

TERRESTRIAL ECOSYSTEM MAPPING SECHELT LANDSCAPE UNIT



Prepared For:

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Attention: Ian Robertson, RPF, FIA Coordinator

Reference: Terrestrial Ecosystem Mapping within the Sunshine Coast TSA: Sechelt Landscape Unit

Dear Ian,

Please find enclosed the final project deliverables for the Sechelt Landscape Unit TEM project:

Non-Spatial Attribute Databases

1. TEM project database - ([tem_4678*_mta.csv](#))
2. TEM polygon database - ([tem_4678_evp.csv](#))
3. Venus 5.0 (ground inspection) database - ([tem_4678_eci.mdb](#))
4. Excel (visual inspection) database - ([tem_4678_eci.xls](#))

Reports and Legends

5. Map legend - ([tem_4678_ml.pdf](#))
6. Expanded (vegetation) legend - ([tem_4678_el.pdf](#))
7. Final Report - ([tem_4678_rpt.pdf](#))

ARC/INFO Spatial Databases

8. TEM polygon information - ([tem_4678_evp.e00](#))
9. TEM field plot data - ([tem_4678_eci.e00](#))

Other Deliverables (available upon request)

- Typed air photos (with numbered ecosystem polygons and labeled BGC lines)
- Original field forms

** Business Area Project ID (BAPID, supplied from the Ministry of Environment)*

Please contact me if you have any further questions or comments on the submitted deliverables.

Sincerely,

Scott Hawker, B.Sc., R.P.Bio.
Project Manager

Timberline Natural Resource Group Ltd.

ACKNOWLEDGEMENTS

Terrestrial ecosystem mapping of the Sechelt Landscape Unit could not have been successfully completed without the efforts of many people.

This project was funded through the Forest Investment Account (FIA) and was coordinated by the participating Sunshine Coast TSA Licensee Group members. Ian Robertson, R.P.F., Forsite Consultants Ltd., acted as the FIA Administrator on behalf of the Sunshine Coast TSA Licensee Group.

Ecological data collection was completed by the following Timberline staff: Scott Hawker, R.P.Bio. (Project Manager), Randy Moody, R.P.Bio. and Kara Aleksich, R.P.F. The skilled staff of Goldwing Helicopters provided safe and efficient helicopter transport throughout the landscape unit.

Digital photo control was completed by Andrew Neale of Andrew Neale Digital Mapping (Victoria, BC). Data capture (via monorestitution) was completed by Eros Pavan, R.P.F., of Timberline. Nick Zukanovic and Eros Pavan of Timberline provided their GIS expertise throughout the project.

EXECUTIVE SUMMARY

The 57,000 hectare Sechelt Landscape Unit is situated within the Sunshine Coast Forest District, encompassing the Sechelt Peninsula, from the community of Sechelt to the Northern tip of the peninsula near Egmont. This landscape unit also includes Nelson, North and South Thormanby, and Captain Islands.

In order to catalogue the ecological resources of the Sechelt Landscape Unit, the Sunshine Coast Timber Supply Area Licensee Group commissioned a terrestrial ecosystem mapping (TEM) project within this LU. The purpose of the project was to complete a TEM of the landscape unit for use in future timber supply reviews and other resource management activities. A total of **1,794** terrestrial ecosystem polygons were mapped within this landscape unit.

Mapping was completed according to the *Standards for Terrestrial Ecosystem Mapping in British Columbia* (RIC 1998), although the project followed a non-standard approach, as outlined in this document. As per standard TEM projects, the ecosystem mapping was based on the three level ecosystem classification framework, which includes ecoregion units, biogeoclimatic units and ecosystem units. According to licensee requests, and discussions between the mapping contractor, licensee and Ministry of Environment staff in a previous fiscal year, several modifications were made to the 1998 TEM standards. The following variances from a standard TEM project applied to this project:

- Terrain attributes were not mapped,
- Structural stage attributes were not mapped,
- The sampling intensity targets applied largely to the productive forest land base (i.e. parkland ecosystems were not as intensively field sampled; they were largely photo interpreted),
- FS882 field forms were not completed in the field,
- The Coastal Mountain-heather Alpine (CMA) zone was neither mapped nor classified, and
- The expanded legend did not provide a detailed listing of vegetation species by structural stage.

The following five biogeoclimatic units were mapped in the project area:

- CDFmm – Coastal Douglas-fir moist maritime subzone
- CWHxm1 – Coastal Western Hemlock eastern very dry maritime subzone
- CWHdm – Coastal Western Hemlock dry maritime subzone
- CWHvm2 – Coastal Western Hemlock montane very wet maritime variant
- MHmm1 – Mountain Hemlock windward moist maritime variant

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1 INTRODUCTION

1.1 Project Background

The Sechelt Landscape Unit (LU) supports a range of natural resource, recreation and wildlife values and a diversity of social and cultural values and influences. Stakeholders must balance these resource needs with community and ecological requirements. One step in creating a balance between economic, community and ecological requirements is to catalogue the terrestrial ecosystems within the land base through the terrestrial ecosystem mapping (TEM) process.

As defined in the current TEM standards (RIC 1998), terrestrial ecosystem mapping is the stratification of a landscape into discrete map units, according to a combination of ecological features, primarily climate, physiography, surficial material, bedrock geology, soil and vegetation.

Together, the ecological features result in distinctive and repeatable site conditions and climax vegetation communities (site series) across the landscape. Each site series depicts a specified range of vegetation species and site productivity that can be found in a particular location. Ecosystem polygons are essentially lines that demarcate the site series or site series complexes.

TEM data forms a planning framework for a wide range of land or ecosystem-based management applications including:

- base-case analysis in timber supply reviews (TSRs),
- ecosystem distribution and sensitivity analysis,
- long-term ecological monitoring,
- habitat supply modeling and assessment,
- rare ecosystem, plant or animal mapping or modeling,
- forest development, silviculture, site productivity (SIBEC) planning,
- riparian, biodiversity planning,
- wildfire risk analysis, and
- other operational and strategic planning initiatives.

The Sunshine Coast TSA Licensee Group commissioned this project with funding from the Forest Investment Account (FIA). This project contained several variances from the TEM standards (RIC 1998), as the focus was largely directed at the forested land base. Note that, as a Vegetation Resources Inventory (VRI) project is being completed concurrently within the Sunshine Coast TSA, structural stage attributes were not a deliverable for this project.

1.2 Objectives

The objectives of this mapping project within the Sechelt Landscape Unit were to:

1. delineate the terrestrial ecosystems;
2. gather field data to better describe the site series;
3. field sample forested landscapes to Survey Intensity Level 4;
4. assess biogeoclimatic lines and provide new elevation rules, if necessary;
5. provide a seamless map of terrestrial ecosystems (with localized biogeoclimatic information); and to
6. provide deliverables for submission into the Ministry of Environment's Ecological Reports Catalogue (EcoCAT).

1.3 Study Area

1.3.1 Location

At nearly 57,000 hectares (excluding ocean area), the Sechelt Landscape Unit is situated within the Sunshine Coast Forest District, encompassing the Sechelt Peninsula, from the municipality of Sechelt, at the south end, to the northern tip of the peninsula near Egmont. The landscape unit includes Nelson, North and South Thormanby and Captain Islands and covers portions of the following 1:20,000 scale BCGS mapsheets:

- 092G041, 092G042
- 092G051, 092G052
- 092G061
- 092G071
- 092F050
- 092F060, 092F069
- 092F070, 092F079
- 092F080

As described in the Biodiversity Chapter of the Sechelt Landscape Unit Plan (Sutherland *et al.* 2004), nearly 37,000 hectares are within the Crown forest land base and 25,000 hectares are within the Timber Harvesting Land Base (THLB). Much of the lower elevation, productive and gentle terrain areas have been subject to extensive alteration through past harvesting, fire and other disturbance factors. The close proximity to several Sunshine Coast communities has a major effect on the relative values and presents a challenge to developing management strategies. There is a large component of private land, primarily along the western shoreline of the Peninsula.

Timber (primarily second growth), water, fish and wildlife and recreation resources are all important within this landscape unit. Most of the remaining old seral forest occurs at mid to high elevations within Spipiyus Provincial Park. There is an abundance of outdoor

recreation opportunities within the landscape unit as well as several community watersheds.

The Sechelt LU is within the traditional territory of the Sechelt Indian Band and several Indian reserves exist in this landscape unit, including Sallahlus IR 20, Sallahlus IR 20A, Bargain Harbour IR 24 and Oalhykyim IR 4.

Figure 1 presents an overview map of the Sunshine Coast Forest District (Sunshine Coast Timber Supply Area). Situated at the southern end of the TSA, the Sechelt LU boundary is illustrated in Figure 2 (the pale green areas are included in the TSA).

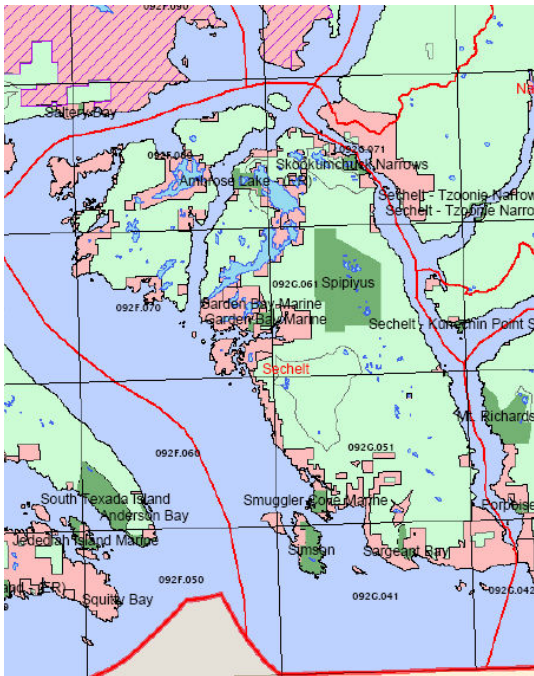


Figure 2. Sechelt LU boundary overview

1.3.1.1 Biophysical Classification

There are two related systems for describing landscapes in BC. The Ecoregion Classification System is a hierarchical system that provides a broad view of geographical relationships (Demarchi 1996). The Biogeoclimatic (BGC) Ecosystem Classification System provides another hierarchical classification method from the landscape to the site level (Pojar *et al.* 1987). The BGC subzones, which are a hierarchical unit within this system, are unique to each ecoregion.

The Sechelt Landscape Unit falls within the Pacific Ranges and Lower Mainland Ecoregions (Figure 3 and Figure 4, respectively).

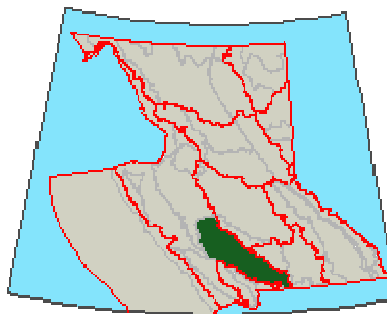


Figure 3. Pacific Ranges Ecoregion

Citing Demarchi (1996), the Pacific Ranges Ecoregion is the southern-most mountain range of the Coast Mountains in British Columbia. It includes the coastal islands, channels and fjords east of Queen Charlotte Sound; otherwise it lies east of the Georgia Depression Ecoprovince. The mountains are characteristically high and rugged in this ecoregion.

The Pacific Ranges Ecoregion consists of four Ecosections. A portion of the Sechelt LU falls within the Southern Pacific Ranges (SPR) Ecosection.

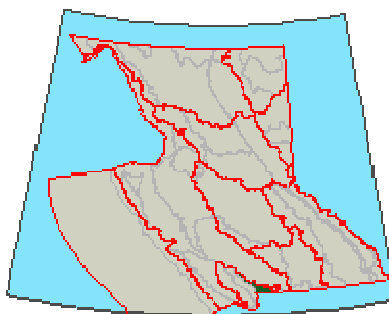


Figure 4. Lower Mainland Ecoregion

Citing Demarchi (1996), the Lower Mainland Ecoregion represents an area of reduced rainfall, although the precipitation increases towards the Coast Mountains. As the rainshadow effect is most prominent towards the Fraser River delta and surrounding lowlands, this landscape unit is likely to receive more precipitation.

The Lower Mainland Ecoregion consists of two Ecosections. A portion of the Sechelt LU falls within the Georgia Lowland (GEL) Ecosection.

The BGC subzones and variants mapped within each of the ecosections in the Sechelt LU are described in Table 1 and Table 2. The elevation ranges and descriptions are adapted from Green and Klinka's (1994) *A Field Guide for Site Identification and Interpretation for the Vancouver Forest Region: Land Management Handbook Number 28*. Further descriptions and notes on the distribution of each unit, including the elevations at which each biogeoclimatic unit has been mapped for this project, are included in Section 3.

Table 1. Field Guide descriptions of the BGC units within the Sechelt LU (SPR Ecosection)

Ecosection	BGC Unit	Name	Elevation Range (m)	Climate
<i>Southern Pacific Ranges</i>	CWHdm	Dry Maritime Coastal Western Hemlock Subzone	0 – 650 m	warm, relatively dry summers and moist, mild winters with little snowfall
	CWHvm1	Submontane Very Wet Maritime Coastal Western Hemlock Variant	0 – 650 m	wet, humid climate with cool summers and mild winters; relatively little snow
	CWHvm2	Montane Very Wet Maritime Coastal Western Hemlock Variant	650 – 1000 m	wet, humid climate with cool, short summers and cool winters; heavier snow than vm1
	MHmm1	Windward Moist Maritime Mountain Hemlock Variant	Lower (800 to 1000 m); Upper (1100 to 1350 m)	long, wet, cold winters with high snowfall and short, cool, moist summers

Table 2. Field Guide descriptions of the BGC units within the Sechelt LU (GEL Ecosection)

Ecosection	BGC Unit	Name	Elevation Range (m)	Climate
<i>Georgia Lowland</i>	CDFmm	Moist maritime Coastal Douglas-fir Subzone	0 – 150 m	warm, dry summers and mild, wet winters (mildest climate in Canada)
	CWHxm1	Eastern Very Dry Maritime Coastal Western Hemlock Variant	0 – 650 m	warm, dry summers and moist, mild winters with relatively little snowfall
	CWHdm	Dry Maritime Coastal Western Hemlock Subzone	0 – 650 m	warm, relatively dry summers and moist, mild winters with little snowfall

1.3.2 Climate

Much of the Sechelt Landscape Unit falls within the Coastal Western Hemlock very dry maritime (CWHxm1) variant, one of the driest and mildest climates in the country next to the Coastal Douglas-fir moist maritime (CDFmm) subzone, which is mapped along the lowest elevations at the southern end of the landscape unit. At lower elevations on cool aspects along the shores of Sechelt Inlet, the Coastal Western Hemlock very dry maritime (xm1) variant is replaced by the dry maritime (dm) subzone, which represents a slightly drier climate. The higher elevations within the landscape unit, within and just south of Spiipiyus Provincial Park, are within the Coastal Western Hemlock montane very wet

maritime (vm2) variant and receive considerably more precipitation than the lower elevation BGC units, much of it in the form of rain and snow during the winter months.

1.3.3 Hydrology

The water courses within the Sechelt Landscape Unit flow into the Strait of Georgia (Malaspina Strait) or into Sechelt Inlet. Some of the watercourses within this landscape unit include Wakefield, Halfmoon, Homesite, Haslam, Anderson, Kleindale and Myer Creeks. There are a number of smaller lakes, ponds and wetlands throughout the landscape unit (Figure 5). The larger lakes on the peninsula include Sakinaw, Ruby and Waugh Lakes, all of which occur towards the northern end of the landscape unit. Another large lake, West Lake occurs on Nelson Island. Several of these lakes are outside of the Timber Supply Area land base.



Figure 5. Photo of a wetland (plot SH29)

As described in the Biodiversity Chapter of the Sechelt Landscape Unit Plan (Sutherland *et al.* 2004), there are a number of community watersheds in this landscape unit including the Dakota, Haslam, Little Quarry Lake, Milne, Waugh Lake and West Lake watersheds.

1.3.4 Topography and Soils

The majority of the land base mapped within the CWHxm1 variant (especially along the south and western portions of the landscape unit, consists largely of gentle, undulating terrain (Figure 6). Steeper, rugged terrain exists at the higher elevations (within the Caren Range in Spipiyus Provincial Park) and towards the north and eastern portions of the landscape unit, within the Coastal Western Hemlock dry maritime (CWHdm) subzone.



Figure 6. Second-growth stand on gentle terrain (plot SH25)

Karst processes, common in areas where the landscape is shaped by the dissolution of a layer or layers of soluble bedrock (such as carbonate rock such as limestone, dolomite or other soluble rocks), have been revealed within the Sechelt landscape unit (Griffiths, P. 2007). Karst features may include limestone outcrops, sinkholes, caves, surface etching and depressions in surficial materials, due to karst modification of underlying bedrock glacial till (Howes and Kenk 1988).

Podzols, characterized by red-brown B horizons dominated by accumulations of aluminum, iron and humified organic material, typically develop on coarse to medium-textured, acidic parent materials, common to much of the Coastal Western Hemlock zone. They are likely widespread on a variety of glacial till and colluvium throughout the study area. Gleysols, typical of local wetter areas, are characterized by mottled grey colours due to prolonged saturation of the soils or fluctuating water levels throughout the year.

1.3.5 Parks

There are a large number of parks within the Sechelt Landscape Unit, including several marine, boat access, parks. The largest park (nearly 3,000 hectares) is Spipiyus Provincial Park, located at higher elevations within the Caren Range. This park protects pockets of old growth forest, prime habitat for the red-listed marbled murrelet. Some of the oldest yellow cedar trees in the country are found within this park.

Near the north end of the landscape unit is Skookumchuk Narrows Provincial Park, a 123 hectare park providing trails and viewing platforms for the tidal rapids in the narrows between Sechelt and Jervis Inlets.

Another important protected area within the Sechelt LU is Ambrose Lake Ecological Reserve, a 228 hectare reserve just south of Earl's Cove, which was established to protect a small coastal lake, adjacent bog land and surrounding forest. The values protected within this ecological reserve are considered of limited extent outside of the reserve and rare within the southwestern portion of the province.

2 METHODOLOGY: ECOSYSTEM MAPPING

A full summary of the hierarchical framework of ecosystem mapping used in BC is described in Appendix 1.

Under a previous contract funded through the Forest Investment Account (FIA) by the Sunshine Coast Licensee Group, Timberline Natural Resource Group (Timberline) completed the following TEM phases within the Sechelt LU:

- Air photo acquisition and preparation (2003-2005 colour; ~1:17,000 scale),
- Digital data acquisition and preparation,
- Ecosystem delineation (TEM delineation) below the CMA zone (where applicable),
- Placement of preliminary Biogeoclimatic (BGC) lines onto the aerial photos,
- Third party Quality-Assurance (QA) of the preliminary delineation, and
- Field sampling plan preparation.

The following phases were completed for this project:

- Digital line capture (monorestitution) of the ecosystem polygons and preliminary BGC lines,
- Field data collection,
- Data entry (Venus 5.0 and Microsoft Excel),
- Edits to ecosystem polygons and refinement of the preliminary BGC lines following field sampling, as required,
- Ecosystem classification (polygon attribution),
- Third party Quality-Assurance of the final classification and mapping,
- Preparation of final digital (GIS) data, and
- Final reporting and data preparation.

The following Ministry of Environment-approved variances from a standard TEM project applied to this project:

- Pre-stratification of terrain polygons was not completed (not a standard 'terrain-based' approach).
- The field program consisted of a combination of ground inspections and visual inspections in a targeted ratio of 70% visual inspections and 30% ground inspections.
- Detailed *FS882* (ecosystem) plots were not completed in the field.
- Structural stage attributes were not catalogued as these attributes were being concurrently described as part of the accompanying VRI.

- The ecosystems within the CMA, Coastal Mountain-heather Alpine, zone were neither mapped nor classified (*not applicable to this project*).
- The expanded legend did not provide a detailed vegetation list for all potential structural stages.

2.1 Polygon Delineation: non-standard approach

Although this project did not follow a standard approach to delineating bioterrain polygons (as the client did not wish to collect comprehensive terrain information), it should be noted that the process to delineate the ecosystem polygons followed the same basic principles that are followed in the delineation of standard TEM bioterrain polygons (i.e. an initial stratification of the landscape according to the physical conditions that influence ecosystem development and expression).

The ecosystem polygons were delineated within the Sechelt Landscape Unit to capture the differences within the following criteria:

- surficial material types and texture (affecting soil drainage),
- surface expression (landform and thickness),
- slope position and gradient,
- topography,
- TEM aspect class (cool and warm), and
- geomorphologic process (i.e. gullying, avalanching, meandering river etc).

2.2 Field Planning

A preliminary sampling plan was developed prior to the commencement of field work. This plan identified the biogeoclimatic units and potential ecosystem units expected in the area and a working legend of expected map units was developed. In devising a preliminary plan, aerial photographs and overview maps were examined to identify accessible areas for potential field sampling. The potential sampling sites were selected to provide a cross section of the biogeoclimatic units and topographic relief present within the landscape unit.

2.3 Field Sampling

The targeted plot production was largely based upon the productive forest land base. In the digital net-down process (to estimate a productive forest land base), a productive land base was estimated at approximately 36,000 hectares, although this is slightly over-estimated as it includes area occupied by lakes, rock, wetlands etc. Field sampling was focused on the productive forested land base within the CWH and MH zones.

Field sampling (Figure 7) in the Sechelt LU was completed over a number of days between August and November of 2007, with supplemental low-elevation sampling in

March of 2008. Each two-person crew consisted of an experienced ecologist and an assistant (VRI forester) familiar with the coastal vegetation species and site interpretation.



Figure 7. Field sampling within the Sechelt LU

The majority of the lower elevation slopes in the middle and northern portions of the landscape unit were easily accessible due to the abundance of roads. However, many of the higher elevation areas were less accessible due to washouts and deactivations. Much of the eastern portion of the landscape unit (along Sechelt Inlet) requires boat or helicopter access. To access field plots in this area, a helicopter was used to provide access between Skaiakos Point and the powerlines to the north.

A total of **289** field plots were completed within the Sechelt LU study area, consisting of **78** ground inspections and **211** visual inspections (including **29** aerial observations and **182** ‘ground-based’ visual assessments). The location of all field plots and air calls were marked and recorded on the air photos or maps at the time of field sampling. Wherever possible, Global Positioning System (GPS) point locations were also recorded in the field. Where satellite coverage was insufficient for an accurate measurement, the field plot locations were marked directly onto air photos. Crews ensured, wherever possible, that the chosen sampling locations expressed homogeneous site, soil and vegetation characteristics. The Field Manual for Describing Terrestrial Ecosystems (Ministry of Forests and BC Environment 1998) provided a detailed methodology for data collection at the ground inspections locations. Standard TEM ground inspection forms (GIF) were used for the ground inspections and for some of the visual inspections. Other visual inspections and air calls were recorded as hand-written notes on field note paper.

2.4 Data Entry and Analysis

The ground inspection data was entered into the Ministry of Environment’s VENUS 5.0 software and the visual inspections were entered into a Microsoft Excel spreadsheet. Both of the databases are submitted with this project.

Upon completion of the field program, each of the project ecologists reviewed the field forms in the office for completeness and accuracy and to ensure that all plot locations were accurately transferred into the GIS spatial database.

2.5 Ecosystem Mapping

Following completion of the field sampling and subsequent review of the field data, the ecosystem polygons were digitized (via monorestitution). The polygons were assigned a unique number and plotted onto a base map that included contour lines and Terrain Resources Information Mapping (TRIM) hydrology features in preparation for ecosystem classification.

Each of the ecosystems were classified and entered into an Microsoft Excel TEM ecosystem 'polygon' database. The ecosystem unit labels were recorded by a project ecologist through manual examination of the air photos using a combination of a Sökkisha MS-27 mirror stereoscope, with 3X binocular attachment for enhanced resolution. The core data entered in the ecosystem database for each polygon includes:

- BCGS Mapsheet Number;
- Polygon number (ECP_Tag);
- Data source (Photo Interpreted, Ground Inspection, or Visual Inspection);
- Flight line (project specific) and photo number;
- Ecoregion code;
- Biogeoclimatic zone, subzone, and variant;
- Ecosystem labels [decile, site series, modifier(s) and structural stage: recorded up to three times per polygon];
- User-defined field: Other "point-feature" habitat elements that are <20% of the polygon area (i.e. RO, TA, OW etc. that may be of importance for future habitat analysis);
- Polygon area (hectares); and
- Comments: additional information on the polygon, including some point wildlife and/or habitat observations.

Each of the ecosystem polygons have been classified as either a single ecosystem unit (simple label) or as a complex unit, with either two or three (maximum) ecosystem units per polygon. Each polygon includes a site series number (and TEM alpha map code) and has been described with up to three site modifier(s) where the conditions differ from the assumed conditions described in the provincial database for each site series. For the complexed units, only the ecosystems estimated to cover approximately 20% of the total polygon area have been recorded.

Draft ecosystem maps were created in ARC/INFO format by combining the base map coverage, polygon digital files and the ecosystem databases.

2.6 Expanded Vegetation Legend

A modified expanded vegetation legend was developed in Microsoft Word and is attached as Appendix 2. Whereas a standard legend has a detailed list of vegetation species for all potential structural stages, this legend does not differentiate between structural stages. The legend provides the following information for each mapped ecosystem unit (site series):

- a description of the typical situation in which the unit has been mapped,
- the assumed modifiers and typical soil moisture regime,
- the provincial, approved, site series (2-letter) map code,
- all mapped modifiers,
- the dominant vegetation species, by layer (tree, shrub, herb and moss layers),
- the associated vegetation species by layer (tree, shrub, herb and moss), and a
- list of the field plots established within each of the units.

For the units not confirmed with field plots, the typical situations and vegetation lists were derived from a combination of the provincial TEM map code database and the current Land Management Handbook for the Vancouver Forest Region: LMH28 (Green and Klinka 1994).

3 RESULTS: MAPPED BGC UNITS AND ECOSYSTEMS

A summary of ecosystem units mapped in the project area is provided below. A full description of the plant associations within each ecosystem mapped in each of the BGC units is provided on separate tables found in Appendix 2.

3.1 Biogeoclimatic Units

Table 3 summarizes the number of polygons mapped within each of the BGC units within the Sechelt Landscape Unit. Across the landscape unit (and excluding lakes), the average TEM polygon size is **19.3 hectares**, slightly greater than the ‘typical’ TEM polygon size range of 12 to 15 hectares.

Table 3. Area summary of mapped polygons by BGC unit

BGC Unit	Name	# Polygons	Area (Ha)
CDFmm	Moist maritime Coastal Douglas-fir subzone	42	714.5
CWHxm1	Eastern very dry maritime Coastal Western Hemlock variant	660	13,738.0
CWHdm	Dry maritime Coastal Western Hemlock subzone	809	15,745.6
CWHvm2	Montane very wet maritime Coastal Western Hemlock variant	271	4,296.5
MHmm1	Windward moist maritime Mountain Hemlock variant	8	63.7

Following are descriptions of each of the biogeoclimatic (BGC) units mapped within the Sechelt Landscape Unit.

3.1.1 CDFmm

The moist maritime Coastal Douglas-fir subzone, with the mildest climate in Canada, has been mapped at the southern end of the landscape unit. Throughout most of its range, it has been mapped from sea level to approximately 200 metres elevation, below the CWHxm1 variant and largely as it is presently mapped in the existing Ministry BGC coverage. Given the limited extent of zonal forested ecosystems in the area mapped as CDFmm, the existing Ministry CDFmm lines were not revised.

With 42 TEM polygons mapped within the CDFmm subzone, the average polygon size is **17.0 hectares**. Table 4 summarizes the site series that have been mapped within the CDFmm subzone. Where applicable, any map units that have been borrowed from other BGC units (as listed in the user-defined deliverable), have been noted within the table.

Table 4. Vegetated site series mapped within CDFmm

Site Series	Map Code	Site Series Name
01	DS	Fd - Salal
02	DA	FdPl - Arbutus
03	DO	Fd - Oniongrass
04	DG	FdBg - Oregon grape
05	RK	CwFd - Kindbergia
06	RF	CwBg - Foamflower
11	RC	Cw - Skunk cabbage
00	SS	Spirea - Sedge wetland

3.1.2 CWHxm1

The eastern very dry maritime Coastal Western Hemlock variant has been mapped at the lowest elevations within much of the Sechelt Landscape Unit, especially within the southern and western portions of the landscape unit. It has typically been mapped from sea level (or above CDFmm at the south end) to approximately 300 metres elevation, below the CWHdm variant. On the peninsula, this variant has been mapped nearly the length of the landscape unit, from Sechelt, at the south end, to just south of Ambrose Lake Ecological Reserve. It has also been mapped on the southwest portion of Nelson Island.

With 663 TEM polygons (excluding lakes) mapped within the CWHxm1 variant, the average polygon size is **20.8 hectares**. Table 5 summarizes the site series that have been mapped within the CWHxm1 variant. Where applicable, any map units that have been borrowed from other BGC units (as listed in the user-defined deliverable), have been noted within the table.

Table 5. Vegetated site series mapped within CWHxm1

Site Series	Map Code	Site Series Name
01	HK	HwFd - Kindbergia
02	DC	FdPl - Cladina
03	DS	FdHw - Salal
04	DF	Fd - Sword fern
05	RS	Cw - Sword fern

06	HD	HwCw - Deer fern
07	RF	Cw - Foamflower
11	LS	Pl - Sphagnum
12	RC	CwSs - Skunk cabbage
00	HL	Hardhack - Labrador tea
00	SW	Sedge wetland

3.1.3 CWHdm

The dry maritime Coastal Western Hemlock subzone has been mapped above the CWHxm1 variant throughout the Sechelt LU and has been mapped to approximately 650 metres, below the CWHvm2 variant. On the eastern slopes above Sechelt Inlet, from just north of Piper Point to the north end of the landscape unit, the CWHdm subzone has been mapped to the shoreline.

With 809 TEM polygons mapped within the CWHdm subzone, the average polygon size is **19.5 hectares**. Table 6 summarizes the site series that have been mapped within the CWHdm subzone. Where applicable, any map units that have been borrowed from other BGC units (as listed in the user-defined deliverable), have been noted within the table.

Table 6. Vegetated site series mapped within CWHdm

Site Series	Map Code	Site Series Name
01	HM	Hw - Flat moss
02	DC	FdPl - Cladina
03	DS	FdHw - Salal
04	DF	Fd - Sword fern
05	RS	Cw - Sword fern
06	HD	HwCw - Deer fern
07	RF	Cw - Foamflower
09	CD	Act - Red-osier dogwood
12	RC	CwSs - Skunk cabbage
00	CT	Cattail marsh
00	HL	Hardhack - Labrador tea
00	SW	Sedge wetland

3.1.4 CWHvm2

The montane very wet maritime Coastal Western Hemlock variant has been mapped above the CWHdm subzone throughout the Sechelt Landscape Unit. This variant, mapped from just south of Carlson Lake to just north of Spiipiyus Provincial Park, has typically been mapped between 650 metres and 1000 metres, above which the MHmm1 variant has been mapped.

With 271 TEM polygons mapped within the CWHvm2 variant, the average polygon size is **15.9 hectares**. Table 7 summarizes the site series that have been mapped within the CWHvm2 variant. Where applicable, any map units that have been borrowed from other BGC units (as listed in the user-defined deliverable), have been noted within the table.

Table 7. Vegetated site series mapped within CWHvm2

Site Series	Map Code	Site Series Name
01	AB	HwBa - Blueberry
02	LC	HwPl - Cladina
03	HS	HwCw - Salal
04	RS	CwHw - Sword fern
05	AF	BaCw - Foamflower
06	HD	HwBa - Deer fern
07	AS	BaCw - Salmonberry
09	YG	CwYc - Goldthread
10	LS	Pl - Sphagnum
11	RC	CwSs - Skunk cabbage
00	FS	Carex fen
00	HG	Hardhack – Sweet gale wetland

3.1.5 MHmm1

The Mountain Hemlock windward moist maritime variant has been mapped above the CWHvm2 variant. Given that most of the elevations greater than 1000 metres occur within Spiipiyus Provincial Park, very little MHmm1 area has been mapped within the Sechelt Landscape Unit. The extent of mapped MHmm1 is limited to a single peak just north of Carlson Lake. There has been no parkland (MHmmp1) mapped within this landscape unit.

With eight TEM polygons mapped within the MHmm1 variant, the average polygon size is **8.0 hectares**. Table 8 summarizes the site series that have been mapped within the MHmm1 variant. Where applicable, any map units that have been borrowed from other BGC units (as listed in the user-defined deliverable), have been noted within the table.

Table 8. Vegetated site series mapped within MHmm1

Site Series	Map Code	Site Series Name
01	MB	HmBa - Blueberry
02	MM	HmBa – Mountain heather
05	MT	BaHm - Twistedstalk

3.1.6 Non-vegetated units

The following non-vegetated units (Table 9) have been mapped within the Sechelt Landscape Unit:

Table 9. Non-vegetated units mapped within the Sechelt LU

Site Series	Map Code	Site Series Name
00	GC	Golf course
00	GP	Gravel pit
00	LA	Lake
00	OW	Open water
00	PD	Pond
00	RO	Rock outcrop
00	RZ	Road surface
00	TA	Talus
00	UR	Urban / suburban

4 QUALITY CONTROL

4.1 Internal Quality Control

Internal quality control was undertaken through all phases of this project. This included internal reviews of preliminary ecosystem delineation, review of preliminary BGC boundaries and a final review of all field forms for logic and completeness of data.

The final deliverables were subject to a quality control process before final submission of the deliverables. In this process, Timberline's project manager:

1. deleted all small 'sliver polygons' (typically < 1ha);
2. checked the spatial and non-spatial data to ensure a 1:1 link of the polygon data;
3. reviewed the database to ensure all deciles of complex map units add to 100%;
4. reviewed the database to ensure the correct application of site modifiers (for the assumed and mapped modifiers);
5. reviewed the database to ensure that the provincial standard TEM codes have been applied to the ecosystems;
6. reviewed the database to ensure that no duplicate or blank fields remain for any of the polygons;
7. visually assessed the final dataset to ensure that every polygon within a specific BGC unit has been mapped appropriately (for example, to ensure there are no CWHxm1 labels within the CWHdm BGC variant); and
8. completed a final review of the Venus and Excel databases for overall completeness.

5 REFERENCES

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APPENDIX 1: ECOSYSTEM UNIT MAPPING - BACKGROUND

Ecosystem mapping is based on the three level ecosystem classification framework defined by BC's Resource Inventory Committee (RIC 1998). This framework consists of ecoregion units, biogeoclimatic units and ecosystem units. Ecosystem unit labels consist of three components: site series, site modifier(s) and a structural stage. Site series are defined within the existing Ministry of Forests and Range (MoFR) biogeoclimatic ecological classification system.

Non-forested ecosystem units (i.e. avalanche units, parkland forest, heathland, and wetlands) may also be encountered that are presently not included in the MoFR site series classification. Definitions and codes for these units may be selected from the Ministry of Environment Provincial Site Series Code list.

Ecoregion

The ecoregion classification system is used to stratify BC's terrestrial and marine ecosystems into discrete geographical units. This system describes areas of similar climate, physiography, oceanography, hydrology, vegetation and wildlife potential (Demarchi 1993). Ecoregion boundaries are delineated on 1:2,000,000 and 1:50,000 terrestrial ecosystem maps. There are five levels of classification. The two highest levels, Ecodomains and Ecodivisions, place BC in a global context. The three lowest levels, Ecoprovinces, Ecoregions and Ecoregions, relate segments of the province to one another.

Biogeoclimatic Subzones

Within each ecoregion unit, biogeoclimatic (BGC) units are used to identify zonal climates and ecosystems. A zonal site is one that best represents the regional climate of an area. Subzones are subsets of zones and consist of unique sequences of geographically related ecosystems (Meidinger and Pojar 1991). Figure 1 below depicts the ecoregion and biogeoclimatic unit label as they appear on typical ecosystem maps (RIC 1998).

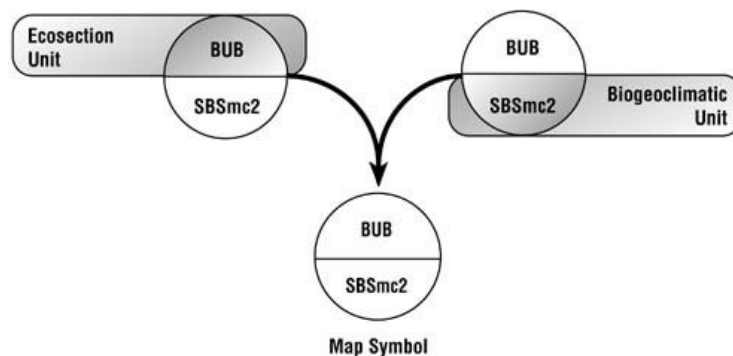


Figure 1. Symbols for Ecoregion and Biogeoclimatic Units

Biogeoclimatic Variants

The BGC variants are a subdivision of a subzone. Because each subzone has considerable variability, variants are used to further reflect differences in climate. These climatic variations give rise to changes in vegetation, soil and ecosystem productivity (Meidinger and Pojar 1991). Figure 2 below (RIC 1998) illustrates the symbols used for biogeoclimatic units.

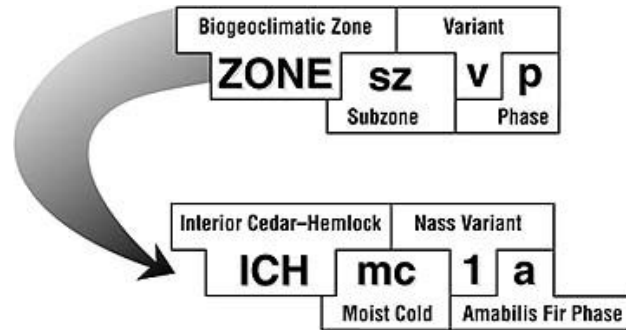


Figure 2. Symbols for biogeoclimatic units

Ecosystem Units

Ecosystem units incorporate the site series of biogeoclimatic classification in addition to physical attributes and structural stages. Generally, site series are relatively homogenous with regard to soils, surficial materials, topographic position, topoclimate and trends of secondary succession. Ecosystem units are typically composed of three components: site series, site modifiers, and structural stage. Ecosystem units have also been developed for non-forested ecosystems presently not included in the MoFR's site series classification system.

Site Series

Site series are the first component of an ecosystem unit. Site series have been developed to describe variation at the site level within the BGC units (RIC 1995, 1998). The site series describe all land areas capable of supporting a specific climax plant association and reflecting a specified range of soil moisture and nutrient regimes within a subzone or variant (RIC 1995, 1998). A two-letter symbol (map code) is assigned to each site series and each map code is unique to each BGC subzone and variant.

Site Modifiers

Site modifiers are used to refine each site series into more specific ecosystem units based upon distinguishing site, soil and terrain characteristics. Typical (or assumed) environmental conditions (modifiers) have been defined for each site series within the MoFR's BGC classification system (RIC 1998). Site modifiers are used to describe sites that differ from the typical conditions.

Table 1 below lists the mapped site modifiers, as defined by the BC Resource Inventory Committee (1998). Within the CWH and MH zones, aspect modifiers apply to slopes greater than 35%.

Table 1. Site Modifiers

Code	Criteria
<i>Topography</i>	
a	active floodplain ¹ – the site series occurs on an active fluvial floodplain (level or very gently sloping surface bordering a river that has been formed by river erosion and deposition), where evidence of active sedimentation and deposition is present.
g	gulying ¹ occurring – the site series occurs within a gully, indicating a certain amount of variation from the typical, or the site series has gulying throughout the area being delineated.
h	hummocky ¹ terrain (optional modifier) – the site series occurs on hummocky terrain, suggesting a certain amount of variability. Commonly, hummocky conditions are indicated by the terrain surface expression but occasionally they occur in a situation not described by terrain features.
j	gentle slope – the site series occurs on gently sloping topography (less than 25% in the interior, less than 35% in the CWH, CDF, and MH zones).
k	cool aspect – the site series occurs on cool, northerly or easterly aspects (285°–135°), on moderately steep slopes (25%–100% slope in the interior and 35%–100% slope in the CWH, CDF and MH zones).
n	fan ¹ – the site series occurs on a fluvial fan (most common), or on a colluvial fan or cone.
q	very steep cool aspect – the site series occurs on very steep slopes (greater than 100% slope) with cool, northerly or easterly aspects (285°–135°).
r	ridge ¹ (optional modifier) – the site series occurs throughout an area of ridged terrain, or it occurs on a ridge crest.
t	terrace ¹ – the site series occurs on a fluvial or glaciofluvial terrace, lacustrine terrace, or rock cut terrace.
w	warm aspect – the site series occurs on warm, southerly or westerly aspects (135°–285°), on moderately steep slopes (25%–100% slope in the interior and 35%–100% slope in the CWH, CDF and MH zones).
z	very steep warm aspect – the site series occurs on very steep slopes (greater than 100%) on warm, southerly or westerly aspects (135°–285°).
<i>Soil</i>	
c	coarse-textured soils ² – the site series occurs on soils with a coarse texture, including sand and loamy sand; and also sandy loam, loam, and sandy clay loam with greater than 70% coarse fragment volume .
s	shallow soils – the site series occurs where soils are considered to be shallow to bedrock (20–100 cm).
v	very shallow soils – the site series occurs where soils are considered to be very shallow to bedrock (less than 20 cm).

¹ Howes and Kenk 1997

² Soil textures have been grouped specifically for the purposes of ecosystem mapping.

³ Canada Soils Survey Committee, 1987

APPENDIX 2: EXPANDED LEGEND – SEHELTL LU