 100 animal and 150 plant species. Material or technology species, such as western redcedar bark for clothing, baskets, household items, and other needs, comprise at least 100 species, while medicinal species probably number 300. In total, 400-500 species are named and utilised, or have had specific cultural importance to First Peoples across the province, and indicates the biodiversity upon which the people depended and upon which considerable aspects of the culture was based. Turner also notes that: erosion of biodiversity in various parts of the province has severely impacted First Peoples and their traditional food systems.

During field surveys in December 2014, small numbers of culturally modified trees (CMTs) were observed. These involved recent bark stripping of western redcedar trees in young age classes and older bark stripping where the bark had partly grown around the scar. Some of the older trees were estimated to be least 100-200 years old. My review also indicates that some elk still survive in the area and are dependent on old forests during periods of inclement weather. Elk, like western redcedar, are recognised as cultural keystone species on the BC coast. Undoubtedly, harvest of mushrooms and other wild plant foods are also important to the local First Nations. While it was beyond the budget and scope of my study to measure the importance of the numerous biodiversity species of the study area to the Sechelt (Shíshálh) and Squamish (Skwxwú7mesh) First Nations, this should be a priority.

Certainly loss of biodiversity values to First Nations on the Sunshine Coast has already been significant. Protection of places like the Elphinstone study area will be important to help preserve what is left for future generations.

2.4 BIODIVERSITY & BIOLOGICAL FEATURES OF THE FOREST HABITATS IN THE ELPHINSTONE STUDY AREA

Considerable biological inventory, some of it quantified and some of it observational and anecdotal, has been gathered over time for the Elphinstone study area. Based on my biodiversity inventory and research on the BC south, central, and north coasts, there is still much we do not know or understand about the complex biota and their interrelationships in the coastal climax and older-aged forests. However, enough has been documented for the Elphinstone study area to provide a good overview of biodiversity values.

2.4.1 Mammal indicator species

I did not do a comprehensive review of species assemblages but rather focused on a small number of mammal species that would potentially be candidates as indicator species for conservation. More research and documentation needs to be done for the study area in this regard, such as for small mammals.

Black bears

Although worthy of mention because of their dependency on coastal old-growth structural features for winter denning, my evaluation of the Elphinstone core study area indicated that habitat potential of early mature to older forests was such that black bears should not be used as an indicator species as they have been used elsewhere on the BC coast. It has been well documented that bear plant foods improve as a result of clearcutting but decrease in value once second-growth forests begin to close in around 30 years of age or more.

However, the significance of old-growth structures suited for potential black bear denning in the older age classes of the Elphinstone study area should not continue to be overlooked.

During field surveys, I used my list of coastal black bear foods to evaluate habitat potential. My surveys indicated that most of the older forest types (ages classes 5 to 8) were poor black bear feeding habitat. Very low and sporadic densities of traditional coastal black bear foods were noted, including the following berry-producing shrubs: salal (*Gaultheria shallon*), devil's club (*Oplopanax horridus*), red huckleberry (*Vaccinium parvifolium*), and

salmonberry (*Rubus spectabilis*). Very small areas of green plant foods (grasses, sedges, skunk cabbage) were noted. During four days of field surveys in early mature to older forests in early December 2014, I saw one older berry scat and one day bed. Although no transects were done through recent clearcuts, more berry and green plant foods were casually observed, which was to be expected. However, the benefits of clearcuts to bears are questionable and short-lived due to the early closed canopy stage at 30+ years post-logging closing off the sunlight needed for understory bear foods to thrive.

Due to the presence of old-growth structures that survived the 1860s fire, including live and downed Douglas-fir and western redcedar tree trunks, the older forests have a low-moderate potential as black bear winter denning habitat. However, a search of numerous basal cavities in larger, hollow standing western redcedar trees and downed hollow structures did not reveal any black bear den sites, although some would most likely exist considering the old-growth structure habitat potential.

Roosevelt Elk (Blue-listed)

My partial review shows that Roosevelt elk on the BC coast have evolved over millennia to be highly dependent on old-growth forest ecosystems during infrequent severe winter weather patterns of prolonged deep snow accumulation or even during periods of heavy rainfall and winds. Extensive clearcut logging of old-growth forests and conversion to plantation forestry has resulted in severe losses and degradations of old-growth ecosystems that are the support base for ungulate populations during bad winters. Lack of adequate old-growth winter habitat as the mainstay of ungulates can result in starvation and population depressions during severe winters.

Because it is blue listed provincially and is partially dependent on old forest winter range, the Roosevelt elk was chosen as one of the biological indicator species for my conservation assessment of the Elphinstone forest. Roosevelt elk are also widely known to be an important cultural heritage and subsistence species for many coastal First Nations; for this reason, they are also referred to herein as a keystone cultural species. This is defined by Garibaldi and Turner (2004) as:

...culturally salient species that shape in a major way the cultural identity of a people. Their importance is reflected in the fundamental roles these species play in diet, materials, medicine, and/or spiritual practices.

During field surveys of the Elphinstone study area in early December 2014, a bull elk track was observed in old forest habitat on the Mt. Elphinstone Community Health Trail, and several older droppings were also pointed out.

The Roosevelt elk subspecies, which likely existed on the Sunshine Coast as a traditional First Nations animal used for food, clothing, and other cultural uses for millennia, has an interesting post-contact history. By 1900, Roosevelt elk were considered extirpated on the Sunshine Coast, as elsewhere on the southern mainland coast of BC, with possible causes being human settlement, market hunting, and habitat alterations. In 1987 and 1993, Roosevelt elk were reintroduced from Vancouver Island to the Sechelt Peninsula to restore populations. A Lower Mainland Roosevelt Elk Recovery Project (LMRERP) was started in 2000 as a

response to a combined need to both control the re-introduced Roosevelt elk that had become nuisance animals along the urban fringe of the Sunshine Coast, as well as to continue re-stocking of historic Roosevelt elk ranges in the Lower Mainland (BC Ministry of Environment 2008).



Figure 10. Elk scat (droppings) near Health Trail. Photo: Ross Muirhead.

The Ministry's elk population unit (EPU) for the Sunshine Coast, including the Elphinstone study area, is called Rainy Gray. Wilson (2012) indicates a population of 60 elk.

In terms of habitat needs, studies show that Roosevelt elk occur in coniferous forests of all age classes as well as in deciduous forests and non-forested habitats including early stage clearcuts, wetlands, and vegetated slide paths. According to Brunt (1990), snow depth is important in determining use of winter habitats. During more severe winter events, elk will move into mature and old forest to seek snow interception cover when snow in more open areas deepens enough to cover low-growing plants (>30 cm). According to Henigman et al. (2005), old-growth forest structure provides forage, security cover, thermal cover, and snow interception for Roosevelt elk.

According to Quayle et al. (2003):

Elk populations declined significantly on southern Vancouver Island during the deep-snow winter of 1968–1969 when old-growth winter range was unavailable (Nyberg et al. 1990)....Forest harvesting has been largely responsible for the loss of high-quality elk winter range on Vancouver Island. High-quality elk winter range occurs

in old forest along valley bottoms or riparian corridors, so elk needs may conflict with the interests of industrial forestry.... Whether threats come from humans or other species, all interactions with Roosevelt elk operate within the vital context of their habitat. For this reason, the greatest threat to the viability of Roosevelt Elk in the long term is the fragmentation of their habitat and the destruction of their winter range. The urban landscape continues to expand into Roosevelt elk habitat, particularly on southern Vancouver Island and parts of the Lower Mainland, and the limited availability of old-growth forest as winter range is reduced by logging.

Although it is difficult to account directly for the population effects of broad-scale habitat trends, it is easy to speculate that diminishing habitat quality in the future will only lead to diminishing numbers of Elk on Vancouver Island. In addition to direct effects, such as reduced overwinter survival, the loss and fragmentation of habitat may directly augment other threats: increasing vulnerability to predators, creating problem wildlife situations, and providing greater access for unregulated hunters.

Alaback (1982) found that understorey shrubs and herbs do not start coming back in logged coastal western hemlock type forests until 140-160 years after logging, and continue to increase as the forest evolves back to an old-growth state. As for the impacts of clearcut logging, he noted that maintaining the most productive forests *in the aggradation stages of development (0-100 yr) through forest management will minimize the development of a productive vascular understorey and thus deprive herbivores of forage during 70-80% of the forest rotation.* In this instance, he was referring to Sitka black-tailed deer that are common to abundant in most coastal rainforests of Alaska and much of coastal BC; but in my opinion, his conclusions would be applicable to native Roosevelt elk on BC's south coast.

According to a recent management discussion paper (Wilson 2012), given the high demand for cultural, recreational, and commercial uses, the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) is proposing a management goal to increase the population and expand distribution, such that the Roosevelt elk could be removed from the provincial blue list within the next 10 years. One of the proposed provincial objectives is to maintain or restore the contribution of Roosevelt elk to natural biodiversity and ecosystem function.

Recommendations

Conserving rather than clearcutting the surviving mature and older forest in the 2,137 ha Elphinstone park expansion proposal area would greatly benefit the local elk population, establish a significant ecological benchmark of surviving old forest habitat for the subspecies, and help sustain local numbers for subsistence and cultural/heritage uses.

Preservation action would also meet the proposed provincial government's Roosevelt elk recovery objective to maintain or restore the contribution of Roosevelt elk to natural biodiversity and ecosystem function. Such natural biodiversity and de-listing from their threatened provincial status can't really be accomplished, in my opinion, if the Roosevelt elk's old forest winter range continues to be logged off.

2.4.2 Rare plant communities identified in the Elphinstone proposal area as indicator species

To date, several rare plant communities have been identified in the Elphinstone study area, including snow bramble and large-leaved rhododendron. By their very nature, rare plant communities are more vulnerable to being extirpated by manmade (roads and clearcut logging) or natural causes (such as natural blowdowns or large, intensive wildfires). In the instance of the Elphinstone study area, clearcut logging has been and is the largest threat.

As discussed later in my report, in my professional opinion, both of these rather unique and rare plant communities in the Elphinstone core study area are under considerable threat due to weak agency protective reserves and proposed logging plans that threaten their long term genetic viability.

Snow bramble

Considerable background research has been done in the core Elphinstone study area on this rare plant species. Snow bramble was actually reported by Kroeger (2000) during mushroom surveys for BC Parks in association with the boundary definition of three small provincial parks (sites #1, #2, and #3) within the original Elphinstone 1500 park proposal area:

*The Red-listed snow dewberry (*Rubus nivalis*) grows in an area about halfway between Sites #2 and #3 at slightly higher elevation between 440 to 550 metres. This is the only population of this plant in the Sunshine Coast Forest District. A road was recently built through the middle of the population and logging has commenced in a portion of the area, TSL A48270 block 2.*

Snow bramble is a trailing, evergreen raspberry plant of which little has been documented as to its occurrence in British Columbia. According to a review by Symon (2007), in 2006, it was known from fewer than 20 locations in southern BC, with most sites occurring in BCTS operating area in the Strait of Georgia. At this time, the plant was considered endangered and was red-listed (imperiled) by the BC Conservation Data Centre. During this same period, BCTS Powell River operating area was informed about the presence of snow bramble in their proposed logging areas on Mt. Elphinstone. A small-scale field study commissioned by BCTS indicated *Rubus nivalis* has specific ecological requirements. Approximately 30 populations of *Rubus nivalis* were found within a 5-km radius within a narrow elevational range in the Coastal Western Hemlock, Dry Maritime (CWHdm) subzone variant (Simon 2007).

As a result, an interim management protocol on snow bramble was produced by Symon (2007) for BCTS Strait of Georgia. BCTS then adopted these recommendations for an interim management protocol to offer some protection of the species, largely through efforts to inventory snow bramble communities prior to logging and then provide small wildlife tree patch (WTP) reserves of some 0.25 ha in size; despite other observations by Symon (2007) that some snow bramble in WTPs showed evidence of leaf burn. Over time, more snow bramble sites were presumably discovered and reported to BCTS and as a result, in 2012, the province down-listed the species from imperiled to vulnerable, with the CDC moving it from red-listed (threatened) to blue-listed (special concern). Formal requests by ELF to BCTS

officials to obtain the information on the additional snow bramble sites were not answered (Ross Muirhead, pers. comm.).

As a result of CDC down-listing the endangered status of snow bramble, BCTS discontinued their interim management protocol (BCTS 2012). In August 2014, Symon did a survey for ELF of three snow bramble sites in proposed BCTS cutblock 87126 in the proposed park expansion area. The survey identified that the larger population appeared very rigorous compared to other locations of snow bramble on Mt. Elphinstone and occupied a sizable area (Symon letter to ELF dated 9/28/2014).

It was interesting that the researcher also reported that a search for a previously known snow bramble community in a wildlife tree patch (WTP) within a BCTS clearcut showed that the snow bramble plants thought to be protected had disappeared, likely the result of the WTP trees blowing down. Despite this important observation, the plant researcher indicated that several of the snow bramble sites in proposed BCTS cutblock 87126 could be protected by WTPs provided they were sufficient to provide adequate interior habitat (Symon letter to ELF dated 9/28/2014). In her interim management protocol, Symon had recommended WTPs of 0.25 ha. No additional effort was made by Symon to account for the threats to snow bramble plant communities by blowdowns in WTPs. As noted elsewhere in my report, an independent international study of reserve sizes needed for rare plant communities (Burgman et al. 2001) strongly suggests that snow bramble patches with a minimum of 50 adult plants necessary to meet genetic viability (such as the larger site on Mt. Elphinstone in proposed cutblock A87126) would require a reserve size of 1,000 hectares—far larger than WTPs. It was not surprising to me that BCTS and others have continued to ignore more rigorous research models readily available in the scientific literature that recommend larger reserve sizes are needed to protect the genetic diversity and functionality of rare plant communities.

Pacific rhododendron

A conservation review by Douglas and Desrosiers (2006) indicated that although this flowering shrub species is found in only a few areas of southwestern BC, it was not considered endangered since most of the communities found in the Skagit were considered healthy and in protected areas. Thus this species is not considered by the CDC to be endangered because northern colonies are found in coastal BC. Nonetheless, as will be seen, the northernmost distribution on the Pacific coast is found in the isolated colony within the Elphinstone study area. It represents a unique saltwater-tolerant genetic clad. For this reason, I rated the Elphinstone rhododendron as genetically significant and a rare plant community.

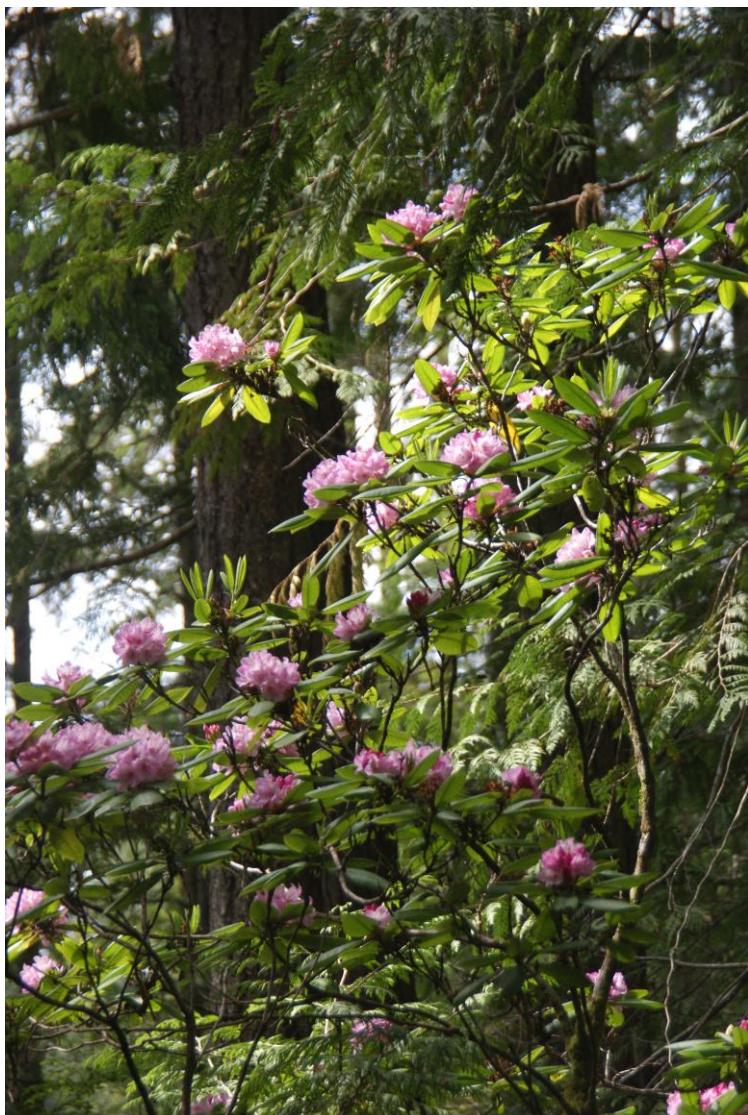
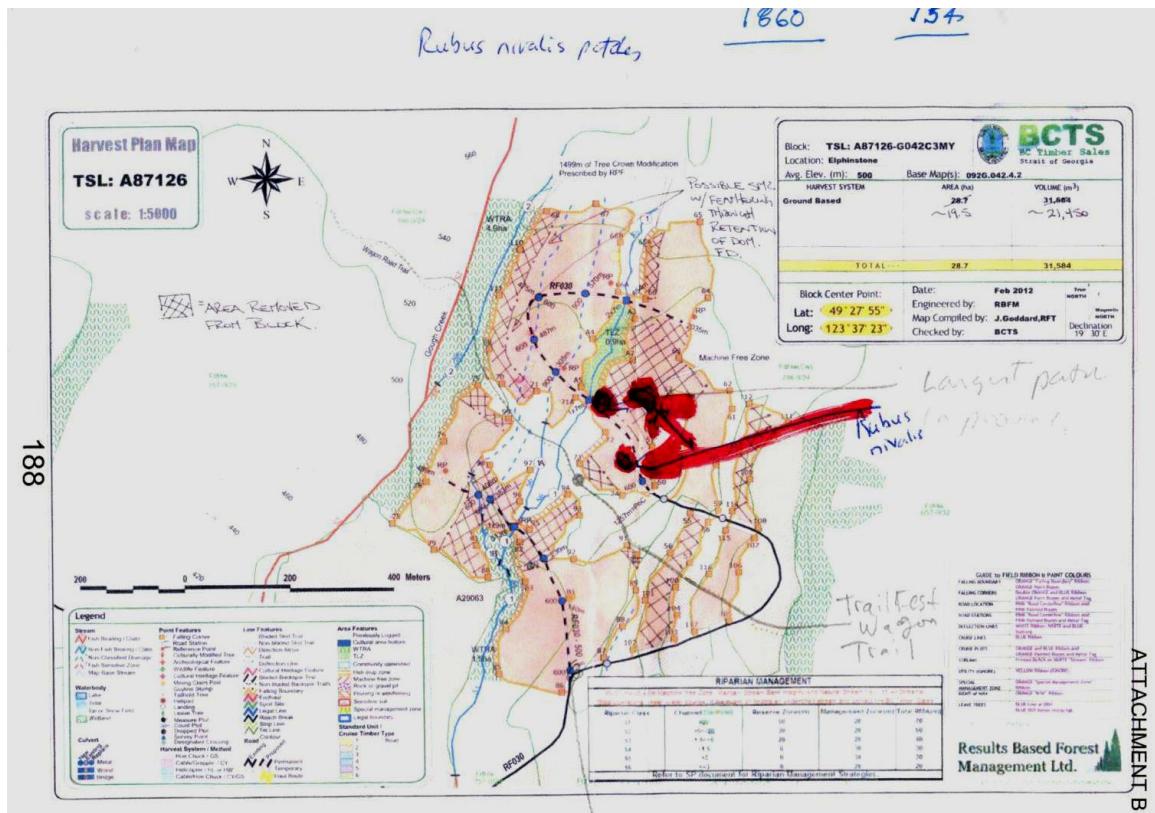


Figure 11. Northernmost occurrence of the unique genetic strain of *Rhododendron macrophyllum* (Pacific rhododendron), in bloom in May 2015 in the Elphinstone study area. Photo: Ross Muirhead.

In December 2014, I did a short field survey, along with an ELF representative, of the subpopulation of wild rhododendron that is on the lower, west side of the Elphinstone study area and within the Sunshine Coast Community Forest tenure area. The rhododendron colony is in a small wildlife tree patch surrounded by clearcuts and roads and “protected” by a rope barrier around the plant clusters. According to the information sign at the site, this rhododendron community is unique in that it is the most northern site of the species distribution along the Pacific coast. In 2006, leaf and flower bud samples were collected from the Elphinstone site by researchers studying the DNA of rhododendron (Xi et al. 2006). This study found that the Mt. Elphinstone subpopulation was part of a unique genetic strain or clad “1” (variation) of the haplotype (in RPB2-i) that prefers to live near saltwater (Map 7).

A follow-up field survey on March 20, 2015, by ELF members, under my direction, was able to document that there were 84 individual plants. This was considered more than adequate to meet the minimum viable population (MVP) threshold of 50 adult plants needed for genetic viability and a recommended reserve size of 1,000 ha for rare plant communities (Burgman et al. 2001). Several of the plants had main stems broken by limbs falling from overhead conifers in the wildlife tree patch (WTP). They attributed this damage to the tree reserve being too small to protect the site from the strong oceanic winds that cause blowdown.



According to Kroeger (2000), the mycorrhizal fungus communities of conifer forests are extremely complex. For example, as many as 2000 species of fungi form mycorrhizae with the single tree species, Douglas-fir. According to Callan (2002) “macrofungi”:

...refers to an artificial grouping of fungus species producing fruiting bodies >1 cm in diameter. Macrofungi are more likely to be observed by amateur naturalists or trained parataxonomists, and can often be recognized to genus or species by the collector in the field. For this reason they may be good candidates for preliminary biodiversity studies.

Also, according to Callan (2002), research on agaric biodiversity provides much valuable information, as many of these species are intimately associated with indigenous plants as mycorrhizal symbionts or parasites.

To the public eye, the more common macrofungi are known as mushrooms, which are the fleshy fungi in the order Agaricales, also known as *agarics*. According to Callan (2002), the majority of the pioneer studies in fungal biodiversity have been, or currently are, conducted on agarics. Such was the case that helped lead to protection of the small Elphinstone provincial park complex.

The following descriptive narrative perhaps gives one of the best overviews of the rich mushroom biodiversity of the Elphinstone forests (Federation of British Columbia Naturalists. FNBC. 1998):

Many of these fungi are mycorrhizal, that is, they live in a close, mutually beneficial partnership with the trees, trading water and minerals collected from the soil for sugars created in the canopy above. The species of fungi clearly differ from place to place through the forest. The relationships between these complex fungal populations and stand species and age composition are poorly understood. Jim Pojar, a senior researcher for the B.C. Forest service has written, ‘Fungi play fundamental roles in nutrient and energy dynamics, and our lack of knowledge about them is appalling.’ Despite their importance ecologically and the irreplaceable service they provide to our silvicultural efforts, their continued survival is generally taken for granted.

The nominators of the Elphinstone Forest have tried to bring forward the idea that mushrooms, too, are an element of biodiversity and may need to be protected. Given the state of our ignorance only the preservation of intact forest ecosystems can ensure that this complexity is not diminished. The Elphinstone Forest is now a rare forest type. Of all the forest in the CWHdm biogeoclimatic subzone, only 6% is as old or older. Paul Kroeger, considered one of the most knowledgeable field mycologists in western Canada, has written that the Elphinstone Forest appears to be especially diverse in mycota compared with other south coast sites.

According to BC Parks, when the province designated 139 hectares as Mount Elphinstone Provincial Park, the three widely separated sites were chosen because they were known to have the greatest diversity of fungi. Selection was based on field surveys by a well-known BC mycologist who identified 152 taxa of mushrooms in the three park sites (Kroeger 2000).

In terms of selection of the Elphinstone Park, according to Kroeger (2000), the rare scented night mushroom was also key:

...the forest mushroom Tricholoma apium especially influenced choice of area because this mushroom is considered to be rare, and, in North America, it grows abundantly only in some areas of Mount Elphinstone, appearing to favour old-growth character habitats. This species has now been documented in six other locations in British Columbia.

As noted, other notable mushroom species also helped guide the park site selection process. According to the Mount Elphinstone provincial park purpose statement and zoning plan (BC Parks 2003):

The primary role of Mount Elphinstone Provincial Park is to protect a mixed old growth and second growth forest and the very diverse and rich fungi populations associated with the forest. The park protects a relatively undisturbed lower elevation forest in three separate sites and provides the biogeoclimatic conditions appropriate for extensive fungi populations. (BC Parks: http://www.env.gov.bc.ca/bcparks/explore/parkpgs/mt_elphinstone/)

Many of the mushrooms on Mount Elphinstone appear to be dependent on older-aged forests. According to Kroeger (2000):

The great diversity and abundance of mushrooms and other large fleshy fungi for which Mount Elphinstone has become known depends upon late-successional conditions. Several organisms in groups other than fungi that are present on Mount Elphinstone also rely on late-successional forest for survival. Conservation of the organisms associated with the forests of Mount Elphinstone hinges upon the retention of their habitat with its late-successional characteristics intact.

Also according to Kroeger (2000), studies in British Columbia and the Pacific Northwest U.S.A. indicate that diversity of mushrooms increases with the age of the forest and is greatest in late-successional and old growth conifer stands. This great diversity appears largely dependent upon the structural attributes of these stands, but particularly large woody debris. As will be noted, this factor also means continued logging of older forests and replacement with rotational second-growth forests poses the greatest threat to the rich mushroom biodiversity identified on the Elphinstone slope.

The issue of the protection of mushroom habitat on the Elphinstone slope is confounded by the fact that neither province nor the CDC include mushrooms on their endangered status list. Additionally, there appears to be some effort within government to downplay the fact that some mushroom species in the area may in fact be rare or endangered. According to a report by the Forest Practices Board (2000), as a result of a complaint filed by a citizen in 1995, a mushroom expert with the Ministry of Forests reviewed what was known about mushrooms on the Sunshine Coast and noted that there was no information to decide whether various species of mushroom were rare or not. However, as noted in his report on the Elphinstone

slope, provincial mushroom expert Paul Kroeger (2000) considered the scented night mushroom as rare. Another researcher, Callan (2002), provides the following insight:

...mushroom collection studies are often limited to narrow windows of opportunity during fall fruiting season, which may last a few days or a few weeks at most. The resulting collections must be handled and identified or preserved quickly, and require detailed field notes or photographs. The vagaries of weather from year to year have an impact on the amount and timing of fruiting. These uncertain parameters make it difficult to confirm if a mushroom species is “rare” or if vegetative thalli (mycelia) are in fact common even though the species rarely fruits.

...One of the characters used as an indicator of “critically imperiled” status is: “5 or fewer extant occurrences or very few remaining individuals” (Redhead 1997).

However, according to the DAVFP database (Table 1), >1,400 fungus species are represented by a single collection! A total of 2,349 species (67% of all species) are represented by 5 or fewer collections in DAVFP. There is thus an obvious need to separate truly rare species from those that have merely been under collected or understudied, due to cryptic habit or lack of local taxonomic expertise.

(The acronym DAVFP is an international reference to The Forest Pathology Herbarium at the Canadian Forest Service’s Pacific Forestry Centre that houses an internationally recognised collection of >35,300 preserved and catalogued forest fungi and disease specimens, representing >3,400 different fungal species).

Although certain critical baseline information is certainly needed, from a conservation perspective, I would agree with attempts by other scientists and agencies to identify the rare and endangered status of macrofungi. For example, Redhead (1997) used the same CDC endangered status rankings to assign preliminary at-risk status to 65 species of rare or notable macrofungi found in British Columbia, most of them mushrooms. (I did not attempt to collate this list with the list prepared by Kroeger for the Elphinstone forests). Also noteworthy is that in the United States, the Northwest Forest Plan identified 234 species of fungi that require special management measures. Many of them are considered rare or endemic species (Anonymous 1994).

Also interesting in the discussion about macrofungi biodiversity on Elphinstone is that Callan (2002) suggests that other groups of macrofungi beyond agarics (mushrooms) might be good candidates for determining “rare” status, such as wood-decay macrofungi (Basidiomycota, Aphyllophorales, Polyporaceae). These produce woody “conks” on trees or downed wood. This might be worth pursuing as inventory continues of the biota of the older forests of the Elphinstone study area.

Threats

The need to protect mushroom biodiversity in the older Elphinstone forests has generated considerable controversy and debate on the impacts to mushrooms from clearcut logging, recreational activities, and commercial picking. Although Kroeger (2000) considers commercial and recreational mushroom picking and outdoor recreational activities associated with the large network of trails on the Elphinstone slope as posing some threat to mushroom

survival, clearcut logging of older forests, in my opinion, is the greatest long-term threat. For example, in terms of logging around the three small provincial parks, Kroeger (2000) recommended higher levels of protection:

Because of the small area contained in the park sites, modification of the surrounding landscape will have a great impact on the pockets of habitat within. I recommend that higher levels of protection be sought for the contiguous forest habitat adjacent to the sites. Creeks and drainages that enter the sites require an especially high level of protection if the ecological functions are to remain intact.

Since the evidence indicates that the greatest mushroom biodiversity is to be found in the older forest ecosystems on the Mt. Elphinstone slopes, BCTS appears to be somewhat in denial as to the overall, long-term cumulative effects their timber harvesting has had and will continue to have on the high mushroom biodiversity values documented. As noted, the study area has at least one rare mushroom species, the scented night mushroom, that has already been impacted by logging. Possibly there are others, since the CDC does not include tracking lists of mushroom species-at-risk.

When I examined the Forest Practices Board (2000) report for their assessment of the effects of logging on mushroom biodiversity on the Elphinstone slope (the result of a complaint by two citizens in 1999), I found that the Board had concluded that the current forest practice of leaving small reserves would help maintain habitat suitable for mushrooms. This was the second time the Board had responded in this manner to citizens' concerns about the impacts of clearcutting on mushrooms, the first one being in 1995 (Forest Practices Board 1996).

According to the 2000 Forest Practices Board report, after the Ministry of Forests established a study forest on Mt. Elphinstone in the early 1990s to research the effects of different timber harvesting strategies, a resident filed a complaint with the Forest Practices Board after the first cut block was approved in 1995. The complainant asserted that the Ministry had failed to adequately protect the habitat of a rare mushroom. The Board found that the district manager had complied with the Forest Practices Code of British Columbia Act and Regulations (the Code).

The Board's report in 2000 came to a similar conclusion. It is interesting that the 2000 report failed to acknowledge available evidence that clearcut logging on the Elphinstone slope had already impacted the habitat of the rare scented night mushroom, i.e., *Tricholoma apium*. According to the 1998 FNBC report it was Paul Kroeger who actually discovered the scented night mushroom in the Elphinstone slope:

His discovery of a rare species, now believed to be Tricholoma apium, in the Roberts Creek Research Forest, generated controversy but did not prevent the destruction in 1996 of most of its known habitat in North America, that is, the clear-cut block of the research forest. Arguments about its rarity may continue but it is worth noting that it wasn't found in the autumn of 1996, despite increased interest, but was found again in the Elphinstone Forest in the particularly wet summer of 1997.

Additionally, while the Board admitted that it agreed with the conclusions of the ministry's "mushroom expert" report (Berch1996):

[...] that there was not enough information available on which to base a decision as to whether implementation of the Biodiversity Guidebook recommendations could ensure maintenance of mushrooms...

The Board then turned around and without any scientific back-up concluded otherwise as follows:

...considers that retention of wildlife tree patches, and spreading harvesting over time and space with large areas of mature forest between blocks, will help to maintain habitat suitable for mushrooms in mature forests (Forest Practices Board 2000).

The simple truth is that if a GIS model was done of how much older forest would be left in the Elphinstone study area, after another 100 years of continuous logging, the opposite of what the Board surmised would be true since there would be very little other than second-growth forest left.

Recommendations

Certainly, far greater protective measures than three small provincially protected parcels combined with small Ministry OGMA's and WTPs are needed to protect the well-documented high mushroom biodiversity of the Elphinstone study area, including one known rare species and endangered species yet to be identified. Overall, this can best be accomplished by making the whole study area a provincial park.

An additional consideration is that surveys of wood-decay type macrofungi (e.g., tree conks) should be included in any future biodiversity analysis of the Elphinstone study area.

2.4.4 Amphibians as biodiversity indicator species

The Elphinstone study area has a good biodiversity representation of south coast rainforest amphibians (eight species) and this, as with the diverse mushroom representation, is a result of so much of the area still being intact with semi-mature to older forests with ample old-growth structures left over from the 1860s burn. For this reason, including their partial or complete dependence for all or parts of their life cycles on older or old-growth forests, coastal amphibians were considered an excellent biodiversity indicator for the Elphinstone study area. Unfortunately, I did not have the time and budget to do other than a short review.

Information on amphibian occurrence in the Elphinstone study area was obtained from a summary list of species in the FNBC report (1998) and a colour brochure prepared by local amphibian expert Rick O'Neill. Endangered status was obtained from the CDC database. A total of eight amphibians are known to occur, including three frog and five salamander/newt species; although a complete inventory of amphibians and their respective habitats has never been done for the study area. The species include:

- Coastal tailed frog (*Ascaphus truei*). Blue listed
- Red-legged frog (*Rana aurora*). Blue listed
- Pacific tree (chorus) frog (*Pseudacris regilla*)
- Ensatina salamander (*Ensatina escholtzii*)

- Northwest salamander (*Ambystoma gracile*)
- Long-toed salamander (*Ambystoma macrodactylum*)
- Western redback salamander (*Plethodon vehiculum*)
- Rough-skinned newt (*Taricha granulosa*)

Notes on the blue-listed coastal tailed frog & red-legged frog

The tailed frog and red-legged frog are blue-listed provincially. The tailed frog has been fairly well documented in the study area, particularly breeding and tadpole rearing habitats in fast-moving mountain creeks. According to the FNBC (1998) report, the tailed frog has been found in each creek on the Elphinstone slope that has been surveyed including Roberts, Clack, Flume, East Wilson, and Gough Creeks.

A comprehensive assessment of the coastal tailed frog and red-legged frog was done on Mt. Elphinstone for the Sunshine Coast Conservation Association (Dupuis 2004). For conservation of both species, Dupuis recommended some 20 ha of Wildlife Habitat Areas (WHAs) along streams, along with other measures, including small connectivity corridors. She also recommended retaining connectivity for the red-legged frog to a private pond outside of the Elphinstone study area that is known as the main breeding and rearing habitat in the area.

Unfortunately, I was unable to locate online the following research paper on amphibians (and small mammals): *The response of amphibians to various silviculture treatments in the Roberts Creek Experimental Forest study area, by Linda Dupuis, MSc. Unpublished, presented to the Ministry of Forests.*

During a December 6, 2014, field survey of the Elphinstone forest near Roberts Creek, we discovered a tailed frog on the mossy forest floor near the base of a large (1+ m DBH) Douglas-fir tree. The somewhat lethargic frog was approximately 20 m from a small, running stream. It was raining with the temperature just above freezing. Previously, there had been frost in the area. The frog eventually made its way over the moss into some woody debris. Rick O'Neill, who makes a hobby of photographing reptiles and amphibians in the area (also author of *Sunshine Coast Amphibians*), identified it as a juvenile tailed frog as no tail was evident (coordinates: W. 455.711. N. 547.6816, elevation approx. 343 m). Mr. O'Neill has quite a number of tailed frog sightings from the Roberts Creek area and other sites on the Elphinstone face, which he has provided to the BC Conservation Data Centre.

Conclusions and Recommendations

The overall distribution and habitats of each of the eight coastal amphibian species in the Elphinstone study area, including the two that are provincially blue listed, is poorly understood. Each has somewhat different but over-lapping life cycles and habitats required for breeding, feeding, hiding, resting, and hibernating. Interestingly, two of the salamander species, the western red-backed and ensatina, are lungless, breathe through their skin, and do not migrate to wetlands to breed as do the other species. They live in older forests year round and breed during the winter.



Figure 12. Red-legged frog, a blue-listed amphibian, from near Clack Creek in Elphinstone study area. The distribution of this species is not well known in the study area, but their presence in older forested habitats highlights high biodiversity values. Photo: Ross Muirhead.

According to one study, the only wetland breeding habitat for the red-legged frog is in a well-kept pond on private land (outside of the study area). Some studies show that decaying downed trees, including old-growth structures on the forest floor, are very important for many of these amphibian species. However, since little is known of the life cycles and habitat needs of the annual life cycle of all eight amphibian species, including hibernation habitat, current logging guidelines, such as for buffers around small wetlands and along streams, are extremely speculative. For example, there are two Wildlife Habitat Areas (WHAs) proposed along Clack, and East and West Gough creeks but apparently have not been ratified for the coastal tailed frog and red-legged frog (Ross Muirhead, pers. comm.). Nonetheless, such small protection zones for amphibians will, in my opinion, as logging of older forests continues, eventually lead to overall subpopulation declines, semi-isolation, and genetic in-breeding over the long term and a potentially high risk of local extinction. I would be particularly concerned about the two lungless salamander species (western redback and ensatina) that live in forests year-round and do not have to use wetlands for breeding.

Further amphibian inventory and a more detailed background review of cumulative effects of roading and clearcut logging on amphibians is urgently needed. Full protection of the entire study area as a benchmark for high amphibian biodiversity will go a long way to resolving conservation concerns.

Hypothetically, several species of reptiles would occur in the study area. However, due to the small number of very small wetlands, reptiles likely have only incidental occurrence and thus were not considered viable as indicator species.

2.5 COMMENTS ON SUFFICIENCY OF EXISTING MINISTRY LOGGING PROTECTION MEASURES. MANAGEMENT IMPLICATIONS & THREATS TO PROTECTION OF THE BIODIVERSITY OF THE ELPHINSTONE FOREST

In 2014, I conducted a very detailed sufficiency analysis of proposed new Ecosystem Based Management (EBM) logging guidelines for coastal grizzly bear habitat in the Phillips watershed on BC's south coast, some distance north of the Elphinstone study area. The study was done for a First Nations group. While my final sufficiency report is not yet publicly available, I was allowed by the First Nations client group to present an abstract and PowerPoint presentation of my findings to the 2014 North American Conference of Conservation Biology in Missoula, Montana. Having had input into the original drafts of the coastal EBM grizzly bear-salmon logging guidelines back in 2001, my 2014 conclusions were that the proposed guidelines as they have evolved through over a decade-long consensus decision-making process would be insufficient to protect grizzly bear-salmon ecosystems over the long term. In particular, I demonstrated how the guidelines had not factored in more recent and very relevant science-based studies readily available to the guideline proponents online. While the coastal grizzly bear-salmon EBM situation is not directly applicable to the Elphinstone study area, it demonstrates a parallel example of how even the best-intentioned provincial processes to develop logging guidelines to protect biodiversity often fall short of the mark and mislead the public in the process, while adding to the growing extinction crisis and extinction debt the province is now facing.

My partial review of government's logging zone protection measures for biodiversity for the Elphinstone study area also show that they fall far short of the strong measures needed to protect the high biodiversity values. Current green space management by BC Timber Sales and the Sunshine Coast Community Forest generally follow BC government-MFLNRO standardised guidelines and policies that include a combination of small retention reserves including: Old Growth Management Areas (OGMAs), wildlife tree patches (WTPs), single tree retention, riparian area buffers, wildlife habitat areas (WHAs—for some at-risk species), and others where applicable. Insofar as I am aware, there are no WHAs designated in the Elphinstone study area, although several have been proposed.

Although these standards and guidelines have been designed with the goal of maintaining biodiversity of species, including old forest structures needed for ecological functioning, they have been derived more from expert opinion, field experience, and consensus-driven stakeholder processes, rather than being based on rigorous scientific research. In many instances, these biodiversity guidelines are also extremely biased to favour the timber industry, such as through the deliberate selection of old-growth management areas (OGMAs) in poor quality stands where no old-growth occurs, or designating most of them in existing protected areas such as parks.



Figure 13. Proposed BC Timber Sales falling boundary (A87126) in Clack Creek area. Photo: Ross Muirhead.

2.5.1 Insufficient protection for high macrofungi biodiversity

While it was beyond the budget and scope of my study to conduct a detailed GIS map model and comprehensive background review of the sufficiency of long-term biodiversity protection of the three small Elphinstone park areas in combination with the various current government-sanctioned logging reserves, even a partial review is highly disappointing. While it was a positive step that the province acknowledged the significance of the macrofungi (mushroom) biodiversity of Mt. Elphinstone by protecting some 139 ha in three small provincial park sites, this only covers 6.5% of the original park proposal area and leaves out approximately 1400 ha of semi-mature to older forests in which high biodiversity values also occur. Both Paul Kroeger (2000), the mycology expert whose surveys helped select the parks, and BC Parks (2003) acknowledge that the protected areas unto themselves may be too small to meet the intended objectives to protect macrofungi. In fact, the following evidence leads me to conclude that if the entire Mt. Elphinstone study area is not fully protected, the current park areas will likely become “islands of extinction” over time.

2.5.2 Old-growth Management Areas (OGMAs) & Wildlife Tree Patches (WTPs)

The designation of Old-growth Management Areas (OGMAs) & Wildlife Tree Patches (WTPs) appears to be the Ministry’s main approach to try to protect biodiversity within the areas designated for logging. OGMAs and WTPs are not the same as parks and do not offer full legislated protection. While industrial logging is not permitted within them, they are open to such things as trail building and can also be amended to accommodate activities such

as road access, “clean energy” projects, transmission lines, and other land tenures that may occur over time. Although the Ministry defines old-growth as age class 9 (>250 years), some old-growth management reserves are not necessarily created in forests classified as old-growth but younger-aged forests that will eventually become old growth. The majority of OGMAAs in the Chapman LU have been deliberately mapped in areas already protected, such as provincial parks or areas not suited for logging. In other words, even the best-intentioned OGMAAs do not offer guaranteed protection of old-growth in landscapes continuously fragmented by logging and roading.

In December 2002, under Section 4 of the *Forest Practices Code of British Columbia Act*, the Chapman Landscape Unit (LU) and objectives were created under ministerial order (File: 36425-225/Chapman LU. https://www.for.gov.bc.ca/tasb/slcp/srmp/coast/sunshine_coast/orders/ChapmanLU_order.pdf).

The Crown Lands-Sunshine Coast Natural Resource District created Sustainable Resource Management Plans and Landscape Unit Plans that supported establishment of Old-Growth Management Areas (OGMAAs) (<https://www.for.gov.bc.ca/tasb/slcp/plan115.html>). The Chapman Unit Landscape Plan under Objective 1 sets forth the establishment of OGMAAs (Map 8) in order to:

...maintain or recruit old growth forest attributes....No timber harvesting, including salvage and single-tree harvesting, is to occur within old growth management areas. Road construction is not to occur within old growth management areas unless no other practicable options exist, in which case replacement old growth management areas may be required.

OGMAAs include both existing old-growth stands and recruitment stands that will be retained to develop old-growth characteristics over time. The plans also set forth conditions by which some logging might be allowed in OGMAAs such as to prevent the spread of insect infestations or where partial-cut timber harvesting may be necessary to thin immature trees <100 years old in portions of OGMAAs where it can be proven that this would accelerate old-growth forest attributes and improve biodiversity and so on (Gordon and Waghorn 2002).

Objective 2 sets forth the conditions to maintain stand level structural diversity by retaining Wildlife Tree Patches (WTPs), also referred to as Wildlife Tree Reserves (WTRs), within clearcut areas themselves and where no logging is to be allowed. Table A (below) from the report shows the amounts to be designated as WTPs in the Chapman LU by biogeoclimatic subzone (Gordon and Waghorn 2002). Most of the Elphinstone study area is in the CWHdm subzone and therefore might have been allocated a total of 10% as WTPs, far too little, when combined with the small amount of OGMAAs shown on Map 8, to adequately protect the very high biodiversity values I have catalogued in my report. Also noted is the problem of WTP blowdowns and their inadequacy in protecting rare plant communities.

Table A. Wildlife Tree Retention by Biogeoclimatic Ecosystem Classification Subzone

BEC Subzone	Total WTR %
CWHxm	7
CWHdm	10
CWHvm	12
MHmm	6

WTR = Wildlife Tree Retention

BEC = Biogeoclimatic Ecosystem Classification

CWHxm: Coastal Western Hemlock biogeoclimatic zone, very dry maritime subzone

CWHdm: Coastal Western Hemlock biogeoclimatic zone, dry maritime subzone

CWHvm: Coastal Western Hemlock biogeoclimatic zone, very moist maritime subzone

MHmm: Mountain Hemlock biogeoclimatic zone, moist maritime subzone

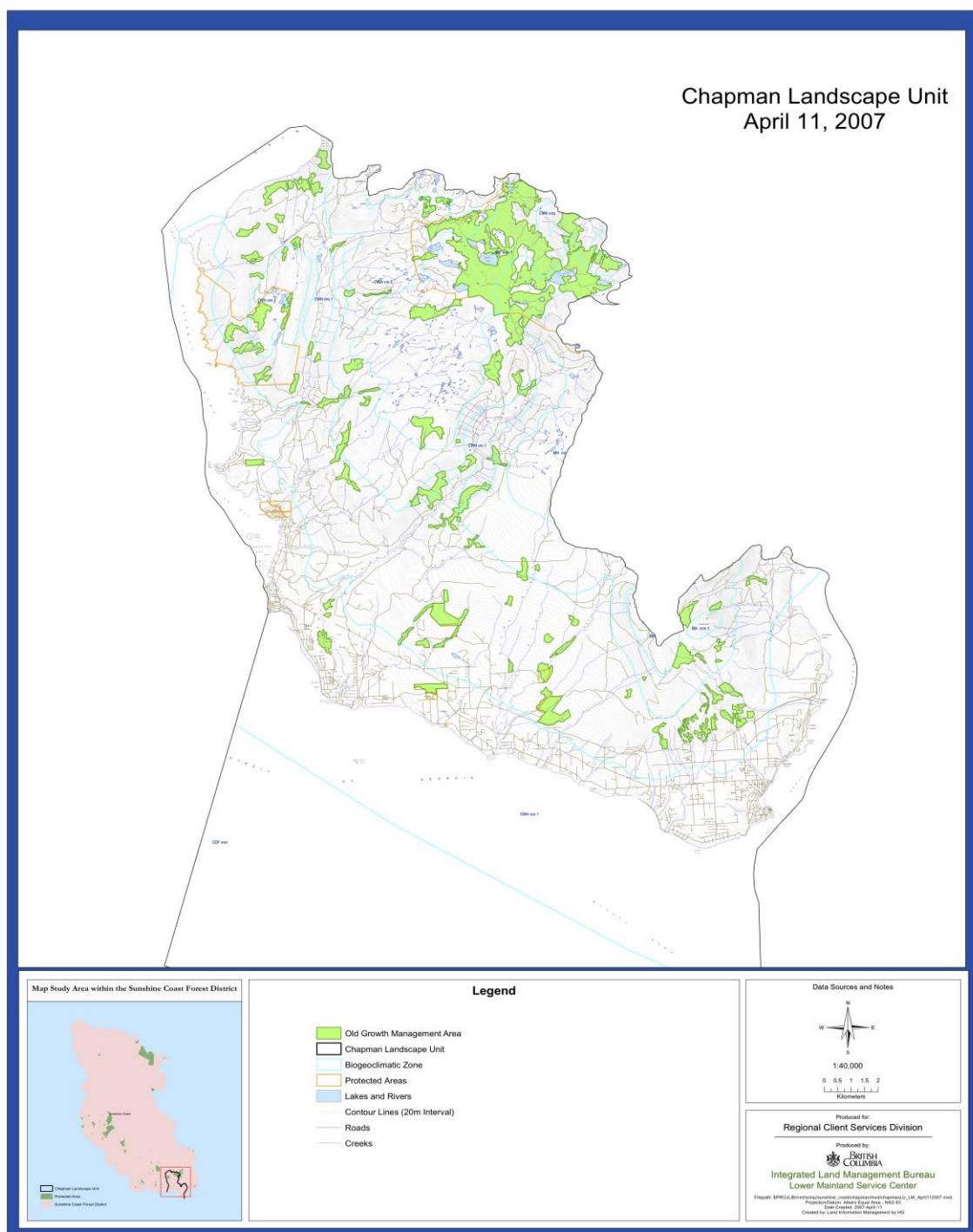
The Chapman LU plan report is also interesting in that, while amply promoting the suitability of the low-elevation forests for logging, it makes the following claim of concern (p. 5):

A high degree of access has the potential to negatively affect some wildlife species and biodiversity in general through human presence, hunting/gathering, and the introduction of foreign species.

Such a statement of impact concern does not mention that much of the road access is created by logging and makes no mention of the need for deactivation or decommissioning of many of the logging roads.

It was interesting, but not surprising, that the Chapman LU ranked 21st out of the 24 LUs in the Sunshine Coast LU biodiversity ranking process. However, while acknowledging that the marbled murrelet and tailed frog both require specific forest habitat, the LU report notes the plan is not intended to specifically provide for these or any single species but instead to provide general old forest habitat as a surrogate for habitat needs for old-serial-dependent species. Forest identified in the LU as suitable for marble murrelets was included in OGMAAs whenever consistent with current policy; however, forest identified as suitable marbled murrelet habitat was not extensively included outside of existing Protected Areas. No areas of OGMAAs were delineated for the tailed frog because its management is provided for by stand-level provisions.

It is also interesting for the total of 765 ha to be set aside for “old serial” representation including WTPs in the CWHdm subzone (the subzone in which most of the Elphinstone study area occurs). Overall, the plan acknowledges that the majority (72%) of OGMAAs do not come from timber harvesting areas but from parks and areas outside of land allocated for logging.



Map 8. Shows small amount of low elevation OGMA (light green) in Chapman Landscape Unit (https://www.for.gov.bc.ca/tasb/slrp/srmp/coast/sunshine_coast/maps/ChapmanLU_OGMAmap.pdf) These are misleading protection measures since about ¼ of the total OGMA are in existing parks and most of the balance includes old-growth outside of lands committed to logging companies.

On July 21, 2012, the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) issued a press announcement adding another 14,750 hectares of OGMA to the Sunshine Coast Forest District (1.5 million hectares), stretching from West Howe Sound to Bute Inlet. A number of these were within the Sunshine Coast Regional District (SCRD). I was not able to determine how much of these additional OGMA might be in the Elphinstone study area and exactly what proportion were inside provincial parks and areas of no value to the logging companies.

Thus, while some attempt has been made by the province to increase protection of biodiversity through green space reserve systems as WTPs, and an increase in OGMA and WTPs, the overall claims to protect biodiversity are extremely misleading since the amount claimed to be set aside is most often already protected in parks or comes from the non-timber-committed land base or the simple fact that many such reserves are too small and often susceptible to blowdowns. Nor has there been any evidence-based evaluation or follow-up monitoring that such areas actually protect biodiversity.

Additionally, although forestry and wildlife managers also claim to adhere to “adaptive management” to incorporate and accommodate new field inventory or scientific information, they most often remain **not** cognitive or inclusive of existing or new scientific studies that would lead to increased overall protection combined with improved management guidelines and appropriate timber quota reductions.

2.5.3 WTPs insufficient to protect rare plant communities

Several examples from my background research for the Elphinstone core study area strongly illustrate the point regarding the lack of scientifically rigorous and credible management guidelines by the Ministry for various species of concern or at risk.

Snow bramble

The first example refers to the rare and at-risk snow bramble plant communities that occur in the Elphinstone study area.

In a management protocol developed by Symon (2007) for BC Timber Sales for this rare trailing evergreen raspberry plant (which at the time was found in three subpopulations in the Elphinstone study area) it was recommended that:

Clustered populations of Rubus nivalis at proposed harvest areas should be located in Wildlife Tree Patches and/or Wildlife Habitat Areas.... Minimum size of Wildlife Tree Patch should be 0.25 ha to mimic the ‘interior effects’ (shading) of a fully stocked mature forest.

As near as I can determine, Symon recommended such small, conventional reserves with no background science as to their long-term genetic viability and survival effectiveness for the species in question.

However, in 2007, the researcher did note that where snow bramble was subjected to shade removal by clearcutting, the plants were susceptible to sunscald, producing discoloured leaves and die-off. In a follow up survey for ELF in 2014, Symon looked at an older harvested block (A67032) in the Mt. Elphinstone study area and was unable to find the snow

bramble at its previously documented location in a WTP that was intended to protect this rare plant community. Blowdown within the small WTP was noted to have churned up the forest floor with a thick layer of woody debris. The researcher speculated that the snow bramble could have been destroyed by the localised disturbance (Symon letter to ELF dated 9/28/2014).

Despite the evidence that WTPs had not been protecting some of the rare snow bramble colonies on the Elphinstone slope, Symon continued to recommend 0.25 ha WTPs for the three snow bramble sites located in proposed BC Timber Sales cutblock 87126 that she examined in 2014 (Map 7). As I have discussed, research elsewhere supports the evidence that much larger reserves than WTPs are needed to protect snow bramble. This research indicates that for snow bramble plant communities with 50 or more adult plants, a reserve of 1,000 ha would be needed, rather than the 0.25 ha WTP where clearcut logging would come right up to the WTP boundary. Although Symon did not count adult plants during her site visit of the three separated small subpopulations of snow bramble on August 11, 2014, she considered the areal extent (120 m^2) of the larger subpopulation to be significant in terms of size (Symon letter to ELF dated 9/28/2014). My impression, after surveys of the same sites in early December 2014, was that at least the largest subpopulation in proposed cutblock 87126 would have over 50 adult plants. (Proposed BCTS cutblock 87126 was recently deferred from logging for a year).

Pacific rhododendron

The other example of insufficient protection is the small WTP reserve surrounding the rare and genetically unique wild rhododendron colony at the west side of the Elphinstone study area. The Sunshine Coast Community Forest manages this area. While no follow up monitoring has been done to ascertain the long-term effectiveness of this small reserve, comprehensive studies done elsewhere concluded that reserve sizes of 1,000 ha are needed to protect rare plant communities (Burgman et al. 2001). This suggests that the Elphinstone rhododendron could be at long-term risk due to inadequate protection of adjacent forests.

Burgman et al. (2001) used potential deterministic and stochastic events that were likely to increase the chance of extinction for a particular plant population (e.g., habitat loss or effects of predation or competition) and linked these to population modeling of genetic viability for three rare plant species (two shrubs and one vine) with quite different life history strategies. Minimum viable population (MVP) size was considered to be 50 adult plants. The researchers concluded that ***rare plants are not expected to be maintained by coarse filter conservation strategies*** (emphasis added) *and are subject to disturbances, which can cause decline or loss of a local population*. The target areas of minimum-sized reserves for rare plant species with population clusters of 50 or more adult plants ranged from 733 to 1103 hectares. The researchers suggested that in lieu of direct information for other rare plant species, these minimum conservation reserve sizes should be applied.

To test this in the Elphinstone study area, ELF volunteers under my supervision were able to count 87 individual plants in the rhododendron colony. The assumption was made that these were mostly adult plants. It was concluded that the rhododendron colony met the minimum

viable population standard of 50 adult plants needed to warrant a much larger reserve size than what currently exists.

Given the more scientifically rigorous recommendations of the Burgman et al. (2001) study, the reserve size needed to protect both the extremely rare wild rhododendron colony and the larger snow bramble plant community on the Elphinstone study area should each be an average of 1,000 ha for a total of 2,000 ha; or nearly as large as the entire study area itself.

2001 UBC study identifies insufficient biodiversity protection on south coast

My results are consistent with the findings of a 2001 University of British Columbia academic review of biodiversity management by government agencies on the south coast, including Vancouver Island:

We conclude that both regions studied still have a long way to go before incentives and mechanisms are in place that encourage land use patterns compatible with biodiversity conservation objectives (Roman et al. 2001).

Rigorous 2015 National Science Foundation study concludes that effects of forest fragmentation on biodiversity are far worse than previously thought

The following international study of the impacts of forest fragmentation conducted by a team of 24 scientists also confirms my findings regarding threats of logging fragmentation on the Elphinstone slope. This study confirms that continued resource development by both BC Timber Sales and the Sunshine Coast Community Forest will have a much more severe impact on biodiversity than these tenure holders and the government agencies overseeing them would have us believe.

This international study was funded by the National Science Foundation. It concluded that the effects of forest fragmentation on biodiversity are far worse than previously thought (Haddad et al. 2015). The study drew on the world's largest and longest-running habitat fragmentation experiments that spanned 35 years and involved disparate biomes on five continents. Rigorous study designs and long time frames were utilised to overcome the many limitations of observational and short-term studies. Data from 76 studies across the five longest-running experiments were drawn from published and unpublished sources for this final analysis.

In terms of global forest cover, the study found that 70% of remaining forests were within 1 km of the forest's edge and subject to the degrading effects of fragmentation. Such fragmentation reduced biodiversity by 13%-75%, decreasing biomass and altering nutrient cycles and thereby impairing ecosystem functioning. Effects were found to be greatest in the smallest and most isolated fragments, and such effects were found to magnify over time. The study concluded:

Across experiments spanning numerous studies and ecosystems, fragmentation consistently degraded ecosystems, reducing species persistence, species richness, nutrient retention, trophic dynamics, and, in more isolated fragments, movement.

Reduced fragment area and increased fragment isolation were found to generally reduce abundance of birds, mammals, insects, and plants. The Haddad et al. (2015) researchers concluded that:

These findings indicate an urgent need for conservation and restoration measures to improve landscape connectivity, which will reduce extinction rates and help maintain ecosystem services.

As is obvious, many assumptions and uncertainties have been involved in the formulation of BC forestry and wildlife management guidelines, such as the *Biodiversity Guidelines* and *Old Growth Management Areas*, and other small reserve designs. In my professional opinion, this leads to highly misleading and speculative management decisions by BC Timber Sales and others that will only cause more and more species to become endangered, more extinction debt and more extinction function debt for biodiversity and society-at-large; including if not protected to the fullest extent possible, the probable permanent loss of biodiversity functioning of the older forests in the Elphinstone study area. [*Extinction debt* represents a delayed loss of species due to fragmentation while *ecosystem function debt* represents delayed changes in ecosystem function due to reduced fragment size or increased isolation (Haddad et al. (2015)].

2.6 CONCLUSIONS AND RECOMMENDATIONS

See beginning of report.

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