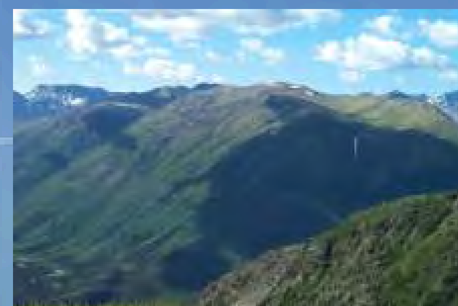
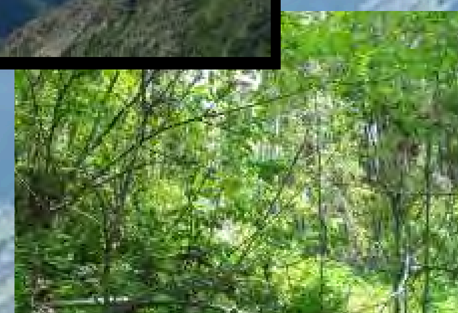
Regional Ecosystem Classification & Mapping

# of The Yukon Southern Lakes & Pelly Mountains Ecoregions





Submitted to:

Government of the Yukon
Department of Environment
Box 2703
Whitehorse, Yukon

Attention: John Meikle

Prepared by:

EBA ENGINEERING
CONSULTANTS LTD.
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July 10, 2003

EBA ENGINEERING CONSULTANTS LTD.

FINAL REPORT:
REGIONAL ECOSYSTEM CLASSIFICATION AND MAPPING OF THE YUKON SOUTHERN LAKES & PELLY MOUNTAINS ECOREGIONS

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Project No. 5800131

November 7, 2003

November 7, 2003

EBA File No: 0805-5800131

Government of the Yukon
Department of Environment
Box 2703
Whitehorse, Yukon
Y1A 2C6

Attention: John Meikle
Project Manager, A/Habitat Protection Coordinator

Dear Mr. Meikle:

Subject: Regional Ecosystem Classification and Mapping of the Yukon Southern Lakes & Pelly Mountains Ecoregions

We are pleased to provide a project final report related to EBA's recent project entitled: "*Regional Ecosystem Classification and Mapping: Regional Ecosystem Classification System Manual and Yukon Southern Lakes & Pelly Mountains Ecoregions Ecosystem Map*".

We have enjoyed undertaking this project, and working in association with you and others to complete this investigation. We hope the attached report and accompanying digital materials will serve a range of resource planning applications and, as well, provide a basis for moving forward with this important initiative.

Please contact Jack Dennett (EBA Whitehorse; ph: 867-668-2071, ext.30) or Richard Sims (EBA Vancouver; ph: 604-685-0275) if there are any questions.

Yours truly,

EBA ENGINEERING CONSULTANTS LTD.

Richard Sims, Ph.D., R.P.Bio.
Principal Scientist

ACKNOWLEDGMENTS

EBA Engineering Consultants Ltd. (EBA) conducted this project, with the co-ordinated involvement of staff from EBA's Whitehorse, Kelowna and Vancouver offices. Yukon's Department of Environment is gratefully acknowledged for initiating and funding the project.

We would like to acknowledge the contributions made by a number of key individuals who helped us to complete the project

- John Meikle (Department of Environment, Government of Yukon, Whitehorse) was the contract monitor and a key contact person throughout the project. He provided critical ongoing support and guidance.

- Val Loewen, Gerry Perrier and Fritz Mueller provided ongoing assistance and helpful suggestions, particularly regarding methodology and input databases.

- Several individuals involved in an "Ecosystem Classification and Mapping (ECM) Workshop" (held in Whitehorse in February 2003) also shared their thoughts and comments regarding appropriate directions. In particular, Shawn Francis, Bas Oosenbrug, Alan Banner and Page Spencer provided valuable insights based upon their ongoing efforts and experiences to develop a comprehensive ECM system within Yukon, Northwest Territories, BC and Alaska.

Several EBA staff participated in the project, and their mix of abilities and expertise, and dedication to the task, were responsible for the co-ordinated completion of final outputs. EBA staff involved with this project included Jack Dennett (project manager), Richard Sims (senior reviewer), John Grods (ecosystem mapping specialist), Jeff Matheson (ecologist), Wayne Darlington (geomatics specialist), Janet Thomas (remote sensing technologist) and Karen Warrendorf (geomatics specialist).

EXECUTIVE SUMMARY

EBA Engineering Consultants Ltd. (EBA) completed regional ecosystem classification and mapping and selected materials for inclusion in a regional classification manual for the Yukon Southern Lakes and Pelly Mountains Ecoregions. Three levels of the draft Yukon Ecosystem Classification and Mapping Framework were addressed: Ecoregion (Level 2), Ecodistrict (Level 3), and Bio-Climate Zone (Level 4).

Bio-climate Zones were mapped using a new technique adapted from Predictive Ecosystem Mapping (PEM) methodologies in British Columbia. A rule-based elevation model was first used to generate a “first cut” of Bio-Climate Zones using a 90m Digital Elevation Model (DEM). The linework was then overlaid on Landsat 7 Thematic Mapper satellite imagery and elevational contour data and refined using on-screen editing tools. The advantages of this automated approach are discussed.

A number of observations and recommendations for future directions for the Yukon Ecosystem Classification and Mapping Framework were made.

- Make optimum use of earth observations satellite imagery for ECM Mapping in the Yukon.
- Create slope and aspect-based spatial layers as a key input to ECM Mapping in the Yukon.
- Wherever possible, ECM Mapping in the Yukon should include spatial data layers for surficial landforms.
- Yukon standards for the collection of field plot data need to be developed or adopted.
- Automated procedures for ECM Map generation should be adopted as a key concept in the Yukon ECM Framework.
- Develop classification and mapping standards with map interpretations in mind.
- Ecosystem units are the building blocks for classification at the local and regional level.
- Use an edatopic grid to illustrate fundamental ecosystem characteristics.
- Ecosystem units from adjacent areas in BC can be used as a first approximation for some units.
- Use the Yukon Southern Lakes and Pelly Mountains as a Pilot Area.

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1.0 INTRODUCTION

1.1 Background

The Yukon Ecosystem Classification and Mapping (ECM) Technical Committee is working toward the development of an “ECM Framework” for the Yukon. When fully assembled, the Yukon ECM Framework will address both regional (small scale) and site level (large scale) conditions.

The ECM Framework is currently under development. Recent activities were summarized in the *Yukon Ecosystem Classification and Mapping Framework, Working Draft, Version 1.3* (Government of Yukon (YTG), 2003), which describes an interim version of a hierarchical system for both the regional and site levels. The ECM Framework is also intended to mesh, as appropriate and practical, with the hierarchical National Ecological Framework (NEF) system of Ecozones, Ecoregions and Ecodistricts. The draft ECM Framework recommends some provisional classification and mapping standards for regional (1:250,000) and local (1:100,000 to 1:50,000) map products (YTG, 2003).

During the past few years, five 1:250,000 scale ECM pilot projects have been undertaken in the Yukon, to help with the process of deriving a suitable methodology for ECM. These pilot studies, commissioned by the YTG, have focussed upon five Yukon Ecoregions: Hyland Highland, Eagle Plains, Peel River Plateau, Mackenzie Mountains, and Yukon Plateau North.

For the current project, EBA was requested to complete ECM work within the Yukon Southern Lakes and Pelly Mountains Ecoregions using similar protocols to the other pilot projects. Some new techniques, adapted from Predictive Ecosystem Mapping (PEM) methodologies in British Columbia (Resources Inventory Branch, 2000a, 2000b) were used to further improve the evolving approach for the Yukon. As part of the current project, EBA was also requested to assemble some additional background materials that would assist with the creation of an “ECM manual” for the entire Taiga Cordillera and Boreal Cordillera Ecozones, which includes the current project and the previous five ECM pilot projects.

This final project report is organized into 4 sections and appendices:

- Section 1, ***Introduction*** (the current section) describes project objectives and general approach;

- Section 2, ***Ecosystem Classification and Mapping of the Yukon Southern Lakes and Pelly Mountains Ecoregions***, provides methods and results for the pilot ECM work conducted in these two Ecoregions;

- Section 3, ***Recommendations and Future Directions,*** provides some observations and directions for the continued development of the Yukon ECM Framework; and,

- At the back of the document, there is a ***References*** Section (Section 4) as well as some ***Appendices*** with other supporting materials.

1.2 Project Objectives

The project's main objective was to assemble map and written deliverables according to the Yukon ECM Framework's current directions. These materials include the following two components:

1. Regional Scale Ecosystem Mapping for the Yukon Southern Lakes and Pelly Mountains Ecoregions. This work is described in Sections 2 and 3 of this report, and, in part, is also delivered separately in digital form. ECM levels addressed included the following[1]:

   - Ecoregion (Level 2);
   - Ecodistrict (Level 3); and,
   - Bio-Climate Zone (Level 4).

2. Selected materials for inclusion in a "Regional ECM Manual" for the Yukon Southern Lakes and Pelly Mountains Ecoregions. These materials are included in Section 3 of this report. Initially, this material was to include draft standards and protocols appropriate to the Yukon portions of the entire Taiga Cordillera and Boreal Cordillera Ecozones. Given the state of flux with respect to adoption of ECM methodologies[2], the scope of work was scaled down to focus upon the development of some materials for inclusion in a regional ECM manual.

[1] In the initial stages of the project, Landscape Type (Level 5) was also to be included in the mapping. Subsequent re-examination of the classification framework by the ECM Working Group and others determined that Landscape Type did not fit appropriately in the ECM framework hierarchy and was therefore not completed for this project.

[2] For example, Daryl Cowell and Richard Sims, two ecological land classification (ELC) specialists, provided a critical review of the Yukon ECM Framework Working Draft version 1.3 and conducted a workshop in Whitehorse March 13 and 14, 2003 for the Department of Environment.

One other rationale for this adjustment was that, as the project progressed, it became apparent that the mapping completed for other portions of the Taiga Cordillera and Boreal Cordillera Ecozones were inconsistent with the standards applied in the current work. As a result, it was not practical to prepare a comprehensive set of standards that could be applied to all previous ECM areas, and further efforts to develop a comprehensive Yukon ECM Framework are still required.

1.3 Project Area

The Yukon Regional ECM project area involves the entire Yukon Southern Lakes and Pelly Mountains Ecoregions, south-central Yukon (Figure 1).

Given the large extent of the project area (6.2 million ha), there are a wide variety of associated terrain conditions, climatic ranges, physiographic features and environments (Smith, 2002 and YEWG, 2002).

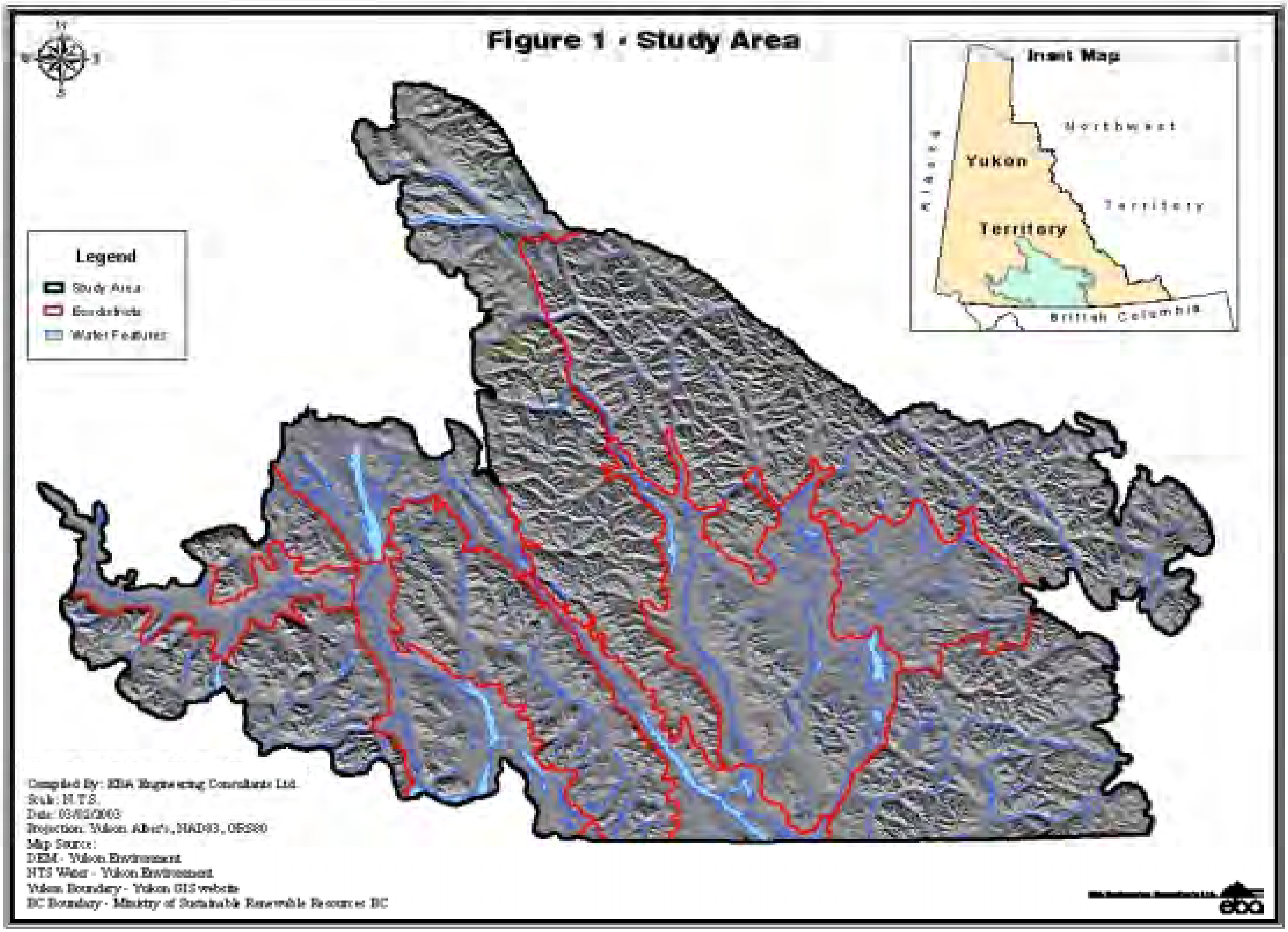

Figure 1. Study Area

2.0 ECOSYSTEM CLASSIFICATION AND MAPPING OF THE YUKON SOUTHERN LAKES AND PELLY MOUNTAINS ECOREGIONS

2.1 Introduction

This section of the report describes the completion of the ECM for the Yukon Southern Lakes and Pelly Mountains Ecoregions. Section 2.2 outlines the classification units that were defined, and Section 2.3 summarizes the mapping approach that was taken. The digital map outputs were submitted to the YTG under separate cover.

Recommendations are presented later in the report (see Section 3.0) related to future directions for ECM and the derivation of ECM standards for the Yukon. Most of these arose from experiences gained and observations made by the project team during the ECM pilot project.

2.2 Ecosystem Classification

2.2.1 Overview of the YK Ecosystem Classification

Details of the most recent version of the draft ECM Framework are provided by AEM (2002) and the YTG (2003). In general, the Yukon ECM Framework is evolving as a hierarchical classification system. It combines some of the characteristics and terminology of the National Ecological Framework (NEF) – Ecozones, Ecoregions and Ecodistricts – with a more detailed regional and local ECM approach that is somewhat like the Terrestrial Ecosystem Mapping (TEM) or Predictive Ecosystem Mapping (PEM) approaches being followed in British Columbia (see Resources Inventory Committee (RIC) 2000a, 2000b).

Seven levels for the Yukon ECM Framework were originally proposed. However, some recent observations by Cowell and Sims (2003a) identified some deficiencies in the lower levels (Levels 5, 6 and 7) of the draft Yukon ECM Framework and recommended some revisions. These revisions are currently (mid-2003) being implemented. A draft version of these revisions to the overall concept is provided in Figure 2.

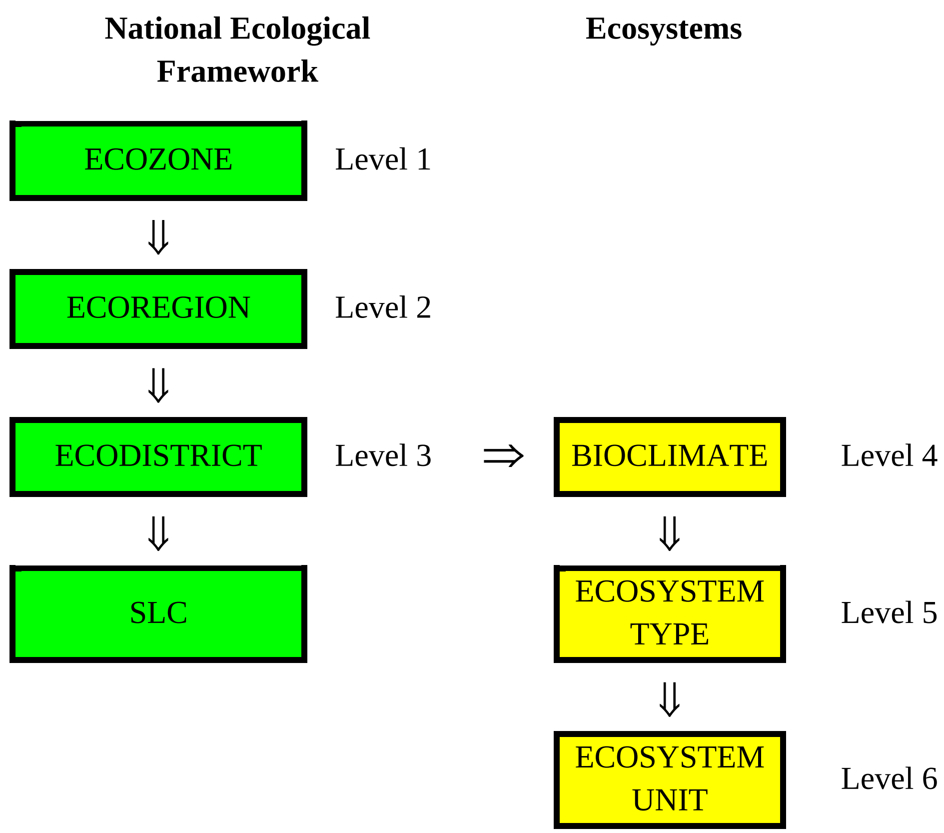

Figure 2. Provisional Yukon ECM Schema (Revised April, 2003)

2.2.2 Ecozones and Ecoregions – Levels 1 and 2

The NEF hierarchical framework for ecological classification uses an approach that divides up landscapes, at different levels of resolution, into logical and homogeneous units. Ecozones are the broadest level of this framework and they are described as “areas of the earth’s surface representative of large generalized ecological units, and characterized by interactive and adjusting abiotic and biotic factors” (ESWG, 1995). Criteria used in defining Ecozones are varied but mainly include geomorphologically-based broad landform patterns, generalized soil landscapes, broad physiographic conditions, very broad vegetational patterns, and macroclimatically-similar broad geographic areas.

Ecoregions are the next nested level in the NEF system, and are characterized by distinctively regional ecological factors (ESWG, 1995). Geomorphologically large landform assemblages, great groups of soils, vegetation assemblages and meso-climate factors are the criteria used in distinguishing ecosystems at this level. According to NEF, this level is a bridge between the continental scales of ecozones and the localized ecodistricts.

2.2.3 Ecodistricts – Level 3

Ecodistricts, the third level of the NEF system, are characterized by distinctive assemblages of landform, relief, surficial features, soil subgroups, water bodies and drainage patterns, and vegetation assemblages (ESWG, 1995). The original classification of Ecodistricts in the Yukon was derived from Soil Landscapes of Canada (SLC) mapping that was conducted as a small scale (1:1M) mapping project across the entire country (SCWG, 1998).

As part of the current project, EBA examined the current Yukon Ecodistrict linework in the vicinity of the Yukon / BC border. Demarchi (1995) completed an updated version of the BC Ecosection (synonymous with Ecodistricts in the Yukon) linework, and as part of this work there was an extension of the linework into the Yukon, up to the 62^{nd} parallel. EBA compared the two sets of lines within the overlap area in the Yukon, showing the overlap and areas of agreement as part of the digital deliverables for the current project.

Table 1 provides a summary description of the Ecodistricts within the Yukon Southern Lakes and Pelly Mountains Ecoregions. For each Ecodistrict, there is a short description that includes the approximate elevation range as well as other information on the unit's distribution within the project area. Descriptions in Table 1 should be considered as provisional and it is expected that they will be refined / updated in the future, for example using additional climate, geology, surficial materials or other mapped information that may become available in the future.

Information provided in Table 1 was used as a basis for the mapping work that was conducted for the project area. The Ecodistrict summaries in Table 1 are also complementary and augmentative to descriptions of these Ecodistricts provided by Smith (2002) and YEWG (2002).

Table 1. Ecodistricts of the Yukon Southern Lakes and Pelly Mountains Ecoregions.

Ecoregion	Ecodistrict	Area (ha)	Description[1]	Elevation Range (m asl)	Bio-Climate Area as a Proportion of the Ecodistrict[2]			
					BOL	BOH	SUB	ALP
Yukon Southern Lakes	Lebarge Plateau (904)	320,112	Found in the northern portion of the ecoregion, and dominated by gentle rolling slopes intermixed with lakes and wetlands. White spruce, lodgepole pine and aspen are the dominant tree species; Balsam popular is found in association with fluvial systems.	600 - 1650	-	97	3	-
	Nisutlin Plateau (905)	752,161	Found in the eastern portions of the ecoregion, lying bewteen the Big Salmon range to the west and the Toya and Syncyr Ranges to the east. Gentle rolling topography intermixed with wide river valleys and lakes, extending into British Columbia. White spruce, lodgepole pine, subalpine fir and aspen are the major tree species, with minor components of white birch and black spruce. Balsam popular is found along fluvial systems. The subalpine and alpine portions are restricted to areas within the Englishman Range.	660 - 2000	39	52	8	1
	Whitehorse Lowland (1905)	334,547	Large valley basin draining the Yukon River into the Lebarge River, to the north. Found in the rain shadow of the coastal mountains to the west. Level and gentle slopes are characteristic of this ecodistrict. There is some influence of urbanization in this ecodistrict. Lodgepole pine, white spruce and aspen are the major tree species, with minor components of subalpine fir, black spruce, and white birch. A minor extent of alpine occurs to the south, above Carcross.	600 - 2020	81	13	5	1

Ecoregion	Ecodistrict	Area (ha)	Description[1]	Elevation Range (m asl)	Bio-Climate Area as a Proportion of the Ecodistrict[2]			
					BOL	BOH	SUB	ALP
	Miner's Range (906)	130,486	This ecodistrict is confined to the northern portion of the ecoregion above the Takhini River Basin. There are characteristic gentle to moderate mountain slopes on the eastern edges of the Coastal Ranges. White spruce, lodgepole pine, and aspen dominate, with balsam poplar found along river systems.	730 - 2130	1	34	43	22
	Whitehorse Range (907)	578,385	Found between the Yukon River to the west, and Teslin River to the east, this ecodistrict is characterized by large river basins and moderate mountain slopes which then extend southward into BC. Lodgepole pine, white spruce and aspen are the dominant species. Subalpine fir, black spruce and white birch are minor inclusions.	650 - 2060	26	46	23	5
	Takhini Basin (908)	207,329	This ecodistrict is the drainage plain for the Takhini River to the east, and it consists of level to gentle sloping terrain, extending westward. Dominant tree species are white spruce, aspen and lodgepole pine. White birch and balsam popular mainly occur along fluvial systems.	630 - 1580	92	7	1	-
	Stikine Boundary (909)	471,581	Mountains within this ecodistrict are part of the Coastal Range, and are characterized by moderate to steep slopes. Tree species ar white spruce, subalpine fir and aspen, withminor components of white birch and black spruce. Balsam polar occurs in association with river systems.	670 - 2190	10	42	34	14

Ecoregion	Ecodistrict	Area (ha)	Description[1]	Elevation Range (m asl)	Bio-Climate Area as a Proportion of the Ecodistrict[2]			
					BOL	BOH	SUB	ALP
	Teslin Basin (910)	198,856	This ecodistrict drains Teslin Lake to the north, and is characterized by gentle rolling slopes. It extends southward into BC. Forests are dominated by white spruce, lodgepole pine, aspen and black spruce. There are minor inclusions of subalpine fir and white birch, and balsam poplar occurs in association with fluvial systems.	640 - 1540	90	9	1	-
Pelly Mountains	Big Salmon Range (911)	1,012,377	This is a large ecodistrict in terms of total area, and is associated with variable topographies and slope conditions. It is characterized by steeper slopes in the south, associated with mountainous terrain, but towards the north, the topography is more subdued, as the area drains towards Big Salmon Lake. Dominant tree species are white spruce, lodgepole pine, subalpine fir and aspen. Minor components of black spruce, white birch and balsam popular (encrouching from the south) also occur.	600 - 2160	<1	54	35	10
	Syncyr Range (912)	1,533,543	The most easterly portion of this ecodistrict is dominated by steep sloping mountains and sharply-defined valleys lying west of the Tintina Trench. Forests are dominated by white spruce, lodgepole pine, subalpine fir and black spruce. Lesser components of aspen, white birch and larch (the latter encroaching from the east) also occur.	700 - 2380	<1	39	45	16
	Upper Liard (913)	336,630	This ecodistrict is characterized by gentle rolling terrain. The area drains to the south-east into the Liard Basin, and it is dominanted by wetlands and lakes. Common tree species include lodgepole pine, white spruce and subalpine fir. Minor components of black spruce, white birch, larch and aspen are common.	820 - 1700	3	70	27	-

Ecoregion	Ecodistrict	Area (ha)	Description[1]	Elevation Range (m asl)	Bio-Climate Area as a Proportion of the Ecodistrict[2]			
					BOL	BOH	SUB	ALP
	Toya Range (914)	717,229	This ecodistrict involves the upper portion of the Cassiar Mountains, which extend southward into BC, This ecodistrict is characterized by large rolling valley bottoms and steep sided mountainous slopes. Forests are dominated by lodgepole pine, subalpine fir and white spruce, with minor inclusions of black spruce, white spruce, larch and aspen.	780 - 2085	4	52	37	7

[1] Tree species are listed according to descending dominance within each Ecodistrict.

[2] Bio-Climate Units: BOL – Boreal Low, BOH – Boreal High, SUB – Subalpine, ALP – Alpine (see Table 2).

2.2.4 Bio-Climate – Level 4

Within broad landscapes that are characterized by a significant elevational or latitudinal zonation, the delineation of bioclimatically-based zonations (i.e., independent of physiographically-based features) results in an important ecological feature for broad-scale mapping (Ponomarenko and Alvo, 1999).

The term Bio-Climate Zone, as used in the proposed Yukon ECM Framework, is adopted, in part, from Holland (1976), who originally used the approach to map the biophysical features of Jasper and Banff National Parks in Alberta (AEM and YECMWG 2003). The approach is also a fundamental component of the BC Biogeoclimatic (BGC) System, which recognizes broadly defined BCG Zones, Subzones and Variants (Meidinger and Pojar 1991). The delineation of Bio-Climate Zones for the Yukon results in a landscape stratification at an intermediate level (Level 4 in the Yukon ECM Framework) of resolution that recognizes observable vegetation patterns that are specifically associated with predominant elevation and latitudinal (i.e., local climates and slope/aspect) gradients.

Summary descriptions of Bio-Climate Zones identified and used in the current project are provided in Table 2. Descriptions were adapted from the draft Yukon ECM Framework (Version 1.3) document (YTG 2003), but modified based upon the following:

- Bio-Climate zones were previously organized and defined within Ecozones by the Yukon ECM Framework. Table 2 lists Bio-Climate zones independent of Ecozones, an approach which offers greater flexibility in terms of constructing consistent ECM units across the whole of the Yukon.

- “Icefield” has been removed in the current list of Bio-Climate Zones. “Icefield” does not meet criteria normally defined for the Bio-Climate level of the classification.

- “Boreal” is now separated into “Boreal Low” and “Boreal High”, in a manner similar to the way units were defined in adjacent BGC Subzones for BC (Meidinger and Pojar 1991). Within BC, Spruce Willow Birch (SWB) would be equivalent to Boreal High and Boreal White and Black Spruce (BWBS) would be equivalent to Boreal Low. Within the Yukon, Boreal High and Boreal Low can be readily separated, we feel, based upon careful examination of Forest Cover and satellite imagery, in relation to elevational and topographic gradients.

- A new “Tundra” Bio-Climate Zone is recognized.

Table 2. Description of Bio-Climate Units

Bio-Climate Unit Name	Bio-Climate Unit Code	Bio-Climate Unit Description	Approx Elevation Range (m)
Boreal Low *	**BOL**	Continuously forested areas at low to middle elevations, below the BOH of all mountain valley and plateau Ecoregions of southern and central Yukon. Landscapes are generally wide valleys. There are long cold winters and short, cool and moist summers. Forests are mostly mixedwood conditions with well developed understories. Wetlands are common.	300 – 1150
Boreal High *	**BOH**	Middle to upper elevations of forested areas at all mountain valley and plateau Ecoregions of southern and central Yukon. Found above the BOL in large valleys. Characterized by steep slopes in the Yukon Southern Lakes Ecoregion and gentle rolling plateaus in the Pelly Mountain Ecoregion. Summers are brief, cool and moist, with long cold winters. Forests are mostly dominated by white spruce and subalpine fir.	1000 – 1350
Wooded Taiga	**WTA**	Primarily coniferous forested areas with an open forest canopy. Wooded Taiga generally occurs in valley bottoms and lower slopes of mountain valleys or on plateaus and plains. The distribution and depth of permafrost is a major influence upon vegetation distribution and dynamics. In steep terrain, active slope processes (rock slides, slumps, talus cones) play a major role in the distribution of forests.	Not in project area
Shrub Taiga	**STA**	High elevation Shrub Taiga replaces the term "Subalpine" in North Yukon. These areas are tall or low shrub-dominated, with sparse or sporadic tree cover. Shrub Taiga generally occurs at high elevations in northern mountain systems. However, the distribution of Shrub Taiga in some areas of North Yukon appears to be influenced by arctic weather systems (e.g., along the eastern foothill slopes of the Richardson Mountains).	Not in project area
Subalpine *	**SUB**	Sparsely forested areas at moderate to higher elevations on steep slopes above the BOH (or BOL). Subalpine areas form a transitional zone between forested Boreal and the non-forested, Alpine Bio-Climate Zones. Open canopy conifer forests (tree cover < 20%) and tall shrub communities are characteristic vegetation conditions. Subalpine fir is a dominant tree species. Winters are long and cold, while summers are short and cool.	1300 – 1700
Alpine *	**ALP**	Higher elevations associated with mountainous conditions. Dwarf shrubs, herb/cryptograms and low-growing and scattered krummholtz trees are the dominant vegetation condition. In high elevation areas, large areas may include bare rock, colluvium or ice/snow.	1600+
Tundra	**TUN**	Higher latitudinal areas in the Yukon above the arctic tree line. Dwarf shrubs, herb/cryptograms and low-growing and scattered krummholtz trees are the dominant vegetation condition.	Not in project area

* These descriptions are based on Yukon ECM Framework (ver 1.3) but updated based upon observations from the current project.

2.3 Ecosystem Mapping

2.3.1 Import and Data Preparation

Steps involved during the import and data preparation phase of the project included gathering information from YTG experts, acquisition of data, and “screening-in” of spatial databases. These databases were subsequently used in the ECM project, to generate mapped outputs.

EBA reviewed relevant spatial data and other support materials associated with the project area. Assistance was provided by YTG and DIAND staff in terms of locating and obtaining the most current versions of available databases. Screening-in of digital databases was conducted so that any obvious data errors could be identified. As part of EBA’s review, inaccuracies or inconsistencies in key databases, in terms of data content and attribution, spatial positioning, linework completeness, or level of data quality, were corrected. EBA uses a “data tracking table” for such purposes (Appendix A).

Key data sources included the following:

- Hard copy surficial landform mapping for a large portion of the project area (variable scales ranging from 1:250K to 1:100K);
- Digital Forest Cover (1:50K) for a large portion of the project area complete with well documented standards and mapping protocols;
- Digital National Topographic Data base mapping including DEM for the whole of the project area, recently updated by the National Topographic Information Service;
- Recent Landsat-7 satellite imagery, in digital form, for the whole of the project area;
- Digital Ecoregional linework, SLC linework and other pre-existing ecosystem linework for various areas throughout the Yukon; and,
- Copies of digital outputs of most of the five previously-completed ECM pilot projects.

2.3.2 Satellite Imagery

Recent Landsat 7 satellite imagery covering the majority of the project area was obtained at the outset of the project. The YTG provided these materials as pre-processed and ortho-corrected digital Landsat-7 coverages. As they were received, images were assessed in terms of their overall quality (cloud cover, seaming and geo-positioning) for ECM (Table 3).

Table 3. Landsat 7 Satellite Imagery for the Project Area

Path and Frame	Date Received by EBA
55-18	22/01/04
56-17	22/01/05
57-16	22/01/06
57-17	22/01/07
57-18	22/01/08
59-16	22/01/09
59-17	22/01/10
59-18	22/01/11
61-18	22/01/12

Enhanced and themed / interpreted satellite images were used for:

1. Delineation of vegetation cover conditions, especially for non-forested ecosystems (i.e. Alpine);

2. Manual verification of ECM units and attributes; and,

3. Manual verification of the approximate level of accuracy and resolution of other spatial datasets (forest cover, NTS, etc…)

EBA used ERMapper® as a satellite image analysis tool. Enhanced and themed / interpreted images were exported as compressed image files in *ecw* formats, for viewing in ArcView®.

2.3.3 Digital Elevation Model

YTG Digital Elevation Model (DEM) data at a resolution of 30m and 90m were processed by EBA to produce two separate seamless coverages for the entire project area. Both DEMs were used as we were unsure which would be most appropriate for use in the regional ECM. A buffer area of at least 5km around the full perimeter of the project area was also maintained as part of this layer. The buffer was required so that edge-matching and lost data issues could be resolved, and so the “resultant” layers could be vectorized and clipped to the project area boundary for further processing.

Spot-checks were conducted on DEM predictions with YTG base map contours to confirm that DEM calculations were being properly executed. Additional checks were conducted by overlaying satellite enhanced and themed / interpreted images, to confirm that DEM derivations were reflected in the vegetation and land cover conditions that could be observed at a variety of locations across the landscape within the project area.

As outlined in the following sections, three input layers of slope, aspect, and modelled soil moisture class were derived from DEM data.

2.3.3.1 Slope

A seamless slope grid was derived from each of the 30m and 90m DEMs. Each of the slope grids was then reclassified into user-defined slope classes (Table 4). The classes for slopes up to 45 degrees are those described in the Yukon ECM Framework (Version 1.3), which were derived from Howes and Kenk (1997) and are widely used in BC’s TEM and PEM programs (RIC 1998a, 1998b, 2000a, 2000b). We defined additional slope classes from 45 to 85+ degrees. We have found these steeper slopes to be useful for other ecosystem map interpretations, particularly for wildlife habitat suitability.

The slope grid was vectorized into polygons with each polygon containing one of the ten slope classes (Table 4). Polygons were then dissolved to eliminate adjacent “like polygons”, and to create one final layer.

Table 4. Slope classes derived from the DEM

Slope Classes	Map Label	Degree Ranges for Slope Classes	Minimum Polygon size
Plain	P	0 - 3	15ha
Gentle	J	3 - 15	15ha
Moderate	A	15 - 25	15ha
Moderate Steep	K	25 - 35	15ha
Steep	S	35 - 45	15ha
Very Steep	Z	45 - 55	10ha
Very Steep 1	Z1	55 - 65	10ha
Very Steep 2	Z2	65 - 75	2ha
Very Steep 3	Z3	75 - 85	2ha
Very Steep 4	Z4	85 +	2ha

An Arc Macro Language (AML) / Visual Basic (VB) program developed by EBA then was applied to the data, and this dissolved slope layers and eliminated all the polygons that had an area less than the predetermined minimum polygon size listed in Table 4. This step was conducted to ensure that the integrity of the data was not lost, and that steeper slope classes were not over-generalized. The AML/VB tool checked all surrounding polygons of a selected polygon to see which polygon was in the next lowest class. As a final step, the AML/VB then dissolved the selected polygon into the next lowest class.

Slope layers were checked visually with the YTG contour data, to ensure the data made sense. It was spot-checked against satellite imagery (as an on-screen backdrop) to confirm the aspect was appropriate. All slope layers were then clipped to the non-buffered sub-areas, and combined to create an overall slope layer encompassing the entire project area. The goal was to provide a final product that was sufficiently detailed to support the ECM modeling work, but which maintained sufficient resolution and data integrity.

2.3.3.2 Aspect

The 90m and 30m DEMs were used to create two separate aspect grids. The aspect grids were then reclassified to cool, warm, and flat classes, as defined in Table 5. This aspect classification was created using a process that was independent of the slope classification described in Section 2.3.3.1. The aspect grid was vectorized into polygons identifying the aspect classes. Given that for aspect there are only a few classes being derived, the aspect layer was processed for the entire project area all at once.

Table 5. Aspect classes derived from the DEM

Aspect	Label	Degrees
no aspect (flat)	F	None
cool aspect	K	285 to 134
warm aspect	W	134 to 285

The aspect layer was dissolved to ensure that all neighbouring "like polygons" were merged. A minimum polygon area size was set to further reduce the size of the aspect layer. For this project, this was set at 15 ha. This dissolve process was accomplished by eliminating smaller polygons into the next-largest bordering polygon.

The aspect layer was visually checked against both the YTG water and contour layers to ensure the data was consistent. It was also spot-checked against satellite imagery (as an on-screen backdrop) to confirm the aspect was appropriately assigned. The aspect output layer was also checked for other errors such as small island polygons, null polygons, and slivers.

2.3.3.3 Modelled Soil Moisture Class

A "moisture class analysis" was conducted for the entire study using DEM data. It was initially thought that a moisture class layer might be useful for delineation of lower levels of the ECM framework. However, lower levels of the ECM framework were not mapped for this project and the methodology is described here for future use.

The soil moisture analysis was conducted using SELES (Fall 2002, Fall and Morgan 2000), a spatially-based moisture modeling tool. SELES analyses a landscape's slope/aspect data, and takes into account various influences upon the downslope movement of water, such as topography, slope, aspect and soil porosity (the latter is included when such data is available, otherwise – as in the current project – default parameters for porosity are invoked). The various input variables are handled by SELES, by setting key parameters of catchment shape, surface flows, surface absorption, and seepage of the sub-surface flows. Derived slope shape and upslope lengths are used by SELES to calculate upslope contributing area and soil wetness index surfaces (Fall 2002, Fall and Morgan 2000).

In preparation for the SELES modeling, the DEM underwent various analyses which helped deal with inconsistencies and limitations in the input data. The DEM was checked for any pits or holes and a SELES-associated software program (Fall and Morgan 2000) was used to fill them in, in order to create a new pitless DEM.

A flow direction raster was derived from the pitless DEM. The rasterized flow direction layer was used to determine the contributing areas or upslope catchment size. This analysis resulted in a contributing index output layer. The SELES model then ran a scenario to create the soil moisture index, as a continuous soil moisture value (Fall 2002). The final combination of the pitless DEM, contributing area, flow direction, and soil wetness data resulted in a raster that predicted soil moisture more accurately than many previous models used in PEM projects (Fall 2002).

As a final set of spatial analyses, the soil moisture raster was classified into dry (d), fresh (f), moist (m), and wet (w) classes. The classified moisture raster was vectorized into a polygon layer and then clipped to the project area boundary.

A combination of quality assurance checks were conducted on the SELES-derived outputs. These included randomized checks against YTG water features and specific checks using satellite imagery from a variety of locations within the project area. Additional visual checks were completed against the hard copy surficial landform maps, with consideration given to patterns of landforms and parent materials.

2.3.4 Water Features

YTG base mapping and DEM coverages are derived directly from digitally updated National Topographic Series (1:50K) base mapping. The water features from this YTG base mapping were extracted by EBA and used directly in the Bio-Climate map base generation. This step followed Resource Inventory Committee (2000a, b) standards for water feature inclusion in TEM and PEM projects in BC.

As outlined in the Yukon ECM Framework, the standard datasets that are created by ECM projects will be formatted to National Topographic Data Base (NTDB) criteria.

2.3.5 Forest Cover

YTG forest cover maps (linework and attributes) were acquired for most of the project area, but arrived relatively late in the project, so they weren’t used in the initial analyses to produce an ECM output. Forest cover maps were still valuable for checking the quality of some of the input spatial databases.

The forest cover was compiled into a seamless layer and digitally overlain onto the ECM outputs. Once compiled, some preliminary analyses were conducted to delineate and analyse general vegetation conditions across the landscape.

2.3.6 Surficial Landforms

Surficial landform maps (as hard copy only) were acquired late in the project, so were not used directly in the ECM modelling. They did, however, provide useful supplemental data for distinguishing amongst Ecodistricts.

2.3.7 Working Legend

As a part of the setup process for this ECM project, a working legend was assembled to help identify the units that would be expected to be encountered within the project area. This exercise helps to develop an initial appreciation for the range of conditions that exist, and guides the process so that there is, in the end, a consistent interpretation of ECM features. The working legend guided the ECM assignment using rule-sets (Appendix B).

2.3.8 Ecodistrict Mapping

Delineation of Ecodistricts (level 3) started with an examination of existing data and review of previous mapping methods. This included a half-day session that John Grods undertook with Scott Smith (Agriculture Canada, Summerland, BC) to obtain background information on how the original ecodistrict mapping activities were conducted within the Yukon.

EBA used an "on-screen digitizing" approach to refine pre-existing Ecodistrict linework. The ortho-rectified satellite imagery provided the base map including all YTG water features, icefields and glaciers. Contour lines and DEM-derived data were overlain onto this base.

To complete this work, EBA used two ArcView extensions -- MNDNR Stream Digitizing Extension and EDITTOOLS ver 3.6. These were useful for simplifying the update process. The tools have several advantages:

- They are fast and efficient, with visual updates being done by a person using a hand-held (wireless, optical) mouse and a high resolution large format monitor;

- They include several operator-controlled functions (e.g., vertex density, smoothing, etc…) that can be invoked and used to view best-fits of lines;

- The extension also invokes an on-screen menu that can be used to call up special functions for specific edit functions; and,

- The on-screen view is readily scaleable, so that – with an image backdrop and the linework to be edited or generated in the view – the user can use a scrolling function to zoom in to view details and zoom out to assess general patterns.

Delineation progressed as an iterative process between EBA and John Meikle, YTG. John Meikle provided valuable insights and firsthand knowledge of each Ecodistrict.

2.3.9 Bio-Climate Mapping

The Bio-Climate mapping (level 4) was completed as a two-step process. A rule-based elevation model was first used to generate a "first cut" of Bio-Climate Zones, then linework was further refined, using an on-screen editing function.

EBA adapted an automated tool for the current project using a similar tool that had been assembled for use by the BC Ministry of Forests for Biogeoclimatic line derivation / localization. Arc Macro Language (AML) models were run against rule sets (that defined elevational, aspect and Ecodistrict parameters—see Table 6) and the DEM to establish draft Bio-Climate lines. The lines were subsequently adjusted and refined using visual inspection, based upon satellite imagery and elevational contour data.

The advantages of an automated approach are:

1. It provides a uniform, standard base;
2. Linework can be updated, whenever new information is available;
3. Results are easily adjusted and refined;
4. It may be applied to any scale of map;
5. The approach is transferable to other regions of the Yukon;
6. The exercise should result in a "seamless coverage"; and,
7. Definitions are clear and quantitative, a situation that should guide ECM practitioners to become more consistent.

The method required a structured methodology to ensure that the amount of error was minimized. The line work captured is of higher quality than is required for the project scale of 1:250K, and is roughly ±150m (compared to a project accuracy objective of ±250m).

The automated tool was run using the Yukon 90m Digital Elevation Model (DEM). The 90m DEM was selected over the 30m DEM for this work for a couple of reasons. First, given the final ECM map scale of 1:250K, the 90m DEM was of sufficient accuracy to support the intended level of resolution. Computationally, it was also easier to handle, and the 30m DEM, while denser, was not based on greater sampling, rather it was re-sampled from the 90m DEM.

The DEM was clipped to a buffered project area boundary that was extracted from the Ecodistricts layer. By allowing a buffer of 100m beyond the project area, edge effect was eliminated, providing increased accuracy. The DEM was then converted to points where the center of each DEM pixel was represented by a single point with elevational and aspect values.

The AML tool was run using the elevational rule sets in Table 6. The AML tool was run separately for each Ecodistrict. The resulting layers were then merged and cleaned. The model output accounted well for slight elevational differences and it produced a very good quality initial output that was seamless and fully edge-matched (Figure 3).

Table 6. Bio-Climate elevational (in metres ASL) rule sets for the Southern Lakes and Pelly Mountain Ecoregions.

Ecodistrict	BOL warm	BOL neutral	BOL cool	BOL transition cool	BOL transition warm	BOH warm	BOH neutral	BOH cool	BOH transition cool	BOH transition warm	SUB warm	SUB neutral	SUB cool	SUB transition cool	SUB transition warm
Lebarge Plateau (904)	10	10	10	10	10	1350	1325	1300	1315	1340	3000	3000	3000	3000	3000
Nisutlin Plateau (905)	1000	975	950	960	985	1350	1325	1300	1315	1340	1700	1650	1600	1625	1675
Miner's Range (906)	10	10	10	10	10	1200	1150	1100	1125	1175	1500	1450	1400	1425	1475
Whitehorse Range (907)	1000	975	950	960	985	1300	1250	1200	1225	1275	1600	1550	1500	1525	1575
Takhini Basin (908)	1000	975	950	960	985	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Stikine Boundary (909)	1000	975	950	960	985	1400	1350	1300	1325	1375	1700	1650	1600	1625	1675
Teslin Basin (910)	1000	975	950	960	985	3000	3000	3000	3000	3000	6000	6000	6000	6000	6000
Whitehorse Lowland (1905)	1000	975	950	960	985	1350	1325	1300	1315	1340	1700	1650	1600	1625	1675
Big Salmon Range (911)	10	10	10	10	10	1350	1325	1300	1315	1340	1700	1650	1600	1625	1675
Syncyr Range (912)	10	10	10	10	10	1350	1325	1300	1315	1340	1700	1650	1600	1625	1675
Upper Liard (913)	1000	975	950	960	985	1300	1250	1200	1225	1275	3000	3000	3000	3000	3000
Toya Range (914)	1000	975	950	960	985	1400	1350	1300	1325	1375	1700	1650	1600	1625	1675

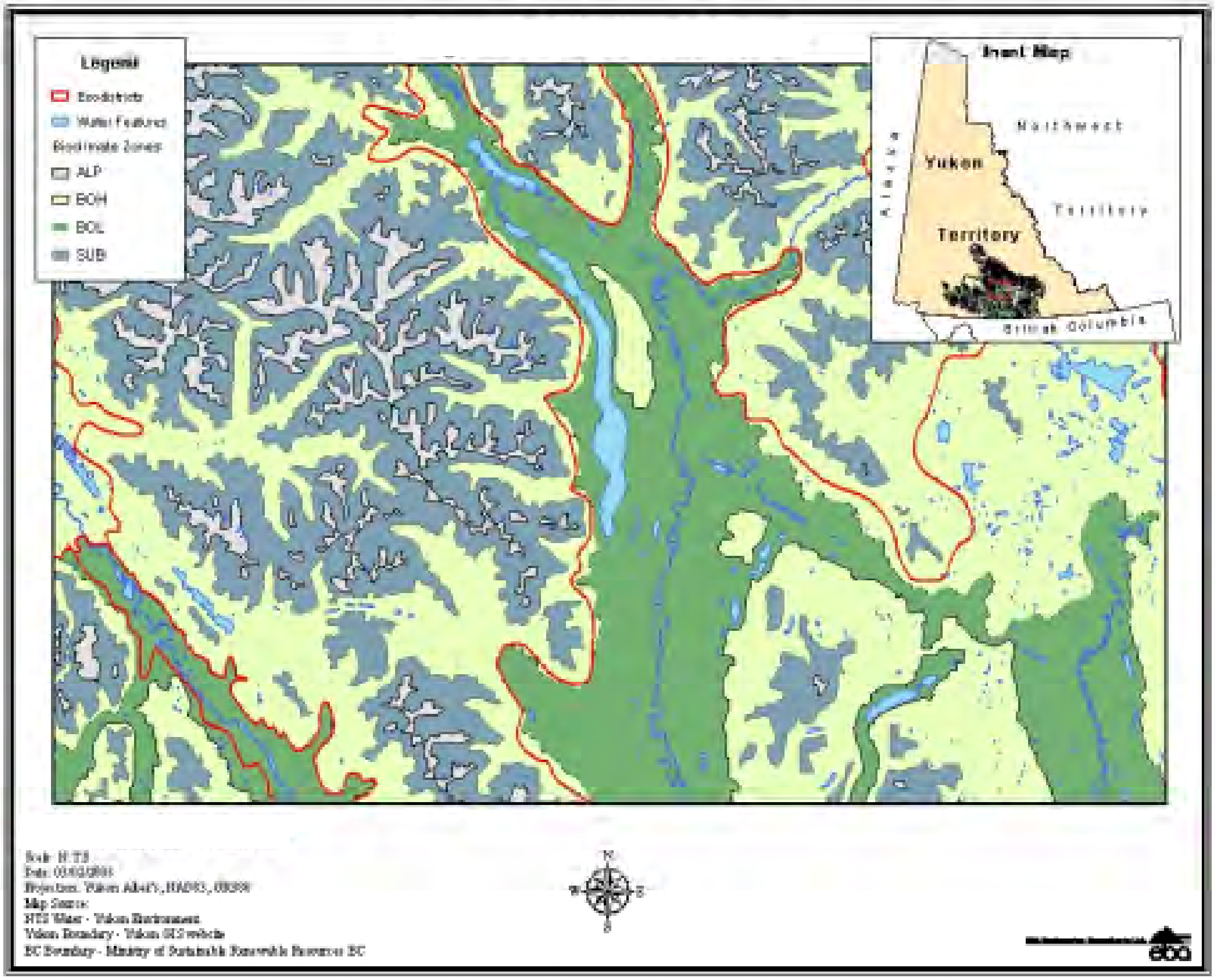

Figure 3. Example of draft Bio-Climate lines generated using a modelling approach.

Refinement and adjustments to the Bio-Climate ecosystem linework were captured using on-screen procedures described earlier. Minor artefacts such as slivers, small island polygons, and elevation discrepancies of the modelling process were handled in this manner.

Satellite imagery was used as a check against the Bio-Climate cover to ensure that the features being delineated were accurate. This process allowed the initial elevational models to be tested and refined as needed. The work progressed on an Ecodistrict by Ecodistrict basis to ensure edge matching and project consistency.

2.3.10 Summary of Map Product

As indicated earlier, this ECM project involved the delineation of classification units and the spatial analysis of several key input layers to derive a prototype mapped product. Appendix E is a map of the Ecodistricts and Bio-Climates of the Study Area. Delivered separately from this report were the digital coverages. Appendix C provides a summary of the digital files that were produced and delivered.

3.0 RECOMMENDATIONS AND FUTURE DIRECTIONS

This section provides a number of recommendations and potential future directions for the Yukon ECM Framework. The items include both classification and mapping issues and are not presented in any particular priority.

1. ***Make optimum use of earth observations satellite imagery for ECM mapping.***

   Earth observation satellite imagery, in particular Landsat-7, provides valuable data for Ecodistrict level ECM. It is recommended that land cover types be defined in a systematic and analytical manner for any operational ECM program within the Yukon. Table 7 lists some potential classes that were useful for another land classification project. Once derived in an objective manner, and verified using a systematic ground truthing system, these vegetation cover types can be used within a knowledge base, much like the approach used in some PEM projects in BC (RIC, 2000a, 2000b) and can support verification of other datasets, like forest cover.

2. ***Create slope and aspect-based spatial layers as a key input to ECM mapping.***

   Slope and Aspect surfaces should be delineated from DEM data in a consistent manner, and subjected – as was done in this project – to moisture class modelling, in order to provide another key input into an automated mapping tool for the Yukon ECM Framework. This process can be readily completed for the entire Yukon using existing DEM datasets. The result provides a valuable input to a knowledge base approach for ecosystem mapping.

   Moisture class can be used as a fundamental method of characterising ecosystems, and provides a significant capability, within an automated procedure, for deriving predictive mapping of ecological conditions (RIC 2000a, 2000b).

Table 7. Example land cover classes that might be delineated from Landsat-7 imagery for use within the Yukon ECM Framework.

Label	Interpreted Land Cover Class
0	NULL
1	Water
2	Shallow Water
3	Coniferous Dark
4	Coniferous
5	Coniferous / Deciduous
6	Deciduous / Coniferous
7	Deciduous
8	Herb Grass Wet
9	Herb Grass Dry
10	Shrub Wet
11	Shrub Dry
12	Rock / Talus
13	Cleared
14	Marsh
15	Snow / Ice
16	Shadow
17	Cleared / Road

3. ***Wherever possible, Yukon ECM mapping should include spatial data layers for surficial landforms.***

Surficial mapping – at an appropriate scale for ECM mapping – is needed to produce higher quality ECM products. Surficial landform mapping is frequently cited as a critical input database for predictive mapping of ecosystems (eg, see Moon, 1999a, 1999b; Meidinger, 2000; RIC 2000a, 2000b). For the Yukon, this spatial information needs to be generated over broad areas within the Yukon as a consistent coverage.

The importance of surficial landform mapping was emphasized during the recent workshop (see Cowell and Sims, 2003a). Also during the workshop, it was emphasized that a significant portion of the Yukon in fact has surficial mapping completed at a broad or intermediate scale, however most of this is only prepared in hard copy formats.

It is strongly recommended that – as a first step – some pilot projects be initiated to test the quality of these existing data sources for regional ECM applications in various parts of the Yukon. Contingent upon the outcome of these test studies, a further recommendation would be that a consistent seamless digital coverage (including digital annotation capture), over broad areas, be developed for surficial landforms within the Yukon.

4. ***Yukon standards for the collection of field plot data need to be developed or adopted.***

As recommended at the March, 2003 Workshop (Cowell and Sims, 2003b), the YTG needs to opportunistically augment the Yukon territorial database for field plot data associated with ecosystem description. In order to do this is a consistent manner, there is a need for the Yukon to develop or derive some standards for field data collection. There are several "models" for ecosystem field data collection that could be examined, so that the effort to create a Yukon system could be minimized. Suitable field guides for ecosystem sampling exist in BC, Alberta and many other provinces. Saskatchewan, for example, is currently in the process of developing such a field manual for data collection (M. MacLaughlin, Saskatchewan Dept of Forestry, pers. comm.).

BC's Describing Ecosystems in the Field (DEIF) field manual (see http://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh25/01-Site.pdf) is widely used in BC and other parts of western Canada, and could be readily adapted to the Yukon, with little modification. The DEIF manual provides instruction on the standardized collection of a range of abiotic and biotic site attributes that, collectively, serve to describe ecosystems, including:

- Site;
- Soil;
- Vegetation;
- Mensuration;
- Wildlife Habitat Assessment;
- Tree Attributes for Wildlife; and,
- Coarse Woody Debris.

The BC DEIF system also has the advantage of having some other standardized tools for field data collection and subsequent management. Associated with DEIF are standardized field tally forms, FS882 (pages 1 through 7), digital capture software (VENUS or VPRO), technical training programs and a provincially-sanctioned and supported DEIF certification process.

The VENUS software tool (see http://www.for.gov.bc.ca/hre/becweb/software.htm) can error-check, manage and even export vegetation and environmental variables into a few common statistical and tabulation packages for environmental ordination and classification procedures.

A supplemental sampling protocol to the DEIF procedure is a “quick” ecological survey procedure known as Ground Inspection (RIC 1998a). Ground Inspection involves the field collection of a set of core ecological data that is especially useful for ecosystem mapping field verification. The Ground Inspection data collection system has associated digital capture software known as GRAVITI (Ground And Visual Inspection TEM Interface), a tool that has been incorporated into more recent versions (e.g., 2000 onward) of VENUS (see http://www.for.gov.bc.ca/hre/becweb/software.htm).

5. Automated procedures for ECM map generation should be adopted as a key concept in the Yukon ECM Framework.

Earlier parts of this report have made reference to the BC system of PEM. During the current project, the approach taken to generate Bio-Climate ecosystems was in essence a Yukon adaptation of the PEM approach. Rulesets were developed for Bio-Climate elevational lines and applied with GIS programming.

PEM has become widely used and very popular in BC over the past few years. PEM takes a number of available spatial databases and uses GIS modeling approaches to combine these, using ecological field knowledge and a set of rule sets (known as a “knowledge base”) to generate the mapped outputs (RIC 2000a, 2000b). Additional background on BC’s PEM program can be obtained at the following two websites:
http://srmwww.gov.bc.ca/risc/pubs/teecolo/ and http://www.for.gov.bc.ca/research/temalt/

A PEM-like approach for the Yukon is attractive for a number of reasons. It is far more cost-effective than other methods of ecosystem mapping (i.e., those that involve a great deal of field inspection and considerable photo-interpretation activities). PEM is also considered to be consistently repeatable, and larger areas can be completed if there are good quality “input data bases” available for a given area. Over time, PEM-like products can be updated if newer mapped information or improved ecological knowledge becomes available.

Datasets currently available in the Yukon were summarized as part of the March 2003 workshop (Cowell and Sims, 2003b). Many of these databases are readily available for use in an automated ECM procedure. These datasets can be broadly grouped, as follows:

1. Satellite Imagery analysis (to derive land cover types)
2. DEM modelling (to derive slope, aspect, and moisture class surfaces)
3. Forest Cover (to identify leading species and assist with land cover type derivation)
4. Surficial Landforms and Soils (particularly to provide surface landform information and geomorphological information, as well as drainage and texture information so that moisture classes can be more accurately derived)
5. Bedrock Geology (lithological information important in the derivation of information about nutrient status, drainage and other key surface and subsurface features)
6. Others (including spatial and non-spatial data that is associated with climate and weather, surface albedo and light energy, wetland landforms, etc..)

There are some constraints to a PEM-like approach for the Yukon. The reliability of the product is based entirely upon the quality of the input databases and so these must be consistent and reliable coverages in their own right. Some of these databases may not be as reliable as needed. Positional and thematic problems of the original data sets become problematic as well, when several layers are brought together. Some specialized skills are needed on the part of the "ecosystem modeller" – they need to have good field ecological skills, but must also be comfortable and adept with data analysis, mathematical modelling and information management (Moon 1999a, 1999b; Sims and Matheson, 1999).

6. Develop classification and mapping standards with map interpretations in mind.

Ecosystem maps are often used to derive or interpret other themes or values, such as wildlife habitat suitability, site index values or biodiversity representation. The attributes that are required for some interpretations are often not captured in the ecosystem mapping if the attribute is not ecologically relevant to vegetation distribution. For example, wildlife habitat suitability for mountain goat and mountain sheep is dependent on very steep slopes (from 45 to 90 degrees), which are not ecologically relevant to vegetation distribution and therefore not captured. In order to produce integrated interpretations for land management, considerations for useful or likely map interpretations should be considered in advance.

7. ***Ecosystem units are the building blocks for classification at the local and regional level.***

At the Yukon ECM workshop held during March, 2003, one issue that was raised involved the need for a simple characterisation of Ecosystem Units, which are the building blocks for ECM map units and map legends (see Figure 2 in Section 2.2). A clearer concept of how Ecosystem Units are appropriately nested within Bio-climate Zones is needed. It is also important to improve the description of how Ecosystem Units, as defined within the Yukon ECM Framework, are assembled from Bioterrain Components and Vegetation Components (Figure 4). Bioterrain Components are defined in relation to characteristic soils and surficial materials, while Vegetation Components are defined in terms of identifiable vegetation community types or vegetation conditions associated with a definable range of site moisture and nutrient status.

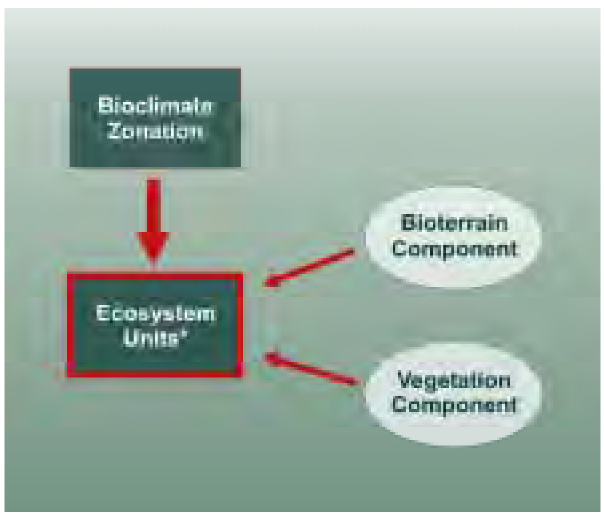

Figure 4. A conceptual model of Ecosystem Units, showing them nested within a Bioclimate Zonation, and consisting of both a Bioterrain and Vegetation Component

8. ***Use an edatopic grid to illustrate fundamental ecosystem characteristics.***

Many ecological classification systems (e.g., BC and Alberta) organize and represent ecosystems along gradients of soil moisture and nutrients creating a grid, referred to as an edatopic grid. Sites with similar stable plant communities reflect similar environmental properties, particularly soil moisture and soil nutrients. The edatopic grid provides a qualitative, nonspecific type of ecosystem model that is based upon fundamental ecosystem characteristics of terrestrial sites. Figure 5 show an example of an edatopic grid. It is recommended that this type of representation be adopted for use in the Yukon EMC Framework. See Meidinger and Pojar (1991) for more on the edatopic grid.

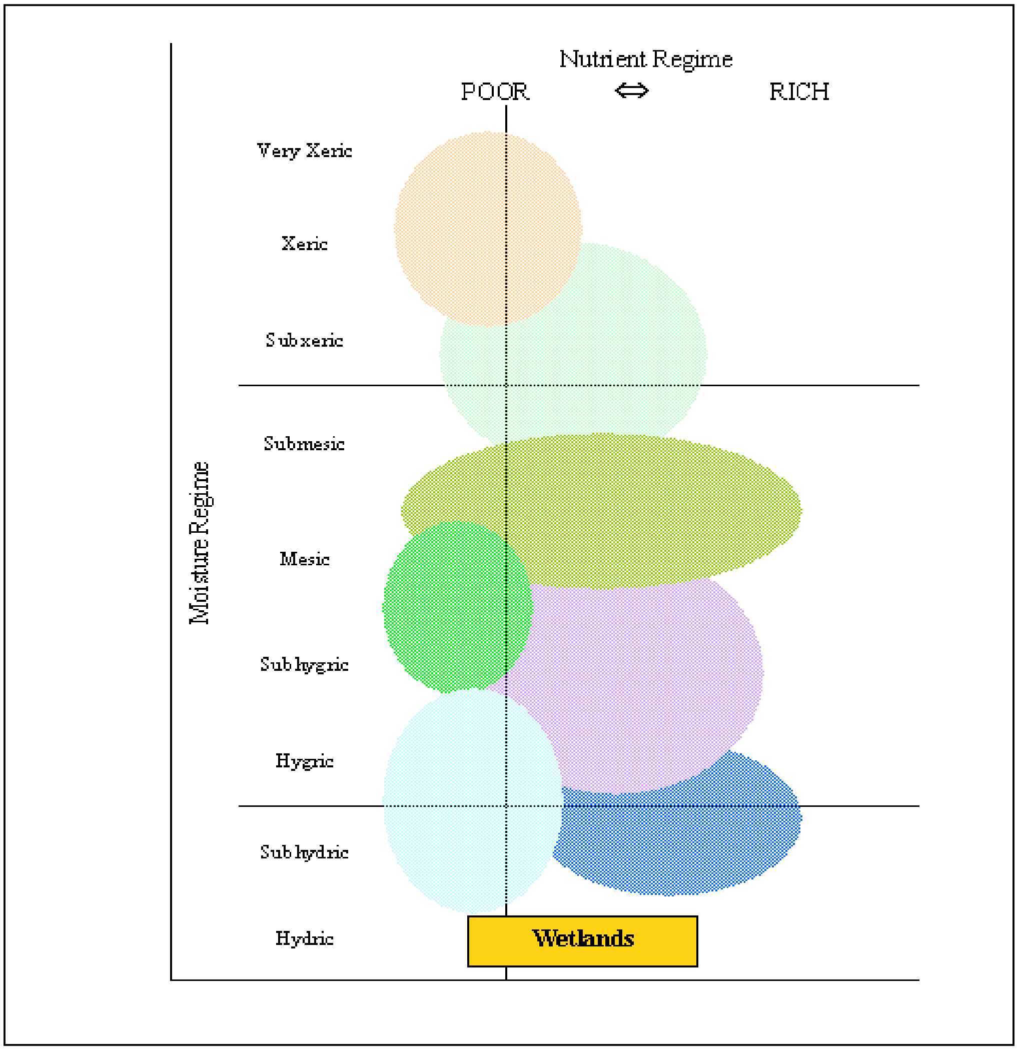

Figure 5. Example of an Edatopic Grid showing the distribution of ecosystems as a function of soil moisture and soil nutrients.

9. Ecosystem units from adjacent areas in BC can be used as a first approximation for some units.

If the approach to classifying ecosystem units in the Yukon is similar to the BEC approach in BC, ecosystem units in northern BC could be used as a first approximation for areas in the southern Yukon. Most of the Yukon Southern Lakes and Pelly Mountain Ecoregions could be mapped using existing site series from northern BC. Appendix D is a list of northern BC site series (Banner *et al.*, 1993) that could exist within these two Ecoregions. In this table, Bio-climate zone has been substituted in place of the equivalent BC Biogeoclimatic Zone/subzone/variant. This table is included to illustrate that there currently exists a large amount of ecological classification information for adjacent areas and there may already exist fundamental ecological building blocks that could be adopted.

10. Use the Yukon Southern Lakes and Pelly Mountains as a pilot area.

The Yukon Southern Lakes and Pelly Mountains Ecoregions are likely the most data rich areas the Yukon Territory. It is therefore logical to test new protocols and conduct pilot projects within this area. Also, since a portion of this area is adjacent to British Columbia where at least some medium and large-scale ecosystem mapping has occurred, there are opportunities to compare and contrast ECM units on each side of the border.

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Appendix A. Yukon EMC Data Acquisition / Tracking Summary Table

Layer	Source	File Name (with extension)	Zipped File Name	Projection	Data Accuracy	Description	Date Received	Checked	Status
Study Area	YT-DOE	ysl_pmt.shp,shx,dbf	no zip file	Yukon albers	1:250000	YSL / Pelly Ecoregions as study area	1/9/03	yes	ok
Eagle Plains Project	YT-DOE	eco_classification.shp,shx,dbf,sbn,sbx	eagleplains-eco_class.zip	Yukon albers	1:250001	Previously Completed	11/15/02	yes	ok
Mackenzie / Peel Projects	YT-DOE	mp2.shp,shx,dbf,sbn,sbx	macpeel-eco_class.zip	Yukon albers	1:250002	Previously Completed	11/15/02	yes	ok
Yukon Plateau North Project	YT-DOE	ypnorth-eco.e00	ypnorth-eco_class.zip	Yukon albers	1:250003	Previously Completed	11/15/02	yes	ok
DEM	YT-DOE	104n_dem_90m.asc	104n_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	104o_dem_90m.asc	104o_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	105a_dem_90m.asc	105a_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	105b_dem_90m.asc	105b_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	105c_dem_90m.asc	105c_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	105d_dem_90m.asc	105d_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	105e_dem_90m.asc	105e_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	105f_dem_90m.asc	105f_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	105g_dem_90m.asc	105g_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	105h_dem_90m.asc	105h_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	105k_dem_90m.asc	105k_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	105l_dem_90m.asc	105l_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	115a_dem_90m.asc	115a_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
DEM	YT-DOE	115h_dem_90m.asc	115h_dem_90m.zip	Yukon albers	90m+-	30m resampled to 90m	12/13/02	yes	ok
NTS Base Mapping	YT-MOE	eco-sec.shp, 50k-base.mdb	50k-base.zip	Yukon albers	1:50000	returned	23/01/03	yes	corrupted
NTS Contours	YT-MOE	50k-contours.shp	50k-contours.zip	Yukon albers	1:50000	returned	23/01/03	yes	missing dbf
30m DEM	YT-MOE	ArcInfo Grid files	DEM.zip	Yukon albers	30m +-	30m digital elevation	23/01/03	yes	ok
NTS Base Mapping	YT-MOE	contours.shp, waterbodies.shp,watercourses.shp, ice.shp, transportation.shp	50k-base.zip	Yukon albers	1:50000	Base Mapping	2/3/03	yes	ok
Yukon Forest Inventory	YT-MOE	105a 04,12,13,14	e00	Yukon albers	50m +-	Forest Cover	3/14/03	yes	ok
Yukon Forest Inventory	YT-MOE	105b1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	e00	Yukon albers	1:50000	Forest Cover	3/14/03	yes	ok
Yukon Forest Inventory	YT-MOE	105c1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	e00	Yukon albers	1:50000	Forest Cover	3/14/03	yes	ok
Yukon Forest Inventory	YT-MOE	105d1,2,5,6,7,8,9,10,11,12,13,14,15,16	e00	Yukon albers	1:50000	Forest Cover	3/14/03	yes	ok
Yukon Forest Inventory	YT-MOE	105e1,2,3,4,5,6,7,15	e00	Yukon albers	1:50000	Forest Cover	3/14/03	yes	ok
Yukon Forest Inventory	YT-MOE	105f1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	e00	Yukon albers	1:50000	Forest Cover	3/14/03	yes	ok
Yukon Forest Inventory	YT-MOE	105g4,5	e00	Yukon albers	1:50000	Forest Cover	3/14/03	yes	ok
Yukon Forest Inventory	YT-MOE	105k3,4	e00	Yukon albers	1:50000	Forest Cover	3/14/03	yes	ok
Yukon Forest Inventory	YT-MOE	105l2,3	e00	Yukon albers	1:50000	Forest Cover	3/14/03	yes	ok
Yukon Forest Inventory	YT-MOE	105i1	e00	Yukon albers	1:50000	Forest Cover	3/14/03	yes	ok
Yukon Forest Inventory	YT-MOE	115a7,8,9,10,11,13,14,15,16	e00	Yukon albers	1:50000	Forest Cover	3/14/03	yes	ok
Yukon Forest Inventory	YT-MOE	115h1,2,3	e00	Yukon albers	1:50000	Forest Cover	3/14/03	yes	ok
Yukon Digital Geology	YT-MOE / Indian and Northern Affairs Canada	*.e00		Yukon albers		Geology	3/14/03		

Appendix B. Working Legend for Yukon EMC Bio-Climate

Ecoregion	Ecodistrict Name	Ecodistrict Number	Lower elevation (m)	Upper elevation (m)	General Description	Vegetation Expression	Terrain Expression	Bio-Climate Zone	Ecosystem Name
Yukon	Lac Labarge Plateau	904	1300c 1350w	x		In this ecodistrict vegetation communities (shrub and krummholtz forms) found at the higher elevations above continuous forest.	Adjacent to the eastern edge of the ecodistrict along the Salmon Range.	SUB	Subalpine
			x	1300c 1350w		Forests below continuous tree line or lowland shrub communities. Balsam popular predominantly found along fluvial systems in the eastern portions of this zone. Forests are mostly white spruce, lodgepole pine. Aspen is common and most likely associated with disturbance. Some subalpine fir can be found at the higher elevations in this zone but is not common.	Predominantly tills on rolling topography.	BOH	Boreal-High
	Nissutlin Basin	905	1600c 1700w	x	This zone is only found associated to the upper extents of the Englishman Range.	Vegetation is sparse dwarf shrub, herb/cryptogram and low stature, scattered krummholtz trees.	Steep talus slopes and bare rock is the dominant features.	ALP	Alpine
			1300c 1350w	1600c 1700w	This zone is only found associated to the higher elevations of the Englishman Range area.	In this ecodistrict vegetation communities (shrub and krummholtz forms) found at the higher elevations above continuous forest.	Generally gentle to steep tills.	SUB	Subalpine
			950c 1000w	1300c 1350w		Tall shrub is common in this zone associated with disturbances and edaphic conditions. White spruce and Lodgepole pine are the dominant forest species. Subalpine fir is found in pockets most likely associated to cooler conditions such as cold air drainages. Aspen encroaches from the lower boreal unit at the lower extents.	Dominated by tills and glaciation processes and undulating topography in the low lying areas.	BOH	Boreal-High
			x	950c 1000w	Generally along the major fluvial systems in the ecodistrict	Larger pockets of balsam popular are associated along the Nisutlin River and sporadic pockets on other fluvial systems. Isolated pockets of white birch can also be found in this zone, tending to richer sites. Subalpine fir encroaches from above in cooler situations. White spruce, lodgepole pine and aspen are the most widely distributed species under a variety of conditions.	Dominated by tills and glaciation processes and undulating topography in the upper portions and fluvial process in the low lying areas.	BOL	Boreal-Low
		906	1400c 1500w	x		Vegetation is sparse dwarf shrub, herb/cryptogram and low stature, scattered krummholtz trees.	Steep talus slopes and bare rock is the dominant features.	ALP	Alpine
			1100c 1200w	1400c 1500w		In this ecodistrict subalpine vegetation communities are dominated by shrub forms. Krummholtz forms are found at the higher elevations above continuous forest.	Generally gentle to steep tills.	SUB	Subalpine

Ecoregion	Ecodistrict Name	Ecodistrict Number	Lower elevation (m)	Upper elevation (m)	General Description	Vegetation Expression	Terrain Expression	Bio-Climate Zone	Ecosystem Name
			950c 1000w	1100c 1200w		Tall shrub is common in this zone associated with disturbances and edaphic conditions. White spruce and Lodgepole pine are the dominant forest species. Aspen encroaches from the lower boreal unit at the lower extents.	Dominated by tills and glaciation processes and undulating topography in the low lying areas.	BOH	Boreal-High
			x	950c 1000w	Very small extent of this zone coming in from the Takhini Basin	White spruce, lodgepole pine and aspen are the most widely distributed species.	Dominated by tills and glaciation processes and undulating topography in the low lying areas.	BOL	Boreal-Low
	Whitehorse Uplands	907	1400c 1500w	x		Vegetation is sparse dwarf shrub, herb/cryptogram and low stature, scattered krummholtz trees.	Talus slopes and bare rock is the dominant features.	ALP	Alpine
	Whitehorse Uplands	907	1100c 1200w	1400c 1500w		In this ecodistrict vegetation communities (shrub and krummholtz forms) found at the higher elevations above continuous forest.	Generally gentle to steep tills.	SUB	Subalpine
	Whitehorse Uplands	907	950c 1000w	1100c 1200w		Tall shrub is common in this zone associated with disturbances and edaphic conditions. White spruce and Lodgepole pine are the dominant forest species. Subalpine fir is found in pockets most likely associated to cooler conditions such as cold air drainages. Aspen encroaches from the lower boreal unit at the lower extents.	Dominated by tills and glaciation processes and undulating topography in the valley slopes and low lying areas.	BOH	Boreal-High
	Whitehorse Uplands	907	x	950c 1000w	Michi Creek and 'Clintock Drainages disect this ecodistrict to create this low lying zone.	Small pockets of balsam popular and black spruce are associated along the lower fluvial systems. White spruce, lodgepole pine and aspen are the most widely distributed species under a variety of conditions.	Dominated by tills and glaciation processes and undulating topography in the upper portions and fluvial process in the low lying areas.	BOL	Boreal-Low
	Takhini Basin	908	950c 1000w	x	Very small extent of this zone is found on higher elevations in the eastern portions of the Takhini Basin	Tall shrub is common in this zone associated with disturbances and edaphic conditions. White spruce and Lodgepole pine are the dominant forest species. Aspen encroaches from the lower boreal unit at the lower extents.	Dominated by gentle to moderately steep tills and glaciation processes and on the valley slopes.	BOH	Boreal-High
	Takhini Basin	908	x	950c 1000w		Small pockets of balsam popular are associated along the lower fluvial systems. White spruce and aspen are the most widely distributed species under a variety of conditions. Lodgepole pine is a dominant species but restricted to the lower portions of the basin.	Dominated by tills and glaciation processes and undulating topography in the upper portions and fluvial process in the low lying areas.	BOL	Boreal-Low
	Stikine	909	1600c 1700w	x		Vegetation is sparse dwarf shrub, herb/cryptogram and low stature, scattered krummholtz trees.	Very steep talus slopes and bare rock is the dominant features.	ALP	Alpine

Ecoregion	Ecodistrict Name	Ecodistrict Number	Lower elevation (m)	Upper elevation (m)	General Description	Vegetation Expression	Terrain Expression	Bio-Climate Zone	Ecosystem Name
			1300c 1350w	1600c 1700w		In this ecodistrict vegetation communities (shrub and krummholtz forms) found at the higher elevations above continuous forest.	Steep tills.	SUB	Subalpine
			950c 1000w	1300c 1350w		Tall shrub is common in this zone associated with disturbances and edaphic conditions. White spruce and Lodgepole pine are the dominant forest species, but closed forests are not extensive.	Dominated by tills and glaciation processes and undulating topography in the valley slopes and low lying areas.	BOH	Boreal-High
			x	950c 1000w		Small pockets of balsam popular are associated along the lower fluvial systems. White spruce and aspen are the most widely distributed species under a variety of conditions. Lodgepole pine is almost absent.	Dominated by tills and glaciation processes and undulating topography in the upper portions and fluvial process in the low lying areas.	BOL	Boreal-Low
	Teslin Basin	910	950c 1000w	x	This zone is predominantly encroachment from the Big Salmon Range.	Tall shrub is common in this zone associated with disturbances and edaphic conditions. White spruce and Lodgepole pine are the dominant forest species. Subalpine fir is found in pockets most likely associated to cooler conditions such as cold air drainages. Aspen encroaches from the lower boreal unit at the lower extents.	Dominated by tills and glaciation processes and undulating topography in the valley slopes and low lying areas.	BOH	Boreal-High
			x	950c 1000w	Generally along the major fluvial and lacustrine systems in the ecodistrict	Isolated pockets of balsam popular are associated along the Teslin River and other fluvial systems. Isolated pockets of white birch can also be found in this zone, tending to richer sites. Subalpine fir encroaches from above in cooler situations. White spruce, lodgepole pine, aspen an black spruce are the most widely distributed species under a variety of conditions.	Dominated by gentle slope tills and glaciation processes and undulating topography in the upper portions and fluvial process in the low lying areas.	BOL	Boreal-Low
		1905	1600c 1700w	x	Small extent of this zone in the southern portions.	Vegetation is sparse dwarf shrub, herb/cryptogram and low stature, scattered krummholtz trees.	Gentle talus slopes and bare rock is the dominant features.	ALP	Alpine
			1300c 1350w	1600c 1700w		In this ecodistrict vegetation communities (shrub and krummholtz forms) found at the higher elevations above continuous forest.	Generally gentle to moderately steep tills.	SUB	Subalpine
			950c 1000w	1300c 1350w		Shrub communities are common in this zone associated with disturbances and edaphic conditions. White spruce and Lodgepole pine are the dominant forest species, but closed forests are not extensive. Subalpine fir is minor on cooler sites.	Dominated by tills and glaciation processes and undulating topography in the valley slopes and low lying areas.	BOH	Boreal-High

Ecoregion	Ecodistrict Name	Ecodistrict Number	Lower elevation (m)	Upper elevation (m)	General Description	Vegetation Expression	Terrain Expression	Bio-Climate Zone	Ecosystem Name
			x	950c 1000w	This particular zone is the most influenced area from anthropogenic pressures in the Yukon.	Balsam popular is almost absent along the lower fluvial systems. Lodgepole pine, white spruce and aspen are the most widely distributed species under a variety of conditions. Small pockets of black spruce can be found on very wet conditions.	Dominated by tills and glaciation processes and undulating topography in the upper portions and fluvial process in the low lying areas.	BOL	Boreal-Low
Pelly	Big Salmon Range	911	1600c 1700w	x		Vegetation is sparse dwarf shrub, herb/cryptogram and low stature, scattered krummholtz trees.	Very steep talus slopes and bare rock are the dominant features.	ALP	Alpine
			1300c 1350w	1600c 1700w		In this ecodistrict vegetation communities (shrub and krummholtz forms) found at the higher elevations above continuous forest.	Generally gentle to steep tills.	SUB	Subalpine
			x	1300c 1350w	Northerly portions of this zone are large wide valleys compared to the sharp steep valleys to the south.	Shrub communities are common in this zone associated with disturbances and edaphic conditions. White spruce and Lodgepole pine are the dominant forest species. Subalpine fir is more prevalent in this zone, found on cooler sites. Aspen can be found along the along the valley bottoms. Balsam popular is common to fluvial sites predominantly along Big Salmon River in the north. White birch is constrained to the northerly portions in the valley bottoms associated with richer site conditions. Black spruce is also found associated with wetter conditions.	Dominated by tills and glaciation processes and undulating topography in the valley slopes and low lying areas.	BOH	Boreal-High
	Saintcyr Range	912	1600c 1700w	x		Vegetation is sparse dwarf shrub, herb/cryptogram and low stature, scattered krummholtz trees.	Very steep talus slopes and bare rock are the dominant features.	ALP	Alpine
			1300c 1350w	1600c 1700w		In this ecodistrict vegetation communities (shrub and krummholtz forms) found at the higher elevations above continuous forest.	Generally gentle to steep tills.	SUB	Subalpine
			x	1300c 1350w	Northerly portions of this zone are large wide valleys compared to the sharp steep valleys to the south.	Shrub communities are common in this zone associated with disturbances and edaphic conditions. White spruce and Lodgepole pine are the dominant forest species. Subalpine fir is more prevalent in this zone, found on cooler sites. Minor components are white birch and larch constrained to the valley bottoms. Black spruce is also found associated with wetter conditions.	Dominated by tills and glaciation processes and undulating topography in the low lying areas.	BOH	Boreal-High
	Upper	913	1300c 1350w	x		In this ecodistrict vegetation communities (shrub and krummholtz forms) found at the higher elevations above continuous forest.	Generally gentle tills.	SUB	Subalpine

Ecoregion	Ecodistrict Name	Ecodistrict Number	Lower elevation (m)	Upper elevation (m)	General Description	Vegetation Expression	Terrain Expression	Bio-Climate Zone	Ecosystem Name
			950c 1000w	1300c 1350w		Tall shrub is common in this zone associated with disturbances and edaphic conditions. White spruce, subalpine fir and lodgepole pine are the dominant forest species. Aspen encroaches from the lower boreal unit at the lower extents. Black spruce is also found in greater proportions along low lying areas.	Dominated by tills and glaciation processes and undulating topography in the low lying areas.	BOH	Boreal-High
			x	950c 1000w	Restricted to the upper Liard River in the ecodistrict	Isolated pockets of white birch can also be found in this zone, tending to richer sites. Subalpine fir encroaches from above in cooler situations. White spruce and lodgepole pine are the most widely distributed species under a variety of conditions. Aspen can be found along the western areas of this zone as small occurrences.	Dominated by tills and glaciation processes and undulating topography in the upper portions and fluvial process in the low lying areas.	BOL	Boreal-Low
	Tuya Range	914	1600c 1700w	x		Vegetation is sparse dwarf shrub, herb/cryptogram and low stature, scattered krummholtz trees.	Steep talus slopes and bare rock is the dominant features.	ALP	Alpine
			1300c 1350w	1600c 1700w		In this ecodistrict vegetation communities (shrub and krummholtz forms) found at the higher elevations above continuous forest.	Generally gentle to moderately steep tills.	SUB	Subalpine
			950c 1000w	1300c 1350w		Shrub communities are common in this zone associated with disturbances and edaphic conditions. White spruce, subalpine fir and lodgepole pine are the dominant forest species. Black spruce is common to wetter conditions along the lower extents of this zone. White birch occurs in pockets on richer conditions.	Dominated by tills and glaciation processes and undulating topography in the valley slopes and low lying areas.	BOH	Boreal-High
			x	950c 1000w		Balsam popular is almost absent along the lower fluvial systems. Lodgepole pine and white spruce are the most widely distributed species under a variety of conditions. Small pockets of black spruce can be found on very wet conditions. Small occurrences of larch are restricted to the eastern portion of this zone. White birch occurs on richer conditions to a minor extent.	Dominated by tills and glaciation processes and undulating topography in the upper portions and fluvial process in the low lying areas.	BOL	Boreal-Low

Appendix C. Yukon EMC Data Dictionary

Yukon_EMC_Delivery:

The following data dictionary is a hard copy version of the digital "Read Me" file that accompanies digital databases prepared for the current project.

EBA delivered all files for this project in ArcInfo® e00 format, uncompressed, and zipped (using WinZip®).

Bioclimate
grbio_yslpm.zip (grbio_yslpm.e00)

Readme
Yukon EMC Data Dictionary.doc

Ecodistrict
reco_yslpm.zip (greco_yslpm.e00)

Inputs

Aspect	derived from 90m digital elevation model *slpm_asp.zip (yslpm_asp.e00)*
Forest_Cover	seamed from Yukon forest inventory for study *yslpm_fc.zip (yslpm_fc.e00)*
Islands	lake and river islands with slope aspect attributes *yslpm_isl.zip (yslpm_isl.e00)*
Slope	derived from 90m digital elevation model *yslpm_slp.zip (yslpm_slp.e00)*
Study	study boundary. *yslpm_study.zip (yslpm_study.e00)*
Water	lakes and double banked rivers. *yslpm_wat.zip (yslpm_wat.e00)*

PEM_Base
grpem_yslpm.zip (grpem_yslpm.e00)

Table Structure Index for Bioclimate and Ecodistrict Definitions:

Width = number of spaces (or bytes) used to store item values.
Out Width = number of spaces used to display the item values.
Type = the data type of the item.
C = Character
I = Integer

B = Boolean
D = Date
F = Fixed
N = Number

Note: Table structure according to "Concepts, Rationale and Suggested Standards for the Yukon Ecosystem Classification and Mapping Framework - First Approximation Manual" unless otherwise indicated.

***Greco_yslpm.e00* - Ecodistrict Data Table Structure:**

Area – ArcInfo Internal
Perimeter - ArcInfo Internal
Greco_yslpm# - ArcInfo Internal ID
Greco_yslpm-id – ArcInfo User ID
Ecp_Tag – width (15), Out Width (15), Type (C), MSRM BC- TEM Digital Data Capture
 = Mapheet "#" + Poly_Id
Fcode – width (10), Out Width (10), Type (C), MSRM BC- TEM Digital Data Capture
 = "ELC9000300" for all Eco District polygons
Ecoreg-id – width (2), Out Width (2), Type (I)
Poly-Id - width (8), Out Width (8), Type (I)
Ecozone - width (4), Out Width (4), Type (I)
Ecozone_Name - width (20), Out Width (20), Type (C)
Ecoreg - width (4), Out Width (4), Type (I)
Ecoreg_Name - width (20), Out Width (20), Type (C)
Ecodist - width (4), Out Width (4), Type (I)
Ecodist_Name - width (20), Out Width (20), Type (C)
Bio-Zone - width (6), Out Width (6), Type (C)
Land_Pos - width (1), Out Width (1), Type (C)
Land_Subtype - width (1), Out Width (1), Type (C)
Land_Type - width (3), Out Width (3), Type (C)
Eco_Dec1 - width (2), Out Width (2), Type (I)
Eco_1 - width (5), Out Width (5), Type (C)
Eco_Mod1 - width (2), Out Width (2), Type (C)
Veg_1 - width (2), Out Width (2), Type (C)
Veg_Str1 - width (1), Out Width (1), Type (I)
Veg_Smod1 - width (1), Out Width (1), Type (C)
Eco_Dec2 - width (2), Out Width (2), Type (I)
Eco_2 - width (5), Out Width (5), Type (C)
Eco_Mod2 - width (2), Out Width (2), Type (C)
Veg_2 - width (2), Out Width (2), Type (C)
Veg_Str2 - width (1), Out Width (1), Type (I)
Veg_Smod2 - width (1), Out Width (1), Type (C)
Ref_Year - width (4), Out Width (4), Type (C)
Comment - width (50), Out Width (50), Type (C)

***Grbio_yslpm.e00* - Bioclimate Data Table Structure:**

Area – ArcInfo Internal
Perimeter - ArcInfo Internal
Grbio_yslpm# - ArcInfo Internal ID
Grbio_yslpm-id – ArcInfo User ID
Ecp_Tag – width (15), Out Width (15), Type (C), MSRM BC- TEM Digital Data Capture
    = Mapheet "#" + Poly_Id
Fcode – width (10), Out Width (10), Type (C), MSRM BC- TEM Digital Data Capture
    = "ELC9000400" for all Bioclimate polygons
Ecoreg-id – width (2), Out Width (2), Type (I)
Poly-Id - width (8), Out Width (8), Type (I)
Ecozone - width (4), Out Width (4), Type (I)
Ecozone_Name - width (20), Out Width (20), Type (C)
Ecoreg - width (4), Out Width (4), Type (I)
Ecoreg_Name - width (20), Out Width (20), Type (C)
Ecodist - width (4), Out Width (4), Type (I)
Ecodist_Name - width (20), Out Width (20), Type (C)
Bio-Zone - width (6), Out Width (6), Type (C)
    ALP – Alpine
    SUB – Subalpine
    BOH – BOH
    BOL - BOL
Land_Pos - width (1), Out Width (1), Type (C)
Land_Subtype - width (1), Out Width (1), Type (C)
Land_Type - width (3), Out Width (3), Type (C)
Eco_Dec1 - width (2), Out Width (2), Type (I)
Eco_1 - width (5), Out Width (5), Type (C)
Eco_Mod1 - width (2), Out Width (2), Type (C)
Veg_1 - width (2), Out Width (2), Type (C)
Veg_Str1 - width (1), Out Width (1), Type (I)
Veg_Smod1 - width (1), Out Width (1), Type (C)
Eco_Dec2 - width (2), Out Width (2), Type (I)
Eco_2 - width (5), Out Width (5), Type (C)
Eco_Mod2 - width (2), Out Width (2), Type (C)
Veg_2 - width (2), Out Width (2), Type (C)
Veg_Str2 - width (1), Out Width (1), Type (I)
Veg_Smod2 - width (1), Out Width (1), Type (C)
Ref_Year - width (4), Out Width (4), Type (C)
Comment - width (50), Out Width (50), Type (C)

Yslpm_slp.e00 **Data Description:**

Slp(field) – Slope Values
1 - p (0 – 3 deg.)
2 - j (3 – 15 deg.)
3 - a (15 – 25 deg.)
4 - k (25 – 35 deg.)
5 - s (35 – 45 deg.)
6 - z (45 – 55 deg.)
7 - z1 (55 – 65 deg.)
8 - z2 (65 – 75 deg.)
9 - z3 (75 – 85 deg.)
10 – z4 (> 85 deg.)

Yslpm_asp.e00 **Data Description:**

Asp(field) – Aspect Values
1 – f (-1)
2 – k (0 – 135, 285 – 360 deg.)
3 – w (135 – 285 deg.)

Yslpm_wat.e00 **Data Description:**

Wat(field) – Water Values
D – Dry (Land)
L – Lake (Water)
R – River (Water)

Yslpm_wat.e00 **Data Description:**

- Table is same as from Yukon Environment (i.e., same structure)

Yslpm_study.e00 **Data Description:**

- Created from the final Ecodistrict line work, dissolved all internal lines to leave the remaining boundary

Projection:

Yukon Albers Equal Area Conic, Datum – NAD83, Ellipsoid – GRS80
1st Standard Parallel = 61 40’ 0”
2nd Standard Parallel = 69 0’ 0”
Central Meridian = 132 30’ 0”
Reference Latitude = 59 0’ 0”
False Easting = 500000
False Northing = 500000

Precision:

All coverages were delivered in SINGLE precision

Compression:

All coverages were delivered in ArcInfo e00 format uncompressed

Accuracy:

Grbio_yslpm.e00 (Bioclimate) - within +- 250m
Greco_yslpm.e00 (Ecodistricts) - within +- 250m
Grpem_yslpm.e00 (PEM Base) - within +- 100m

Minimum Tolerances:

Grbio_yslpm.e00 - minimum polygon size of 250,000sqm.
Grpem_yslpm.e00 and *yslpm_slp.e00* – minimum polygon size:
Slp(field)
P(1) – 150,000sqm
J(2) – 150,000sqm
A(3) – 150,000sqm
K(4) – 150,000sqm
S(5) – 150,000sqm
Z(6) – 100,000sqm
z1(7) – 100,000sqm
z2(8) – 20,000sqm
z3(9) – 20,000sqm
z4(10) – 20,000sqm

yslpm_asp.e00 – minimum polygon size:
asp(field)
1 (flat) – 150,000sqm
2 (cool) – 150,000sqm
3 (warm) – 150,000sqm

Note: In order to maintain data integrity, polygons were dissolved into the next lowest adjacent class, starting with the steeper slopes and ending with flat slopes. For example, a slope polygon of z4 which was less than 20,000sqm was dissolved into a polygon of z3, if adjacent; if it was not adjacent, then a polygon of z2 was checked for. The method maintains data integrity, but also keeps the database query manageable and useable.

Appendix D. Potential Base ELC Units for the Yukon EMC

Note: Provisional base ELC Units listed in the following table were derived from comparable units in adjacent BGC zones of British Columbia.

Bio-climate Zone	Bio-climate Code	Site Series Code	Ecosystem Name	Assumed Situation	Typical Soil Moisture Regime
Alpine	AT	AD	Mountain arnica - subalpine daisy meadow (Mesic meadow)	Arnilat/ Erigper/ Polypil; MR 3; lower to upper slopes; deep, medium-textured soils, gentle slopes	mesic - subhygric
Alpine	AT	AH	Alder - Hellebore avalanche track	significant slope, deep, coarse-textured soil	subhygric - hygric
Alpine	AT	AW	Mountain-avens - Dwarf willow	Wind swept slopes; gentle upper slopes, or crest position, shallow, coarse-textured well drained soils; vegetation dominated by low willows, dwarf blueberry, Dryas spp., or other dwarf shrubs.	subxeric - mesic
Alpine	AT	BV	Birch - Vaccinium	Crest position, coarse shallow soil over bedrock in sparse windswept areas in complexes with rubble.	xeric - subxeric
Alpine	AT	CG	Cryptogam - Altai Fescue	steep rugged terrain; colluvial veneers over bedrock. Code was previously CF - Changed due to code conflict.	xeric - subxeric
Alpine	AT	FA	Fescue - arctic lupine	Upper, crest position; shallow, rapidly-drained, medium-textured soils.	submesic - mesic
Alpine	AT	FB	Subalpine fir - Five-leaved bramble	Significant slope; cool aspect; deep coarse-textured soils; krummholz site.	submesic
Alpine	AT	FH	Bl - Heather krummholz	shallow, coarse-textured soils	subxeric - mesic
Alpine	AT	FK	Subalpine fir krummholz	gentle slopes; shallow, medium-textured soils	xeric - submesic
Alpine	AT	FL	Alpine fescue - Lichen dry meadow (Low forb dry meadow)	Dry slopes with shallow, medium-textured soils; usually on gentle slopes. Vegetation mostly dominated by low forbs and sedges to form a near continuous turf. (Erigcom/ Antealp/ Festbra)	
Alpine	AT	FW	Altai fescue - dwarf willow	gentle to moderate slopes, shallow, medium textured soils, ridge, crest or upper slope position	xeric - submesic

Bio-climate Zone	Bio-climate Code	Site Series Code	Ecosystem Name	Assumed Situation	Typical Soil Moisture Regime
Alpine	AT	HB	Hellebore - Sedge - Bluejoint seepage meadow	Middle, lower and toe slope position; deep, medium-textured soil	subhygric
Alpine	AT	HL	Heather - Lichen meadow (Dry heath meadow)	gentle slopes, shallow medium textured soils; In areas where snow lies longer and soils are well drained (mesic and drier). Vegetation a mix of heathers and dry site graminoids and low forbs.	xeric
Alpine	AT	HP	Mountain-heather - Partridgefoot	Gentle to moderate slope, shallow coarse-textured soil, may occur in avalanche tracks	subxeric - submesic
Alpine	AT	HS	Horsetail - Sedge fen	organic	hygric - subhygric
Alpine	AT	HW	Netted willow - Four-angled mountain heather		
Alpine	AT	LC	Bracted lousewort - Palmate coltsfoot		xeric - subhydric
Alpine	AT	MA	Entire-leaved white mountain-avens - arctic lupine	significant slope, warm aspect; shallow soils over bedrock, coarse-textured soils; herb dominated community	subxeric - submesic
Alpine	AT	MB	Entire-leaved white mountain avens - bog birch	Significant slope, cool aspect; shallow soils over bedrock; coarse-textured soils; herb dominated community.	submesic - mesic
Alpine	AT	MC	Moss campion - Coral lichen meadow(Dry meadow)	gentle slopes, medium textured shallow soils, low veg cover, Sileaca/ Stereoc/ Poly/ Clad dry meadow; MR 2-3	
Alpine	AT	MH	Mountain-heather - Leafy liverwort snowbed community	gentle to moderate slope, receiving positions, deep, medium-textured soil, late snowpack	submesic - subhygric
Alpine	AT	PH	Wooly pussytoes - Heather dry meadow	upper crest often south facing slopes; shallow coarse-texture soils; very poor to poor SNR	xeric - submesic
Alpine	AT	SD	Sedge - Dwarf willow moist meadow	lower to upper gentle slopes; deep, coarse textured soil	mesic - subhygric
Alpine	AT	SP	Sedge - Partidgefoot	Significant slope, warm aspect, shallow coarse-textured soil, may occur in avalanche tracks	subxeric - submesic
Alpine	AT	SS	Leatherleaf saxifrage - Sedge wetland	Level to depressional site; poorly drained, deep, fine-textured soil	

Bio-climate Zone	Bio-climate Code	Site Series Code	Ecosystem Name	Assumed Situation	Typical Soil Moisture Regime
Alpine	AT	VA	Valerian - Arnica - Pasqueflower avalanche track	gentle slopes; deep, coarse-textured soils	submesic - subhygric
Alpine	AT	VG	Valerian - Arrow-leaved groundsel avalanche track	significant slope; deep, medium-textured soil	submesic
Alpine	AT	VH	Sitka valerian - Indian hellebore avalanche track	deep, coarse-textured soils, significant slopes (use aspect modifiers)	hygric - subhygric
Alpine	AT	VP	Valerian - Pasqueflower	snow lying gentle slopes; medium-textured, shallow soils; may avalanche	submesic - mesic
Alpine	AT	WA	Willow - Mountain arnica meadow	lower to upper gentle slopes, deep, coarse-textured soils	subhygric - submesic
Alpine	AT	WV	Willow - Sitka valerian	gentle slopes; deep, medium-textured soils, moist shrub units	mesic - subhygric
Boreal low	BOL	AH	Mountain alder - Common Horsetail	* Noncorrelated Unit, talk with Regional Ecologist	
Boreal low	BOL	BB	Scrub birch - Beaked sedge fen	depression, organic	hydric
Boreal low	BOL	BM	Beaked sedge - Marsh horsetail	* Noncorrelated Unit, talk with Regional Ecologist	
Boreal low	BOL	BP	Bluejoint - Cow parsnip avalanche track	significant slope, deep medium-textured soil, use aspect modifiers	subhygric - hygric
Boreal low	BOL	BW	Beaked sedge - Water sedge	* Noncorrelated Unit, talk with Regional Ecologist	
Boreal low	BOL	CS	Cottongrass - Sphagnum wetland	wetlands; organic blankets and veneers	subhydric
Boreal low	BOL	DM	Deer sedge - Sausage moss	* Noncorrelated Unit, talk with Regional Ecologist	
Boreal low	BOL	FB	Scrub birch - Sedge fen	depression, organic	hydric
Boreal low	BOL	FS	Slender sedge - Fen moss fen	depression, organic	hydric
Boreal low	BOL	HG	Horsetail - Giant water moss oxbow marsh	depression, organic	hydric
Boreal low	BOL	HS	Slender sedge - Hook moss fen	* Noncorrelated Unit, talk with Regional Ecologist	
Boreal low	BOL	KR	Kalm's lobelia - Rush marl flats	depression, organic	hydric
Boreal low	BOL	KS	Kinnikinnick - Sage	shallow soils, crest position	very xeric - subxeric
Boreal low	BOL	MS	Shore sedge - Hook moss	* Noncorrelated Unit, talk with Regional Ecologist.	
Boreal low	BOL	PH	Acb - Mountain alder - Common horsetail	* Noncorrelated Unit, talk with Regional Ecologist	

Bio-climate Zone	Bio-climate Code	Site Series Code	Ecosystem Name	Assumed Situation	Typical Soil Moisture Regime
Boreal low	BOL	PW	Pacific willow - Dogwood low bench riparian	depresion, organic	hydric
Boreal low	BOL	RS	Rush - Sedge marsh	depression, organic	hydric
Boreal low	BOL	SA	Scrub birch - Altai fescue - Coral lichen	* Noncorrelated Unit, talk with Regional Ecologist	
Boreal low	BOL	SE	Sedge - Asphodel fen	depression, organic	hydric
Boreal low	BOL	SF	Sedge - Fuzzy Fen moss fen	* Noncorrelated Unit, talk with Regional Ecologist	hygric - hydric
Boreal low	BOL	SO	Sw - Oak fern	lower, toe slope position	subhygric
Boreal low	BOL	SO	Sw - Oak fern: At - Oak fern seral association		subhygric
Boreal low	BOL	TC	Timothy - Sedge herb meadow	level to gently sloping meadows; medium-textured soils, deep fluvial and lacustrine deposits	subhygric - hygric
Boreal low	BOL	WE	Scrub birch - Willow fen edge	depression, organic. DO NOT USE - Project specific code.	hydric
Boreal low	BOL	WF	Willow - Birch floodplain	level to depression sites on deep fluvial deposits	hygric - subhydric
Boreal low	BOL	WM	Pacific willow - MacKenzie's willow	* Noncorrelated Unit, talk with Regional Ecologist	
Boreal low	BOL	SM	Sw - Knight's plume - Step moss	gentle slope; deep, coarse - textured soils	mesic
Boreal low	BOL	LL	Pl - Lingonberry - Feathermoss	gentle slope; deep, coarse - textured soils	xeric
Boreal low	BOL	SW	Sw - Wildrye - Feathermoss	significant slope; warm aspect deep, medium - textured soil	subxeric
Boreal low	BOL	BL	Sb - Lingonberry - Knight's plume	gentle slope to level sites; deep, medium- textured soils, subject to cold air ponding	subxeric - submesic
Boreal low	BOL	SS	SwPl - Soopolallie - Twinflower	gentle slope; deep, coarse - textured soils, richer soil nutrient regime	submesic
Boreal low	BOL	SR	Sw - Scouring-rush - Step moss	gentle, lower slope receiving sites; deep, medium - textured soil	subhygric
Boreal low	BOL	BC	Sb - Lingonberry - Coltsfoot	gentle slope, deep, medium-textured soil, cool sites	subhygric
Boreal low	BOL	SC	Sw - Currant - Horsetail	level to toe slopes; deep, medium- textured soils, imperfectly to poorly drained soils	subhygric - hygric
Boreal low	BOL	BH	Sb - Horsetail - Sphagnum	organic wetland, poor soil drainage	hygric

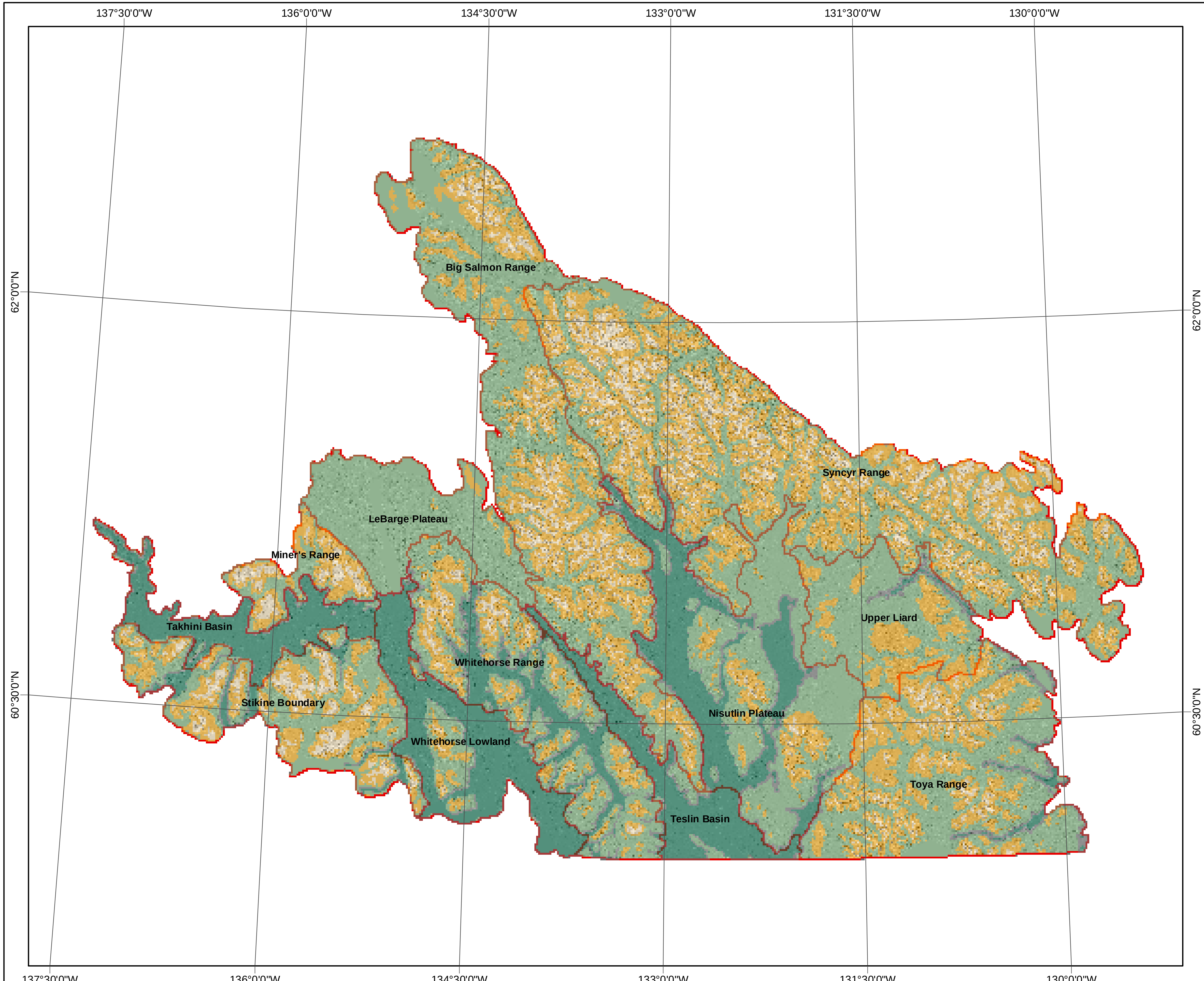
Bio-climate Zone	Bio-climate Code	Site Series Code	Ecosystem Name	Assumed Situation	Typical Soil Moisture Regime
Boreal low	BOL	BS	Sb - Labrador tea - Sphagnum	organic bog forest	subhydric
Boreal low	BOL	SG	Sw - Willow - Glow moss	swamp forests, deep medium-textured soils	subhydric
Boreal High	BOH	AD	Mountain arnica - Subalpine daisy meadow	lower to upper slopes and level; deep, medium textured soils	mesic - subhygric
Boreal High	BOH	AO	Great northern aster - Timber oatgrass		
Boreal High	BOH	AW	Mountain aven - Dwarf willow	crest to upper slopes, shallow soil	subxeric - submesic
Boreal High	BOH	BB	Bog birch - Buckbean		
Boreal High	BOH	BJ	Bluejoint - Avens high meadow	lower, depression, cold air pooling, gentle slopes, deep, medium textured soils	mesic - hygric
Boreal High	BOH	BP	bluejoint - cow parsnip avalanche track	well to imperfectly drained; avalanche tracks, significant slopes; deep, medium textured soil	subhygric - hygric
Boreal High	BOH	FB	Scrub birch - Sedge fen	depression organic	hygric
Boreal High	BOH	FF	Bl - Feathermoss avalanche track	significant slopes, deep, medium textured soil	subxeric - mesic
Boreal High	BOH	FS	Slender sedge - Fen moss fen	depression, organic	hygric
Boreal High	BOH	HS	Mountain hairgrass - Sedge	active floodplain; marsh; deep coarse-textured soils on active fluvial materials	hygric - subhydric
Boreal High	BOH	JB	Tall Jacob's ladder - Bluejoint	gentle slopes; deep, medium-textured soils; wet meadow unit	hygric
Boreal High	BOH	LG	Labrador tea - Glow ;moss sloping fen	depression, organic	hygric
Boreal High	BOH	MW	Water sedge - Fen moss fen	depression, organic	hydric
Boreal High	BOH	PA	Cow - Parsnip - Arrow - leaved groundsel wet meadow		
Boreal High	BOH	SA	Scrub birch - altai fescue	shallow coarse textured soils; rapidly drained	subxeric - submesic
Boreal High	BOH	SD	Sedge - Dwarf willow moist meadow	lower to upper slopes, medium textured soil	mesic - subhygric
Boreal High	BOH	SE	Sedge - Asphodel fen	depression, organic	hygric
Boreal High	BOH	SF	Sedge fen	fen; deep organic wetland	hygric - subhydric

Bio-climate Zone	Bio-climate Code	Site Series Code	Ecosystem Name	Assumed Situation	Typical Soil Moisture Regime
Boreal High	BOH	SP	Sw - Polargrass	gentle slopes; deep, medium-textured soils; stunted bog community	hygric - subhydric
Boreal High	BOH	TC	Shrub - Carr	Moist, mineral soils at low elevations; usually in association with cold air drainage or periodic flooding	mesic - hygric
Boreal High	BOH	VH	Sitka valerian - Indian hellebore avalanche track	well to imperfectly drained; avalanche tracks, significant slopes; deep medium textured soil	subhygric - hygric
Boreal High	BOH	WA	Willow - Mountain arnica moist meadow	lower to upper slope and level; deep, medium textured soil	submesic - subhygric
Boreal High	BOH	WB	Willow - bluejoint	level sites; deep, coarse-textured soils	subhygric - subhydric
Boreal High	BOH	WE	Willow - Scrub birch fen edge	depression, organic. DO NOT USE - Project specific code.	hygric
Boreal High	BOH	WF	Willow - Sedge wetland	level sites; deep, coarse-textured soils	subhygric - hygric
Boreal High	BOH	WG	Willow - Groundsel shrub carr	Lower, depression, cold air pooling, gentle slopes, deep, medium textured soils	mesic - hygric
Boreal High	BOH	WH	Willow - Common horsetail	gentle slopes; deep, coarse-textured soils	hygric - subhydric
Boreal High	BOH	WM	Willow - Mountain sagewort	significant slope; cool aspect; deep, meduim-textured soils; shrub dominated community	mesic - subhygric
Boreal High	BOH	WP	Water sedge - Bristle stalked sedge perched fen	depression, organic	hygric
Boreal High	BOH	WS	Willow - Sedge wetland	organic wetland * Noncorrelated Unit, talk with Regional Ecologist	subhydric
Boreal High	BOH	SB	Sw - Grey-leaved willow - Scrub birch	gentle slope; deep, medium-textured soils	mesic
Boreal High	BOH	PL	Sw - Scrub birch - Cladina	significant slope, warm aspect, shallow soils over bedrock	xeric - subxeric
Boreal High	BOH	SK	Sw - Juniper - Wildrye	significant slope, warm aspects; deep, medium-textured soils	xeric - subxeric
Boreal High	BOH	SW	Sw - Arctic lupine - Step moss	gentle slope, deep medium-textured soils	submesic - mesic
Boreal High	BOH	SL	Sw - Willow - Crowberry	significant slope, cool aspect; deep medium-textured soils	submesic - subhygric
Boreal High	BOH	SS	Sw - Willow - Step moss	gentle slope; deep medium-textured soils	subhygric
Boreal High	BOH	SC	Sw - Scrub birch - Bluejoint	significant slope, cool aspect; deep medium-textured soils	subhygric

Bio-climate Zone	Bio-climate Code	Site Series Code	Ecosystem Name	Assumed Situation	Typical Soil Moisture Regime
Boreal High	BOH	SH	Sw - Shrubby cinquefoil - Horsetail	gentle slope, deep, coarse-textured soils	hygric - subhygric
Subalpine	SUB	AD	Mountain arnica - Subalpine daisy meadow	Lower to upper meso slopes & level, deep, medium-textured soils.	submesic - mesic
Subalpine	SUB	AS	Entire-leaved white mountain avens - Sedges	crest slope positions; shallow soil over bedrock, coarse-textured; dry sites, sparsely vegetated in wind swept positions	xeric - subxeric
Subalpine	SUB	AW	Entire-leaved mountain-avens - Netted willow	gentle slopes; shallow soils, medium-textured	subxeric - submesic
Subalpine	SUB	BH	Bog birch - Four-angled mountain heather	gentle slopes; shallow soils over bedrock, coarse-textured; moist swale areas	mesic - subhygric
Subalpine	SUB	BL	Bog birch - Comon coral lichen	gentle slope; deep coarse-textured soils; shrub community on knolls	submesic
Subalpine	SUB	BS	Birch - fescue	Rapidly drained coarse soils; variable slope; in complex with talus; vegetation dense to sparse	xeric - submesic
Subalpine	SUB	BV	Birch - Vaccinium	Crest position, coarse shallow soil over bedrock in sparse windswept areas in complexes with rubble.	xeric - subxeric
Subalpine	SUB	FA	Fescue - arctic lupine	Upper, crest position; shallow, rapidly-drained, medium-textured soils.	submesic - mesic
Subalpine	SUB	FB	Subalpine fir - Five-leaved bramble	significant slope, cool aspect; deep, coarse-textured soils; krummholz site	submesic
Subalpine	SUB	FF	Bl-feathermoss avalanche track	significant slope (use aspect modifiers), deep, medium-textured soils	
Subalpine	SUB	FG	Subalpine fir - Globeflower	significant slope, warm aspect; deep, coarse-textured soils; forested site	subxeric - submesic
Subalpine	SUB	FH	Bl - Heather krummholz	significant slope (use aspect modifiers), shallow, medium-textured soils	
Subalpine	SUB	FV	Subalpine fir - Sitka valerian	significant slope, cool aspect; deep, coarse-textured soils forested site	mesic - subhygric

Bio-climate Zone	Bio-climate Code	Site Series Code	Ecosystem Name	Assumed Situation	Typical Soil Moisture Regime
Subalpine	SUB	FW	Subalpine fir - Grey-leaved willow	significant slope, warm aspect; shallow soils over bedrock, coarse-textured soils; krummholz site	submesic
Subalpine	SUB	HS	Horsetail - sedge fen	depression	
Subalpine	SUB	MA	Entire-leaved white mountain-avens - arctic lupine	significant slope, warm aspect; shallow soils over bedrock, coarse-textured soils; herb dominated community	subxeric - submesic
Subalpine	SUB	MB	Entire-leaved white mountain avens - Bog birch	significant slope, cool aspect; shallow soils over bedrock, coarse textured soils; herb dominated community	submesic - mesic
Subalpine	SUB	PA	Cow-parsnip - Arrow-leaved groundsel, wet meadow	moist herb meadow; gentle slope; deep, coarse-textured soils	hygric
Subalpine	SUB	PL	Sw - Scrub birch - Cladina	significant slope, warm aspect, shallow soils	
Subalpine	SUB	SA	Scrub birch - Altai fescue	gentle slopes; deep, medium textured soils	mesic - subhygric
Subalpine	SUB	SB	Sw - Grey-leaved willow scrub birch	gentle slopes, deep, medium-textured soils	
Subalpine	SUB	SC	Sw - Scrub birch - Bluejoint	significant slopes, cool aspects; deep, medium-textured soils	subhygric
Subalpine	SUB	SD	Sedge - Dwarf willow moist meadow	lower to upper slopes, medium textured soil	mesic - subhygric
Subalpine	SUB	SF	Sedge - Fen	deep, organic wetland	subhydric - hygric
Subalpine	SUB	SH	Sw - Horsetail	gentle slope; deep, coarse-textured soils	subhygric - hygric
Subalpine	SUB	SK	Sw - Juniper - Wildrye	significant slope, warm aspect, deep, medium-textured soils	subhygric - hygric
Subalpine	SUB	SL	Sw - Willow - Crowberry	significant slope, cool aspect, deep, medium-textured soils	submesic - subhygric
Subalpine	SUB	SS	Sw - Willow - Step moss	gentle slopes, deep, medium-textured soils	subhygric
Subalpine	SUB	SW	Sw - Arctic lupine - Step moss	gentle slopes, deep, medium-textured soils	submesic - mesic
Subalpine	SUB	VH	Sitka valerian - Indian hellebore	significant slope, cool aspect; shallow soils over bedrock, coarse-textured; avalanche chute	mesic
Subalpine	SUB	WA	Willow - Mountain arnica moist meadow	Lower to upper meso slopes & level, deep, medium-textured soils.	submesic - subhygric
Subalpine	SUB	WF	Willow - Sedge wetland	level sites; deep, coarse-textured soils	subhygric - hygric
Subalpine	SUB	WM	Willow - Mountain sagewort	significant slope; cool aspect; deep, meduim-textured soils; shrub dominated community	submesic

Bio-climate Zone	Bio-climate Code	Site Series Code	Ecosystem Name	Assumed Situation	Typical Soil Moisture Regime
Subalpine	SUB	WS	Sedge - Dwarf willow moist meadow	Mostly above 1900m, level, lower to upper meso slopes, deep, medium-textured soil	
Subalpine	SUB	WV	Willow - Sitka valerian	gentle slopes; deep, medium-textured soils, moist shrub units	mesic - subhygric



Appendix E
Map of Ecodistricts and Bio-Climates of the Yukon Southern Lakes and Pelly Mountains Ecoregions

N
W E
S

0 100 200 400 600 800 1,000
Kilometers

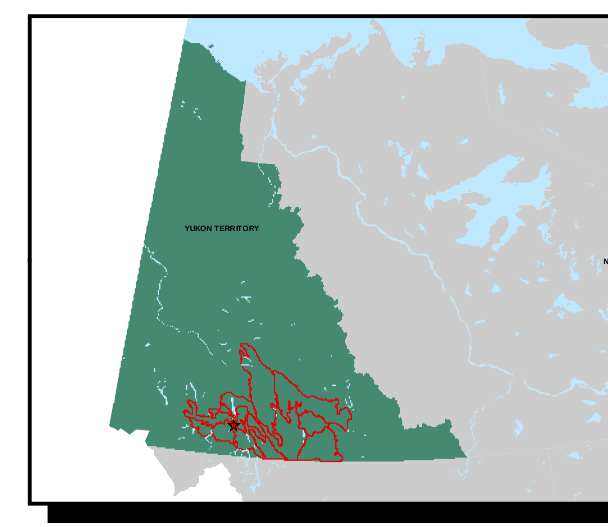
Legend

Ecodistrict

Bio-Climate Zones

Alpine
Subalpine
Boreal Low
Boreal High

Index Map



Compiled by: EBA Engineering Consultants
Approximate Scale: 1:1,500,000
Date: 07/11/03
Projection: Yukon Albers - Nad 83 - GRS 80
Map Source:
DEM - Yukon Environment

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