A GIS ANALYSIS OF THE SECHELT, CHAPMAN, AND HOWE LANDSCAPE UNITS

SPECIFIC RECOMMENDATIONS IN RESPONSE TO THE REPORT “A NEW FUTURE FOR OLD FORESTS”
Regarding short-term deferral and management of old forests in British Columbia in support of biological diversity

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Report for Elphinstone Logging Focus
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ABOUT THE AUTHOR

Baden Cross of Applied Conservation GIS is a mathematician and GIS analyst with extensive experience over the last 25 years working as an independent consultant on wildlife and conservation analyses in northwestern Canada and the USA.

My expertise includes working with GIS software, particularly the latest ArcGIS and associated habitat modeling software, such as species Least Cost Paths, Corridors and CircuitScape analysis. My mathematical background has been a major asset in designing algorithms for different GIS habitat models, such as den habitat maps for the Spirit Bear and Grizzly Bears on the BC central coast, and including Sitka deer winter range. I have worked extensively with McCrory Wildlife Services Ltd. and many others for some 20 years on various consulting projects ranging from GIS habitat models for whitebark pine stands in the BC Chilcotin to GIS habitat & grizzly bear encounter risk models for the BC Parks North Cascades Grizzly Bear Recovery Plan. I have also helped develop a GIS grizzly bear encounter risk model for a BC Parks study for Kakwa Provincial Park in the Canadian Rockies.

Other projects have included preliminary GIS assessment for the Jumbo Ski Resort in the central Purcells Mountains, and developing a Conservation Area Design (CAD) with the Craighead Institute for the Inland Temperate Rainforest (ITR) extending down into Idaho and northwestern Montana. This has included involvement with the Y2Y (Yellowstone to Yukon) Conservation Science and Planning Committee to help develop GIS strategies for the seven Y2Y subregions of the ITR. This included developing a fine scale conservation analysis in the Robson Valley with Save-The-Cedar League and Selkirk Mountain Caribou Park Proposal in the Kootenay region of BC for the Valhalla Wilderness Society.

My most recent work has been assisting the development of bear viewing/management areas in coastal watersheds of BC. I have also worked extensively with many scientists and different organisations in developing GIS map models for large landscape reserve networks. In addition, renewed public interest in the remaining old growth forests in BC has led to initial analyses of regions on the BC southern coast that are concerned with the rapid loss of these critical forested areas.

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This report has been reviewed and comments provided by Dr. Karen Price and Dr. Jim Pojar (December 2020).

Cover image: Ancient Yellow-cedar, Dakota Bear Sanctuary (Howe Sound LU)  
Credit: Ross Muirhead
SUMMARY

Over the last three decades, remaining elements of old growth forests have become a major concern within the province of British Columbia. In response to this concern, in July 2019, the BC government commissioned an independent panel of two foresters, Al Gorley and Garry Merkel, to carry out a review of the status of old forests in the province in order “to inform the development of broad public policy regarding old growth forests.” In April 2020, this “old growth panel” submitted their report to government: “A NEW FUTURE FOR OLD FORESTS, A Strategic Review of How British Columbia Manages for Old Forests Within its Ancient Ecosystems.” Included in that report were two items requiring an immediate response:

1. *Until a new strategy is implemented, defer development in old forests where ecosystems are at very high and near-term risk of irreversible biodiversity loss.*
2. *Bring management of old forests into compliance with existing provincial targets and guidelines for maintaining biological diversity.*

Within the context of the above, short-term forest deferrals were recommended for the following:

1. Old forest (>250 yrs. old) in any BGC subzone variant – Landscape Unit (LU) combination that currently has less than 10% old forest.
2. Ancient forests (e.g., forests >500 years on the coast and wet ICH) and forests >300 years in ecosystems with higher disturbance intervals.
3. Old forest areas with a Site Index (SI) of >20m.

This report focusses on a GIS (Geographical Information Systems) spatial analysis of these three criteria within three Landscape Units (Sechelt, Chapman, and Howe) on the Sunshine Coast.

The analysis determined that in these three LUs, some 15,594 hectares (ha) are “old forest.” This old forest includes approximately 1,800 ha of ancient forest and some 1,233 ha with an SI of >20 m. **There is spatial overlap of these three areas with each other.**

The analysis also identifies nine BioGeoClimatic (BGC) subzone variant–Landscape Unit combinations (BGC x LU) that currently have less than 10% remaining old forest. These were determined to be:

1. The CWHdm subzone variant in Sechelt (4.6%), in Chapman (2.3%) and in Howe (3.6%).
2. The CWHxm 1 subzone variant in Sechelt (0.6%), in Chapman (0.02%) and in Howe (0.5%).
3. The CWHvm 1 subzone variant in both Chapman (4.4%) and Howe (5.8%).
4. The CDFmm subzone variant in Sechelt (0%)
These nine BGC x LUs contain some 1,934 ha of old forest that would qualify for deferral. Adding the ancient forest areas and old forest areas with a SI >20 m not captured in the BGC x LU old forest areas indicates a total of approximately 3,755 hectares that qualify for deferral. This constitutes some 24% of the remaining old forest in the Sechelt, Chapman, and Howe Landscape Units.

A recently published report (Price, Holt, and Daust. 2020) used forest age >400 years because age definitions on the coast are so poor, we’ve also mapped ancient forests >400 years.

Using this age (>400 years) to define ancient forests, the total amount of old forest that would qualify for deferral increased to some 7,313 ha representing approximately 47% of the remaining old forest in the three LUs. **Supporting tables and maps are presented in the body of the report.**
1.0 BACKGROUND

1.1 Short discussion and relevant quotes from the report “A NEW FUTURE FOR OLD FORESTS, A Strategic Review of How British Columbia Manages for Old Forests Within its Ancient Ecosystems”

On 17 July 2019, the Government of British Columbia announced that Al Gorley and Garry Merkel, both of whom are Registered Professional Foresters (RPFs) in the province of British Columbia, would be appointed as an independent panel to undertake a province-wide Old Growth Strategic Review and provide a report to the Minister of Forests, Lands, Natural Resource Operations, and Rural Development by 30 April 2020. The purpose would be “to inform the development of broad public policy regarding old growth forests.” The government committed to releasing the report to the public within six months of the report’s submission to the ministry.

On 30 April 2020, the Honorable Doug Donaldson, Minister of Forests, Lands, Natural Resource Operations, and Rural Development was presented with the report: “A NEW FUTURE FOR OLD FORESTS, A Strategic Review of How British Columbia Manages for Old Forests Within its Ancient Ecosystems” (Gorley & Merkel, 2020).

According to this report: “Almost three decades ago, over a hundred people from various walks of life, including government, worked for 18 months to find consensus on An Old Growth Strategy for British Columbia (BC Ministry of Forests, May 1992). In that report the development team said:

Members of the public, public interest groups, professional resource managers, and representatives of industry have expressed increasing concern about management of old growth forests in British Columbia. Not only does the forest industry depend heavily on old growth for its current wood supply, but many new demands are being placed on the remaining old growth to satisfy a broad range of forest values. In parts of the province, meanwhile, opportunities to reserve representative samples of old growth are dwindling rapidly. These pressures are leading to increased instances of conflict among supporters of competing land uses.

Although many subsequent measures were taken under the auspices of land use planning and the Forest Practices Code (some of which carried forward to the current legislation), many critical aspects of the strategy laid out in that report were either discarded or only partly implemented. Had that strategy been fully implemented, we would likely not be facing the challenges around old growth to the extent we are today:

1) High risk to loss of biodiversity in many ecosystems.
2) Risk to potential economic benefits due to uncertainty and conflict.
3) Widespread lack of confidence in the system of managing forests.

The report suggests, “if the government accepts our recommendations, it develop a formal implementation plan to accompany its public response.”
The report further stated:

Our strategic review of the management of old forests led us to conclude that despite the good intentions and efforts of many people, including government personnel associated with forest management development and implementation, the overall system of forest management has not supported the effective implementation or achievement of the stated and legislated public objectives for old forests. This has not come about because of any one group or decision, but through a pattern of many choices made over several decades within an outdated paradigm.

According to the report (Gorley & Merkel, 2020):

Currently, old forest retention in BC is administered in one of three ways:

1. Legal, spatially defined Old Growth Management Areas (OGMAs)
2. Non-legal, spatially defined OGMAs
3. Aspatial old forest management

One notable concern was from recent research on edge-effect in OGMAs that were established to maintain intact old forests. It showed that old forest-dependent species had disappeared and many old forest functions were often compromised, on average, up to 100 meters from the edge of the adjacent opening (logging, roads, etc.) depending on the OGMA shape, topography, and the nature of adjacent openings or other features. When this edge-effect was applied to sample local areas, soon-to-be-published research submitted to the panel found that there were “almost no intact old forests that retained their original function in those areas.”

A major citation from the report (Gorley & Merkel, 2020) was to consider the following for short-term deferral of old growth forest:

a. Any BEC* (Biogeoclimatic Ecosystem Classification) variant with less than 10% old forest remaining today;

b. Old forest in any BEC–Landscape Unit combination that has less than 10% old forest today;

c. Ancient forests (e.g., forests >500 years on the coast and wet ICH forests >300 years in ecosystems with higher disturbance intervals)

d. Areas with a high potential to contribute towards larger ecosystem resilience; and

e. Areas with a Site Index of >20m.

Re item c above (Price et al., 2020 also used forest age >400 years “because age definitions on the coast are so poor): (Site Index—An indicator of site productivity described by the height that a stand of trees reaches in a given time, e.g., SI50 means the height at 50 years.)

*Note: BEC is often used interchangeably with BGC. Further in this analysis, the term BGC will be used.
1.2 **Reason for this analysis**

In response to the report’s recommendations (Gorley & Merkel, 2020) for deferrals, Elphinstone Logging Focus (ELF, an environmental organisation located on the Sunshine Coast) contracted Applied Conservation GIS to do a GIS analysis with respect to items b, c, and e listed above, within the Sechelt, Chapman, and Howe Landscape Units. The results in this report are derived from analysis of the BC government’s latest (2019) Vegetation Resource Inventory (VRI) data.

1.3 **General description of the region covered by this GIS analysis**

The Sechelt LU area covers a total area of 106,503 ha, the Chapman LU covers 69,090 ha, and the Howe LU covers 53,282 ha, for a total of approximately 228,875 ha. These LU definitions and area measurements include **both land and coastal waters** (see Map 1).

This analysis showed that **forested lands only** within the Sechelt LU amount to some 46,345 ha, the Chapman LU 29,774 ha, and the Howe LU 30,683 ha for a total of approximately 106,802 ha (see Map 2 on next page). The non-forested areas are typically lakes, shrub, herb, or bryoid landscapes, bedrock, exposed soil, talus, urban areas, etc.

[Map 1. Extent of the Sechelt, Chapman, and Howe Landscape Units (land and water)]
2.0 METHODS

GIS software (ESRI ArcMap 10.2) was used to determine which forested areas of the three landscape units would qualify for short term deferral of old growth forest. This basic approach was to analyse the BC government’s most up to date Vegetation Resource Inventory (VRI) data for the following parameters recommended by Gorley and Merkel (2020) for short term deferral from development:

1. Old forest in any BGC–Landscape Unit combination that has less than 10% old forest (age class 9 = >250 years)
2. Ancient Forests (age = >500 years)
3. Old forest with a Site Index of >20 m
This process involved filtering the attributes of the VRI database at various levels using spatial identities, overlays, numerical calculations, and the use of other ArcGIS functions and algorithms that involved ArcTools (Clip, Merge, Intersect, Union, Dissolve, etc.)

The VRI database extends across the whole BC province, thus the spatial and attribute data of the VRI database was “clipped” to the area bounded by the Sechelt, Chapman, and Howe Landscape Units (the “study area”) and filtered for remaining forested areas.

Old forest polygons were identified by filtering the records in the study area’s VRI attribute table (see Table 1) that registered “9” in the “age class” columns for 1st or 2nd leading species. The areas of these old forest polygons were summarised for the different BGC subzone variants in each Landscape Unit to identify which subzone variants had <10% remaining old forest.

The study area VRI attribute table old forest polygons were also filtered for polygon records that registered a Site Index >20 m in the “Site Index” column and these specific polygons (old forest with a SI >20 m) were exported to a new GIS layer and the total area calculated.

The study area VRI attribute table was also filtered for polygon records that registered an age >500 years in the “age” columns for 1st or 2nd leading species over all three LUs and these polygons were exported to a new GIS layer and the total area of ancient forest calculated. The process was repeated using age >400 years as per comments by Price et al. (2020): …because age definitions on the coast are so poor, we've also mapped ancient forests >400 years.

The old forest polygons identified in the three LUs that contained <10% old forest were then spatially overlain with the old forest polygons having a SI >20 m and the forest polygons identified as “ancient” forest (>500 yrs.) to identify the composite area that would meet the old forest panel’s recommendations for old growth short-term deferral (Map 9). A separate spatial overlay was done using forest polygons with an age of >400 years (rather than >500 years) and the two previously mentioned layers (BGC x LUs <10% and SI >20 m polygons).

### 3.0 SHORT DISCUSSION AND RESULTS

#### 3.1 Analysis of Old Forest within the three Landscape Units

*In British Columbia, the term ‘old growth’ is officially defined by the age of trees in a forest using specific thresholds (often over 250 years on the coast and 140 years in the Interior).*

(Gorley & Merkel, 2020)

The old growth strategy panel categorised old forests (often intermingled with the term “old growth” forest), especially those with very large trees, as

*the product of ancient ecosystems, icons of British Columbia’s landscape, and a key aspect of the province’s unique identity. In addition to their intrinsic value, the timber they provide is important to the provincial economy and a primary source of income in many communities. These same forests anchor ecosystems that are critical to the well-being of many species of plants and animals, including people, now and in the*
future. The conditions that exist in many of these forests and ecosystems are also simply non-renewable in any reasonable time frame.

Specifically, the panel recommended the short term deferral from further development, any old growth forest in any BGC subzone variant–Landscape Unit segment that contains <10% old forest remaining today.

Of the 106,802 ha of remaining forest land in the three LUs, the analysis identified 15,594 ha of old forest in age class 9 (>250 years) considering either 1<sup>st</sup> or 2<sup>nd</sup> leading species (Map 3). Sechelt contains 2,200 ha, Chapman 6,236 ha, and Howe 7,158 ha of the remaining old forest. This amounts to 14.6% of overall forest land in the three LUs being old forest.

![Map 3. Remaining old forest in the Sechelt, Chapman, and Howe LUs.](image)

**3.2 Analysis of old forest within the BioGeoClimatic subzone variants in the Sechelt, Chapman, and Howe Landscape Units**

A recent report by a group of independent forest scientists (Price et al. 2020) that was submitted to the old growth strategy panel suggested that we are in situations of high risk to biodiversity in many areas in the province, particularly in high-productivity, low elevation ecosystems. Their research identified BGC subzone variants that contain less than 10% of
their original old forests, as well as BGC x LUs that contained <10% old forest throughout the province of BC. The nine BGC x LUs identified in this GIS analysis as containing <10% of their old forest concur with the results in the Price et al. 2020 report.

There are seven BGC subzone variants within the Sechelt, Chapman, and Howe Landscape Units: CDFmm (Coastal Douglas Fir moist maritime), CWHdm (Coastal Western Hemlock dry maritime), CWHvm 1 (Coastal Western Hemlock very wet maritime 1), CWHvm 2 (Coastal Western Hemlock very wet maritime 2), CWHxm 1 (Coastal Western Hemlock very dry maritime 1), MHmm 1 (Mountain Hemlock moist maritime 1), and CMA unp (Coastal Mountain Heather Alpine-undifferentiated and Parkland) (Map 4).

Map 4. The seven BioGeoClimatic subzone variants within the Sechelt, Chapman, and Howe Landscape Units.

Table 1 on the next page indicates the total forested area within each of the seven BGC subzone variants and the percentage of old forest that remains in each of these subzone variants in each Landscape Unit. Red percentage figures indicate less than 10% old forest remaining in the associated subzone variant.
Table 1. Areas of the seven BGC forested subzone variants and the percentage of old forest that remains in each BGC subzone variant - Landscape Unit.

<table>
<thead>
<tr>
<th>BGC Subzone Variant</th>
<th>Howe BGC forested area (ha)</th>
<th>Howe BGC old forest (ha)</th>
<th>Howe % old forest</th>
<th>Chapman BGC forested area (ha)</th>
<th>Chapman BGC old forest (ha)</th>
<th>Chapman % old forest</th>
<th>Sechelt BGC forested area (ha)</th>
<th>Sechelt BGC old forest (ha)</th>
<th>Sechelt % old forest</th>
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<tr>
<td>CDF mm</td>
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<td>0</td>
<td>n/a</td>
<td>0</td>
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<td>2,969</td>
<td>0</td>
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<td>209</td>
<td>3.6%</td>
<td>11,237</td>
<td>262</td>
<td>2.3%</td>
<td>18,641</td>
<td>855</td>
<td>4.6%</td>
</tr>
<tr>
<td>CWH vm 1</td>
<td>7,597</td>
<td>443</td>
<td>5.8%</td>
<td>816</td>
<td>36</td>
<td>4.4%</td>
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<td>3,061</td>
<td>37.4%</td>
<td>7,847</td>
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<td>26.0%</td>
<td>5,598</td>
<td>1,101</td>
<td>19.7%</td>
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<td>4,626</td>
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Again, referring to one of the specific recommendations of the old growth strategy panel report that any old forest in any BGC x LU that has less than 10% old forest today should have a short-term deferral, this analysis indicates the short term deferral would include the CWHdm and CWHxm 1 BGC subzone variants in all three Landscape Units, as well as the CWHvm 1 subzone variant in both Chapman and Howe LUs, and the CDFmm subzone variant in the Sechelt LU.

These results are consistent with the independent findings of the Price et al. (2020) old growth report which found that province-wide, the CWHdm, CWHxm 1 and CDFmm subzone variants were among a long list of BGC subzone variants and BGC x LUs that had less than 10% remaining old forest.
Map 5. Showing the four BGC subzone variants in the three landscape units that would meet the old growth strategy panel recommendation for short term deferrals of their remaining old growth forest.

Within the recommended BGC subzone variant–LU deferral combinations (BGC x LUs), there are 1,934 ha of old forest (see Map 6).
3.3 Ancient forests within the three Landscape Units

The Merkel and Gorley (2020) report also recommends “ancient forests” (e.g., forests >500 years on the coast) be included in the short-term deferral. This GIS analysis revealed that within the three Landscape Units, there are 1,800 ha of forest of age >500 years.

Considering “ancient” forest to begin at age >400 years because age definitions on the coast are so poor, we’ve also mapped ancient forests >400 years (per. conv. K. Price, Price et al. 2020), there are 5,514 ha within the three Landscape Units, adding 3,714 ha of “ancient” forest for short term deferral consideration. (There is a small pocket of >400-year-old forest within the CMAunp subzone variant in the Chapman LU – 0.13 ha)

Map 7 identifies the remaining “ancient” forest with the threshold of age >500 years as well as additional areas if the >400 age threshold was used to define “ancient” forest.
Map 7. Ancient Forest within the three Landscape Units according to two thresholds (>400 years and >500 years of age).

3.4 Analysis of Forests with Site Index >20m

The old growth strategy panel report also recommends the deferral of old growth forest areas that have a Site Index >20 m, which, theoretically, identifies the forest polygons capable of growing the biggest trees. Site Index can be confusing to the lay person. Three samples are provided below:

1. The VRI Data Dictionary (VRI Data Standards: https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/data-management-and-access/vri-data-standards) provides the following definition for Site Index: *Estimated site index is an estimate of site productivity for tree growth (height in meters at breast height age of 50 years).*
The old growth strategy panel provides the following definition for Site Index in DEFINITIONS: An indicator of site productivity described by the height that a stand of trees reaches in a given time, e.g., SI_{50} means the height at 50 years.

2. Karen Price (Price et al. 2020) provided the following description as an example: SI_{20} is a height of 20m at 50 years.

3. This GIS analysis identified 1,233 ha of old growth forest with a Site Index of >20 m within the three Landscape Units.

Map 8. Old growth forest areas with a Site Index >20 m in the three Landscape Units.

3.5 Combining the old growth within the BGC subzone variants—Landscape Unit combinations with less than 10% old forest, old forest with a SI >20m, and ancient forest in the three Landscape Units

Old growth forest areas in the BGC x LUs that meet the old growth strategy panel’s definition for short-term deferrals (<10% remaining old growth) were combined with additional old forest areas with a SI >20 m, and additional ancient forest according to two different thresholds (>400 years or >500 years of age) within the three Landscape Units (“additional” implies SI>20 m and ancient forest areas not captured in the BGC x LU old
This identified a total of 3,755 ha of old growth forest in the three landscape units for short term deferral using the >500 years old ancient forest threshold, and a total of 7,313 ha of old growth forest in the three landscape units for short term deferral using the >400 years old ancient forest threshold.

Map 9. Total old growth areas within the Sechelt, Chapman and Howe Landscape Units which qualify under the old growth panel’s recommendations for short term deferral from development.
4.0 SUMMARY OF FINDINGS

1. The Sechelt, Chapman, and Howe Landscape Units contain a total of 106,802 ha of remaining forest area (Map 2).

2. Some 15,594 ha of old forest (based on age class 9 >250 yrs.) remains within the three Landscape Units. This comprises 14.6% of the remaining forested area (Map 3).

3. The CWHdm and CWHxm 1 BGC subzone variants in all three Landscape Units, the CWHvm 1 subzone variant in both Chapman and Howe Landscape Units, and the CDFmm in the Sechelt LU contain <10% old growth forest, and the old forest within these BGC x LU areas fall within the old growth strategy panel’s recommendation for short term deferral (Map 5).

4. Within the three Landscape Units, there are 1,800 ha of ancient forest of age >500 years. Irrespective of the BGC x LU, this falls within the old growth strategy panel’s recommendation for short term deferral of any ancient forest in the LU’s (Map 7).

5. Considering ancient forest to be age >400 years, 5,514 ha fall within the old growth strategy panel’s recommendation for short term deferral of any ancient forest in the LU’s (Map 7).

6. There are 1,233 ha of old growth forest with Site Index >20 m within the Sechelt, Chapman, and Howe LUs that fall within the old growth strategy panel’s recommendation for short term deferral (Map 8).

7. Combining the BGC x LU old growth deferral areas with areas of both ancient forests (> 500 years) and old growth areas with a site index of > 20 not captured within the BGC x LU old growth deferral areas, results in a total of 3,755 ha that fall within the criteria for deferral recommended by the old growth strategy panel.

8. Combining the BGC x LU old growth deferral areas with areas of both ancient forests (> 400 years) and old growth areas with a site index of > 20 not captured within the BGC x LU old growth deferral areas, results in a total of 7,313 ha that fall within the criteria for deferral recommended by the old growth strategy panel.
## 5.0 SUMMARY TABLE

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<th>Landscape Units (BGC subzone variants)</th>
<th>Total forest (ha)</th>
<th>Old forest (ha)</th>
<th>Old forest (%)</th>
<th>Additional ancient forest (ha) &gt;500 years</th>
<th>Additional SI &gt; 20 (ha)</th>
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6.0 REFERENCES


VRI Data Standards: https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/data-management-and-access/vri-data-standards. (See VRI Data Dictionary)