TERRESTRIAL ECOSYSTEM MAPPING
of the
KLAWLI STUDY AREA

for:

SLOCAN GROUP
MACKENZIE OPERATIONS

by:

Stephan Kesting, *M.Sc., R.P.Bio.*
Jan Teversham, *M.A., R.P.Bio.*
MADRONE CONSULTANTS LTD.
1081 Canada Avenue, Duncan, BC V9L 1V2

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1.0 INTRODUCTION

1.1 Objectives

The project objectives are to classify, map (at a scale of 1:20,000), and describe the terrestrial ecosystem units of the Klawli study area, and to interpret them with respect to their wildlife habitat values. This information will provide a basis for future ecosystem and wildlife management.

2.0 DESCRIPTION OF STUDY AREA

2.1 Location and Extent

The Klawli study area is shown in Figure 1. The area lies west of Williston Lake, between the Rocky Mountains and the Coast Mountains. The village of Germansen Landing, north of the study area, is the closest settlement. The study area covers approximately 113,200 ha.

The Klawli study area falls within the Mackenzie Forest District. The Fort St. James Forest District borders the study area to the east. The study area is bordered to the northeast by the Germansen management unit, roughly along the height of land of the Germansen Range. The Wolverine and Manson management units border the study area on the northwest side, and the Gaffney landscape unit borders the study area on the western side along a mountainous divide. The southern boundary is formed by a mountainous divide that separates the Klawli study area from the Nation River watershed (with the exception of the Sylvester Creek drainage).

The northern portion of the study area is drained by the South Germansen and Manson Rivers. Klawli River (also known as Valleau Creek), Gillis Creek, Moosmoos Creek, and Tsaydaychi Creek drain the central portion of the study area and Sylvester Creek drains the southeast corner of the area. Klawli and Tsaydaychi Lakes are located in the southwest part of the study area.

2.2 Physiography and Geology

The Klawli study area is located in the Swannell Ranges of the Omineca Mountains (Holland, 1976). It is roughly rectangular in shape with the long axis skewed northwest to southeast. Topographic relief over the entire study area approaches 1000 m and ranges from the heights of Mount Germansen at 1926 m down to Klawli Lake at 997 m. In general, the northern half is higher in elevation than the southern portion and includes most of the high peaks, including Baldy Mountain (1796 m), Blackjack Mountain (1550 m), and Mount Gillis (1850 m). Most of the land that lies below 1200 m occurs within the southern half of the study area. Along the southeastern edge of the study area, Porcupine Mountain and Mount Sylvester rise to 1565 m and 1505 m respectively. 'Adade Yus Mountain rises to 1905 m along the southwestern border.

Approximately two-thirds of the Klawli study area is underlain by the Germansen Batholith of Upper Jurassic age. The main rock type is coarse-grained granite composed of quartz, potassium, and plagioclase feldspar. Rock types in the southwestern portion are slightly older, having originated in the Upper Triassic period, and are primarily volcanic in origin. They include andesitic and basaltic flows, tuffs and breccias, and agglomerates.

During the last ice age, the Cordilleran Ice sheet moved eastward across the Klawli study area towards the Rocky Mountain Trench. The ice sheet covered the landscape to a height of 1800 m. Consequently, the peaks of Mount Germansen and Adade Yus Mountain escaped continental glaciation. The rest of the mountains in Klawli have rounded surfaces typical of continental glaciation. As the Cordilleran Ice Sheet melted, drainages were re-established.

Figure 1

Alpine glaciation occurred at higher elevations and was limited to north and northeast aspect slopes, which receive less insolation. This gave the valleys an asymmetric profile as can be seen around Mount Germansen. Cool aspects slopes that were subject to alpine glaciation are steep and often covered in colluvium, while warm aspect slopes are shallower, blending to rounded summits. The valleys in the study area tend to be broad and flat.

Till is the most common parent material in Klawli. Ridgetops are covered with a thin layer of till that deepens in the valley bottoms. The till tends to be medium to coarse textured (silty loam to sandy loam) due to the coarse-grained bedrock of the Germansen Batholith. There are deep fluvioglacial deposits along the major rivers. Their surface expression varies from broad, flat plains along the South Germansen River to undulating or deeply kettled areas along the Manson River. Eskers are common features in the study area landscape. Meltwater channels have been inscribed in both till and fluvioglacial parent materials.

Fluvial deposits are found at lower elevations throughout the Klawli study area with the most extensive deposit along the east-west trending sections of Klawli River and Moosmoos Creek. The current river floodplain is much smaller than the valley through which it meanders. Meander scars are common. Active and non-active fluvial fans extend onto this large fluvial plain. Expanses of organic material are often intermixed with the fluvial deposits. Organic deposits also accumulate in depressions in till or fluvioglacial material.

Colluvium derived from till is intermixed with till on the steeper slopes. Colluvium derived from the bedrock of the resistant and cohesive rock of the Germansen Batholith tends to consist of large blocks.

Epp and Kenk (1983) have identified more than 16 soil associations within the Klawli study area. Podzols, especially humo-ferric podzols, are the most common soil type and have formed on fluvioglacial, till, colluvium, and fluvial deposits throughout the study area. Brunisols are fairly common and have formed on similar parent materials.

Gleysols are limited in extent and develop on fluvioglacial, till, and fluvial deposits. Gleysol soils can be expected where soil is saturated for long periods such as in depressions or on gentle slopes in moisture receiving positions. Organic soils also develop on poorly to very poorly drained sites.

A detailed description of soil orders can be found in *The Canadian System of Soil Classification* (National Research Council of Canada 1998). For more information on the soil associations of the Klawli study area, refer to *Soils of the Manson River - Fort Fraser Area* (Epp and Kenk 1983).

2.3 Biogeoclimatic Ecosystem Classification

The Ecoregion Classification system, developed by the B.C. Ministry of Environment, Lands and Parks, is based on macroclimatic processes and landforms (Demarchi 1996). The Klawli study area falls within the Omineca Mountains Ecoregion of the Sub-boreal Interior Ecoprovince. Most of the study area falls within the Manson Plateau Ecosection, a rolling upland that lies south of the higher Omineca Mountains. Moist, warm air often flows into the area from the southwest. The northern portion of the study area falls within the Southern Omineca Mountains Ecosection, which consists of rounded mountains and ridges separated by wide valleys. It has the driest climate in the Ecoregion.

The Biogeoclimatic Ecosystem Classification (BEC) system is a hierarchical ecosystem classification system based on climate, vegetation, and site characteristics (Pojar et al. 1987). Figure 2 shows the BEC units of the study area. Most of the study area lies in the Engelmann Spruce - Subalpine Fir (ESSF) biogeoclimatic zone, including the parkland areas at high elevation. Alpine Tundra (AT) is found at the highest elevations in the study area. The BWBS zone occurs at the northern end of the Klawli study area, while the Sub-Boreal Spruce (SBS) zone occurs in valleys of the southern part of the study area. The relative areas of each biogeoclimatic unit are shown in Table 1 below.

Table 1. Relative Area by Biogeoclimatic Unit

Biogeoclimatic Unit	Percentage of total area
BWBSdk1	0.8
ESSFmv3	88.6
ESSFmvp3 (parkland)	2.7
SBSmk1	7.6
AT	0.3
Total area (ha)	113,150

2.3.1 BWBSdk1

The Boreal White and Black Spruce, Dry Cool Subzone, Stikine Variant (BWBSdk1) occurs at lower elevations (less than 1100 m), at the north end of the Klawli study area. Found only in the South Germansen and Manson River valleys, the BWBSdk1 occurs below the ESSFmv3.

Forests dominate this lowland to montane biogeoclimatic unit. Fire history results in a mosaic of different seral stages that have regenerated following disturbance. White spruce and lodgepole pine dominate mature stands, while black spruce occurs on the wetter and/or poorer sites. The BWBSdk1 is described in both the *Northwest Portion, Prince George Forest Region Field Guide* (MacKinnon et al. 1990) and the *Prince Rupert Forest Region Field Guide* (Banner et al.1993).

2.3.2 ESSFmv3

The Engelmann Spruce - Subalpine Fir, Moist Very Cold Subzone, Omineca Variant (ESSFmv3) is the most widespread biogeoclimatic zone in the Klawli study area. This high-elevation biogeoclimatic unit is distributed between approximately 1100 m and 1690 m. The ESSFmv3 lies above the SBSmk1 and BWBSdk1 biogeoclimatic units and below the ESSFmvp3 parkland subzone.

Engelmann spruce and subalpine fir dominate climax forests. Lodgepole pine also occurs, especially on non-zonal sites. Black spruce is present, but infrequent. The ESSFmv3 is described in the *Northwest Portion, Prince George Forest Region Field Guide* (MacKinnon et al. 1990). At upper elevations within the ESSFmv3 (approximately above 1500 m), the

Figure 2

forested units begin to resemble those of the ESSFmvp3, albeit with a more closed canopy. This issue is more fully addressed in section 5.2 (High Elevation ESSF Forests).

2.3.3 ESSFmvp3

The Engelmann Spruce – Subalpine Fir, Moist Very Cold Parkland Subzone, Omineca Variant (ESSFmvp3) occurs above 1650 m on cool aspects and 1690 m on warm aspects in the study area. The upper boundary is mapped at 1780 m on cool aspects and 1800 m on warm aspects. This subzone occurs above ESSFmv3 and below alpine tundra.

In the subalpine parkland, clumps of stunted Engelmann spruce and subalpine fir trees occur with areas of krummholz, heath, meadow, and grassland. On optimal sites, canopy closure is still usually less than 25%. Avalanches, seepage, and other edaphic factors may reduce tree crown closure further. Available field guides do not describe parkland vegetation in detail. Map units in the ESSFmvp3 were largely drawn from the Omineca Biophysical Habitat Mapping Project (Lacelle et al*.* 1996), as the vegetation found at higher elevations in the Klawli study area is very similar to the previously described units.

2.3.4 SBSmk1

The Sub-boreal Spruce, Moist Cool Subzone, Mossvale Variant (SBS mk1) occurs at lower elevations (less than 1100 m) towards the southern end of the Mackenzie Timber Supply Area (TSA), especially in the valley of the Nation River. Annual precipitation is considerably greater than in the BWBSdk1, and intermediate with regard to the other SBS subzones. This unit occurs below the ESSFmv3.

The upland coniferous forests typical of this unit are dominated by white spruce with trembling aspen and lodgepole pine often acting as successional intermediates. Douglas-fir, black spruce, paper birch, and black cottonwood also occur locally. The SBSmk1 is described in the *Southwest Portion, Prince George Forest Region Field Guide* (DeLong et al*.* 1993).

2.3.5 AT

In the Klawli study area, Alpine Tundra (AT) occurs above approximately 1780 m on cool aspects and 1800 m on warm aspects. Alpine Tundra occurs above the ESSFmvp3 parkland unit. The climate in the AT zone is extreme with low temperatures and high wind speeds preventing the establishment of forests. The cover of krummholz in the AT is usually less than 10%, and exposed rock and soil is relatively common.

3.0 METHODOLOGY

3.1 Data Sources

Black and white aerial photographs taken in 1994 (approximately 1:17,000 scale) were used to map the Klawli study area. Forest cover maps (1:50,000 scale), produced by the B.C. Ministry of Forests, were provided by Slocan Forest Products. Geographic Data BC provided 1:20,000 TRIM (Terrain Resource Information Mapping) data. Hugh Hamilton Ltd. modeled slope and aspect from the TRIM database, and the resulting maps aided in distinguishing significant slopes and aspects. A fire history map (1:600,000) of the Mackenzie Region was provided by Slocan Forest Products and was useful in understanding the burn history of the study area. Slocan also provided development plans for the delineation of recent cutblocks. The area mapped by the Omineca Biophysical Mapping project (1:50,000 scale) overlapped part of the Klawli study area and provided information on ecosystem distribution in the area.

3.2 Fieldwork

Stephan Kesting, Gill Radcliffe, and Pamela Williams carried out a reconnaissance flight of the study area on August 21, 1997. The data collected on this trip was used in the development of a sampling plan.

Fieldwork for the Klawli project was carried out from July 29 to August 12, 1998. The field crew consisted of ecologists Stephan Kesting, *M.Sc., R.P.Bio*, Jan Teversham, *M.A., R.P. Bio.*, and Ksenia Barton, *M.Sc., R.P.Bio*. Jason Hindson, *B.Sc*., and Pamela Williams, *B.Sc*., provided expertise in geomorphology and soil science, and wildlife specialists Tania Tripp, *B.Sc*., and Dana Becker, *B.Sc.*, *R.P. Bio.*, completed the crew. Fieldwork was helicopter-based, as road access into the study area is extremely limited.

Kershaw et al. (1998) and MacKinnon et al. (1992) were used for field identification of plant species. Vascular plants that could not be field identified were keyed out using Douglas et al. (1989, 1991, and 1994) and Hitchcock (1973). Schofield (1992) and Vitt et al. (1988) were consulted for bryophyte and lichen identification. The late date of the Klawli field trip prevented precise identification of some willow, grass, and sedge species. Ksenia Barton subsequently identified some of the plants collected during fieldwork

3.3 Parkland and Alpine Boundary Delineation

Alpine (ESSFmvp3-AT) and parkland (ESSFmv3-ESSFmvp3) boundaries were interpreted from airphotos, digitized before fieldwork, and revised afterwards. The parkland boundary is located at the elevation above which forest crown closure is less than 25%. This occurs at about 1650 m on north-facing slopes and at about 1690 m on south-facing slopes. The alpine boundary is located at the elevation above which krummholz cover is generally less than 10%. This transition occurs at about 1780 m on north-facing slopes and about 1800 m on south-facing slopes. These boundaries are relatively constant (+/- 25 m) for a given aspect.

3.4 Ecosystem Classification and Mapping

Classification and mapping follow the methodology documented in "Standards for Terrestrial Ecosystem Mapping in British Columbia" (Resources Inventory Committee 1998). Bioterrain polygons were initially delineated and labeled on the airphotos with the ESSFmvp3 and AT boundaries already in place. These bioterrain polygons were further subdivided by the addition of the SBSmk1 and BWBSdk1 boundaries and polygon boundaries associated with the variation of seral stages and aspect throughout the area. Labeling of ecosystem units and bioterrain is in accordance with the 1998 standards (Ecosystem Working Group 1998). Each forested ecosystem unit is assigned a two-letter code that is equivalent to one recognized BEC site series. Site series that have been identified are described in the *Southwest Portion, Prince George Forest Region Field Guide* (DeLong et al. 1993), *Northwest Portion, Prince George Forest Region Field Guide* (MacKinnon et al. 1990), and the *Prince Rupert Forest Region Field Guide* (Banner et al. 1993). Labeling for recognized forested ecosystem units follows the updated "Site Series Coding Master List" available from the B.C. Ministry of Forests.

Ecosystems not described in the B.C. Ministry of Forests field guides include non-forested units at lower elevations and both forested and non-forested units at higher elevations. Ecosystem unit labels have been assigned to non-forested units in consultation with Craig Delong (B.C. Ministry of Forests) and Corey Erwin (B.C. Ministry of Environment, Lands, and Parks). Many of these units were initially described in the Omineca Biophysical Habitat Mapping Project (Lacelle et al.1996) and they are applicable to the Klawli study area. Other units have been described specifically for this project. Sparsely vegetated, non-vegetated, and anthropogenic units follow the symbols assigned in the 1998 standards (Ecosystem Working Group 1998).

Tables 2-6 list all the ecosystem units identified in the study area along with the environmental parameters associated with the unit and frequency of occurrence. Detailed descriptions of vegetation follow in a later section.

Site modifiers in TEM are used to describe ecosystems occurring in atypical situations. There is a complete list of site modifiers in Appendix 7.1, and they were used as per the 1998 standards (Ecosystem Working Group 1998).

Structural stages in TEM mapping are used to differentiate between non-vegetated, herb-dominated, shrub-dominated, and various successional stages of forested ecosystems; a list of structural stages is available in Appendix 7.2. The seven-level structural stage system was used as per the 1998 standards. Sparse (1a) and bryoid (1b) structural stages were not distinguished in the mapping, as the difference between these units was not photo-interpretable.

Broadleaf, Mixed, and Coniferous (B, M, and C) stand composition modifiers were added to structural stages in the ST unit of the SBS and ESSFmv3 (variation in stand composition was minimal in other biogeoclimatic units).

To illustrate the interpretation of map labels consider the hypothetical label "ST4B" in the SBSmk1 biogeoclimatic zone. This would refer to the ST (05: SxwFd – Toad-flax) ecosystem, or site series, with young trees in the pole sapling stage (4), dominated by deciduous trees (B) (in this case aspen). A typical ESSFmv3 unit might be FRv7, referring to

zonal (01: Bl-White-flowered Rhododendron) old forest (7) occurring on shallower-than-usual soil (v).

3.5 Data Limitations and Map Reliability

3.5.1 Survey Intensity

The Klawli TEM project was conducted at survey intensity 4, which corresponds to a polygon visitation rate of 15% with a ratio of 5:20:75 of ecosystem field plots, ground inspections and visual inspections, respectively. Sixty full ecosystem plots, 223 ground inspections, 431 visuals, and 385 air calls were completed for a total of 1099 plots in the Klawli study area.

3.5.2 Air Photographs

The airphotos supplied for the Klawli area were black and white photographs (approximately 1:17,000 scale). The overall quality was excellent, although interpretation of wetland, sparsely vegetated, and non-vegetated units would have been easier with colour photography.

3.5.3 Forest Cover Maps

The B.C. Ministry of Forests produced forest cover mapping for the study area. The precision and accuracy of the forest cover maps provided was good, especially for determining the distribution of dominant tree species. Age class estimates were generally acceptable and they were used in conjunction with airphoto interpretation to determine structural stage. The forest cover maps were especially useful in determining the distribution of LC and LCx units and in delineating the boundary between the low and high-elevation ESSFmv3 forested map units.

3.5.4 Ecosystem Unit Identification

Differentiation between the FO (site series 04) and FD (site series 05) units in the ESSFmv3 was problematic. The primary FD indicator species, devil's club, did not occur in the study area and few sites were identified as FD in the field. Additional sampling in the southeast of the study area would have been required to better characterize the FD site series. In addition, the vegetation of the BT (site series 03) unit in the ESSFmv3 differed significantly from the field guide description. The soil moisture and nutrient regimes were consistent, however.

In the SBSmk1, lodgepole pine rather than black spruce always dominated the BH unit (site series 06), and scrub birch occurred more consistently than black huckleberry in the shrub layer. Other species were, however, similar to the described site series.

Relatively few plots were completed in the BWBSdk1; most of the site series had only one or two plots recorded in them. The bog forest unit (BH), in particular, was mapped but no plot data was collected. Only one plot was obtained of the SR (06:Sw-Scouring rush-Step moss) site series, and this plot was a regenerating shrubby site, making certain identification of correct site series difficult. Furthermore, the wetland units in the BWBSdk1 were described using data from the ESSFmv3. The reliability, therefore, of the mapping in this very small portion of the study area may be lower than for the other, better-sampled subzones.

During mapping, ecosystem units were identified using air photo interpretation. Some of the map units in alpine tundra and exposed crest positions using black and white air photographs were difficult to differentiate. Distinguishing among the FW, CF, TA, and RO ecosystem units, all of which tended to be light in colour, was usually difficult without plot data.

4.0 RARE VASCULAR PLANTS AND PLANT COMMUNITIES

4.1 Rare Vascular Plants

No red- or blue-listed plant species have been identified in the study area. Appendix 7.3 catalogs rare plants listed by the Conservation Data Centre for the Mackenzie Forest District. A complete list of all plants identified can be found in Appendix 7.4.

4.2 Rare Plant Communities

The following plant communities have been mapped in the study area and are listed by the Conservation Data Centre (Appendix 7.3):

- ESSFmv3 site series 03, Abies lasiocarpa - Picea mariana - Ledum groenlandicum – Provincial Rank S3, Provincial Listing: Blue

- SBSmk1 site series 06, Picea mariana - Vaccinium membranaceum - Petasites – Provincial Rank S3, Provincial Listing: Blue

Although these ecosystem units have been mapped for the study area, the vegetation of these units is actually rather different than described in the field guides. These ecosystem units were mapped on the basis of site edatopic position and not necessarily on field-determined plant community composition.

For site series 03 in the ESSFmv3 in Klawli, lodgepole pine dominates the tree canopy rather than black spruce. Scrub birch occurs in all plots with a mean cover of about 16%, while Labrador tea and soopolallie were not found in association with this unit. The herb layer is diverse and includes crowberry, dwarf blueberry, subalpine daisy, palmate coltsfoot, and various sedge species. Mosses include red-stemmed feathermoss, *Barbilophozia, Dicranum,* and *Sphagnum* species.

For site series 06 in the SBSmk1, lodgepole pine forms the main tree cover in mature forests while black spruce is virtually absent. Although black huckleberry may be present, scrub birch is dominant in the shrub layer. Species in the herb layer are consistent with the description for site series 06 (MacKinnon et al. 1990).

5.0 ECOSYSTEM UNIT DESCRIPTIONS

5.1 Introduction

A general description of the dominant plant species of each biogeoclimatic unit is given earlier in the Biogeoclimatic Ecosystem Classification section of this report. Site series described in the field guides were, for the most part, used for mapping the BWBSdk1, the SBSmk1, and the low-elevation portions of the ESSFmv3. The upper portions of the ESSFmv3, the ESSFmvp3, and the Alpine Tundra, however, required the description and mapping of additional units. The classification of high elevation ESSFmv3 ecosystem units is described at length in the following section.

5.2 High Elevation ESSFmv3 Forests

Below about 1450 m in the ESSFmv3, ecosystem units found in the field were consistent with those described in the field guide. Above this elevation, however, there was much poorer correlation between the field guide descriptions for site series of the ESSFmv3 and the existing vegetation. The species composition of these high-elevation ESSFmv3 ecosystem units was similar to that of the parkland (ESSFmvp3) units. There was, however, insufficient data to define an upper variant of the ESSFmv3. Parkland units (ESSFmvp3) were therefore extensively mapped at higher elevations in the ESSFmv3. Forest stands in the upper ESSFmv3 stands have greater crown closure and taller trees than those in the parkland subzone.

Lower elevation ESSFmv3 mesic forest is typically FR (Fir-Rhododendron - Feathermoss). At elevations between 1450 m and 1530 m, however, rhododendron is replaced by a carpet of white mountain heather and the vegetation is more typical of the FM unit (Fir - White Mountain Heather). FM is common in the parkland and is typically complexed with MH, a treeless mountain heather heath. Another common ecosystem unit of the parkland found on submesic to mesic slopes is FK (Fir-Krummholz). This unit occurs where exposure or avalanching has maintained a low-shrub krummholz fir community. It primarily occurs in the parkland but extends into the AT and down into the upper ESSFmv3.

FO (Fir - Oak Fern - Knight's plume) and/or FH (Fir - Horsetail - Feathermoss) units are found on rich, moist, low elevation sites in the ESSFmv3. At higher elevations above approximately 1400 m, but occasionally as low as 1360 m, these ecosystem units are replaced by FV (Fir - Valerian) forest with a typical subalpine complement of herbs and bryophytes. FV is also found on moist, rich sites in the parkland subzone, but the trees are typically somewhat stunted (less than 10 m) and the forest canopy more open. The VG (Valerian - Ragwort) herbaceous meadow unit becomes more abundant in the parkland zone as herbaceous openings between trees become large enough to be mapped as a separate unit.

The LC unit (Subalpine fir – Lodgepole pine – Crowberry - Cladina) typically occupies dry sites at lower elevations in the ESSFmv3. Lodgepole pine is relatively rare in the Klawli study area above 1400 m. Dry, forested sites above this elevation are more typical of FC (Fir - Crowberry). Dry forest in the parkland subzone is represented by FC, often complexed with treeless FW (Altai fescue-Dwarf willow) meadow. FW is the primary ecosystem unit found on dry crests in the Alpine Tundra zone.

There are certain affinities and similarities between treed and treeless high elevation units. FV, for example, is floristically very similar to the VG herbaceous meadow with the addition of

trees. FM is similar to the MH snowpack unit, but with trees, and FC is analogous to a treed FW meadow unit. When the openings in forested units are fairly small (less than 5 m diameter), it is assumed that these are simply gaps in the forest and they were not picked out in the mapping. When these openings are larger, however, a complex of the forested unit and the non-forested unit (*i.e.* VG, MH, or FW) was mapped.

5.3 Sources of Disturbance

The primary source of disturbance in the study area is fire. The extensive LC and LCx ecosystem units occurring on fluvial-glacial deposits are very dry and fire-prone, providing excellent conditions for lightening-induced fires to develop and spread. Fire is somewhat less common in subalpine areas but is still the most common source of disturbance. Some logging is currently occurring in the southeast portion of the study area. Other sources of disturbance, especially in non-forested parkland and alpine areas, include rockfall, slumping, and avalanching.

5.4 Detailed Site Series Descriptions

5.4.1 Map Unit Summary Tables

Tables 2-6 below summarize the abiotic environment of the various map units of the Klawli study area for each biogeoclimatic unit. In the BWBSdk1, where plot data was limited, the *Prince Rupert Field Guide* (Banner et al. 1993) provided additional information. Because the ESSFmv3, the ESSFmvp3, and the AT shared some common units, plots from adjacent zones were often combined to generate the data in the following section.

Legends for slope position, soil drainage, soil moisture regime, and soil nutrient regime are found in Appendix 7.5. Legends for surficial material and soil type are in Appendix 7.6.

Table 7 lists the sparsely vegetated, non-vegetated, and anthropogenic units for all zones. The areal percentage cover for each BEC unit is shown.

Table 2. Ecosystem Unit Description Summary Table – BWBSdk1

Site series and Map Unit	Brief Description (Values derived from field data and field guide))	% area of BEC unit	Slope Position and Gradient	Surficial Materials	Soil Type	Soil Drainage	Soil Moisture Regime	Soil Nutrient Regime
Forested Ecosystem Units								
SM/01: Sw - Knight's plume - Step moss	Diverse coniferous and deciduous forests and shrubs with an impoverished herb layer.	21.9	LW, MD, UP 0-85%	Variable but usually F or M (also *FG in study* area)	*GL, HFP*	*m-w*	3-5	B-D
LL/02: Pl - Lingonberry - Feathermoss	Dry lodgepole pine forests with a moss and lichen understory.	41.8	MD, (*LV, UP, CR)* *0-30%*	FG or C over rock	*HFP*	*(w)-r*	1-2	A-B
SS/05: SwPl - Soopolallie - Twinflower	Dry forests dominated by lodgepole pine and soopolallie with few lichens.	17.9	MD, CR, (*UP)* *0-5%*	FG or F	*DYB*	*(m)-r*	3-4	C-D
SR/06: Sw - Scouring rush - Step moss	Moist, rich white spruce forest with scattered horsetails in understory.	1.4	LW-MD *5-15%*	*variable*	-	*m*	5	C-D
BC/07: Sb - Lingonberry - Coltsfoot	Poor, moist lodgepole pine forest with Labrador tea and low herb cover.	3.6	*LW-TO (MD)* *0-45%*	*F, M or O*	-	*(m)-w*	5-6	A - C
SC/08: Sw - Currant - Horsetail	Floodplain spruce forest with abundant horsetails.	7.8	LV or TO 0-3%	F or O	*HFP*	*(m)-w*	6	C-E
BH/09: Sb - Horsetail – Sphagnum	Stunted black spruce bog woodland with typical bog vegetation.	0.7	*TO, DP, LV* *0-12%*	*O*	-	*i-v*	*7*	*A-D*
Shrub and Herb Ecosystem Units								
CS 00: Cottongrass – Sphagnum wetland	Cottongrass and sphagnum dominated wetland.	0.5	*DP, MD, TO* *0-20%*	*Ov, Ob*	*TY.M, TY.H*	*i-v*	*6-7*	*A-C*
SF 00: Sedge - Fuzzy fen moss	Sedge dominated wetland.	0.1	*LV, TO, DP* *0–8%*	*O*	-	*p-v*	*6-8*	*B-D*
TC 00: Timothy – Sedge - Herb meadow	Diverse grass – herb meadow.	0.3	*LV, TO, DP* *0-2%*	*F, L*	-	*w-i*	*4-6*	*B-D*
WF 00: Willow Floodplain fen	Tall, dense willows on fluvial sites.	2.5	*LV, TO, DP* *0% (10%)*	*F*	-	*m-i*	*5-7*	*C-D*

Table 3. Ecosystem unit Description Summary Table – ESSFmv3

Site series and Map Unit	Brief Description (All values derived from field data)	% area of BEC unit	Slope Position and Gradient	Surficial Materials	Soil Type	Soil Drainage	Soil Moisture Regime	Soil Nutrient Regime
Forested Ecosystem Units								
FR/01 Bl-Rhododendron-Feathermoss	Mesic subalpine fir forest with abundant rhododendron shrub understory.	46.2	All slope Positions 0-70%	FG, M, C	*HFP, DYB*	*m-r*	4	B-C
LC/02 BlPl-Crowberry-Cladina	Dry lodgepole pine forest with some subalpine fir and spruce; roughly equal amounts of mosses and lichens.	9.33	CR, MD, LV 0-50%	FG	*HFP*	*(m) w-r*	2-3 (4)	A-B (C)
LCw/02 BlPl-Crowberry-Cladina; warm aspect variant	Dry, south-facing lodgepole pine forest with abundant lichens. Shrubs include rose, juniper and soopolallie.	0.95	MD, CR 40-80%	FGr, FG	-	*r*	1-2	A-B
LCx/02 BlPl-Crowberry-Cladina; drier-than-average variant	Very dry lodgepole pine forest with minimal subalpine fir or spruce. Typically found on FG terraces. Lichens abundant.	6.4	LV, MD 0-10%	sFGt, sFGu, sFGp	*DYB*	*r*	1-2	A-B
BT/03 BlSb-Labrador tea	Lodgepole pine forest with scrub birch in understory. Nutrient poor, and seasonally wet, typically found at wetland edges.	1.95	LV, MD, DP 0-10%	FG	*DYB, HFP*	*(w) m-p*	3-6	A-B
FO/04 Bl-Oak fern-Knight's plume	Rich, fresh subalpine fir forest with diverse shrubs and herbs.	3.06	LW, LV, MD 0-45%	F, M, C	*DYB, SB, G*	*w-i*	4-5	C-D
FD/05 Bl-Devil's club-Rhododendron	Rich, wet subalpine fir forest with diverse shrubs and herbs. Devil's club not found in study area.	0.24	LW, MD 7-10% (40%)	FGv/M	*DYB*	*m-i*	5	C-E
FH/07 Bl-Horsetail-Feathermoss	Moist fir forest with abundant horsetails in understory. Typically on mineral soils, occasionally on organic soils.	5.73	TO, LV, DP 0-19%	FG	*HFP*	*p-i*	5-6	C-D
FC: 00 Fir-Crowberry parkland forest	Open woodland found at higher elevations on ridges and other subxeric sites. Scattered subalpine fir with grass and lichen understory.	2.27	*UP, CR, LV 0-47%*	*M, FG, Mv*	*HFP*	*w-r*	*1-3*	*A-B*
FM: 00 Fir-Mountain Heather parkland forest	Open to closed high elevation forest on mesic sites. Subalpine fir forest with continuous mountain-heather (or sometimes liverwort) carpet.	3.69	*All slope positions 0-31%*	*M, FG*	*DYB, FHP. HFP*	*m-r*	*3-4*	*B (C)*

Site series and Map Unit	Brief Description (All values derived from field data)	% area of BEC unit	Slope Position and Gradient	Surficial Materials	Soil Type	Soil Drainage	Soil Moisture Regime	Soil Nutrient Regime
FV: 00 Fir-Valerian parkland forest	Open to somewhat closed high elevation forest on rich, moist sites. Scattered subalpine fir with lush, diverse herb understory.	6.94	*All slope positions except CR 0-55%*	*F, C, M*	*DYB, SB, HFP. G*	*w-i*	*4-6*	*C-D*
ST: 00 Sxw-Toadflax	Aspen-dominated unit on warm colluvial slopes; unit from the SBSmk1	0.09	*UP, MD*	*C*		*w-r*	*(2)3-4*	*B-C*
Shrub and Herb Ecosystem Units								
BS: 00 Black Spruce - Peat Moss bog	Stunted black spruce bog wetland, abundant shrubs and bog vegetation.	0.15	*LV* *0%*	*Ov/F*	*G*	*p*	*6*	*A-B*
CF: 00 Cryptogam - Altai Fescue	Grass and dwarf shrub unit on steep, high-elevation talus slopes.	0.03	*MD, UP* *70%*	*Cv*	*HFP*	*w-r*	*1-2*	*B*
CS: 00 Cottongrass – Sphagnum wetland	Cottongrass and sphagnum dominated wetland.	2.53	*DP, MD, TO* *0-20%*	*Ov, Ob*	*TY.H, TY.M*	*i-v*	*6-7*	*A-C*
FK: 00 Fir Krummholz	Stunted and homogenous fir krummholz unit.	0.21	*CR, MD, UP 5-49%*	*C, Mv*	*DYB, HFP*	*w-r*	*2-3*	*B*
FW: 00 Altai Fescue - Dwarf willow	High elevation grassy crest unit.	0.23	*CR, UP, MD 0-20%*	*Mv, Dv, Cv*	*SB, DYB, HFP*	*m-r*	*2-3*	*B-C*
FWy: 00 Altai fescue - Dwarf willow, moister than average	High elevation moist grass unit, receiving sites.	included in FW	*TO* *5-18%*	*C, M*	*-*	*m-i*	*4-5*	*C-D*
MH: 00 Mountain Heather – Leafy Liverwort snowbed community	Subalpine snow bed community, dominated by mountain heather and leafy liverworts.	0.17	*DP* *0% (25%)*	*Cx, M*	*DYB*	*w-i*	*3-6*	*B-C*
SB: 00 Buckbean Wetland	Buckbean dominated marsh or flark with standing water.	0.08	*DP* *0%*	*O*	*TY.F*	*v*	*8*	*B*
SF: 00 Sedge - Fuzzy fen moss	Sedge dominated wetland.	1.04	*LV, TO, DP* *0–8%*	*O*	*-*	*p-v*	*6-8*	*B-D*
TC: 00 Timonthy - Sedge - Herb meadow	Low elevation herb and grass meadow with high floristic diversity.	0.36	*LV, TO, DP* *0-2%*	*F, L*	*-*	*w-i*	*4-6*	*C-D*
VG: 00 Valerian - Ragwort herb meadow	Lush subalpine herb meadow.	1.27	*All positions except CR* *0-35%*	*M, Ox/M*	*DYB*	*m-i*	*4-6*	*C-D*

Site series and Map Unit	Brief Description (All values derived from field data)	% area of BEC unit	Slope Position and Gradient	Surficial Materials	Soil Type	Soil Drainage	Soil Moisture Regime	Soil Nutrient Regime
WB: 00 Willow - Birch wetland	Willow, scrub birch and sedge dominated wetland.	3.10	*LW, TO, DP* *0-15%*	*O*	-	*i-v*	*6-7*	*B-D*
WF: 00 Willow Floodplain fen	Tall dense willows on fluvial sites.	0.80	*LV, TO, DP* *0% (10%)*	*F*	-	*m-i*	*(3) 5-7*	*C-D*

Table 4. Ecosystem unit Description Summary Table – ESSFmvp3

Site series and Map Unit	Brief Description (All values derived from field data)	% area of BEC unit	Slope Position and Gradient	Surficial Materials	Soil Type	Soil Drainage	Soil Moisture Regime	Soil Nutrient Regime
Forested Ecosystem Units								
FC: 00 Fir-Crowberry parkland forest	Open forest found at higher elevations on ridges and other subxeric sites. Scattered subalpine fir trees with grass and lichen understory.	2.77	*UP, CR, LV* *0-47%*	*M, FG, Mv*	*HFP*	*w-r*	*1-3*	*A-B*
FM: 00 Fir-Mountain Heather parkland forest	Open to closed high elevation forest on mesic sites. Subalpine fir forest with continuous heather (or sometimes liverwort) carpet.	6.05	*All slope positions* *0-31%*	*M, FG*	*DYB, FHP. HFP*	*m-r*	*3-4*	*B (C)*
FV: 00 Fir-Valerian parkland forest	Open to somewhat closed high elevation forest on rich, moist sites. Scattered subalpine fir with lush, diverse herb understory.	0.46	*All slope positions except CR* *0-55%*	*F, C, M*	*DYB, SB, HFP. G*	*w-i*	*4-6*	*C-D*
Shrub and Herb Ecosystem Units								
CF: 00 Cryptogam - Altai Fescue	Grass and dwarf shrub on steep, high-elevation talus slopes.	5.88	*MD, UP* *70%*	*Cv*	*HFP*	*w-r*	*2*	*B*
CS: 00 Cottongrass – Sphagnum wetland	Cottongrass and sphagnum dominated wetland.	0.23	*DP, MD, TO* *0-20%*	*Ov, Ob*	*TY.M, TY.H*	*i-v*	*6-7*	*A-C*
FK: 00 Fir Krummholz	Stunted and homogenous fir krummholz unit.	30.79	*CR, MD, UP 5-49%*	*C, Mv*	*DYB, HFP*	*w-r*	*2-3*	*B*
FW: 00 Altai Fescue - Dwarf willow	High elevation grassy crest unit.	18.99	*CR, UP, MD* *0-20%*	*Mv, Dv, Cv*	*SB, DYB, HFP*	*m-r*	*2-3*	*B-C*
FWy: 00 Altai fescue - Dwarf willow, moister than average	High elevation moist grass unit, receiving sites.	included in FW	*TO* *5-18%*	*C, M*	-	*m-i*	*4-5*	*C-D*
MH: 00 Mountain Heather - Liverwort snowbed community	Subalpine snow bed community, dominated by mountain heather and leafy liverworts.	8.37	*DP* *0% (25%)*	*Cx, M*	*DYB*	*w-i*	*3-6*	*B-C*
VG: 00 Valerian - Ragwort herb meadow	Lush subalpine herb meadow.	6.8	*All positions except CR* *0-35%*	*M, Ox/M*	*DYB*	*m-i*	*4-6*	*C-D*

Table 5. Ecosystem Unit Description Summary Table – SBS mk1

Site series and Map Unit	Brief Description (All values derived from field data)	% area of BEC unit	Slope Position and Gradient	Surficial Material	Soil Type	Soil Drainage	Soil Moisture Regime	Soil Nutrient Regime
Forested Ecosystem Units								
SB/01: Sxw – Black huckleberry – Highbush cranberry	Lodgepole pine or spruce forests with diverse herbs and shrubs. Valley floor locations in the study area.	22.31	MD 0-40%	M and/or F	-	*w-m*	4-5	B-D
LC/03: Pl –Feathermoss – Cladina	Dry lodgepole pine - moss forests with sparse herbs and shrubs.	20.34	LV 0-5%	F(*All FG in study area)*	-	*w-r*	2	A-B
ST/05: SxwFd –Toad-flax	Lodgepole pine or aspen forests on warm slopes.	2.95	MD-UP, rarely LV 0-45%	M or FG (*C in study area)*	-	*w-r*	3-4	B-C
BH/06: Sb – Huckleberry – Spiraea	Lodgepole pine and scrub birch stands adjacent to wetlands.	21.99	LW, LV <10%	M, F, G, or L	*E.DYB, BR, GL*	*m*	3-6	A-B
SO/07: Sxw – Oak fern	Spruce/fir forests with diverse herbs on fluvial sites.	3.94	MD-TO	variable	-	*w-i*	5	B-D
SH/09: Sxw – Horsetail	Moist spruce forests with conspicuous horsetails.	6.14	LV	variable	*GL.DYB O.DYB*	*m-i*	5-6	C-E
BB/10: Sb – Scrub birch – Sedge	Organic bog wetland with very open black spruce canopy. Scrub birch, sedges, and sphagnum moss are dominant species.	2.19	LV, DP	Ob	*TY.M*	*p-v*	7	B-D
Shrub and Herb Ecosystem Units								
BS: 00 Scrub birch – Sedge poor fen	Scrub birch and sedge dominated fen.	3.66	*LV*	*Ob*	-	*p*	*6-7*	*B-C*
SF: 00 Sedge – Fuzzy Fen moss fen	Sedge dominated fen.	0.96	*LV*	*Ov,L*	-	*i-*	*6-8*	*B-D*
SM: 00 Sedge –Moss bog wetland	Organic bog wetland dominated by moss.	0.08	*LV*	*Ob*	*HU.M*	*v-p*	*7*	*A-B*
TC: 00 Timonthy - Sedge - Herb meadow	Herb and grass meadow with high floristic diversity	0.79	*LV, TO, DP* *0-2%*	*F, L*	*GL.GL*	*-i*	*4-6*	*B-D*
WB: 00 Willow – Bluejoint floodplain	Willow-dominated shrubby ecosystem on floodplain.	7.67	*LV*	*Fp, FAp*	-	*i*	*5-7*	*C-D*

Table 6. Ecosystem Unit Description Summary Table – Alpine Tundra

Site series and Map Unit	Brief Description (All values derived from field data)	% area of BEC unit	Slope Position and Gradient	Surficial Materials	Soil Type	Soil Drainage	Soil Moisture Regime	Soil Nutrient Regime
CF: 00 Cryptogam - Altai Fescue	Grass and dwarf shrub unit on steep, high-elevation talus slopes.	10.5	*MD, UP* *70%*	*Cv*	*HFP*	*w-r*	*2*	*B*
FK: 00 Fir Krummholz	Stunted and homogenous fir krummholz unit.	8.5	*CR, MD, UP* *5-49%*	*C, Mv*	*DYB, HFP*	*w-r*	*2-3*	*B*
FW: 00 Altai Fescue - Dwarf willow	High elevation grassy crest unit.	34.0	*CR, UP, MD* *0-20%*	*Mv, Dv, Cv*	*SB, DYB, HFP*	*m-r*	*2-3*	*B-C*
MH: 00 Mountain Heather - Liverwort snowbed community	Snow bed community, dominated by mountain heather and leafy liverworts.	2.3	*DP* *0% (25%)*	*Cx, M*	*DYB*	*w-i*	*3-6*	*B-C*

Table 7. Sparsely Vegetated, Non-Vegetated, and Anthropogenic Units

Code	Description	% of BWBSdk1	% of ESSFmv3	% of ESSFmvp3	% of SBSmk1	% of AT
BE	Beach				0.2	
CL	Cliff			0.03		1.0
ES	Exposed Soil		0.01		0.1	
GB	Gravel Bar				0.31	
LA	Lake		0.19		5.11	
OW	Shallow Open Water		0.25	0.03	0.39	
PD	Pond		0.1		0.28	trace
RI	River	1.3	0.03		0.51	
RO	Rock Outcrop		0.15	4.32	0.07	11.1
RP	Road Surface		0.02		0.03	
RR	Rural				trace	
RU	Rubble		0.01	0.59		3.3
TA	Talus Slope		0.2	16.21	0.05	29.4

5.4.2 Detailed Ecosystem unit Descriptions by BEC Unit

This section summarizes biotic information and mapping conventions used for ecosystem units in the Klawli study area. In the BWBSdk1, where plot data was limited, the *Prince Rupert Field Guide* (Banner et al. 1993) was used to provide additional information. Because the ESSFmv3, ESSFmvp3, and the AT shared some common units, plots from all three zones were often combined to generate the following descriptions. Plot numbers in the following tables are bold when they occur in the zone being described and in italics if from adjacent variants or zones. Visual plots are only used when details of species composition were recorded.

On the map an ecosystem label generally consists of a map unit, site modifiers, and structural stage. In the following section each site series and/or map unit has various attributes listed, including the assumed site modifiers under the typical situation, site modifiers used, structural stages mapped, and typical situation. The assumed site modifiers are those conditions (e.g. deep soil, coarse textured soil, organic soil, gentle slope, etc.) which are assumed to occur for that given map unit. These site modifiers are implicit for that particular map unit, so it is not necessary to specify them in the actual map label. The site modifiers listing refers to the subset of site modifiers used for that map unit in the mapping of the Klawli study area. Each map unit description also lists the actual structural stages mapped for the Klawli study area. Not every structural stage of every map unit was actually mapped, even though all structural stages for a given map unit were generally described. The 'typical situation' is a verbal description of the conditions under which the map unit is generally found; it is closely linked to the assumed site modifiers listed earlier in each section. For some units in the SBSmk1, a stand composition modifier was appended onto the map label. The stand composition modifier identifies coniferous ('C'), broadleaf B, or mixed coniferous/broadleaf ('M') phases of the same ecosystem unit.

The determination of "dominant" and "associate" species used the following criteria. A "dominant" species occurred in at least 40% of all plots and had a mean cover of at least 1% when averaged across all plots. An "associate" species occurred in at least 20% of all plots and had a cover of at least 0.2%. These rules were modified when there were less than 3 plots, or when there were a large number of plots (in which case these criteria generated far too many species). Summaries of species composition for each site series/structural stage can be found in Appendix 7.7. These are based on detailed and ground inspection plot data.

Where plot data was available, percent cover (mean and range) for the tree, shrub, herb, and moss layers were added. Caution should be used when interpreting percent cover figures based on 3 or fewer plots, as significant variation may exist.

5.4.3 Boreal White and Black Spruce (BWBSdk1): Forested Ecosystem Units

5.4.3.1 01: SM: Sw - Knight's plume - Step moss

General Description and Distribution: This mesic ecosystem unit has a diversity of tree species with white spruce and lodgepole pine being the dominant species. Engelmann spruce, subalpine fir, trembling aspen, and black cottonwood can also all be present. The shrub layer is moderately well developed, but the herb layer is relatively sparse. This unit occurs on a variety of parent materials and slope positions.

Assumed Site Modifiers under the Typical Situation: c, d, and j

Site Modifiers Used: k, s, t, w

Structural Stages Mapped: 4, 5, 6, 7

Typical Situation: Gentle slope; deep coarse-textured soils

Photo 1: SM7 forest (plot 9801876)

Map Symbol	SM3	SM4	SM5	SM6	SM7
% Mean Tree Cover and Range			35	35	28
% Mean Shrub Cover and Range			15	20	30
% Mean Herb Cover and Range			25	16	8
% Mean Cryptogam Cover and Range			55	20	35
Dominant Vegetation	**Speculation:** The shrub layer might be dominated by various *Salix* spp., trembling aspen, highbush cranberry, black huckleberry, and mountain alder. Regenerating lodgepole pine and white spruce are present at varying abundance depending on time since disturbance. Herbs are probably relatively abundant for this map unit, and might include all the herbs present in later structural stages. Step moss, red-stemmed feathermoss and knight's plume are likely present	**Speculation:** Lodgepole pine and/or white spruce form a thick single-layer canopy. Shrubs would probably include Labrador tea, mountain alder, and highbush cranberry. Herbs might include bunchberry, palmate coltsfoot, and fireweed. The moss layer would probably be abundant and consist of stepmoss, red-stemmed feathermoss and knight's plume	Lodgepole pine is the dominant tree species, with a smaller component of white spruce and trembling aspen. Shrubs are relatively sparse, with Labrador tea, soopolallie and mountain alder each covering about 5% of the site. Bunchberry, fireweed, palmate coltsfoot, and twinberry are the dominant herbs. In the cryptogam layer, red-stemmed feathermoss and knight's plume are both abundant.	White spruce is the dominant tree species of the site identified but lodgepole pine and black cottonwood are both present. Shrubs species include high bush cranberry, prickly rose, black twinberry, and willow. Herbs include fireweed, common horsetail and one-sided wintergreen, Dominant mosses include red-stemmed feathermoss and stepmoss	Lodgepole pine dominates the tree canopy a deciduous component of trembling aspen and black cottonwood exists, but mostly consists of dead stems. Black huckleberry dominates The shrub layer with mountain alder, highbush cranberry, and regenerating lodgepole pine. A sparse herb layer includes twinflower, fireweed, bluejoint, bunchberry, and stiff clubmoss. Red-stemmed feathermoss dominates the moss layer.
Associated Vegetation	Trembling aspen, black cottonwood, and subalpine fir may be present in the shrub layer. Labrador tea, soopolallie, and black gooseberry may also occur in the SM3. Associated herbs may be similar to those in later structural stages.	Trembling aspen and black cottonwood may be relatively abundant (insufficient plot data). *Salix* spp. may occur in the shrub layer, and herbs might include twinberry and stiff clubmoss.	Cottonwood may be present in small quantities. Black huckleberry, highbush cranberry, black gooseberry, and an unidentified *Salix* sp. were present at low percent cover. Herbs may include stiff clubmoss, common horsetail, bluejoint, lingonberry, and sweet-scented bedstraw.	Engelmann spruce and/or subalpine fir occasionally occurs. Associated shrubs include black gooseberry and soopolallie, and various *Salix* spp. Additional herbs may include heart-leaved arnica, bluejoint, and tall bluebells. Knight's plume may also be present in the moss layer.	Engelmann spruce and/or subalpine fir occasionally occurs. Associated shrubs include black gooseberry and soopolallie, as well as Bebb's willow. Additional herbs may include heart-leaved arnica and one-sided wintergreen. Knight's plume may also be present in the moss layer.
Plots	No Plot Data	No Plot Data	**9801874**	**GS24**	**9801876**
Comments	Vegetation partially derived from field guide	Vegetation partially derived from field guide			

5.4.3.2 02: LL: Pl - Lingonberry - Feathermoss

(Boreal White and Black Spruce (BWBSdk1): Forested Ecosystem Units)

General Description and Distribution: These dry lodgepole pine-dominated ecosystems are usually found on glaciofluvial deposits, especially on south-facing scarps and esker slopes. Plot data was insufficient to determine if south-facing LL units differed floristically from regular LL units (as they did in the ESSFmv3).

The vegetation descriptions below are drawn from the *Prince Rupert Field Guide* (Banner et al. 1993) and from limited plot data. The *Prince Rupert Field Guid*e (Banner et al. 1993) describes this site series as having white spruce, but Engelmann spruce was noted at both plot locations. It is possible that this anomaly results from the relative proximity of these plots to the ESSFmv3 boundary and that the plots are transitional in nature.

Assumed Site Modifiers under the Typical Situation: c, d, j

Site Modifiers Used: h, n, t, w

Structural Stages Mapped: 3, 4, 5

Typical Situation: Gentle slope; deep, coarse-textured soils

Photo 2: The LC unit in the ESSFmv3 (VS66), very similar to the LL unit.

Map Symbol	LL3	LL4	LL5	LL6	LL7
% Mean Tree Cover and Range		25	40		
% Mean Shrub Cover and Range		0.1	35		
% Mean Herb Cover and Range		5	10		
% Mean Cryptogam Cover and Range		5	60		
Dominant Vegetation	**Speculation:** Regenerating lodgepole pine is mixed with soopolallie, prickly rose, and *Salix* spp. in the shrub layer. Herbs might include twinberry, bunchberry, and lingonberry. The cryptogam layer might include *Cladonia and Cladina* spp., *Dicranum* spp., and red-stemmed feathermoss.	Lodgepole pine is the dominant tree species, with scattered soopolallie and prickly rose in the shrub layer. The sparse herb layer includes twinberry, bunchberry, and lingonberry. Mosses and lichens are roughly equal in abundance and include various *Cladonia and Cladina* spp., *Dicranum* spp., and red-stemmed feathermoss	Lodgepole pine, with lesser amounts of subalpine fir, trembling aspen and Engelmann (or white) spruce, dominate the tree canopy. Shrubs include soopolallie, and black huckleberry. Herbs are sparse but include fireweed and, bunchberry Mosses are dominated by and red-stemmed feathermoss with some knight's plume.	**Speculation:** Lodgepole pine, with lesser amounts of subalpine fir and Engelmann (or white) spruce, dominate the tree canopy. Potential shrubs might include soopolallie, black huckleberry, and prickly rose. Potential herbs might include fireweed, bunchberry, and lingonberry. Mosses and lichens might include various *Cladonia and Cladina* spp., *Dicranum* spp., and red-stemmed feathermoss	**Speculation:** Lodgepole pine, with lesser amounts of subalpine fir and Engelmann (or white) spruce, dominates the tree canopy. Potential shrubs might include soopolallie, black huckleberry, and prickly rose. Potential herbs might include fireweed, bunchberry, and lingonberry. Mosses and lichens might include various *Cladonia and Cladina* spp., *Dicranum* spp., and red-stemmed feathermoss
Associated Vegetation	Associated vegetation might include regenerating subalpine fir and Engelmann spruce. Associated herbs ought to include rough-leaved ricers and fireweed.	Subalpine fir and Engelmann spruce may occur as scattered trees. Common juniper and black huckleberry may occur. Associated herbs may include rough-leaved ricers and fireweed.	Additional shrubs include *Salix* spp., prickly rose, and highbush cranberry. Herb species include rough-leaved ricegrass, lingonberry, and northern bedstraw.	Additional shrubs might include *Salix* spp., and highbush cranberry. Herb species may include rough-leaved ricegrass and twinberry.	Additional shrubs might include *Salix* spp., and highbush cranberry. Herb species may include rough-leaved ricegrass and twinberry.
Plots	No Plot Data	**9801877**	**GS20**	No Plot Data	No Plot Data
Comments	Vegetation partially derived from field guide			Expected to be fairly rare due to fire-susceptibility of the LL unit	Expected to be rare due to fire-susceptibility of the LL unit

5.4.3.3 05: SS: SwPl - Soopolallie - Twinflower

(Boreal White and Black Spruce (BWBSdk1): Forested Ecosystem Units)

General Description and Distribution: These sites, often found on south-facing fluvial-glacial slopes, are dominated by soopolallie but lack the extensive lichen so common in the LL (02) unit. The vegetation descriptions below are drawn from the *Prince Rupert Field Guide* (Banner et al. 1993) as well as from limited plot data.

Assumed Site Modifiers under the Typical Situation: c, d, and j

Site Modifiers Used: k, t, w

Structural Stages Mapped: 4, 5, 6, 7

Typical Situation: Gentle slope; deep, coarse-textured soils; richer soil nutrient regime

Photo 3: SSk5 (plot 9801875)

Map Symbol	SS3	SS4	SS5	SS6	SS7
% Mean Tree Cover and Range			35 (30 - 40)		
% Mean Shrub Cover and Range			32 (30 - 35)		
% Mean Herb Cover and Range			11 (10 - 12)		
% Mean Cryptogam Cover and Range			47 (35 - 60)		
Dominant Vegetation	**Speculation:** Lodgepole pine will be a strong component of the shrub layer, which might also include soopolallie and *Salix* spp. Fireweed, bunchberry, and twinberry might be expected among the herbs. The dominant moss is probably red-stemmed feathermoss	**Speculation:** Lodgepole pine will be the dominant tree species in the relatively dense canopy of SS4. Soopolallie, and to a lesser degree *Salix* spp., probably occur in the understory. Fireweed, bunchberry, and twinberry are probably the dominant herbs. Common cryptogams are probably limited to red-stemmed feathermoss	Lodgepole pine is the dominant tree species. Soopolallie is the most abundant shrub, along with various *Salix* spp. Common herbs include fireweed, bunchberry, twinberry, and rough-leaved ricegrass. Mosses are not very diverse, but include red-stemmed feathermoss and knight's plume. The lichen layer is very depauperate.	**Speculation:** Lodgepole pine dominates the tree layer. Likely shrub species include soopolallie and *Salix* spp. Herbs might include fireweed, bunchberry, twinberry, and rough-leaved ricegrass. Red-stemmed feathermoss and knight's plume are likely present amongst the cryptogams	**Speculation:** Lodgepole pine dominates the tree layer. Likely shrub species include soopolallie and *Salix* spp. Herbs might include fireweed, bunchberry, twinberry, and rough-leaved ricegrass. Red-stemmed feathermoss and knight's plume are likely present amongst the cryptogams
Associated Vegetation	Subalpine fir and Engelmann (white) spruce might be scattered in the shrub layer. Bastard toadflax, kinnikinnick and lingonberry are potential associate species	Subalpine fir and Engelmann (white) spruce might be scattered in, and beneath, the main canopy. Bastard toadflax, kinnikinnick and lingonberry are potential associate species	Subalpine fir and Engelmann (white) spruce are occasionally present in the tree and shrub layers. Bastard toadflax, lingonberry, and kinnikinnick may occasionally occur in the herb layer.	Subalpine fir and Engelmann (white) spruce probably occur in the tree and shrub layers. Bastard toadflax, lingonberry, and kinnikinnick might occur in the herb layer.	Subalpine fir and Engelmann (white) spruce probably occur in the tree and shrub layers. Bastard toadflax, lingonberry, and kinnikinnick might occur in the herb layer.
Plots	No Plot Data	No Plot Data	**9801875, GS20**	No Plot Data	No Plot Data

5.4.3.4 06: SR: Sw - Scouring rush - Step moss

(Boreal White and Black Spruce (BWBSdk1): Forested Ecosystem Units)

General Description and Distribution: This moist, rich ecosystem unit is dominated by white spruce with scattered horsetails in the understory. The vegetation descriptions below are mostly drawn from the *Prince Rupert Field Guide* (Banner et al. 1993) as well as from limited plot data. In the Klawli study area, only one plot, structural stage 3, was recorded. This site occurred in a wet area that had previously been disturbed by slumping.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: g, w

Structural Stages Mapped: 3, 5, 6

Typical Situation: Gentle, lower slope receiving sites; deep, medium-textured soil

No photograph available

Map Symbol	SR3	SR4	SR5	SR6	SR7
% Mean Tree Cover and Range	3				
% Mean Shrub Cover and Range	75				
% Mean Herb Cover and Range	30				
% Mean Cryptogam Cover and Range	10				
Dominant Vegetation	Shrub vegetation is very thick and abundant, including mountain alder, *Salix* spp., highbush cranberry, and black twinberry. Herbs are less abundant but include common horsetail and fireweed. Mosses are scarce, but include red-stemmed feathermoss and *Plagiomnium* spp.	**Speculation:** White spruce is probably the dominant species with some scattered lodgepole pine. Shrubs are probably Not very abundant and might include soopolallie and highbush cranberry. Horsetails, fireweed, and lingonberry are probably present. Step moss is likely the dominant moss	**Speculation:** White spruce, with a lesser amount of lodgepole pine, dominates the canopy. The field guide suggests that soopolallie and Labrador tea should occur in the shrub layer. Common herbs might include horsetails, twinberry, lingonberry, and crowberry. Step moss dominates the moss layer	**Speculation:** White spruce, with a lesser amount of lodgepole pine, dominates the canopy. The field guide suggests that soopolallie and Labrador tea should occur in the shrub layer. Common herbs might include horsetails, twinberry, lingonberry, and crowberry. Step moss dominates the moss layer	**Speculation:** White spruce, with a lesser amount of lodgepole pine, dominates the canopy. The field guide suggests that soopolallie and Labrador tea should occur in the shrub layer. Common herbs might include horsetails, twinberry, lingonberry, and crowberry. Step moss dominates the moss layer
Associated Vegetation	White spruce and lodgepole pine were beginning to regenerate in plot GS28. Black gooseberry, bluejoint, sweet-scented bedstraw, and tall bluebells also occurred throughout the plot.	Mountain alder may remain in the shrub layer. Red-stemmed feathermoss and *Plagiomnium* spp. probably occur in the cryptogam layer.	Red-stemmed feathermoss is likely found in the cryptogam layer.	Red-stemmed feathermoss is likely found in the cryptogam layer.	Red-stemmed feathermoss is likely found in the cryptogam layer.
Plots	**GS28**	No Plot Data	No Plot Data	No Plot Data	No Plot Data
Comments		Vegetation derived from field guide	Vegetation derived from field guide	Vegetation derived from field guide	Vegetation derived from field guide

5.4.3.5 07: BC: Sb - Lingonberry - Coltsfoot

(Boreal White and Black Spruce (BWBSdk1): Forested Ecosystem Units)

General Description and Distribution: This lodgepole pine and spruce-dominated ecosystem unit was mapped on poor, moist fluvial areas. Labrador tea is the most abundant shrub in the understory, and the herbs are not diverse or abundant. The vegetation descriptions below are drawn from the *Prince Rupert Field Guide* (Banner et al. 1993) as well as from the limited plot data.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: none

Structural Stages Mapped: 5

Typical Situation: Gentle slope; deep, medium-textured soil; cool sites

Photo 4: BC5 forest (plot GS25)

Map Symbol	BC3	BC4	BC5	BC6	BC7
% Mean Tree Cover and Range			30		
% Mean Shrub Cover and Range			10		
% Mean Herb Cover and Range			20		
% Mean Cryptogam Cover and Range			70		
Dominant Vegetation	**Speculation:** The shrubs of this unit are probably fairly dense and might include regenerating white spruce and lodgepole pine, as well as Labrador tea, soopolallie, prickly rose, black twinberry, highbush cranberry, and *Salix* spp. Herbs might include fireweed, bunchberry, twinberry and palmate coltsfoot. Some red-stemmed feathermoss probably occurs	**Speculation:** A mix of white spruce and lodgepole pine probably dominates the dense canopy. Common shrubs include Labrador tea, soopolallie, and prickly rose. Common herbs might include fireweed, bunchberry, palmate coltsfoot, and twinberry. Knight's plume and red-stemmed feathermoss are likely common in the cryptogam layer	The tree layer is dominated by lodgepole pine with a component of white spruce. Labrador tea, black twinberry, highbush cranberry, and little tree willow are the dominant shrub species. Common in the herb layer are fireweed, bunchberry, bluejoint, stiff clubmoss, and twinberry. Knight's plume and red-stemmed feathermoss are common in the cryptogam layer	**Speculation:** A mix of white spruce and lodgepole pine probably dominates the open canopy. Common shrubs include Labrador tea, soopolallie, and prickly rose. Common herbs might include fireweed, bunchberry, palmate coltsfoot, and twinberry. Knight's plume and red-stemmed feathermoss are likely common in the cryptogam layer	**Speculation:** A mix of white spruce and lodgepole pine probably dominates the open canopy. Common shrubs include Labrador tea, soopolallie, and prickly rose. Common herbs might include fireweed, bunchberry, palmate coltsfoot, and twinberry. Knight's plume and red-stemmed feathermoss are likely common in the cryptogam layer
Associated Vegetation	Associated herbs might include bluejoint and five-leaved bramble. Knight's plume may also occur in the moss layer.	Associated shrubs might include black twinberry and highbush cranberry. Herbs that might occur in low numbers include bluejoint, five-leaved bramble, stiff clubmoss and one-sided wintergreen	Associated shrubs include scattered black gooseberry and prickly rose. Less abundant herbs include tall bluebells, palmate coltsfoot, five-leaved bramble, and one-sided wintergreen	Associated shrubs might include black twinberry and highbush cranberry. Herbs that might occur in low numbers include bluejoint, five-leaved bramble, stiff clubmoss and one-sided wintergreen	Associated shrubs might include black twinberry and highbush cranberry. Herbs that might occur in low numbers include bluejoint, five-leaved bramble, stiff clubmoss and one-sided wintergreen
Plots	No Plot Data	No Plot Data	**GS25**	No Plot Data	No Plot Data
Comments	Vegetation derived from field guide	Vegetation derived from field guide		Vegetation derived from field guide	Vegetation derived from field guide

5.4.3.6 08: SC: Sw - Currant - Horsetail

(Boreal White and Black Spruce (BWBSdk1): Forested Ecosystem units)

General Description and Distribution: This map unit was primarily mapped on active floodplains (SCa), and is characterized by diverse tree species with abundant horsetails in the herb layer.

The vegetation descriptions below are drawn from the *Prince Rupert Field Guide* (Banner et al. 1993) as well as from limited plot data. Detailed plot data was limited to a single plot on an active floodplain—the vegetation described, therefore, may not be representative of SC units in general. The presence of white-flowered rhododendron in the plot may indicate the transitional nature of the site, it being fairly close to the ESSFmv3 boundary.

Assumed Site Modifiers under the Typical Situation: d, m

Site Modifiers Used: a, n, t

Structural Stages Mapped: 5, 6, 7

Typical Situation: Level to toe slopes; deep, medium-textured soils; imperfectly to poorly drained soils

Photo 5: Small clearing in SCa6 floodplain forest (plot 9801879) with Tania Tripp.

Map Symbol	SC3	SC4	SC5	SC6	SC7
% Mean Tree Cover and Range				30	
% Mean Shrub Cover and Range				20	
% Mean Herb Cover and Range				70	
% Mean Cryptogam Cover and Range				70	
Dominant Vegetation	**Speculation:** White spruce, subalpine fir and lodgepole pine, highbush cranberry, black gooseberry and black twinberry might be common shrubs in SC3. The common horsetail, meadow horsetail, and dwarf scouring rush are common. Other common herbs might include bastard toadflax, twinberry, bunchberry, and lingonberry. The moss layer is probably less abundant than in later stages and might include red-stemmed feathermoss, step moss and knight's plume	**Speculation:** White spruce, along with lesser amounts of subalpine fir and lodgepole pine, form a dense canopy. Highbush cranberry, black gooseberry, and black twinberry might occur in this unit. The common horsetail, meadow horsetail and dwarf scouring rush are common. Other herbs might include bastard toadflax, twinberry, bunchberry, and lingonberry. Mosses include red-stemmed feathermoss, step moss and knight's plume	White spruce, along with lesser amounts of subalpine fir and lodgepole pine, dominate the canopy. Highbush cranberry, black gooseberry, and black twinberry might occur in this unit. The common horsetail, along with the meadow horsetail and dwarf scouring rush, are probably very common. Other common herbs might include bastard toadflax, twinberry, bunchberry, and lingonberry. Mosses include red-stemmed feathermoss, step moss and knight's plume	Subalpine fir was the most abundant tree in the plot, but spruce (probably white) and lodgepole pine also occurred. Highbush cranberry, black twinberry, black gooseberry, and *Salix* spp. may all occur in the shrub layer. Common horsetail was very abundant, forming a lush carpet throughout the plot. Bunchberry, palmate coltsfoot, tall bluebells, and bluejoint also occurred. Red-stemmed feathermoss, step moss, and knight's plume are all abundant in the moss layer.	**Speculation:** Subalpine fir was the most abundant tree in the plot, but spruce (probably white) and lodgepole pine also occurred. Highbush cranberry, black twinberry, black gooseberry, and *Salix* spp. may all occur in the shrub layer. Common horsetail was very abundant, forming a lush carpet throughout the plot. Bunchberry, palmate coltsfoot, tall bluebells, and bluejoint also occurred. Red-stemmed feathermoss, step moss and knight's plume are all abundant in the moss layer.
Associated Vegetation	Prickly rose might occur occasionally in the shrub layer. Associated herbs might include palmate coltsfoot, tall bluebells, fireweed, northern bedstraw, and bluejoint.	Prickly rose might occur occasionally in the shrub layer. Associated herbs might include palmate coltsfoot, tall bluebells, fireweed, northern bedstraw, and bluejoint.	Prickly rose and mountain alder might occur occasionally in the shrub layer. Associated herbs might include palmate coltsfoot, tall bluebells, fireweed, stiff clubmoss, Sitka burnet, northern bedstraw, and bluejoint.	It may be anticipated that prickly rose and mountain alder might sometimes occur in SC6. Fireweed, northern bedstraw, heart-leaved arnica, Sitka burnet, twinberry, dwarf nagoonberry and additional horsetail species might sometimes be associated with the unit	It may be anticipated that prickly rose and mountain alder might sometimes occur in SC7. Fireweed, northern bedstraw, heart-leaved arnica, Sitka burnet, twinberry, dwarf nagoonberry and additional horsetail species might sometimes be associated with the unit
Plots	No Plot Data	No Plot Data	**VS30**	**9801879**	No Plot Data
Comments	Vegetation derived from field guide	Vegetation derived from field guide	Vegetation partially derived from field guide and from visual plot VS30	Plot was on an active fluvial plain	Vegetation derived from field guide

5.4.3.7 09: BH: Sb - Horsetail – Sphagnum

(Boreal White and Black Spruce (BWBSdk1): Forested Ecosystem Units)

General Description and Distribution: Stunted black spruce with an understory of Labrador tea, willows, horsetails, *Sphagnum* spp., and other bog-vegetation characterize this map unit. Soils are always organic, waterlogged, and nutrient-poor. Due to problems with access, no plot data for this unit was obtained. The presence of this unit was photo-interpreted for a few polygons, and the current description is drawn entirely from the *Prince Rupert Field Guide* (Banner et al. 1993).

Assumed Site Modifiers under the Typical Situation: p

Site Modifiers Used: none

Structural Stages Mapped: 3b

Typical Situation: Organic wetland, poor soil drainage

No photograph available

Map Symbol	BH3b
% Mean Tree Cover and Range	none to low
% Mean Shrub Cover and Range	moderate
% Mean Herb Cover and Range	low to moderate
% Mean Cryptogam Cover and Range	high
Dominant Vegetation	Stunted black (and probably white) spruce occupies the shrub layer along with Labrador tea, scrub birch and *Salix* spp. The herb flora is reminiscent of bog vegetation, including the common horsetail, lingonberry, crowberry, and various sedge species. *Sphagnum* spp., red-stemmed feathermoss and glow moss are the dominant mosses
Associated Vegetation	Cloudberry may occur occasionally, as may other bog species. Step moss may occur in the moss layer, and *Cladina* spp. may occur on hummock tops.
Plots	No Plot Data
Comments	Vegetation derived from field guide

5.4.4 Boreal White and Black Spruce (BWBSdk1): Shrub and Herb Dominated Ecosystem units

5.4.4.1 00: CS - Cottongrass - Sphagnum wetland

(Boreal White and Black Spruce (BWBSdk1): Shrub and Herb Dominated Ecosystem units)

General Description and Distribution: These wetlands are dominated by low-growing cotton-grasses and other graminoids with relatively low shrub cover. Standing water in these open ecosystem units is relatively rare. No plots were completed for this unit in the BWBSdk1; the following description is developed from plot data in the adjoining ESSFmv3.

Assumed Site Modifiers under the Typical Situation: d, p

Site Modifiers Used: none

Structural Stages Mapped: 2b

Typical Situation: Subhydric wetlands; organic blankets

Photo 6: CS2b (plot 9801833) from the ESSFmv3

Map Symbol	CS2b
% Mean Tree Cover and Range	none to low
% Mean Shrub Cover and Range	low
% Mean Herb Cover and Range	high
% Mean Cryptogam Cover and Range	high
Dominant Vegetation	Scattered low willows and scrub birch usually occur throughout the plot, typically at 5% cover or less. Low growing narrow-leaved cotton-grass is the dominant herb species, although Sitka burnet is also commonly found. *Sphagnum* spp. usually dominate the moist cryptogam layer
Associated Vegetation	A *Trichophorum* sp. and Bellard's kobresia sometimes replace the cotton-grass as the dominant graminoid, but the community structure and residual flora remain identical. Associated herbs may include alpine white marsh-marigold, water sedge, marsh cinquefoil, arrow-leaved groundsel, bluejoint, and many different sedge spp. Additional mosses might include golden fuzzy fen moss, *Tomenthypnum,* and *Barbilophozia* spp.
Plots	No plot data in the BWBS
Comments	Vegetation description taken from the CS2b unit in the ESSFmv3

5.4.4.2 00: SF: Sedge - Fuzzy fen moss

(Boreal White and Black Spruce (BWBSdk1): Shrub and Herb Dominated Ecosystem units)

General Description and Distribution: This fen unit is dominated by sedges with minimal shrubs present. It is quite distinct when viewed from the air and appears bright white on airphotos.

Assumed Site Modifiers under the Typical Situation: d, p

Site Modifiers Used: None

Structural Stages Mapped: 2b

Typical Situation: Hygric to hydric sites; deep organic (sometimes lacustrine) deposits

No photograph available: Similar to sites in the ESSFmv3 (Section 5. 4.6.9)

Map Symbol	**SF2b**
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	9.5 (0-20)
% Mean Herb Cover and Range	44 (6.5-80)
% Mean Cryptogam Cover and Range	47 (9.5-90)
Dominant Vegetation	Water sedge is the most common and abundant sedge in this unit, occurring in two-thirds of plots with up to 70% cover. Narrow-leaved cotton-grass is also common, but not quite as abundant (mean cover 2.1 %). Various low *Salix* spp. occur (mean cover 6%) among the sedges, as does Sitka burnet. The moss layer is often dominated by golden fuzzy fen moss, usually with a *Sphagnum* spp. component
Associated Vegetation	Scrub birch occurs in about half of all plots, but is never very abundant. Ross' sedge is very abundant in about a third of all plots, and hair bentgrass occurs occasionally on drier hummocks and/or wetland margins. Other herbs may include various sedges, rushes, and spike-rushes. Associated mosses include glow moss, sickle moss and *Polytrichum* spp.
Plots	No plot data in the BWBS
Comments	Vegetation description taken from the SF2b unit in the ESSFmv3

5.4.4.3 00: TC: Timothy – Sedge herb meadow

(**Boreal White and Black Spruce (BWBSdk1): Shrub and Herb Dominated Ecosystem Units**)

General Description and Distribution: The TC meadow unit occurs on rich, moist, lacustrine and fluvial deposits. Grasses and sedges are abundant in the diverse herb flora. This unit is similar to a moist TC2b unit in the ESSFmv3.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: none

Structural Stages Mapped: 2b

Typical Situation: Subhygric to hygric, level to gently sloping meadows; typical on deep fluvial and lacustrine deposits.

Photo 7: TC2b (with some SF2b) with Dana Becker (plot GS18)

Map Symbol	TC2b
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	0
% Mean Herb Cover and Range	100
% Mean Cryptogam Cover and Range	2
Dominant Vegetation	Bluejoint is abundant in this unit. This is mixed in with russet sedge in wetter areas. Sitka burnet is also commonly found in this unit. Moss, liverworts, and lichens are not common in this unit.
Associated Vegetation	The diverse herb layer may include common horsetail, western meadowrue, as well as a variety of grasses and sedges. Young trembling aspen and short-fruited willow may be scattered in clumps throughout the unit.
Plots	**GS18**

5.4.4.4 00: WF: Fluvial Willow fen

(Boreal White and Black Spruce (BWBSdk1): Shrub and Herb Dominated Ecosystem Units)

General Description and Distribution: This unit typically occurs in old river sloughs where, at normal water levels, there is little or no standing water. It also occurs in fluvial fens too wet to maintain many trees. The shrub layer is very well developed and is typically 2 m to 4 m tall. Horsetails and grasses are common in the understory. Mosses are not very diverse or very abundant.

No detail or ground-truth plots were completed for this unit in the BWBSdk1. The community description is drawn from the description of the WF3b unit in the adjoining ESSFmv3, as well as from several visual plots in the BWBSdk1.

Assumed Site Modifiers under the Typical Situation: a, d, m

Site Modifiers Used: n

Structural Stages Mapped: 3b

Typical Situation: Level to depression; deep fluvial deposits; old river meanders; high water table.

Photo 8: WF3b (plot GK211) from the ESSFmv3.

Map Symbol	WF3b
% Mean Tree Cover and Range	none to low
% Mean Shrub Cover and Range	high
% Mean Herb Cover and Range	medium
% Mean Cryptogam Cover and Range	medium
Dominant Vegetation	This unit is characterized by dense, usually tall willows (cover between 40% and 80%). Herbs in the understory include Sitka burnet, arrow-leaved groundsel, and bluejoint. Horsetails were abundant in all WF3b units observed in the BWBSdk1.
Associated Vegetation	Scattered Engelmann spruce and subalpine fir may occur in this unit, most commonly as tall shrubs but occasionally as isolated taller trees. Additional shrubs may include scrub birch and black twinberry. Herbs are diverse, but typically not too abundant, and may include western meadowrue and water sedge. Mosses are not very abundant in the strongly shaded and periodically inundated cryptogam layer, but probably include glow moss and golden fuzzy fen moss.
Plots	**VS13, VS16**
Comments	No detail or ground-truth plots for this unit in the BWBSdk1, vegetation adapted from the WF3b unit in the ESSFmv3

5.4.5 Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem units

5.4.5.1 01: FR: Bl – Rhododendron – Feathermoss

(Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem Units)

General Description and Distribution: These mesic ecosystem units are characterized by abundant white-flowered rhododendron beneath a subalpine fir canopy. Other tree species, such as Engelmann spruce and lodgepole pine, are scattered throughout. Understory vegetation, never very lush, is influenced by elevation with subalpine species (e.g. Sitka valerian, Indian hellebore) becoming more common at upper elevations. The primary source of disturbance for this unit in the study area is fire with minor amounts of logging and slumping.

FR is found on a variety of slope positions, parent materials, and slope gradients. FRk is the typical ecosystem unit found on the north-facing slope of eskers in the ESSFmv3 (with LCw on the south-facing slope). This FR site series occurs from the lower elevation boundary of the ESSFmv3 to relatively high elevations (c. 1550m), close to the parkland boundary.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: g, h, k, n, r, s, t, v, w

Structural Stages Mapped: 3, 4, 5, 6, 7

Typical Situation: Gentle slope; deep, medium-textured soils.

Photo 9: FR7 forest (plot GS81)

Map Symbol	FR3	FR4	FR5	FR6	FR7
% Mean Tree Cover and Range	0.6 (0-2)	26 (5-35)	22 (5-50)	23 (5-40)	17 (6-30)
% Mean Shrub Cover and Range	37 (7-80)	27 (11-50)	51 (7-80)	36 (10-70)	37 (18-65)
% Mean Herb Cover and Range	24 (8-70)	7 (2-20)	14 (1-80)	17 (3-40)	20 (5-90)
% Mean Cryptogam Cover and Range	48 (2-90)	76 (50-95)	76 (30-90)	76 (38-95)	80 (40-95)
Dominant Vegetation	White-flowered rhododendron is very common and abundant, as a waist-high shrub. Black huckleberry and regenerating subalpine fir are commonly scattered throughout these ecosystems. Herbs are varied, but not abundant, and include crowberry, bunchberry, Sitka valerian, and fireweed. The moss layer varies, but includes *Barbilophozia* spp, red-stemmed feathermoss and *Dicranum* spp.	Lodgepole pine and/or subalpine fir dominate the overstorey and are usually found in the shrub layer as well. White-flowered rhododendron is found in all sites, but is not as abundant as for the other structural stages. Bunchberry is the most abundant herb, and the moss layer is dominated by a relatively continuous red-stem feathermoss carpet with Dicranum, *Barbilophozia, Cladina,* and *Cladonia* spp.	Subalpine fir, lodgepole pine and Engelmann spruce are all common and abundant in the tree layer, and white-flowered rhododendron, black huckleberry and young fir dominating the shrub layer. Bunchberry and heart-leaved arnica occur in most plots, but cover only 2-3% on average. Red-stem feathermoss, *Dicranum,* and *Barbilophozia* spp are dominant in the cryptogam layer.	Subalpine fir is now the dominant tree species, both in the tree and shrub layers. White-flowered rhododendron and black huckleberry dominate the understory. The herb layer is well developed with bunchberry, five-leaved bramble, and one-sided wintergreen. Sitka valerian and other subalpine plants become more common at high elevation. Red-stem feathermoss, *Dicranum,* and *Barbilophozia* spp are dominant in the cryptogam layer.	Subalpine fir is now the dominant tree species, both in the tree and shrub layers. White-flowered rhododendron and lesser amounts of black huckleberry dominate the understory. The herb layer is well developed with bunchberry, five-leaved bramble, and one-sided wintergreen. Sitka valerian and other subalpine plants become more common at high elevation. Red-stem feathermoss, *Dicranum,* and *Barbilophozia* spp are dominant in the cryptogam layer.
Associated Vegetation	Regenerating Engelmann spruce and lodgepole pine occasionally occur. Associated herbs include Indian hellebore, heart-leaved arnica, and five-leaved bramble. Pink mountain-heather is also occasionally found at higher elevations. *Cladina* and *Cladonia* species are occasionally scattered in some sites.	Black huckleberry, scrub birch, and willows sometimes occur in the shrub layer, although they are never very abundant. Crowberry, coltsfoot, one-sided wintergreen, five-leaved bramble, and heart-leaved arnica may also occur, as may *Barbilophozia* spp.	Soopalallie may occur in the shrub layer, and the relatively diverse assortment of herbs includes twinflower, five-leaved bramble, Sitka valerian, Indian hellebore and crowberry may occur. Diverse mosses occur, with freckle pelt, *Cladina* and *Cladonia* spp. in some plots.	Lodgepole pine and Engelmann spruce sometimes occur in the tree layer, although rarely with more than 10% cover. Diverse herbs such as palmate coltsfoot, heart-leaved arnica, fireweed, dwarf blueberry, crowberry and subalpine daisy may occur. Freckled pelt is commonly found in the moss layer at low % cover.	Lodgepole pine and Engelmann spruce sometimes occur in the tree layer, although rarely with more than 10% cover. Diverse herbs such as palmate coltsfoot, heart-leaved arnica, fireweed, dwarf blueberry, crowberry and subalpine daisy may occur. Freckled pelt is commonly found in the moss layer at low % cover.
Plots	**9801837, 9801841, 9801853, 9801863, GJ139,GJ142, GK88**	**GK123**, **GK128**, **GK201**, **GS05, GS211, GS241**	**9801870**, **GJ05, GJ88, GJ105, GJ164, GJ248, GK05, GK86, GK111, GK188, GS08**	**9801830, 9801840**, **GJ03**, **GK237**, **GK43**, **GK96, GS02**, **GS172**, **GS206**	**9801867**, **GJ99**, **GJ161**, **GJ177**, **GJ213, GS81, GS101**
Comments	Almost exclusively the result of fire disturbance	Most common at low elevations in the study area		Most common at high elevation, thus subalpine plants are more common	Most common at high elevation, thus subalpine plants are more common

5.4.5.2 02: LC: BlPl - Crowberry - Cladina

(Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem Units)

General Description and Distribution: This lodgepole pine, moss, and lichen dominated ecosystem unit is typically found on fluvial-glacial deposits, typically fluvial-glacial blankets or undulating plains. The LC unit has approximately equal amounts of mosses and lichens in the understory, and tree regeneration consists of a mix of lodgepole pine, spruce, and fir. The understory is usually quite open, and shrubs and regenerating trees are sparse. Floristically, this unit intergrades with the 01 (FR) in areas of variable moisture, the 03 (BT) close to wetlands, and the FC (Fir-crowberry) at higher elevations where lodgepole pine no longer grows (above about 1400 m). Fire is by far the most important disturbance in these ecosystem units and occurs frequently; structural stages 6 and 7 are therefore quite rare for this map unit in the study area.

The LC unit differs from two other BlPl-Crowberry-Cladina map units (LCw and LCx) in its typical situation and in its vegetation. LCx, for example, typically occurs on very dry fluvial-glacial terraces. LCw typically occurs on the south-facing sides of eskers and/or south-facing terrace scarps.

Assumed Site Modifiers under the Typical Situation: c, d, j

Site Modifiers Used: h, k, n, r, s, t, v

Structural Stages Mapped: 3b, 3, 4, 5, 6, 7

Typical Situation: Gentle slope; deep, coarse-textured soils; poor nutrient regime.

Photo 10: LC4 (plot GS62); note the mix of lichen and crowberry on the forest floor.

Map Symbol	LC3b	LC3	LC4	LC5	LC6	LC7
% Mean Tree Cover and Range		0	26 (15-45)	15 (10-24)	10	11
% Mean Shrub Cover and Range		15	6 (1-12)	11 (2-20)	5	14
% Mean Herb Cover and Range		12	20 (3-50)	20 (7-50)	40	3
% Mean Cryptogam Cover and Range		25	59 (30-98)	62 (20-95)	55	80
Dominant Vegetation	**Speculation**: These stands are probably old forests growing on poor site with very shallow soil so that the trees are stunted. Understory species are probably similar to mature and old forests.	Regenerating lodgepole pine is dominates the shrub layer. The predominant herb, based on limited data, is twinflower. The cryptogam layer is sparser than in later structural stages and consists of *Polytrichum, Cladina,* and *Cladina* spp.	Lodgepole pine dominates the tree layer (15% to 45 % cover). Black huckleberry is commonly found in the shrub layer. Crowberry is very abundant (average 10% cover), with twinflower, dwarf blueberry, and one-sided wintergreen also commonly occurring. There are roughly equal amounts of lichens and mosses, with red-stemmed feathermoss and *Cladonia and Cladina* spp. dominating	The canopy and regenerating trees are predominantly lodgepole pine, although it is beginning to open up. White-flowered rhododendron and black huckleberry dominate the shrub layer. Herbs include bunchberry, crowberry and dwarf blueberry. Moss and lichen cover are roughly equal, the dominants being red-stemmed feathermoss, curly heron's bill moss, grey and grey reindeer lichens and several *Cladonia* spp.	Lodgepole pine is the most abundant tree species in the main canopy but subalpine fir and Engelmann spruce can also occur. Black huckleberry and the same tree species can occur in the shrub layer. Crowberry dominates the herb layer but can be scattered. Dominant mosses and lichens include green reindeer lichen, red-stemmed feathermoss, and curly heron's bill moss.	Lodgepole pine is the most abundant tree species in the main canopy but subalpine fir and Engelmann spruce can also occur. Black huckleberry dominates the shrub layer with Engelmann spruce, subalpine fir and lodgepole pine present in the shrub layer. Crowberry is the most abundant herb. Dominant mosses and lichens include green reindeer lichen, black-foot cladonia, maple liverwort, and curly heron's bill moss.
Associated Vegetation		Black huckleberry is scattered throughout the shrub layer. Herbs include bunchberry and fireweed	Regenerating subalpine fir and Engelmann spruce occur with white-flowered rhododendron in the shrub layer. Bunchberry is commonly associated with this stage, as are *Polytrichum* spp.	Scattered subalpine fir and Engelmann spruce occurs in both the shrub and tree layers. Common juniper occurs in some sites. Running clubmoss, heart-leaved arnica, bluejoint, and pink mountain heather may be found. Many additional lichen and moss species may occur at relatively low % cover	Associate vegetation may include scrub birch, mountain heather and a variety of mosses and lichens.	Associate vegetation may include mountain-heather and a variety of mosses and lichens.

Map Symbol	LC3b	LC3	LC4	LC5	LC6	LC7
Plots	No Plot Data	**GJ64**	**9801846, GS10, GS142, GS205, GS210**	**GJ55, GJ85, GJ95, GJ251, GJ258, GK139, GS62, GS219**	**GJ169**	**GJ178**
Comments		Relatively rare, as this unit proceeds quickly to structural stage 4	Based on preliminary tree ring data, structural stage 4 for this map unit occurs approximately 15 to 25 years after a serious fire		Rare in Klawli due to extensive fire history. More plot data would likely have revealed a flora relatively similar to that of LC5	Rare in Klawli due to extensive fire history. More plot data would likely have revealed a flora relatively similar to that of LC5

5.4.5.3 02: LCw: BlPl - Crowberry - Cladina; warm aspect

(Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem Units)

General Description and Distribution: This unit is described separately because the vegetation on these south-facing slopes differs significantly from the regular 02 (LC). Bare soil is more common and overall moss and lichen cover is lower than in the regular 02 (LC) unit. Prickly rose, soopolallie, and lingonberry are moderately abundant in the understory. This warm aspect unit occurs most commonly on coarse-textured south-facing slopes of eskers and fluvial-glacial scarps

Assumed Site Modifiers under the Typical Situation: c, d, j

Site Modifiers Used: s, v, w

Structural Stages Mapped: 3, 3b, 4, 5, 6

Typical Situation: Gentle slope; deep, coarse-textured soils; poor nutrient regime.

Photo 11: LCw4 (plot GS07); note the mix of shrubs, lichens, and crowberry in the understorey.

Map Symbol	LCw3b	LCw3	LCw4	LCw5	LCw6	LCw7
% Mean Tree Cover and Range		1.3 (0-4)	40	22 (15-30)		
% Mean Shrub Cover and Range		13 (9-20)	35	29 (9-50)		
% Mean Herb Cover and Range		6 (3-10)	5	3.5 (2-5)		
% Mean Cryptogam Cover and Range		32 (1-70)	35	23 (17-30)		
Dominant Vegetation	**Speculation**: This unit is probably a mature stand on a poor site. The understory will be similar to mature stands	Lodgepole pine and soopolallie dominate the shrub layer. Fireweed is common and has a cover of approximately 1% in the plots. Juniper haircap moss is the most common moss, and *Stereocaulon tomentosum* is the most common lichen	Lodgepole pine is abundant and can form a dense, single-layer canopy. Soopolallie, prickly rose, and black huckleberry also occur. Bunchberry and lingonberry are abundant in the herb layer. The cryptogam layer in the plot is dominated by red-stemmed feathermoss	Lodgepole pine is the most abundant tree species, with Engelmann spruce and subalpine fir present in smaller quantities in the tree and shrub layers. Black huckleberry, common juniper, and soopolallie are common shrubs. Heart-leaved arnica is the most common herb. Curly heron's bill moss and *Cladonia gracilis* dominate the moss layer	**Speculation:** Tree canopy dominated by lodgepole pine and lesser amounts of Engelmann spruce and subalpine fir. Shrubs might include soopolallie, black huckleberry, and common juniper. Bunchberry and lingonberry might form a sparse herb carpet. Mosses include red-stemmed feathermoss and various lichen spp.	**Speculation:** Tree canopy dominated by lodgepole pine and lesser amounts of Engelmann spruce and subalpine fir. Shrubs might include soopolallie, black huckleberry, and common juniper. Bunchberry and lingonberry might form a sparse herb carpet. Mosses include red-stemmed feathermoss and various lichen spp.
Associated Vegetation		Subalpine fir and Engelmann spruce occasionally occur in the shrub layer along with prickly rose and common juniper. Herbs include bunchberry, dwarf blueberry, hair bentgrass, and altai fescue. Juniper haircap moss is very abundant in some plots, and *Stereocaulon tomentosum* and *Cladonia/Cladina* spp. may also occur	Willows and highbush cranberry may occur in this unit. The herbs may often include twinberry and fireweed. Grey reindeer lichen, freckle pelt and *Cladonia* sp. are some of the associated lichens.	White-flowered rhododendron is present in some plots. Bunchberry, dwarf blueberry, and fireweed are sometimes scattered in these plots. Various *Cladonia and Cladina* spp. and red-stemmed feathermoss may occur in the moss layer.	Scattered shrub layer includes tree saplings, white-flowered rhododendron, and willows. Herbs include dwarf blueberry and twinflower. Sparse moss and lichen layer includes *Cladina/Cladonia* spp. and freckle pelt	Scattered shrub layer includes tree saplings, white-flowered rhododendron, and willows. Herbs include dwarf blueberry and twinflower. Sparse moss and lichen layer includes *Cladina/Cladonia* spp. and freckle pelt
Plots	No Plot Data	**GJ54, GJ246, GS117**	**GS07**	**GJ110, GK94**	No Plot Data	No Plot Data

5.4.5.4 02: LCx: BlPl - Crowberry - Cladina; drier than average

(Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem Units)

General Description and Distribution: These units do not have a very diverse vascular flora and consist of a lodgepole pine overstorey, depauperate shrub and herb layers, and a cryptogam layer that is dominated by lichens rather than mosses. The lichen layer is diverse, consisting of up to 10 species. Green and grey reindeer lichens are by far the most abundant lichen, often forming a thick carpet underfoot.

This unit is almost exclusively found on coarse-textured fluvial-glacial terraces and can be very extensive at times. The LCx is very susceptible to fire and burns often. It is often complexed with FR (01) and 'regular' LC (02) where soil moisture status is a little wetter.

Assumed Site Modifiers under the Typical Situation: c, d, j,

Site Modifiers Used: h, n, s, t, v, x

Structural Stages Mapped: 3, 4, 5, 6

Typical Situation: Gentle slope; deep, coarse-textured fluvial-glacial terraces; poor nutrient regime

Photo 12: LCx4 (plot GK11); note the abundance of ground lichens.

Map Symbol	LCx3	LCx4	LCx5	LCx6	LCx7
% Mean Tree Cover and Range	0	22 (20-25)	21 (12-30)	5	
% Mean Shrub Cover and Range	15	2 (1-3)	1 (0-2)	7	
% Mean Herb Cover and Range	15	1.5 (1-2)	5 (3-7)	25	
% Mean Cryptogam Cover and Range	20	50 (50- 50)	67 (60-75)	75	
Dominant Vegetation	Lodgepole pine occupies the high and the low shrub layers. Few herbs are present except *Arctostaphylos uva-ursi.* Lichens are predominantly *Cladonia* spp., *Stereocaulon tomentosum,* and various crustose lichens.	Lodgepole pine dominates the canopy, with a relatively sparse shrub understory consisting mainly of black huckleberry and pine saplings. Herb cover is low, consisting of scattered crowberry and lingonberry. Mosses are rare, and only curly heron's bill moss achieves any abundance (c. 1%). The most abundant lichen is grey reindeer lichen, but other *Cladina* spp. are also abundant.	Lodgepole pine dominates both the tree and shrub layers, with lesser amounts of black huckleberry in the shrub layer. Crowberry and dwarf blueberry are common, but never abundant, in the sparse herb layer. The cryptogam layer is dominated by *Cladina* spp., with curly heron's bill moss and *Stereocaulon tomentosum* moderately abundant as well.	Lodgepole pine dominates the relatively open canopy, with scattered pine and black huckleberry in the shrub layer. Crowberry is abundant in the herb layer, but, based on limited plot data, there are few other herbs. Green reindeer lichen has a cover of c. 50% and *Cladonia* spp. are abundant.	**Speculation**: Lodgepole pine dominates the relatively open canopy, with scattered pine and black huckleberry in the shrub layer. Crowberry is abundant in the herb layer, but, based on limited plot data, there are few other herbs. Green reindeer lichen has a cover of c. 50% and *Cladonia* spp. are abundant.
Associated Vegetation	Insufficient plot data to describe associated vegetation in detail: additional lichen species (esp. *Cladina* spp.) and scattered crowberry is likely	Besides the dominant lodgepole pine, other tree species are very rare. Plot data on associated species is limited, but suggests that the lichen flora is fairly varied, with a varied assortment of *Cladonia* and *Cladina* spp.	Small amounts of Engelmann spruce and subalpine fir are beginning to regenerate in the shrub layer and bearberry is an occasional herb. Mosses are much fewer than lichens, but include some red-stemmed feathermoss and some *Polytrichum* spp.	Plots data is limited, but extrapolation suggests that dwarf blueberry, lingonberry, curly heron's bill moss, *Stereocaulon tomentosum* and other lichen species should occasionally occur.	Plots data is limited, but extrapolation suggests that dwarf blueberry, lingonberry, curly heron's bill moss, *Stereocaulon tomentosum* and other lichen species should occasionally occur.
Plots	**GS49**	**GK11, GS06**	**9801847, GS214**	**GK49**	No Plot Data
Comments				Quite rare in the study area, as these dry sites are very fire-susceptible	Quite rare in the study area, as these dry sites are very fire-susceptible Vegetation data from the field guide

5.4.5.5 03: BT: BlSb - Labrador Tea

(Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem units)

General Description and Distribution: The BT (03) unit is typically found in a fringe surrounding lakes or wetlands and intergrades into adjacent FR (01) or LC (02). This unit is common, but not abundant, in the southern two-thirds of the study area; it was neither found nor mapped on the northern-most line of mapsheets.

The vegetation of this unit differed significantly from that described for the BlSb-Labrador tea (03) unit in the *Northwest Portion, Prince George Forest Region Field Guide* (MacKinnon et al.1990). Black spruce was completely absent and was characterized instead by a lodgepole pine canopy, scrub birch in the understory, and an abundant moss layer. Given the differences in vegetation, this unit was labelled as 'BT' on the basis of edatopic position. Low cover of white-flowered rhododendron and the presence of scrub birch differentiate BT (03) from FR (01).

Assumed Site Modifiers under the Typical Situation: d, m

Site Modifiers Used: n, p, s, t

Structural Stages Mapped: 3, 4, 5, 6, 7

Typical Situation: Level, cool sites; deep, medium-textured soils; poor nutrient regime.

Photo 13: BT5 forest (plot 9801044)

Map Symbol	BT3	BT4	BT5	BT6	BT7
% Mean Tree Cover and Range		25	20	11 (5-18)	20
% Mean Shrub Cover and Range		17	10	23 (15-35)	35
% Mean Herb Cover and Range		25	15	28 (20-45)	25
% Mean Cryptogam Cover and Range		90	95	85 (60-100)	)50
Dominant Vegetation	**Speculation:** Regenerating lodgepole pine is abundant in the shrub layer, as are willows and scrub birch. Herbs might include palmate coltsfoot, five-leaved bramble, bunchberry, and dwarf blueberry. Red-stemmed feathermoss is likely the dominant moss.	Lodgepole pine dominates the tree layer, with regenerating subalpine fir and Engelmann spruce in the understory. Shrubs include scrub birch and willows. Five-leaved bramble, one-sided wintergreen, dwarf blueberry, and bunchberry are common herbs. Red-stemmed feathermoss is the dominant moss.	Lodgepole pine is the dominant tree species, with significant amounts of subalpine fir and Engelmann spruce in the canopy and understory. Scrub birch and willows dominate the shrub layer, and dwarf blueberry, bunchberry, palmate coltsfoot, and five-leaved bramble occurring in the herb layer. Red-stemmed feathermoss is the most abundant moss.	Lodgepole pine dominates the tree canopy, with some spruce mixed in. Scrub birch occurs consistently. Other shrubs include willows and young lodgepole pine, subalpine fir, Engelmann spruce. Herbs are diverse, and include crowberry, dwarf blueberry, subalpine daisy, palmate coltsfoot and various *Carex* spp. Mosses include red-stemmed feathermoss, *Barbilophozia, Dicranum,* and *Sphagnum* spp.	Lodgepole pine dominates the tree canopy, with some spruce mixed in. Pine. Spruce and subalpine fir all occur in the understory. . Scrub birch and grey-leaved willow dominate the shrub layer. Herbs are diverse, and include crowberry, dwarf blueberry, subalpine daisy, palmate coltsfoot and heart-leaved arnica. Mosses include red-stemmed feathermoss and *Barbilophozia.*
Associated Vegetation	Very young subalpine fir and Engelmann spruce might be found in the shrub layer. *Equisetum* spp, bluejoint, and subalpine daisy are likely associate species. The cryptogams might include *Barbilophozia* spp. and freckle pelt	Black twinberry and white-flowered rhododendron were present in plot GS208, but are probably only occasionally found in this unit. Palmate coltsfoot and subalpine daisy are likely associate species. The moss layer includes *Barbilophozia* spp., freckle pelt, and green kidney lichen.	Based on limited plot data it is inferred that associated herbs might include *Equisetum* spp., crowberry, fireweed, bluejoint, and other grasses. Cryptogams might include freckle pelt, curly heron's bill moss, knight's plume, and/or *Polytrichum* spp.	White spruce is occasionally found among the trees and shrubs. Wood horsetail, bluejoint, bunchberry, mountain hairgrass, and *Juncus* spp. may be found in the herb layer. The cryptogams include *Cladonia* spp. on hummock tops, and glow moss and golden fuzzy fen moss in the wetter areas	White spruce is occasionally found among the trees and shrubs. Wood horsetail, bluejoint, bunchberry, mountain hairgrass, Sitka burnet, dwarf nagoonberry, and arctic lupine may also be found in the herb layer. The cryptogams include *Polytrichum* sp., frog's pelt, as well as various *Cladina* and *Cladonia* species.
Plots	No Plot Data	**GS208**	**9801844**	**9801869, GJ168, GK44**	**GS203**

5.4.5.6 04: FO: Bl - Oak fern - Knight's plume

(Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem Units)

General Description and Distribution: Never very extensive, this ecosystem unit is often complexed with the 01 (FR) unit on morainal slopes. This unit occurs in receiving areas, often in gullies or along paths of drainage. It also occurs on well-drained fluvial deposits that are not moist enough to support the 07 (FH) unit.

This rich, moist ecosystem unit has a diverse flora, which varies considerably from plot to plot. Despite the name of the map unit (Fir - Oak fern - Knight's plume), oak fern is not found in every plot. Edatopic position and a lush herb flora are important defining characteristics for this unit.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: a, g, k, n, s, w

Structural Stages Mapped: 3, 4, 5, 6, 7

Typical Situation: Gentle lower slope; receiving position; deep, medium-textured soils.

Photo 14: FO5 forest (plot GS217).

Map Symbol	FO3	FO4	FO5	FO6	FO7
% Mean Tree Cover and Range	0		26 (10-45)	31 (10-50)	15 (10-30)
% Mean Shrub Cover and Range	42 (35-50)		19 (10-30)	24 (10-40)	18 (7-30)
% Mean Herb Cover and Range	40 (20-60)		43 (15-60)	46 (12-75)	45 (30-60)
% Mean Cryptogam Cover and Range	15 (1-30)		69 (55-80)	69 (50-95)	74 (60-85)
Dominant Vegetation	Subalpine fir and Engelmann spruce are apparently the first tree species to regenerate following disturbance. Black huckleberry is very abundant, with lesser amounts of willows, oval-leaved blueberry, and trailing black currant. The lush herb layer includes oak fern, fireweed, bunchberry, Sitka valerian, and five-leaved bramble. Cryptogams are scattered and include *Barbilophozia* and *Dicranum* spp.	**Speculation:** Engelmann spruce, subalpine fir and lodgepole pine might be about equally common. Black twinberry is the dominant shrub. Herbs are probably more diverse than for many other structural stage 4 ecosystems and may include oak fern, fireweed, Sitka valerian and five-leaved bramble. Red-stemmed feathermoss and *Barbilophozia* are probably the dominant cryptogams	Engelmann spruce, subalpine fir and lodgepole pine are all about equally common. Black twinberry is abundant (mean cover *c.* 5%). Common herbs include oak fern, heart-leaved arnica, bunchberry, subalpine daisy, Sitka valerian, five-leaved bramble, Sitka burnet, and northern bedstraw. Red-stemmed feathermoss and *Barbilophozia* are the most abundant cryptogams but knight's plume is also common	Engelmann spruce, subalpine fir and lodgepole pine are all found in the canopy and regenerating in the understory. Common shrubs include black twinberry, white-flowered rhododendron, willows, and black gooseberry. The herb layer is very diverse and includes Sitka burnet, Sitka valerian, heart-leaved arnica, bluejoint, five-leaved bramble, bunchberry, oak fern, and subalpine daisy. Red-stemmed feathermoss and *Barbilophozia* spp. Are common mosses.	Engelmann spruce, subalpine fir and lodgepole pine are all found in the canopy and regenerating in the understory. The dominant shrubs are black twinberry, and black gooseberry. The herb layer is very diverse and includes bunchberry. Sitka burnet, Sitka valerian, fireweed, bluejoint, five-leaved bramble, three-leaved foamflower and subalpine daisy Red-stemmed feathermoss, common green sphagnum, *Barbilophozia*, *Rhizomnium*, and step moss are abundant.
Associated Vegetation	Lodgepole pine is sometimes found in the shrub layer along with moderate amounts of white-flowered rhododendron and black twinberry. Bluejoint, Indian hellebore, heart-leaved arnica, and three-leaved foamflower may be found in the herb layer. The cryptogam layer is not very well developed but might include green reindeer lichen on hummock tops	Associated shrub species might include scrub birch, and various *Ribes* and *Vaccinium* spp. The herb flora might include Indian hellebore, Sitka burnet and palmate coltsfoot and many other species. The moss and lichen flora is likely not too diverse.	Associated shrub species include various willows, scrub birch, black gooseberry and black huckleberry. The herb flora is very diverse, but may include fireweed, palmate coltsfoot, clasping twistedstalk, wood horsetail, and dwarf blueberry. Mosses occasionally found include curly heron's bill moss and *Polytrichum* spp.	The shrub layer may include scattered black huckleberry, oval-leaved huckleberry, mountain alder (tenu), and scrub birch. Associated herb species include fireweed, and clasping twistedstalk. Many additional herb species are also sometimes found. Cryptogams may include freckle pelt, step moss and many other lichens and mosses	The shrub layer may include scattered black huckleberry, oval-leaved blueberry, white-flowered rhododendron, and scrub birch. Associated herb species include clasping twistedstalk, Indian hellebore, dwarf blueberry and, of course, oak fern. Many additional herb species are also sometimes found. Cryptogams may include freckle pelt, and many other lichens and mosses
Plots	**9801856, GK172**	No Plot Data	**GJ281**, **GK125, GS58, GS174, GS217**	**9801829, 9801832, 9801843, 9801885, GJ257, GK48, GK89, GK144, GS102**	**GJ67, GJ75, GJ234**, **GS137**

5.4.5.7 05: FD: Bl - Devil's Club – Rhododendron

(Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem Units)

General Description and Distribution: This unit was found only in the extreme south-east of the study area and around Klawli Lake. Plot data is limited and further research is required before this unit can be fully characterized.

Common shrubs for this site series in the study area include black twinberry, oval-leaved blueberry, black gooseberry, and western mountain-ash. No devil's club was found in any of the plots. Oak fern, Sitka valerian, fireweed, and Sitka burnet are diagnostic herbs. This unit is distinguished from the FO (Bl-Oak fern-Knight's plume) unit based on edatopic position and relatively gentle slope.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: w

Structural Stages Mapped: 3, 4, 5, 6, 7

Typical Situation: Gentle lower slope receiving position; deep, medium-textured soils; rich nutrient regime.

Photo 15: Logged FD3 site (plot 9801854)

Map Symbol	FD3	FD4	FD5	FD6	FD7
% Mean Tree Cover and Range	0		10	25	
% Mean Shrub Cover and Range	25		70	25	
% Mean Herb Cover and Range	60		15	60	
% Mean Cryptogam Cover and Range	10		10	90	
Dominant Vegetation	Black twinberry, black gooseberry, oval-leaved blueberry, and western mountain ash are the dominant shrub species, with varying amounts of Engelmann spruce and subalpine fir (depending on stage of regeneration). Oak fern and Sitka valerian are very abundant, with lesser amounts of fireweed, fringed grass-of-Parnassus, five-leaved bramble, three-leaved foamflower, and Sitka burnet. Glow moss is the dominant moss.	Subalpine fir and Engelmann spruce are the dominant tree species. Black twinberry, black gooseberry, oval-leaved blueberry, and western mountain ash might occur in the understory. Common herbs may include oak fern, Sitka valerian, and five-leaved bramble. Red-stemmed feathermoss and knight's plume may be expected in the cryptogam layer	Subalpine fir and Engelmann spruce are the dominant tree species. Soopolallie, along with black huckleberry, western mountain ash, and black gooseberry, were the dominant shrub species in the plot data available. Common herbs include fuzzy-spiked wildrye, common horsetail, fireweed, and Sitka burnet.	Subalpine fir and Engelmann spruce are the dominant tree species, with black twinberry, oval-leaved blueberry, and black gooseberry as shrub species. Common herbs include oak fern, Sitka valerian, and five-leaved bramble. Mosses are abundant and include Brachythecium spp., *Rhizomnium nudum,* curly heron's bill moss, and red-stemmed feathermoss.	Subalpine fir and Engelmann spruce are the dominant tree species, with black twinberry, oval-leaved blueberry, and black gooseberry as shrub species. Common herbs include oak fern, Sitka valerian, and five-leaved bramble. Mosses are abundant, and include *Brachythecium* spp., *Rhizomnium nudum,* curly heron's bill moss and red-stemmed feathermoss.
Associated Vegetation	Wood horsetail and arrow-leaved groundsel occur at low percent cover. Various moss, lichen, and liverworts occur, including *Barbilophozia* spp. and *Sphagnum* spp.	Bunchberry, fireweed, and three-leaved foamflower will probably occur in the herb layer. *Barbilophozia* might occur in the cryptogam layer.	Additional shrubs and herbs include green alder, willow, bunchberry, and western meadowrue. Plot information regarding cryptogam species is limited, but red-stemmed feathermoss and knight's plume may be expected	Black huckleberry and Sitka mountain ash may occur in the shrub layer. Indian hellebore is moderately common among the herbs. Knight's plume and *Barbilophozia* spp. may occur in the moss layer.	Black huckleberry and Sitka mountain ash may occur in the shrub layer. Indian hellebore is moderately common among the herbs. Knight's plume and *Barbilophozia* spp. may occur in the moss layer.
Plots	**9801854**	No Plot Data	**GJ145**	**9801855**	No Plot Data
Comments			This plot is close to the SBS boundary and may be transitional in nature.		

5.4.5.8 07: FH: Bl - Horsetail – Feathermoss

(Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem Units)

General Description and Distribution: This moist forest unit is characterized by an abundance of horsetails under a dense subalpine fir canopy. Willows and wet-site herbs are also abundant.

These forests often occur on lower slope positions, fluvial plains, and other areas where the water table is close to the surface year round. Subalpine fir-Sitka valerian (FV) ecosystem units tend to occur on similar edatopic positions above approximately 1350 m.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: a, g, n, p, s, t

Structural Stages Mapped: 3b, 3, 4, 5, 6, 7

Typical Situation: Level to depression; deep; coarse-textured soil; high water table.

Photo 16: An open FHp6 site (GS64)

Map Symbol	FH3b	FH3	FH4	FH5	FH6	FH7
% Mean Tree Cover and Range		0.5 (0-1)			24 (5-40)	16 (7-20)
% Mean Shrub Cover and Range		37 (35-40)			10 (6-12)	8 (5-40)
% Mean Herb Cover and Range		25 (15-35)			27 (12-35)	54 (30-75)
% Mean Cryptogam Cover and Range		92 (90-95)			89 (80-100)	79 (50-95)
Dominant Vegetation	This map unit occurs when the fir is stunted. Species composition is probably similar to mature and old forests.	Vigorous willow growth characterizes the early structural stages of this unit. Subalpine fir is the first tree species to prosper, growing up through the *willow* layer. Herbs include horsetails (common and wood horsetail), bluejoint, Sitka valerian, subalpine daisy, and leatherleaf saxifrage. The dominant cryptogams are variable, but might include *Sphagnum* spp., glow moss, or sickle moss.	**Speculation:** Subalpine fir and Engelmann spruce form a thick canopy. Shrubs are probably mostly willows. The common and wood horsetail are the most common herbs, with other common herbs probably including bluejoint, leatherleaf saxifrage, and Sitka valerian.	**Speculation:** Subalpine fir and Engelmann spruce form a thick canopy. Shrubs are probably mostly willows. Common and wood horsetails are abundant. Herbs are diverse, probably including Sitka burnet, five leaved bramble, Sitka valerian, and bunchberry. The cryptogam layer may be dominated by one or more of the following: *Sphagnum* spp., red-stemmed feathermoss, sickle moss, and/or step moss.	Engelmann spruce and subalpine fir of various heights dominates the tree and shrub layers. Willows are common and abundant in the shrub understory. Common and wood horsetails form a thick carpet on the forest floor. The diverse herb layer includes Sitka burnet, bramble, Sitka valerian, and dwarf blueberry. The thick moss carpet includes *Sphagnum* spp., red-stemmed feathermoss, step moss, or common haircap moss.	Engelmann spruce and subalpine fir of various heights dominate the tree and shrub layers, with a small component of lodgepole pine. Willow and subalpine fir regeneration are common and abundant in the shrub understory, as well as mountain alder and scrub birch. Common horsetail forms a thick carpet on the forest floor. The diverse herb layer also includes Sitka burnet, five-leaved bramble, Sitka valerian, fireweed, and bunchberry. *Sphagnum* spp. and red-stemmed feathermoss are the dominant mosses present.

Map Symbol	FH3b	FH3	FH4	FH5	FH6	FH7
Associated Vegetation		Young, scattered Engelmann spruce occurs in the shrub layer of this unit along with occasional black twinberry. Associated herbs may include Indian hellebore, *Viola* spp., and dwarf nagoonberry. *Barbilophozia* spp., curly heron's bill moss and red-stemmed feathermoss may occur.	It is likely that black twinberry will occasionally be found in this unit. Various wet-site herbs may be anticipated, including subalpine daisy, dwarf nagoonberry and Indian hellebore. *Barbilophozia* spp., curly heron's bill moss and red-stemmed feathermoss may occur.	It is likely that black twinberry will occasionally be found in this unit, along with various *Ribes* and *Rubus* spp. Associated herbs might include bluejoint, subalpine daisy, Indian hellebore, and palmate coltsfoot. *Barbilophozia spp*., knight's plume, and curly heron's bill moss might also be expected in small quantities.	Scattered black twinberry can occur in these units. Associated herbs include bluejoint, Sitka valerian, and three-leaved foamflower, *Barbilophozia* spp. and knight's plume are often present in small amounts in the moss layer	Scattered black twinberry and northern gooseberry can occur in these units. Associated herbs include bluejoint, fireweed, subalpine daisy, and palmate coltsfoot. *Barbilophozia* spp., leafy mosses and knight's plume are often present in small amounts in the moss layer
Plots	No Plot Data	**GK92, GK239**	No Plot Data	No Plot Data	**9801878, GJ83, GS64, GS140**	**GJ113, GJ117, GS03, GS72, GS188**
Comments			Relatively infrequent in the study area	Relatively infrequent in the study area		

5.4.5.9 00: FC: Subalpine fir – Crowberry

(Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem Units)

General Description and Distribution: This dry, subalpine unit is characterized by the presence of subalpine fir, abundant crowberry and more lichen than mosses in the cryptogam layer. Stunted subalpine fir tends to dominate the tall shrub layer, although lodgepole pine and some Engelmann spruce can also occur.

The FC unit occurs in the upper portion of the ESSFmv3 (above c. 1450 m) as well as in the ESSFmvp3 parkland subzone. At higher elevations, this unit is often complexed with the dry FW alpine meadow unit. FC gives way to lodgepole pine dominated stands (LC) on submesic to xeric sites in the lower elevations of this variant. The plots used to describe the FC map unit were drawn from both the ESSFmv3 and the ESSFmvp3, as they were very similar floristically. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: j, m, r, s

Site Modifiers Used: d, h, k, t, v, w

Structural Stages Mapped: 3b, 3, 4, 5, 6

Typical Situation: Xeric to subxeric; gentle slopes on rocky ridges; dry, shedding site with shallow, medium-textured soils.

Photo 17: FCv3b (plot 9801838) with Pamela Williams; note the extensive cover of crowberry

Map Symbol	FC3b	FC3	FC4	FC5	FC6	FC7
% Mean Tree Cover and Range	2 (2 &2)	0.5 (0-1)			9.5 (4-15)	
% Mean Shrub Cover and Range	20 (15-25)	29 (14-45)			37 (30-45)	
% Mean Herb Cover and Range	45 (40-50)	14 (5-23)			20 (20-20)	
% Mean Cryptogam Cover and Range	38 (16-60)	28 (2-55)			60 (30-90)	
Dominant Vegetation	Stunted (<10 m) subalpine fir is the dominant tree in FC3b. Crowberry is abundant (mean cover 18%), and other dominant herbs include four-angled mountain heather, dwarf blueberry, altai fescue, mountain sagewort and pink mountain heather. Green reindeer lichen is abundant, as are various *Cladonia* spp. *Barbilophozia* spp. may also occur.	Young lodgepole pine and subalpine fir occur, sometimes forming a relatively thick shrub layer. Black huckleberry, soopolallie, and common juniper also occur in the shrub layer. Crowberry, dwarf blueberry, and twinberry are the most abundant herbs. *Cladina* and *Cladonia* spp. are the dominant cryptogam species	**Speculation:** Subalpine fir and crowberry dominate this ecosystem. Other dominant plants might include black huckleberry, soopolallie, and dwarf blueberry. *Cladina* and *Cladonia* would probably be the dominant cryptogams	**Speculation:** Subalpine fir and crowberry dominate this ecosystem. Other dominant plants might include black huckleberry, soopolallie, and dwarf blueberry. *Cladina* and *Cladonia* would probably be the dominant cryptogams	This map unit is has relatively abundant subalpine fir at a diversity of heights. Shrubs include scattered white-flowered rhododendron and black huckleberry. Crowberry is the most common and abundant herb; grouseberry is also sometimes present. Cryptogams are varied.	**Speculation**: This map unit is has relatively abundant subalpine fir at a diversity of heights. Shrubs include scattered white-flowered rhododendron and black huckleberry. Crowberry is the most common and abundant herb; grouseberry is also sometimes present. Cryptogams are varied.
Associated Vegetation	Stunted lodgepole pine and Engelmann spruce occasionally occur in the shrub layer, but are never as abundant as subalpine fir. *Salix* spp. may, or may not, be present. Lichens may include Green kidney lichen, curly heron's bill moss and *Stereocaulon tomentosum*	Engelmann spruce may sometimes occur among the regenerating shrubs and trees. Scrub birch and various *Salix* spp. may occur occasionally. Associate herbs include bunchberry and ground cedar	Engelmann spruce and lodgepole pine might occasionally occur in the canopy and/or understory. Shrubs might include common juniper and *Salix* spp. Herbs and cryptogams might include four-angled mountain heather and *Stereocaulon tomentosum*	Engelmann spruce and lodgepole pine might occasionally occur in the canopy and/or understory. Shrubs might include common juniper and *Salix* spp. Herbs and cryptogams might include four-angled mountain heather and *Stereocaulon tomentosum*	Associated shrubs and herbs include common juniper, four-angled mountain heather, and pink mountain heather. Red-stemmed feathermoss is occasionally abundant (10% in one plot)	Associated shrubs and herbs include common juniper, four-angled mountain heather, and pink mountain heather. Red-stemmed feathermoss is occasionally abundant (10% in one plot)

Map Symbol	FC3b	FC3	FC4	FC5	FC6	FC7
Plots	**9801838, 9801840,** *GS113, GS158*	*GJ22, GK02*	No plot data	No Plot Data	*GJ135, GK22*	No Plot Data
Comments	FC3b represents a climatic climax; the scattered trees are stunted by the extreme climate and will probably never get taller than the tall shrub stage	FC3 represents a regenerative stage following disturbance: it is typically at lower elevation than the 3b.			This structural stage only occurs at lower elevations in the mv3.	This structural stage only occurs at lower elevations. The description is taken from structural stage 6 in the mv3

5.4.5.10 00: FM: Subalpine fir - White mountain heather

(Engelmann spruce Subalpine Fir (ESSFmv3): Forested Ecosystem Units)

General Description and Distribution: The Subalpine fir – White mountain heather forest is characterized by subalpine fir trees and scattered shrubs interspersed by a carpet of white mountain heather and *Barbilophozia* spp. Herbs are sparse and limited, reflecting this unit's mesic status, low nutrient regime, and possibly a late snowpack in the spring. In some areas the white mountain heather is lacking or very sparse and is replaced by the *Barbilophozia spp*. These differences cannot be photo-interpreted and have been mapped as the same unit.

The FM unit occurs in the upper portions of the ESSFmv3 (above c. 1460 m) as well as in the ESSFmvp3 parkland subzone. At higher elevations, this unit is often complexed with the Mountain heather-Leafy liverwort snow bed unit (MH). The plots used to describe the FM unit were drawn from both the ESSFmv3 and the ESSFmvp3, as they were very similar floristically. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: k, n, r, s, t, v, w

Structural Stages Mapped: 3b, 3, 4, 5, 6, 7

Typical Situation: Submesic to mesic sites on gentle to moderate slopes; deep, medium textured soils.

Photo 18: FM6 forest (plot GJ130)

Map Symbol	FM3b	FM3	FM4	FM5	FM6	FM7
% Mean Tree Cover and Range	2 (0-10)				16 (5-35)	11 (10-12)
% Mean Shrub Cover and Range	43 (15-65)				54 (25-85)	30 (20-40)
% Mean Herb Cover and Range	36 (0-80)				36 (3-70)	33 (15-50)
% Mean Cryptogam Cover and Range	38 (0.1-95)				58 (7-90)	70 (60-80)
Dominant Vegetation	Stunted subalpine fir dominates the shrub layer, although black huckleberry also occurs. The herb layer is dominated by white mountain heather, which, although not always present, usually covers at least 40% of the community. *Barbilophozia* and *Dicranum* spp. are common and abundant, especially in communities lacking white mountain heather.	**Speculation:** Assuming the disturbance (avalanche or fire) did not totally destroy the ground layer, the white mountain heather carpet should be relatively untouched. Regenerating subalpine fir occurs at various heights. Herbs might include heart-leaved arnica, five-leaved bramble, and Sitka valerian. *Barbilophozia* spp. still dominates the cryptogams.	**Speculation:** Subalpine fir is the primary tree species. Black huckleberry probably occurs in the shrub layer. White mountain heather is the dominant herb, but other herbs might include heart-leaved arnica, five-leaved bramble, and Sitka valerian. *Barbilophozia* spp. is probably the most abundant cryptogam.	**Speculation:** Subalpine fir is the primary tree species. Black huckleberry probably occurs in the shrub layer. White mountain heather is the dominant herb, but other herbs might include heart-leaved arnica, five-leaved bramble, and Sitka valerian. *Barbilophozia* spp. is probably the most abundant cryptogam.	Subalpine fir dominates the tree and shrub layers, with black huckleberry sparsely occurring in the shrub layer. White mountain heather is dominant in the herb layer but five-leaved bramble is also found. *Barbilophozia* spp., are the most abundant cryptogams.	Subalpine fir dominates the tree and shrub layers, with black huckleberry also occurring in the shrub layer. White mountain heather is the dominant herb, but other commonly found herbs include heart-leaved arnica, five-leaved bramble, and Sitka valerian. *Barbilophozia* spp. are usually very abundant, with cover between 20% and 50%)
Associated Vegetation	White-flowered rhododendron, more common at lower elevations, occurs on some transitional plots. Associated herbs include heart-leaved arnica, pink mountain heather, mountain sagewort and a variety of dry site lichens including *Cladina* and *Cladonia*, as well as freckle pelt	White-flowered rhododendron may occur. Herbs are probably similar to other structural stages, likely including one-sided wintergreen and pink mountain heather. In the moss layer red-stemmed feathermoss, freckle pelt and *Dicranum* spp. are expected	White-flowered rhododendron might occur occasionally. Herbs may include one-sided wintergreen, pink mountain heather and three-leaved foamflower. Cryptogams may include red-stemmed feathermoss, freckle pelt, and *Dicranum* spp.	White-flowered rhododendron might occur occasionally. Herbs may include one-sided wintergreen, pink mountain heather and three-leaved foamflower. Cryptogams may include red-stemmed feathermoss, freckle pelt, and *Dicranum* spp.	Herbs may also include heart-leaved arnica, one-leaved foamflower, and pink mountain heather. Occasional cryptogams include step moss, curly heron's-bill moss, grey reindeer lichen, freckle pelt and a variety of lichen and moss species.	Herbs may also include one-sided wintergreen, pink mountain heather and three-leaved foamflower. Occasional cryptogams include red-stemmed feathermoss, freckle pelt, and *Dicranum* spp.

Map Symbol	FM3b	FM3	FM4	FM5	FM6	FM7
Plots	**9801839, 9801848, 9801871, GJ13, GJ15, GK38,** *GK180*, **GS43, GS96, GS114, GS159**	No Plot Data	No Plot Data	No Plot Data	**GJ130, GK20, GS98, GS115**	**GS98, GJ16**,
Comments	FM3b represents a climatic climax: this unit will never advance to a higher structural stage because of site exposure or high elevation	FM3 represents a regenerative stage following disturbance: it is typically at a lower elevation than FM3b			This structural stage is primarily limited to the mv3.	This structural stage is only mapped in the mv3 and does not occur in the parkland subzone.

5.4.5.11 00: FV: Subalpine fir – Sitka valerian

(Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem Units)

General Description and Distribution: Subalpine fir – Sitka valerian forest is characterized by subalpine fir trees interspersed with a very lush and diverse assortment of herbs including Sitka valerian, Indian hellebore, heart-leaved arnica, and Sitka burnet.

This moist forest unit occurs in the upper portion of the ESSFmv3 (above c. 1400 m) as well as in the ESSFmvp3 parkland subzone). At higher elevations, this unit is often complexed with the moist herbaceous meadow unit (Sitka valerian-Arrow-leaved groundsel: VG). The plots used to describe the FV map unit were drawn from both the ESSFmv3 and the ESSFmvp3, as they were very similar floristically. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: a, g, k, r, s, t, v, w

Structural Stages Mapped: 3b, 3, 4, 5, 6, 7

Typical Situation: Gentle lower slope; receiving position; deep, medium-textured soils.

Photo 19: FV6 forest (plot 9801862)

Map Symbol	FV3b	FV3	FV4	FV5	FV6	FV7
% Mean Tree Cover and Range	1.8 (0-7)	0			24 (2-40)	17 (10-20)
% Mean Shrub Cover and Range	34 (10-60)	45			23 (6-30)	13 (4-25)
% Mean Herb Cover and Range	43 (3-70)	40			42 (10-65)	43 (25-70)
% Mean Cryptogam Cover and Range	36 (4-90)	60			71 (55-95)	77 (50-90)
Dominant Vegetation	Widely spaced subalpine fir occurs, along with the occasional Engelmann spruce. Black huckleberry occurs in most plots at low percent cover (<2%). The herb layer is lush and diverse, including Sitka valerian, arrow-leaved groundsel, heart-leaved arnica, fireweed, Indian hellebore, bracted lousewort, Sitka burnet, and arctic lupine. *Barbilophozia* spp. are occasionally abundant in the cryptogam layer	Young subalpine fir may be relatively abundant, depending on time since disturbance. Shrubs and herbs are similar to more mature stands, and include black huckleberry, heart-leaved arnica, arrow-leaved groundsel, arctic lupine, one-sided wintergreen, and dwarf blueberry. *Barbilophozia* spp. and red-stemmed feathermoss are abundant.	**Speculation:** Subalpine fir is the dominant tree and shrub, but black huckleberry is also present in most plots. The herb layer is extremely lush and diverse, the dominant species including Sitka valerian, Indian hellebore, heart-leaved arnica, Sitka burnet, arrow-leaved groundsel, subalpine daisy, and one-sided wintergreen. The dominant cryptogams are probably *Barbilophozia* spp.	**Speculation:** Subalpine fir is the dominant tree and shrub, but black huckleberry is also present in most plots. The herb layer is extremely lush and diverse, the dominant species including Sitka valerian, Indian hellebore, heart-leaved arnica, Sitka burnet, arrow-leaved groundsel, subalpine daisy, and one-sided wintergreen. The dominant cryptogams are probably *Barbilophozia* spp.	Combined tree and shrub cover of subalpine fir cover ranges from about 20% to about 55%. Black huckleberry is present in most plots. The herb layer is extremely lush and diverse. Sitka valerian is most abundant usually with a mean cover of about 20%. Other species include Indian hellebore, heart-leaved arnica, Sitka burnet, arrow-leaved groundsel, subalpine daisy, and one-sided wintergreen. The dominant cryptogams are *Barbilophozia* spp.	Combined tree and shrub cover of subalpine fir cover ranges from about 20% to about 55%. Black huckleberry is Scattered but consistent. The herb layer is extremely lush and diverse, with Sitka valerian as the dominant species. With a mean cover of 21%. Other species include Indian hellebore, heart-leaved arnica, Sitka burnet, arrow-leaved groundsel, subalpine daisy, and three-leaved foamflower. The dominant cryptogams are *Barbilophozia* spp.

Map Symbol	FV3b	FV3	FV4	FV5	FV6	FV7
Associated Vegetation	White flowered rhododendron occasionally occurs (<5% cover). Many additional herbs may be found in this unit, including subalpine daisy, white mountain heather, and mountain monkshood. *Dicranum* spp. are occasionally present among the mosses.	Indian hellebore, subalpine daisy, and running clubmoss may occur at low % cover. Freckle pelt may occur in the moss layer.	Black gooseberry and various low *Salix* spp. may occur in the shrub layer. Possible herbs include one and three-leaved foamflower, western meadowrue, mountain monkshood, fringed grass-of-Parnassus, five-leaved bramble, bracted lousewort and many more. Associated cryptogams may include freckle pelt, curly heron's bill moss, glow moss and red-stemmed feathermoss	Black gooseberry and various low willows may occur in the shrub layer. Possible herbs include one and three-leaved foamflower, western meadowrue, mountain monkshood, fringed grass-of-Parnassus, five-leaved bramble, bracted lousewort and many more. Associated cryptogams may include freckle pelt, curly heron's bill moss, glow moss and red-stemmed feathermoss	Black gooseberry and various low willows may occur in the shrub layer. Possible herbs include one and three-leaved foamflower, western meadowrue, mountain monkshood, stiff clubmoss, yellow anemone, fringed grass-of-Parnassus, five-leaved bramble, bracted lousewort and many more. Associated cryptogams include freckle pelt, curly heron's bill moss, glow moss and red-stemmed feathermoss	Black gooseberry and various low willows may occur in the shrub layer. Other possible herbs include one -leaved foamflower, western meadowrue, mountain monkshood, fringed grass-of-Parnassus, five-leaved bramble, bracted lousewort and many more. Associated cryptogams include freckle pelt, curly heron's bill moss, glow moss and red-stemmed feathermoss
Plots	*9801836*, **9801842, GJ35, GJ102,** *GJ186*, **GS39, GS162**	*GS116*	No Plot Data	No Plot Data	**9801858, 9801860, 9801862, GJ211**, **GK18, GK121, GK186**, **GS79**	**9801850, 9801859, GS143**
Comments	FV3b represents a climatic climax: this unit will never advance to a higher structural stage because of site exposure or high elevation	FV3 represents a regenerative stage following disturbance: it is typically at lower elevation than FV3b			This is the most common structural stage for this ecosystem at lower elevations.	

5.4.5.12 00: ST SxwFd – Toad-flax

(Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem Units)

General Description and Distribution: These sites are conspicuous, as they are aspen dominated within otherwise extensive coniferous forests. They occur on isolated, warm colluvial slopes within the ESSFmv3 close to the boundary of the SBSmk1. This unit is essentially the same as the aspen/lodgepole pines slopes of the 05 (ST) site series of the SBSmk1 and has been mapped as this unit.

This ecosystem unit is the only one observed to have variable stand composition within the study area. The stand composition (B for broad-leaved, M for mixed, and C for coniferous cover) is added to the database. Trembling aspen dominates broad-leaved stands while coniferous stands are dominated by lodgepole pine. At early seral shrub stages, only mixed or aspen stands occur. As the stands age, lodgepole pine becomes more dominant so that in mature forests only coniferous stands occur.

Assumed Site Modifiers under the Typical Situation: d, m, w

Site Modifiers Used: j, s, v

Structural Stages Mapped: 3, 4, 5

Typical Situation: Significant warm slopes on deep, medium-textured soils.

Photo 20: ST5M forest (plot GJ225)

Map Symbol	ST3B	ST4B and M	ST5M and C	ST6C	ST7
% Mean Tree Cover and Range	1(0-2)	50	45(40-50)		
% Mean Shrub Cover and Range	55 (50-60)	40	11(8-15)		
% Mean Herb Cover and Range	10(5-15)	10	17(10-25)		
% Mean Cryptogam Cover and Range	0	15	35(30-40)		
Dominant Vegetation	Trembling aspen, either as pure stands or mixed with some lodgepole pine, form the main shrub layer. Bebb's willow and subalpine fir may also occur as tall shrubs. Scattered pine may occur in the tree layer. Saskatoon and common juniper form the low shrub layer. Herbs are rather sparse and include western meadowrue, twinflower, and bunchberry. The moss layer is lacking.	Mixed stands of lodgepole pine and aspen or pure stands of aspen can occur as the main tree canopy. Subalpine fir may also occur. Prickly rose and soopolallie will be the main shrubs occurring. Bunchberry and twinflower are the most consistent and noticeable herbs. The moss layer will be poorly developed	Pure stands of lodgepole pine or mixed stands of lodgepole pine and aspen form the main tree canopy of these young forests. Prickly rose and soopolallie are the main shrubs occurring. Bunchberry and twinflower are the most consistent and noticeable herbs. The moss layer is varied.	**Speculation**: from SS5 earlier structural stage. Pure stands of lodgepole pine form the main tree canopy of these mature forests. Prickly rose and soopolallie are the main shrubs occurring. Bunchberry and twinflower are the most consistent and noticeable herbs. The moss layer is varied.	Not mapped, but presumably similar to the ST6C
Associated Vegetation	Soopalallie can also occur.	One-sided wintergreen may occur.	Lodgepole pine, subalpine fir, and white spruce may occur in the shrub layers. Common juniper may be scattered while black huckleberry seems to occur in the coniferous stands. Fireweed and one-sided wintergreen can occur. Heart-leaved arnica and clubmoss appears to be more likely in the coniferous stands. Knight's plume is the most frequently occurring moss.	Lodgepole pine, subalpine fir, and white spruce will probably occur in the shrub layers together with black huckleberry. Fireweed, one-sided wintergreen, heart-leaved arnica, and clubmoss are in these coniferous stands. Knight's plume is the most frequently occurring moss.	
Plots	**GJ148, VJ147, VJ150**	*VJ152*	*GJ151, GJ225, VJ154,VK245*	No plots	No plots; not mapped
Comments				Not mapped in the ESSFmv3. Repeated fire disturbance on these slopes limits the occurrence of this structural stage	Not mapped in the ESSFmv3 and very unlikely to occur due to past fire disturbance.

5.4.6 Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units

5.4.6.1 00: BS: Black Spruce -Sphagnum bog

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units)

General Description and Distribution: This unit is dominated by stunted black spruce, scrub birch, Labrador tea, and willow growing in a thick mossy layer and an organic soil. This ecosystem unit was very rare in the Klawli study area: only one community was encountered in 42 team-days of fieldwork. Consequently the mapping reliability for this unit is not very high, and confusion with the WF3b and/or WB3a units (with which it was typically complexed) is possible. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project.

BS was usually mapped as structural stage 3b. Near the ESSF-SBS border, however, it was occasionally mapped as structural stage 3a. This occurs when a very similar SBSmk1unit, BB3a, is mapped in the ESSFmv3 (as BS3a).

Assumed Site Modifiers under the Typical Situation: d, p

Site Modifiers Used: None

Structural Stages Mapped: 3a, 3b

Typical Situation: Hygric to subhygric nutrient-poor sites; high water table; deep organic deposits

Photo 21: BS3b ecosystem (plot 9801861)

Map Symbol	BS3a	BS3b
% Mean Tree Cover and Range	none	0
% Mean Shrub Cover and Range	high	55
% Mean Herb Cover and Range	medium	12
% Mean Cryptogam Cover and Range	high	90
Dominant Vegetation	Black spruce is scattered in the tree, tall, and low shrub layers. Scrub birch is the main low shrub but it is not dense. Sedges, especially along water edges are the main herb species. Sphagnum spp. are dominant as mosses.	Stunted black spruce with a vigorous shrub layer of scrub birch, Labrador tea and Barclay's willow dominate the shrub layer of the BS unit. *Sphagnum* spp. and red-stemmed feathermoss form a continuous moss layer upon which crowberry, wood horsetail, common horsetail and Sitka burnet may be found.
Associated Vegetation	Lodgepole pine is sometimes scattered in the tree and shrub layers. Labrador tea can occur. Crowberry and bluejoint may be present in the herb layer.	Scattered Engelmann spruce and lodgepole pine may also occur in this unit. Herbs and mosses present at 1% cover or less include palmate coltsfoot, subalpine daisy, bluejoint, *sedge,* and freckle pelt.
Plots	*9801881, GJ155*	**9801861**
Comments	Represents the BB3a unit from the SBSmk1 occurring in the ESSFmv3	Rare map unit; description based on limited plot data

5.4.6.2 00: CF: Cryptogam - Altai Fescue

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units)

General Description and Distribution: This community is present on some steep, rubbly talus slopes at high elevation. These sites have abundant boulders and rubble (unvegetated except for crustose lichens), thus CF is often complexed with the TA (Talus) unit. CF itself is usually dominated by a diversity of stunted and dwarf shrubs along with various xeric-site species. Dwarf shrubs were usually marginally more abundant than the other herbs and grasses, hence the designation as structural stage 3a. CF2b communities do occur, but photo-interpretation of these structural stages is not readily possible.

CF plots were recorded at high elevation sites within the ESSFmv3 (as low as c. 1680m) as well as in the ESSFmvp3 and AT. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project. The label 'CF' has been maintained from that project to this project.

Assumed Site Modifiers under the Typical Situation: c, s

Site Modifiers Used: k, w

Structural Stages Mapped: 3a

Typical Situation: Xeric to subxeric sites on steep, rugged terrain; coarse, shallow soils; colluvial veneers over bedrock.

Photo 22: CFk3a ecosystem (plot 9801857); note the abundance of loose rock.

Map Symbol	CF3a
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	12 (10 & 15)
% Mean Herb Cover and Range	13 (8 & 18)
% Mean Cryptogam Cover and Range	17 (15 & 20)
Dominant Vegetation	Stunted and dwarf shrubs are scattered throughout these communities, and include subalpine fir, black huckleberry, common juniper, and *Salix* spp. Mountain sagewort and altai fescue are scattered amongst the shrubs and boulders. Common, but not abundant, cryptogams include red-stemmed feathermoss, *Cetraria, Dicranum* and *Polytrichum* spp.
Associated Vegetation	Spreading stonecrop, three-toothed saxifrage, and a variety of other alpine herbs and grasses may occur at less than 1% percent cover. Freckle pelt is typical lichen, and there is much crustose lichen on the exposed boulders.
Plots	**9801857**, *GS90*
Comments	Many rocks and much exposed soil in this unit.

5.4.6.3 00: CS: Cottongrass – Sphagnum wetland

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units)

General Description and Distribution: These wetlands occur on gently sloping organic soils and are largely devoid of trees and tall shrubs. Cottongrass (or clubrushes, rarely) with a sphagnum understory result in a 'golf course-like' appearance. A wide variety of *Carex* spp. and grass spp. also occur along with a fair diversity of herbs. On occasion, these units are noticeably ridged, usually with the SB (Sedge-Buckbean wetland) unit in the flarks.

Assumed Site Modifiers under the Typical Situation: d, p

Site Modifiers Used: None

Structural Stages Mapped: 2b

Typical Situation: Level to gently sloping subhygric wetlands; deep organic deposits.

Photo 23: CS2b wetland, (plot GS122)

Map Symbol	**CS2b**
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	4.7 (0-26)
% Mean Herb Cover and Range	51 (21-80)
% Mean Cryptogam Cover and Range	79 (30-100)
Dominant Vegetation	Scattered low willows and scrub birch usually occur throughout the plot, typically at 5% cover or less. Low growing, narrow-leaved cotton-grass is the dominant herb species, although Sitka burnet is also commonly found. *Sphagnum* spp. (identified common red sphagnum several times) usually dominates the moist cryptogam layer
Associated Vegetation	A *Trichophorum* sp. and Bellard's kobresia sometimes replace the cotton-grass as the dominant graminoid, but the community structure and residual flora remain identical. Associated herbs may include alpine white marsh-marigold, water sedge, marsh cinquefoil, arrow-leaved groundsel, bluejoint, and many different sedge spp. (e.g. *carex leptalea, pauciflora, nigricans, tenuiflora,* and *limosa*). Mosses might include golden fuzzy fen moss, *Tomenthyptum,* and *Barbilophozia* spp.
Plots	**9801831, 9801833, 9801851, GJ19, GJ46, GJ57, GK37, GS93, GS122, GS149**

5.4.6.4 00: FK: Fir Krummholz

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units)

General Description and Distribution: Continuous cover of extremely stunted subalpine fir, low herb cover, and high cryptogam (mostly *Barbilophozia* spp.) cover characterize this unit. A few anomalous plots (9801835 and GS222) represent areas where richer herb areas finely interspersed with the dense krummholz, resulting in slightly lower krummholz shrub cover and relatively high herb cover.

FK is primarily an alpine (AT) and parkland (ESSFmvp3) unit but occasionally occurs at high elevation within the ESSFmv3 where avalanching keeps the subalpine fir in a krummholz form. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: j, m, s

Site Modifiers Used: d, k, v, w

Structural Stages Mapped: 3a

Typical Situation: Subxeric to mesic sites on gentle slopes with shallow, medium- textured soil.

Photo 24: Continuous FK3a ecosystem (plot GJ33) in avalanche track with forested area in background.

Map Symbol	**FK3a**
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	74 (35-95)
% Mean Herb Cover and Range	26 (2-65)
% Mean Cryptogam Cover and Range	48 (5-95)
Dominant Vegetation	Stunted alpine fir krummholz typically forms a very dense shrub layer. Black huckleberry is usually also present (from 0.1 to 8% cover). Herbs in the understory are usually dwarf shrubs, including crowberry, white mountain heather, dwarf blueberry and five-leaved bramble. *Barbilophozia* spp. are very common and abundant in the cryptogam layer, sometimes almost forming a mono-species carpet
Associated Vegetation	Common juniper may sometimes occur, especially on south-facing slopes. Scattered mountain sagewort, altai fescue and *Phyllodoce* spp. may occur in the herb layer. Red-stemmed feathermoss and *Dicranum* spp. are possible associated mosses.
Plots	**9801835**, *9801865*, **980187**2, *GJ33*, **GK33**, *GS32*, **GS222**

5.4.6.5 00: FW: Altai Fescue - Dwarf willow

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units)

General Description and Distribution: The dry subalpine and alpine meadow unit FW2b unit is characterized by an abundance of grasses (especially Altai fescue) occurring with mountain sagewort, purple mountain saxifrage, occasional dwarf willow, and abundant *Stereocaulon tomentosum.* Cryoturbation and gelifluction usually result in abundant exposed soil and stones on the surface. FW2d is a relatively rare, crowberry-dominated heath unit with scattered (c. 1% cover) fir krummholz. Floristically, FW2d is similar to the Fir-Crowberry (FC) unit with most of the trees absent.

The FW unit is typically found on ridge crests, mountain tops, and exposed upper slopes in the parkland subzone, but it also occurs on crests at the upper elevations of the ESSFmv3 and extends up into the alpine (AT). Plots from all three subzones were combined to generate the vegetation description below. This unit was previously mapped and described in the Omineca Biophysical Mapping Project Legend (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: j, m, s

Site Modifiers Used: d, k, v, w

Structural Stages Mapped: 2b, 2d

Typical Situation: Xeric to submesic sites on gentle to moderate slopes; shallow, medium-textured soils; ridge, crest, or upper slope positions.

Photo 25: FW2b ecosystem (plot VJ 80).

Map Symbol	FW2b	FW2d
% Mean Tree Cover and Range	0	0
% Mean Shrub Cover and Range	0.4 (0-3)	2.5 (1-4)
% Mean Herb Cover and Range	40 (20-60)	42.5 (15-70)
% Mean Cryptogam Cover and Range	33 (19-45)	22.5 (20-25)
Dominant Vegetation	Altai fescue is present in all plots (10% mean cover) as is mountain sagewort (2.4% mean cover). Purple mountain saxifrage is common but not overly abundant, and crowberry is occasionally abundant. Dominant cryptogams include *Stereocaulon tomentosum* and green reindeer lichen	FW2d is sparsely treed by subalpine fir and has abundant crowberry in the herb layer. Scattered common juniper usually occurs, as does scattered mountain sagewort. The cryptogam layer is discontinuous and might include *Stereocaulon tomentosum* and several other lichen species
Associated Vegetation	Stunted, scattered subalpine fir is found in some plots. Arctic willow is occasionally abundant (up to 35% cover) but not found in all plots. Other associated herbs may include inky gentian, *Aster, Phyllodoce,* and *Selaginella* spp.	Stunted lodgepole pine or Engelmann spruce may occur in addition to the more common subalpine fir. Lingonberry, alpine pussytoes and *Saxifraga* spp. may also occur intermittently
Plots	*9801828, 9801834, 9801873,GK27, GK174, GS109*, **GS156,** *VJ180*	**GJ01**, *GS83*
Comments		Not sufficient trees or shrubs to make this unit structural stage 3: dominated by crowberry, a dwarf shrub

5.4.6.6 00: FWy: Altai fescue - Dwarf willow, moister than average

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units)

General Description and Distribution: This moist subalpine alpine meadow unit occurs in receiving positions, moist cirques, and other areas where snowmelt and other moisture may accumulate. The flora of FWy differs from that of the FW unit, but these two units often grow in relatively close proximity. The higher soil moisture status in this ecosystem unit supports vigorous Bluejoint growth along with various other wet-site herbs. The FWy unit differs from the VG2a (Sitka valerian-Arrow-leaved groundsel)) unit in that the FWy is dominated by grasses and not herbs.

This is a relatively rare unit in the study area, occurring at upper elevations within the ESSFmv3 and into the ESSFmvp3 subzone. Plots from both these subzones were combined in order to generate the vegetation descriptions below.

Assumed Site Modifiers under the Typical Situation: j, m, d

Site Modifiers Used: y

Structural Stages Mapped: 2b

Typical Situation: Mesic to hygric sites on gentle slopes; receiving position; deep medium-textured soils.

Photo 26: FWy2b site (GK181)

Map Symbol	FWy2b
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	0.05 (0-0.1)
% Mean Herb Cover and Range	70 (50-90)
% Mean Cryptogam Cover and Range	60 (30-90)
Dominant Vegetation	Bluejoint, with lesser amounts of altai fescue and alpine timothy, is the dominant grass in this map unit. Other important herbs are sibbaldia and arrow-leaved groundsel. Red-stemmed feathermoss is the most abundant moss, but several other, unidentified, mosses were also common
Associated Vegetation	Alpine white marsh-marigold, diverse-leaved cinquefoil, fireweed, and several additional grass and sedge species are commonly associated with this unit. Associated cryptogams include green kidney lichen, green reindeer lichen and a *Polytrichum* sp.
Plots	**GK181**, *GS106*

5.4.6.7 00: MH: Mountain heather – Leafy liverwort snow bed community

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem units)

General Description and Distribution: This plant community occurs in areas of heavy winter snow accumulation and late snowpack in the spring. The flora of this unit is rather species poor and consists primarily of a carpet of white mountain heather with a few dwarf shrubs, grasses, and liverworts (especially *Barbilophozia* spp.). When this unit is in wet depression, however, the species diversity increases and may include more herbs, sedges, and mosses. This wetter variant is very difficult to pick out by photo-interpretation and was not mapped separately.

Detailed plot data for the MH unit is limited and consists of one plot in the ESSFmvp3. The MH unit was present at high elevations in the ESSFmv3 and also extends up into the AT zone.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: k, s

Structural Stages Mapped: 2d

Typical Situation: Submesic to subhygric sites in receiving positions; gentle to moderate slopes; deep, medium-textured soils; areas of snow accumulation and late snowpack.

Photo 27: MH2d site adjacent to forested GJ13 plot.

Map Symbol	MH2d
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	15
% Mean Herb Cover and Range	55
% Mean Cryptogam Cover and Range	70
Dominant Vegetation	White mountain heather is the dominant plant species, with covers ranging from about 30% in the wetter plot to about 80% in the drier plot. The only other dominant species in drier HL communities are *Barbilophozia* spp; wetter communities, by contrast, might have the following herbs and mosses: Sitka burnet, leatherleaf saxifrage, heart-leaved arnica, *Carex* spp., mountain hairgrass, red-stemmed feathermoss, *Drepanocladus* spp., and glow moss.
Associated Vegetation	Associated vegetation depends to some extent on the moisture regime, but might include pink mountain heather, altai fescue and mountain sagewort, as well as black alpine sedge and common horsetail in wetter areas
Plots	*9801866 (VS165)*
Comments	Plot VS165 is perhaps more representative of the typical, gently sloping snowpack unit, plot 9801866 represents a rarer, wetter unit found mainly in depressions. Photo-interpretation of these different units is very difficult and was not attempted

5.4.6.8 00: SB: Sedge - Buckbean wetland

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units)

General Description and Distribution: SB is a unit characteristic of hydric marshes, flarks in cotton-grass wetlands, and the vegetation at the edges of shallow ponds. Buckbean covers up to about 40% of the surface, and various other species occupy the mossy hummocks, if present.

Assumed Site Modifiers under the Typical Situation: d, p

Site Modifiers Used: None

Structural Stages Mapped: 2c

Typical Situation: Subhydric to hydric depressions with standing water, deep organic deposits.

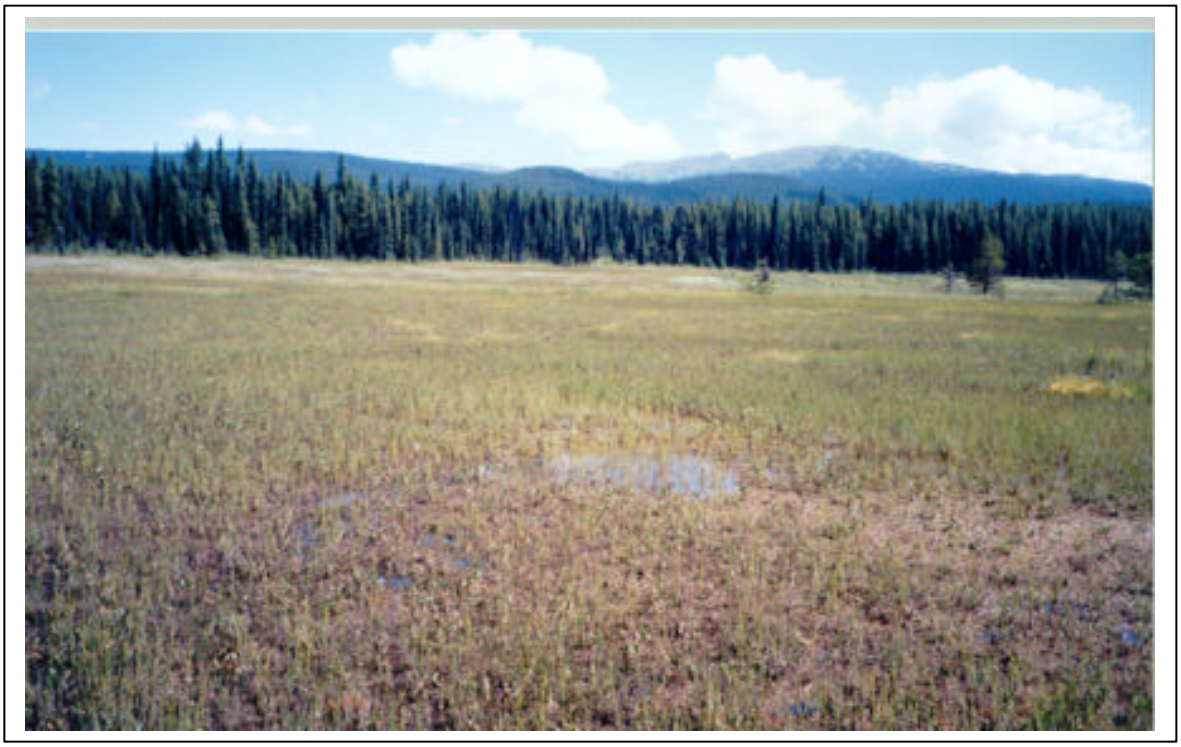

Photo 28: SB2c unit (plot 9801845); sedges are not always as abundant as in this particular plot, and the water level can be considerably higher.

Map Symbol	**SB2c**
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	0
% Mean Herb Cover and Range	15
% Mean Cryptogam Cover and Range	100
Dominant Vegetation	Buckbean and shore sedge grow in the water with long-leaved sundew and northern scouring-rush growing on hummocks. *Drepanocladus* spp., *Spagnum* spp. and glow moss are the dominant cryptogams.
Associated Vegetation	Insufficient data from one plot to speculate on associated plant species. Various aquatic plants (e.g. *Nuphar, Carex,* etc.) may be expected depending on the exact nature of the wetland
Plots	**9801845**

5.4.6.9 00: SF: Sedge - Fuzzy fen moss

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units)

General Description and Distribution: This fen unit is dominated by sedges with minimal shrubs present. It is quite distinct when viewed from the air and appears bright white on airphotos. In areas where it occurs with the Willow-Birch wetland unit (WB3a), there are often transitional areas where shrub cover is intermediate between SF2b and WB3a. SF is usually found on organic soils and is not as common as the WB3a wetland unit.

Assumed Site Modifiers under the Typical Situation: d, p

Site Modifiers Used: None

Structural Stages Mapped: 2b

Typical Situation: Hygric to hydric sites; deep organic (sometimes lacustrine) deposits

Photo 29: SF2b site (GS01) with Tania Tripp; some shrubbier WB3a at edges of fen.

Map Symbol	**SF2b**
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	9.5 (0-20)
% Mean Herb Cover and Range	44 (6.5-80)
% Mean Cryptogam Cover and Range	47 (9.5-90)
Dominant Vegetation	Water sedge is the most common and abundant sedge in this unit, occurring in two-thirds of plots with up to 70% cover. Narrow-leaved cotton-grass is also common, but not quite as abundant (mean cover 2.1 %). Various low *Salix* spp. occur (mean cover 6%) among the sedges, as does Sitka burnet. The moss layer is often dominated by golden fuzzy fen moss, usually with a *Sphagnum* spp. component
Associated Vegetation	Scrub birch occurs in about half of all plots, but is never very abundant. Ross' sedge is very abundant in about a third of all plots, and hair bentgrass occurs occasionally on drier hummocks and/or wetland margins. Other herbs may include various sedges, rushes, and spike-rushes. Associated mosses include glow moss, sickle moss and *Polytrichum* spp.
Plots	**GJ65, GJ70, GK42, GS01, GS44, GS60**

5.4.6.10 00: TC: Timothy - Sedge - herb meadow

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units)

General Description and Distribution: These meadow units are vegetated by low grasses, sedges, and herbs that are characterized by considerable floristic diversity. Trees and taller shrubs, when they occur, tend to be clumped and not spread evenly across the unit. This community is often complexed with SF (Sedge-Fuzzy fen moss fen) or WB (Willow-Birch wetland) communities, representing areas where the water table is closer to the surface.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: n

Structural Stages Mapped: 2b

Typical Situation: Subhygric to hygric; level to gently sloping sites. Medium textured soils on deep fluvial or lacustrine deposits.

Photo 30: TC2b meadow (plot GS200); some WB3a present in wetter areas.

Map Symbol	TC2b
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	6.3 (0-15)
% Mean Herb Cover and Range	66 (40-100)
% Mean Cryptogam Cover and Range	32 (0-70)
Dominant Vegetation	Dominant herbs include the grasses alpine timothy and bluejoint, as well as yarrow, dwarf blueberry, Sitka burnet, and dwarf nagoonberry. Cryptogams are not as abundant as in other treeless units, and there are none that are clearly dominant
Associated Vegetation	A few plots had scattered lodgepole pine or subalpine fir, but these were never very abundant. The diverse herb layer includes subalpine daisy, fireweed, arrow-leaved groundsel, water sedge, mountain sagewort, marsh cinquefoil, northern bedstraw and various *Carex* spp. Mosses that sometimes occur include juniper haircap moss, golden fuzzy fen moss, common red sphagnum, and an unidentified *Polytrichum* sp.
Plots	**GJ25, GJ255, GJ40, GS18, GS48, GS65, GS200**

5.4.6.11 00: VG: Sitka valerian - Arrow-leaved groundsel moist meadow

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units)

General Description and Distribution: The VG2a unit is a very lush, herb dominated ecosystem unit with abundant Sitka burnet, subalpine daisy, arrow-leaved groundsel, altai fescue, Sitka valerian, and many other subalpine herbs. This unit often resembles FV (Fir-Valerian) forest without trees and is often complexed with it. VG3a is rarer than VG2a, perhaps occurring in areas where there is greater movement of water through the soil. The VG3a unit differs from the VG2a unit primarily in its greater cover of willows.

VG occurs above approximately 1480 m within the ESSFmv3 and extends well into the ESSFmvp3. Plot data from both subzones were combined to generate the following vegetation descriptions. This unit was previously mapped and described (as the 'VR' unit) in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: g, k, p, s, w

Structural Stages Mapped: 2a, 3a

Typical Situation: Subhyric sites on gentle to moderate slopes; deep, medium-textured soils

Photo 31: VG2a meadow (9801836)

Map Symbol	VG2a	VG3a
% Mean Tree Cover and Range	0	0
% Mean Shrub Cover and Range	6 (0.1 - 16)	37
% Mean Herb Cover and Range	72 (40-95)	45
% Mean Cryptogam Cover and Range	12 (1-20)	90
Dominant Vegetation	The herb layer is very lush and abundant, typically including Sitka burnet, subalpine daisy, arrow-leaved groundsel, altai fescue, Sitka valerian, mountain sagewort, mountain monkshood, alpine white marsh-marigold, subalpine daisy and alpine timothy. Step moss and *Polytrichum* spp. are fairly common among the cryptogams.	Variable willow had a cover of 35% in the one polygon sampled. Common and abundant herbs include fireweed, leatherleaf saxifrage, common horsetail, Sitka burnet, Sitka valerian, and Indian hellebore. Glow moss and *Philonotis fontana* were abundant in the plot sampled
Associated Vegetation	Various willow species may occur scattered throughout the plot. Associated herbs may include bracted lousewort, dwarf blueberry, yarrow, diverse-leaved cinquefoil, alpine speedwell and many more. Glow moss may occur in the moss layer	Scattered subalpine fir was present in the plot, but not as abundant as in the FV unit. Many species occurred with low cover including *Agrostis variabilis,* bluejoint, soft-leaved sedge, and fireweed. Some *Sphagnum* spp. were present in the moss layer.
Plots	*9801852*, *9801836*, **GJ37, GK01, GK34**	**9801864**
Comments		Less common than VG2a, occurs in seepage areas and along drainage channels

5.4.6.12 00: WB: Willow – Birch-Sedge wetland

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units)

General Description and Distribution: The Willow-Birch (WB) wetland unit is a common, rather ecologically variable, wetland unit vegetated by a combination of sedges, scrub birch, and willow. The relative dominance of these three taxa varies from plot to plot, and this unit is assumed to be structural stage 3a (low shrub). A few plots, however, were actually structural stage 2b (graminoid dominated). The difference between structural stage 2b and 3a was not readily photo-interpretable, and thus all WB units are assumed to be structural stage 3a.

This unit is very similar to the BS3a unit in the SBSmk1.

Assumed Site Modifiers under the Typical Situation: d, j, p

Site Modifiers Used: n

Structural Stages Mapped: 3a

Typical Situation: Level to gently sloping sites on deep, organic deposits

Photo 32: WB3a ecosystem (VJ72)

Map Symbol	WB3a
% Mean Tree Cover and Range	0.7 (0-6)
% Mean Shrub Cover and Range	43 (10-75)
% Mean Herb Cover and Range	42 (15-65)
% Mean Cryptogam Cover and Range	75 (0-95)
Dominant Vegetation	The vegetation of this unit is quite diverse, but *Salix* spp. are usually present with percent covers ranging from 1% to 70%. Scrub birch occurs in slightly more than half of all plots, with covers between 1% and 45%. The dominant sedge is usually water sedge, with up to 50% cover. Sitka burnet and subalpine daisy are common, but not abundant, in the herb layer. *Sphagnum* spp. is sometimes the dominant moss, with covers up to 90%
Associated Vegetation	The associated flora is very diverse, but can include Engelmann spruce and/or lodgepole pine growing singly or in small clumps. Herbs sometimes present include bluejoint, yellow anemone, leatherleaf saxifrage, wood horsetail, common horsetail, and Sitka valerian. Freckle pelt and glow moss may occur in the cryptogam layer, as do many other mosses and liverworts
Plots	**GJ11, GJ50, GJ68, GJ89, GJ132, GJ166, GJ207, GJ256, GJ280, GS45, GS70**

5.4.6.13 00: WF: Willow-Birch floodplain

(Engelmann spruce – Subalpine Fir (ESSFmv3): Shrub and Herb Ecosystem Units)

General Description and Distribution: This unit is characterized by tall willows with a diverse assortment of other shrubs and herbs. Mosses are not very diverse or very abundant. A few plots had willows that were a less than 2 m tall (the cut-off for 3a *vs.* 3b), but this subtle difference in height was not photo-interpretable. All WF units, therefore, were mapped as structural stage 3b. This unit was usually found on fluvial deposits, occasionally with a thin organic veneer.

Assumed Site Modifiers under the Typical Situation: a, d, m

Site Modifiers Used: n, p

Structural Stages Mapped: 3b

Typical Situation: Level to gently sloping sites on deep, medium-textured fluvial deposits (sometimes with a thin organic veneer). Regular flooding.

Photo 33: WF3b from plot GS75 (with a small patch of grass in the foreground)

Map Symbol	WF3b
% Mean Tree Cover and Range	0.1 (0-1)
% Mean Shrub Cover and Range	66 (25-85)
% Mean Herb Cover and Range	50 (8-85)
% Mean Cryptogam Cover and Range	47 (3-90)
Dominant Vegetation	This unit is characterized by dense, usually tall, willows (cover between 40% and 80%). Herbs in the understory include Sitka burnet, arrow-leaved groundsel, fireweed, bluejoint, and common horsetail. Mosses are not very abundant in the strongly shaded and periodically inundated cryptogam layer
Associated Vegetation	Scattered Engelmann spruce and subalpine fir may occur in this unit, most commonly as tall shrubs but occasionally as isolated taller trees. Additional shrubs may include scrub birch and black twinberry. Herbs are diverse, but typically not too abundant, and may include Sitka valerian, western meadowrue, subalpine daisy, fringed grass-of-Parnassus and water sedge. Meadow horsetail was very abundant in one plot (85% cover) but not found in any other plot. Glow moss and golden fuzzy fen moss are two of the more commonly found mosses
Plots	**GJ07, GJ73, GJ212, GJ242, GK47, GK261, GS75, GS213**

5.4.7 Engelmann spruce – Subalpine Fir parkland (ESSFmvp3): Forested Ecosystem Units

5.4.7.1 00: FC: Subalpine fir – Crowberry

(Engelmann spruce – Subalpine Fir parkland (ESSFmvp3): Forested Ecosystem Units)

General Description and Distribution: This dry, subalpine unit is characterized by the presence of subalpine fir, abundant crowberry, and more lichen than mosses in the cryptogam layer. The trees in this ecosystem unit are usually (somewhat stunted) subalpine fir, although lodgepole pine and some Engelmann spruce can also occur. In the parkland subzone, this unit was mapped only as structural stage 3b, as it was never taller than 10 m tall.

The FC unit occurs in the upper portion of the ESSFmv3 (above c. 1450 m) as well as in the ESSFmvp3 parkland subzone. At higher elevations, this unit is often complexed with the dry FW alpine meadow unit. The plots used to describe the FC map unit were drawn from both the ESSFmv3 and the ESSFmvp3, as they were very similar floristically. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: j, m, r, s

Site Modifiers Used: k, v, w

Structural Stages Mapped: 3b

Typical Situation: Xeric to subxeric; gentle slopes on rocky ridges; dry, shedding site with shallow, medium-textured soils.

Photo 34: Stunted FCv3b forest complexed with crowberry dominated FW2d (plot GJ01).

Map Symbol	FC3b
% Mean Tree Cover and Range	2 (2-2)
% Mean Shrub Cover and Range	20 (15-25)
% Mean Herb Cover and Range	45 (40-50)
% Mean Cryptogam Cover and Range	38 (16-60)
Dominant Vegetation	Stunted (<10 m) subalpine fir is the dominant tree in FC3b. Crowberry is abundant (mean cover 18%), and other dominant herbs include four-angled mountain heather, dwarf blueberry, altai fescue, mountain sagewort, and pink mountain heather. Green reindeer lichen is abundant, as are various *Cladonia* spp. *Barbilophozia* spp. may also occur.
Associated Vegetation	Stunted lodgepole pine and Engelmann spruce occasionally occur in the shrub layer, but are never as abundant as subalpine fir. *Salix* spp. may, or may not, be present. Lichens may include Green kidney lichen, curly heron's bill moss and *Stereocaulon tomentosum*
Plots	*9801836, 9801840,* **GS113, GS158**
Comments	FC3b represents a climatic climax; the scattered trees are stunted by the extreme climate and will probably never get taller than the tall shrub stage

5.4.7.2 00: FM: Subalpine fir –White mountain heather

(Engelmann spruce – Subalpine Fir (ESSFmv3): Forested Ecosystem Units)

General Description and Distribution: The Subalpine fir – White mountain heather forest is characterized by subalpine fir trees and scattered shrubs interspersed by a carpet of white mountain heather and *Barbilophozia* spp. Herbs are sparse and limited, reflecting this unit's mesic status, low nutrient regime, and possibly a late snowpack in the spring. In some areas the white mountain heather is lacking or very sparse and is replaced by the *Barbilophozia spp*. These differences cannot be photo-interpreted and have been mapped as the same unit.

The FM unit occurs in the upper portions of the ESSFmv3 (above c. 1460 m) as well as in the ESSFmvp3 parkland subzone. At higher elevations, this unit is often complexed with the Mountain heather-Leafy liverwort snow bed unit (MH). The plots used to describe the FM unit were drawn from both the ESSFmv3 and the ESSFmvp3, as they were very similar floristically. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: k, r, s, w

Structural Stages Mapped: 3b, 3, 5, 6

Typical Situation: Submesic to mesic sites on gentle to moderate slopes; deep, medium-textured soils

Photo 35: FM3b forest (plot GS114) with extensive white-mountain heather cover.

Map Symbol	FM3b	FM3	FM4	FM5	FM6	FM7
% Mean Tree Cover and Range	2 (0-10)				16 (5-35)	11 (10-12)
% Mean Shrub Cover and Range	43 (15-65)				54 (25-85)	30 (20-40)
% Mean Herb Cover and Range	36 (0-80)				36 (3-70)	33 (15-50)
% Mean Cryptogam Cover and Range	38 (0.1-95)				58 (7-90)	70 (60-80)
Dominant Vegetation	Stunted subalpine fir dominates the shrub layer, although black huckleberry also occurs. The herb layer is dominated by white mountain heather, which, although not always present, usually covers at least 40% of the community. *Barbilophozia* and *Dicranum* spp. are common and abundant, especially in communities lacking white mountain heather.	**Speculation:** Assuming the disturbance (avalanche or fire) did not totally destroy the ground layer, the white mountain heather carpet should be relatively untouched. Regenerating subalpine fir occurs at various heights. Herbs might include heart-leaved arnica, five-leaved bramble, and Sitka valerian. *Barbilophozia* spp. still dominates the cryptogams.	**Speculation:** Subalpine fir is the primary tree species. Black huckleberry probably occurs in the shrub layer. White mountain heather is the dominant herb, but other herbs might include heart-leaved arnica, five-leaved bramble, and Sitka valerian. *Barbilophozia* spp. is probably the most abundant cryptogam.	**Speculation:** Subalpine fir is the primary tree species. Black huckleberry probably occurs in the shrub layer. White mountain heather is the dominant herb, but other herbs might include heart-leaved arnica, five-leaved bramble, and Sitka valerian. *Barbilophozia* spp. is probably the most abundant cryptogam.	Subalpine fir dominates the tree and shrub layers, with black huckleberry and white-flowered rhododendron occurring in the shrub layer. White mountain heather is the dominant herb, but other commonly found herbs include crowberry, five-leaved bramble. *Barbilophozia* spp., red-stemmed feathermoss, and *Dicranella* spp. are the most abundant cryptogams.	Subalpine fir dominates the tree and shrub layers, with black huckleberry occurring in the shrub layer. White mountain heather is the dominant herb, but other commonly found herbs include heart-leaved arnica, five-leaved bramble, and Sitka valerian. *Barbilophozia* spp. are usually very abundant, with covers between 20% and 50%)

Map Symbol	FM3b	FM3	FM4	FM5	FM6	FM7
Associated Vegetation	White-flowered rhododendron, more common at lower elevations, occurs on some transitional plots. Associated herbs include heart-leaved arnica, pink mountain heather, mountain sagewort and a variety of dry site lichens including *Cladina* and *Cladonia*, as well as freckle pelt	White-flowered rhododendron may occur. Herbs are probably similar to other structural stages, likely including one-sided wintergreen and pink mountain heather. In the moss layer red-stemmed feathermoss, freckle pelt and *Dicranum* spp. are expected	White-flowered rhododendron might occur occasionally. Herbs may include one-sided wintergreen, pink mountain heather and three-leaved foamflower. Cryptogams may include red-stemmed feathermoss, freckle pelt, and *Dicranum* spp.	White-flowered rhododendron might occur occasionally. Herbs may include one-sided wintergreen, pink mountain heather and three-leaved foamflower. Cryptogams may include red-stemmed feathermoss, freckle pelt, and *Dicranum* spp.	Herbs may include heart-leaved arnica, one-leaved foamflower, running clubmoss, single delight, arrow-leaved groundsel, and dwarf blueberry may occur. Occasional cryptogams include step moss, curly heron's-bill moss, grey reindeer lichen, freckle pelt and a variety of lichen and moss species.	White-flowered rhododendron occurs occasionally. Herbs may include one-sided wintergreen, pink mountain heather and three-leaved foamflower. Occasional cryptogams include red-stemmed feathermoss, freckle pelt, and *Dicranum* spp.
Plots	*9801839, 9801848, 9801871, GJ13, GJ15, GK38,* **GK180**, *GS43, GS96, GS114, GS159*	No Plot Data	No plot data	No Plot Data	*GJ130, GK20, GS98, GS115*	*GS16, GS92*
Comments	FM3b represents a climatic climax: this unit will never advance to a higher structural stage because of site exposure or high elevation	FM3 represents a regenerative stage following disturbance: it is typically at lower elevation than FM3b and is rarely mapped in the parkland. It will eventually advance to FM5/6/7	Not mapped	Rarely mapped in the parkland. Most stands are 3b.	All plot data is from the mv3. Structural stage 6 is rarely mapped in the parkland. Most stands are 3b.	All plot data is from the mv3. Structural stage 7 is not mapped in the parkland.

5.4.7.3 00: FV: Fir – Valerian

(Engelmann spruce – Subalpine Fir parkland (ESSFmvp3): Forested Ecosystem Units)

General Description and Distribution: Subalpine fir – Sitka valerian forest is characterized by subalpine fir trees interspersed with a very lush and diverse assortment of herbs including Sitka valerian, Indian hellebore, heart-leaved arnica, and Sitka burnet. This moist forest unit occurs in the ESSFmv3 above c. 1400 m, as well as in the ESSFmvp3 parkland subzone. Within the parkland, this unit is often complexed with the moist herbaceous meadow unit (VG).

The plots used to describe the FV map units were drawn from both the ESSFmv3 and the ESSFmvp3, as they were very similar floristically. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: s

Structural Stages Mapped: 3b, 6

Typical Situation: Gentle lower slope; receiving position; deep, medium-textured soils.

Photo 36: FV3b forest (plot GS162).

Map Symbol	FV3b	FV3	FV4	FV5	FV6	FV7
% Mean Tree Cover and Range	1.8 (0-7)	0			24 (2-40)	17 (10-20)
% Mean Shrub Cover and Range	34 (10-60)	45			23 (6-30)	13 (4-25)
% Mean Herb Cover and Range	43 (3-70)	40			42 (10-65)	43 (25-70)
% Mean Cryptogam Cover and Range	36 (4-90)	60			71 (55-95)	77 (50-90)
Dominant Vegetation	Widely spaced subalpine fir occurs, along with the occasional Engelmann spruce. Black huckleberry occurs in most plots at low percent cover (<2%). The herb layer is lush and diverse, including Sitka valerian, arrow-leaved groundsel, heart-leaved arnica, fireweed, Indian hellebore, bracted lousewort, Sitka burnet, and arctic lupine. *Barbilophozia* spp. are occasionally abundant in the cryptogam layer	Young subalpine fir may be relatively abundant, depending on time since disturbance. Shrubs and herbs are similar to more mature stands, and include black huckleberry, heart-leaved arnica, arrow-leaved groundsel, arctic lupine, one-sided wintergreen, and dwarf blueberry. *Barbilophozia* spp. and red-stemmed feathermoss are fairly abundant.	**Speculation:** Subalpine fir is the dominant tree and shrub, but black huckleberry is also present in most plots. The herb layer is extremely lush and diverse, the dominant species including Sitka valerian, Indian hellebore, heart-leaved arnica, Sitka burnet, arrow-leaved groundsel, subalpine daisy, and one-sided wintergreen. The dominant cryptogams are probably *Barbilophozia* spp.	**Speculation:** Subalpine fir is the dominant tree and shrub, but black huckleberry is also present in most plots. The herb layer is extremely lush and diverse, the dominant species including Sitka valerian, Indian hellebore, heart-leaved arnica, Sitka burnet, arrow-leaved groundsel, subalpine daisy, and one-sided wintergreen. The dominant cryptogams are probably *Barbilophozia* spp.	Combined tree and shrub cover of subalpine fir cover ranges from about 20% to about 55%. Black huckleberry is present in most plots. The herb layer is extremely lush and diverse, the dominant species including Sitka valerian (mean cover c. 20%), Indian hellebore, heart-leaved arnica, Sitka burnet, arrow-leaved groundsel, subalpine daisy, and one-sided wintergreen. The dominant cryptogams are *Barbilophozia* spp.	Combined tree and shrub cover of subalpine fir cover ranges from about 20% to about 55%. Black huckleberry is present in most plots. The herb layer is extremely lush and diverse, the dominant species including Sitka valerian (mean cover c. 20%), Indian hellebore, heart-leaved arnica, Sitka burnet, arrow-leaved groundsel, subalpine daisy, and one-sided wintergreen. The dominant cryptogams are *Barbilophozia* spp.

Map Symbol	FV3b	FV3	FV4	FV5	FV6	FV7
Associated Vegetation	White flowered rhododendron occasionally occurs (<5% cover). Many additional herbs may be found in this unit, including subalpine daisy, white mountain heather, and mountain monkshood. *Dicranum* spp. are occasionally present among the mosses.	Indian hellebore, subalpine daisy, and running clubmoss may occur at low % cover. Freckle pelt may occur in the moss layer.	Black gooseberry and various low *Salix* spp. may occur in the shrub layer. Possible herbs include one and three-leaved foamflower, western meadowrue, mountain monkshood, fringed grass-of-Parnassus, five-leaved bramble, bracted lousewort and many more. Associated cryptogams may include freckle pelt, curly heron's bill moss, glow moss and red-stemmed feathermoss	Black gooseberry and various low *Salix* spp. may occur in the shrub layer. Possible herbs include one and three-leaved foamflower, western meadowrue, mountain monkshood, fringed grass-of-Parnassus, five-leaved bramble, bracted lousewort and many more. Associated cryptogams may include freckle pelt, curly heron's bill moss, glow moss and red-stemmed feathermoss	Black gooseberry and various low *Salix* spp. may occur in the shrub layer. Possible herbs include one and three-leaved foamflower, western meadowrue, mountain monkshood, fringed grass-of-Parnassus, five-leaved bramble, bracted lousewort and many more. Associated cryptogams include freckle pelt, curly heron's bill moss, glow moss and red-stemmed feathermoss	Black gooseberry and various low *Salix* spp. may occur in the shrub layer. Possible herbs include one and three-leaved foamflower, western meadowrue, mountain monkshood, fringed grass-of-Parnassus, five-leaved bramble, bracted lousewort and many more. Associated cryptogams include freckle pelt, curly heron's bill moss, glow moss and red-stemmed feathermoss
Plots	**9801836**, *9801842*, *GJ35, GJ102,* **GJ186**, *GS39, GS162*	*GS116*	No plot data	No plot data	*9801858, 9801860, 9801862, GJ211, GK18, GK121, GK186, GS79*	*9801850, 9801859, GS143*
Comments	FV3b represents a climatic climax: this unit will never advance to a higher structural stage because of site exposure or high elevation	FV3 represents a regenerative stage following disturbance: it is typically at lower elevation than FV3b and will eventually advance to FV5/6/7 but this stage is not mapped in the parkland	Not mapped in parkland	Not mapped in parkland	All plot data is from the mv3. Only one polygon mapped as structural stage 6 in the parkland. Most is stunted 3b stage.	All plot data is from the mv3. Structural stage 7 forests are not mapped in the mvp3. Probably nearly all 3b.

5.4.8 Engelmann spruce – Subalpine Fir parkland (ESSFmvp3): Shrub and Herb Ecosystem Units

5.4.8.1 00: CF: Cryptogam - Altai Fescue

(Engelmann spruce – Subalpine Fir parkland (ESSFmvp3): Shrub and Herb Ecosystem Units)

General Description and Distribution: This community is present on some steep, rubbly talus slopes at high elevation. These sites have abundant boulders and rubble (unvegetated except for crustose lichens), thus CF is often complexed with the TA (Talus) unit. CF itself is usually dominated by a diversity of stunted and dwarf shrubs along with various xeric-site species. Dwarf shrubs were usually marginally more abundant than the other herbs and grasses, hence the designation as structural stage 3a. CF2b communities do occur, but photo-interpretation of these structural stages is not readily possible.

CF ecosystems occurred at high elevation sites within the ESSFmv3 (as low as c. 1680m) as well as in the ESSFmvp3 and AT. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project. The label 'CF' has been maintained from that project to this project.

Assumed Site Modifiers under the Typical Situation: c, s

Site Modifiers Used: d, k, v, w

Structural Stages Mapped: 3a

Typical Situation: Xeric to subxeric sites on steep, rugged terrain; coarse, shallow soils; colluvial veneers over bedrock.

Photo 37: CFk3a ecosystem (plot GS90); note the abundance of boulders and bedrock.

Map Symbol	CF3a
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	12 (10 & 15)
% Mean Herb Cover and Range	13 (8 & 18)
% Mean Cryptogam Cover and Range	17 (15 & 20)
Dominant Vegetation	Stunted and dwarf shrubs are scattered throughout these communities, and include subalpine fir, black huckleberry, common juniper, and *Salix* spp. Mountain sagewort and altai fescue are scattered amongst the shrubs and boulders. Common, but not abundant, cryptogams include red-stemmed feathermoss, *Cetraria, Dicranum* and *Polytrichum* spp.
Associated Vegetation	Spreading stonecrop, three-toothed saxifrage, and a variety of other alpine herbs and grasses may occur at less than 1% percent cover. Freckle pelt is typical lichen, and there are many crustose lichens on the exposed boulders.
Plots	*9801857*, **GS90**
Comments	Many rocks and much exposed soil in this unit.

5.4.8.2 00: CS: Cottongrass – Sphagnum wetland

(Engelmann spruce – Subalpine Fir parkland (ESSFmvp3): Shrub and Herb Ecosystem Units)

General Description and Distribution: These wetlands occur on gently sloping organic soils and are largely devoid of trees and tall shrubs. Cottongrass (or clubrushes, rarely) with a *Sphagnum* understory result in a 'golf course-like' appearance. A wide variety of *sedge* spp. and grass spp. also occurs, along with a fair diversity of herbs. On occasion, these units are noticeably ridged, usually with the SB (Sedge-Buckbean wetland) unit in the depressions. These ecosystem units occur very infrequently within the parkland, and data to describe this unit comes mostly from the ESSFmv3.

Assumed Site Modifiers under the Typical Situation: d, p

Site Modifiers Used: none

Structural Stages Mapped: 2b

Typical Situation: Level to gently sloping subhygric wetlands; deep organic deposits

No photographs of CS2b in ESSFmvp3 subzone available, but units are visually identical to those at lower elevations.

Map Symbol	CS2b
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	4.7 (0-26)
% Mean Herb Cover and Range	51 (21-80)
% Mean Cryptogam Cover and Range	79 (30-100)
Dominant Vegetation	Scattered low willows and scrub birch usually occur throughout the plot, typically at 5% cover or less. Low growing narrow-leaved cotton-grass is the dominant herb species, although Sitka burnet is also commonly found. *Sphagnum* spp. (identified common red sphagnum several times) usually dominates the moist cryptogam layer
Associated Vegetation	A *Trichophorum* sp. and Bellard's kobresia sometimes replace the cotton-grass as the dominant graminoid, but the community structure and residual flora remain identical. Associated herbs may include alpine white marsh-marigold, water sedge, marsh cinquefoil, arrow-leaved groundsel, bluejoint, and many different sedge spp. (e.g. *carex leptalea, pauciflora, nigricans, tenuiflora,* and *limosa*). Mosses might include golden fuzzy fen moss, *Tomenthyptum,* and *Barbilophozia* spp.
Plots	*9801831, 9801833, 9801851, GJ19, GJ46, GJ57, GK37, GS93, GS122, GS149*

5.4.8.3 00: FK: Fir Krummholz

(Engelmann spruce – Subalpine Fir parkland (ESSFmvp3): Shrub and Herb Ecosystem Units)

General Description and Distribution: This unit is characterized by continuous cover of extremely stunted subalpine fir, low herb cover, and high cryptogam (mostly *Barbilophozia* spp.) cover. A few anomalous plots (9801835 and GS222) represent areas where richer herb areas are finely interspersed with the dense krummholz, resulting in slightly lower krummholz shrub cover and relatively high herb cover.

FK is primarily an alpine (AT) and parkland (ESSFmvp3) unit but occasionally occurs at high elevation within the ESSFmv3 where avalanching keeps the subalpine fir in a krummholz form. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: j, m, s

Site Modifiers Used: d, k, r, v, w

Structural Stages Mapped: 3a

Typical Situation: Subxeric to mesic sites on gentle slopes with shallow, medium- textured soil.

Photo 38: FK3a area on broad ridge crest (plot VK15)

Map Symbol	FK3a
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	74 (35-95)
% Mean Herb Cover and Range	26 (2-65)
% Mean Cryptogam Cover and Range	48 (5-95)
Dominant Vegetation	Stunted alpine fir krummholz typically forms a very dense shrub layer. Black huckleberry is usually also present (from 0.1 to 8% cover). Herbs in the understory are usually dwarf shrubs, including crowberry, white mountain heather, dwarf blueberry and five-leaved bramble. *Barbilophozia* spp. are very common and abundant in the cryptogam layer, sometimes almost forming a mono-species carpet
Associated Vegetation	Common juniper may sometimes occur, especially on south-facing slopes. Scattered mountain sagewort, altai fescue and *Phyllodoce* spp. may occur in the herb layer. Red-stemmed feathermoss and *Dicranum* spp. are possible associated mosses.
Plots	*9801835, 9801865, 9801872, GJ33, GK33, GS32, GS222*

5.4.8.4 00: FW: Altai Fescue - Dwarf willow

(Engelmann spruce – Subalpine Fir parkland (ESSFmvp3): Shrub and Herb Ecosystem Units)

General Description and Distribution: The dry subalpine and alpine meadow unit FW2b unit is characterized by an abundance of grasses (especially Altai fescue) occurring with mountain sagewort, purple mountain saxifrage, occasional dwarf willow, and abundant *Stereocaulon tomentosum.* Cryoturbation and gelifluction usually result in abundant exposed soil and stones on the surface. FW 2d is a relatively rare, crowberry-dominated heath unit with scattered (c. 1% cover) fir krummholz. Floristically, FW2d is similar to the Fir-Crowberry (FC) unit with most of the trees absent.

The FW unit is typically found on ridge crests, mountain tops, and exposed upper slopes in the parkland subzone but it also occurs on crests at the upper elevations of the ESSFmv3 and extends up into the alpine (AT). Plots from all three subzones were combined to generate the vegetation description below. This unit was previously mapped and described in the Omineca Biophysical Mapping Project Legend (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: j, m, s

Site Modifiers Used: d, g, k, v, w

Structural Stages Mapped: 2b, 2d

Typical Situation: Xeric to submesic sites on gentle to moderate slopes; shallow, medium-textured soils; ridge, crest, or upper slope positions

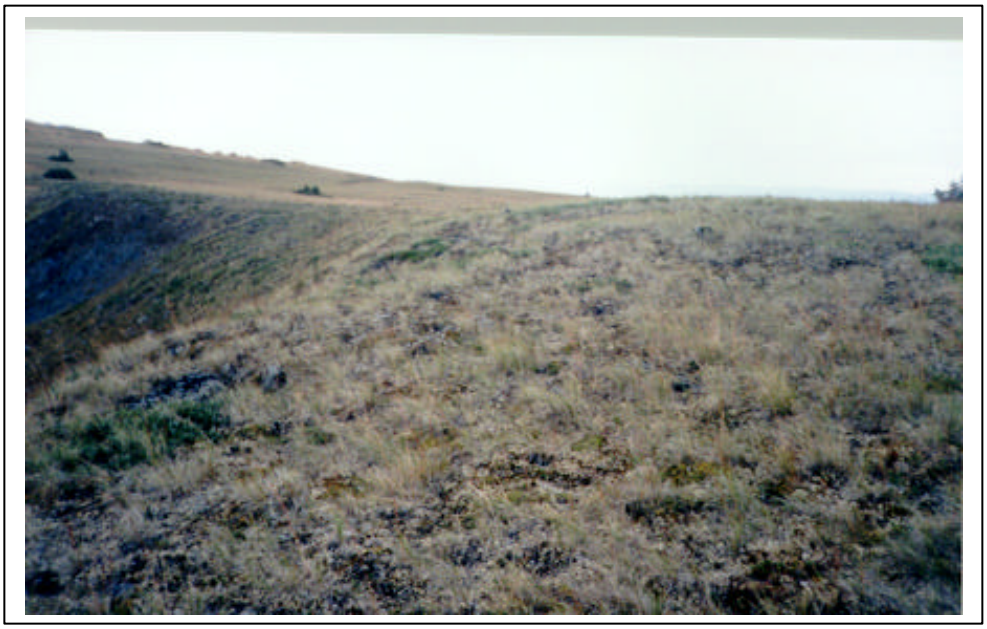

Photo 39: FW2b on ridge crest (plot GK174).

Map Symbol	FW2b	FW2d
% Mean Tree Cover and Range	0	0
% Mean Shrub Cover and Range	0.4 (0-3)	2.5 (1-4)
% Mean Herb Cover and Range	40 (20-60)	42.5 (15-70)
% Mean Cryptogam Cover and Range	33 (19-45)	22.5 (20-25)
Dominant Vegetation	Altai fescue is present in all plots (10% mean cover) as is mountain sagewort (2.4% mean cover). Purple mountain saxifrage is common but not overly abundant, and crowberry is occasionally abundant. Dominant cryptogams include *Stereocaulon tomentosum* and green reindeer lichen	FW2d is sparsely treed by subalpine fir and has abundant crowberry in the herb layer. Scattered common juniper usually occurs, as does scattered mountain sagewort. The cryptogam layer is discontinuous and might include *Stereocaulon tomentosum* and several other lichen species
Associated Vegetation	Stunted, scattered subalpine fir is found in some plots. Arctic willow is occasionally abundant (up to 35% cover) but not found in all plots. Other associated herbs may include inky gentian, *Aster, Phyllodoce,* and *Selaginella* spp.	Stunted lodgepole pine or Engelmann spruce may occur in addition to the more common subalpine fir. Lingonberry, alpine pussytoes and *Saxifraga* spp. may also occur intermittently
Plots	**9801828, 9801834,** *9801873***, GK27, GK174, GS109**, *GS156*, **VJ180**	*GJ01*, **GS83**

5.4.8.5 00: FWy: Altai fescue - Dwarf willow, moister than average

(Engelmann spruce – Subalpine Fir parkland (ESSFmvp3): Shrub and Herb Ecosystem Units)

General Description and Distribution: This moist subalpine alpine meadow unit occurs in receiving positions, moist cirques, and other areas where snowmelt and other moisture may accumulate. The flora of FWy differs from that of the FW unit, but these two units often grow in relatively close proximity. The higher soil moisture status in this ecosystem unit supports vigorous growth of bluejoint, along with various other wet-site herbs. The FWy unit differs from the VG2a (Sitka valerian-Arrow-leaved groundsel)) unit in that the FWy is dominated by grasses and not herbs.

This is a relatively rare unit in the study area, occurring at upper elevations within the ESSFmv3 and into the ESSFmvp3 subzone. Plots from both these subzones were combined in order to generate the vegetation descriptions below.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: y

Structural Stages Mapped: 2b

Typical Situation: Mesic to hygric sites on gentle slopes; receiving position; deep medium-textured soils

Photo 40: FWy2b site (GS106) at base of talus slope with Corey Erwin.

Map Symbol	FWy2b
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	0.05 (0-0.1)
% Mean Herb Cover and Range	70 (50-90)
% Mean Cryptogam Cover and Range	60 (30-90)
Dominant Vegetation	Bluejoint, with lesser amounts of altai fescue and alpine timothy, is the dominant grass in this map unit. Other important herbs are sibbaldia and arrow-leaved groundsel. Red-stemmed feathermoss is the most abundant moss, but several other, unidentified, mosses were also common
Associated Vegetation	Alpine white marsh-marigold, diverse-leaved cinquefoil, fireweed, and several additional grass and sedge species are commonly associated with this unit. Associated cryptogams include green kidney lichen, green reindeer lichen and a *Polytrichum* sp.
Plots	*GK181*, **GS106**

5.4.8.6 00: MH: Mountain heather – Leafy liverwort snow bed community

(Engelmann spruce – Subalpine Fir parkland (ESSFmvp3): Shrub and Herb Ecosystem Units)

General Description and Distribution: This community occurs in areas of heavy winter snow accumulation and late snowpack in the spring. The flora of this unit is rather species poor and consists primarily of a carpet of white mountain heather with a few dwarf shrubs, grasses, and liverworts (especially *Barbilophozia* spp.). When this unit is in a wet depression, however, the species diversity increases and may include more herbs, sedges, and mosses. This wetter variant is very difficult to pick out by photo-interpretation and was not mapped separately.

Detailed plot data for the MH unit is limited and consists of one plot in the ESSFmvp3. The MH unit was present at high elevations in the ESSFmv3 and also extends up into the AT zone.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: k, s, w

Structural Stages Mapped: 2d

Typical Situation: Submesic to subhygric sites in receiving positions; gentle to moderate slope; deep, medium-textured soils; areas of snow accumulation and late snowpack.

Photo 41: MH2d site in slight depression below ridge crest (VS165).

Map Symbol	MH2d
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	15
% Mean Herb Cover and Range	55
% Mean Cryptogam Cover and Range	70
Dominant Vegetation	White mountain heather is the dominant plant species, with covers ranging from about 30% in the wetter plot to about 80% in the drier plot. The only other dominant species in drier HL communities are *Barbilophozia* spp; wetter communities, by contrast, might have the following herbs and mosses: Sitka burnet, leatherleaf saxifrage, heart-leaved arnica, *Carex* spp., mountain hairgrass, red-stemmed feathermoss, *Drepanocladus* spp., and glow moss.
Associated Vegetation	Associated vegetation depends to some extent on the moisture regime, but might include pink mountain heather, altai fescue and mountain sagewort, as well as black alpine sedge and common horsetail in wetter areas
Plots	**9801866 (VS165)**
Comments	Plot VS165 is perhaps more representative of the typical, gently sloping snowpack unit, plot 9801866 represents a rarer, wetter unit found mainly in depressions. Photo-interpretation of these different units is very difficult and was not attempted

5.4.8.7 00: VG: Sitka valerian – Arrow-leaved groundsel moist meadow

(Engelmann spruce – Subalpine Fir parkland (ESSFmvp3): Shrub and Herb Ecosystem Units)

General Description and Distribution: The VG unit is a very lush, herb-dominated ecosystem unit with abundant Sitka burnet, subalpine daisy, arrow-leaved groundsel, altai fescue, Sitka valerian, and many other subalpine herbs. This unit often resembles the FV (Fir-Valerian) forest unit without trees and is often complexed with it. VG3a is rarer than VG2a, perhaps occurring in areas where there is greater movement of water through the soil. The VG3a unit differs from the VG2a unit primarily in its greater cover of willows.

VG occurs above approximately 1480 m within the ESSFmv3 and extends well into the ESSFmvp3. Plot data from both subzones were combined to generate the following vegetation descriptions. This unit was previously mapped and described (as the 'VR' unit) in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: g, k, s, w

Structural Stages Mapped: 2a, 3a

Typical Situation: Subhyric sites on gentle to moderate slopes; deep, medium-textured soils

Photo 42: VGs3a site (GK34); note the diversity and lushness of herb cover.

Map Symbol	VG2a	VG3a
% Mean Tree Cover and Range	0	0
% Mean Shrub Cover and Range	6 (0.1 - 16)	37
% Mean Herb Cover and Range	72 (40-95)	45
% Mean Cryptogam Cover and Range	12 (1-20)	90
Dominant Vegetation	The herb layer is very lush and abundant, typically including Sitka burnet, subalpine daisy, arrow-leaved groundsel, altai fescue, Sitka valerian, mountain sagewort, mountain monkshood, alpine white marsh-marigold, subalpine daisy and alpine timothy. Step moss and *Polytrichum* spp. are fairly common among the cryptogams.	Variable willow had a cover of 35% in the one polygon sampled. Common and abundant herbs include fireweed, leatherleaf saxifrage, common horsetail, Sitka burnet, Sitka valerian, and Indian hellebore. Glow moss and *Philonotis fontana* were abundant in the plot sampled
Associated Vegetation	Various willow species may occur scattered throughout the plot. Associated herbs may include bracted lousewort, dwarf blueberry, yarrow, diverse-leaved cinquefoil, alpine speedwell and many more. Glow moss may occur in the moss layer	Scattered subalpine fir was present in the plot, but not as abundant as in the FV unit. Many species occurred with low cover including *Agrostis variabilis,* bluejoint, soft-leaved sedge, and fireweed. Some *Sphagnum* spp. were present in the moss layer.
Plots	**9801852**, *GJ37, GK01, GK34*	*9801864*
Comments		Rarer than VR2a, typically occurs in seepage areas or in drainage channels

5.4.9 Sub-Boreal Spruce, moist cool, Mossvale variant (SBSmk1)

5.4.10 Sub-Boreal Spruce (SBSmk1) – Forested Ecosystem Units

5.4.10.1 01: SB: Sxw – Black huckleberry – Highbush Cranberry

(Sub-Boreal Spruce (SBSmk1): Forested Ecosystem Units)

General Description and Distribution: Within the study area, mesic stands occurred on fluvial deposits within the main valleys of Moosmoos Creek and Klawli River. Consistently occurring willows and scrub birch are not listed in the field guide and some of the shrubs listed were never observed. Thimbleberry and birch-leaved spirea were not observed in the study area but are the main shrubs listed for mesic sites. Herbs and mosses observed are similar to those listed in the field guide.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: k, s, v, w

Structural Stages Mapped: 3, 4, 5, 6, 7

Typical Situation: Gentle slopes on deep medium-textured soils.

Photo 43: SB6 forest (plot VJ232) on fluvial deposits

Map Symbol	SB3	SB4	SB5	SB6	SB7
% Mean Tree Cover and Range			25 (20-30)		14
% Mean Shrub Cover and Range			26 (12-40)		14
% Mean Herb Cover and Range			53 (60-45)		20
% Mean Cryptogam Cover and Range			65 (50-80)		95
Dominant Vegetation	**Speculation:** No burnt or logged sites were sampled. The shrubs, willows, scrub birch, and black twinberry will probably be denser than under tree cover. Herbs found in the young forests will also occur. The moss layer may be destroyed by fire but would partially remain if logged.	**Speculation:** The youngest forests will be similar to structural stage 5, as the canopy will not be very dense so the shrubs and herbs will be similar. Lodgepole pine forms the main tree canopy. Willow, black twinberry, and scrub birch form the low shrub layer. Herbs are quite diverse and abundant and always include bunchberry, Sitka burnet, dwarf blueberry, fireweed and palmate-leaved coltsfoot. Red-stemmed feathermoss and Knight's plume form a moss carpet.	Lodgepole pine forms the main tree canopy. Willow, black twinberry and scrub birch form the low shrub layer. Herbs are quite diverse and abundant and always include bunchberry, Sitka burnet, dwarf blueberry, fireweed and palmate-leaved coltsfoot. Red-stemmed feathermoss and Knight's plume form a moss carpet.	**Speculation:** These mature forests will resemble the old forests as fir and spruce gain the main canopy. Lodgepole pine and hybrid white spruce form the main tree canopy. Subalpine fir and white spruce are regenerating in the shrub layers. Shrub cover is quite sparse and includes those species of younger forests such as black twinberry, scrub birch and willows. Herbs are rather sparse and always include bunchberry, palmate-leaved coltsfoot, with scattered fireweed and Sitka burnet. Mosses, including red-stemmed feathermoss, knight's plume, and step moss form a carpet. Freckle pelt is scattered.	Lodgepole pine and hybrid white spruce form the main tree canopy. Subalpine fir and white spruce are regenerating in the shrub layers. Shrub cover is quite sparse and includes those species of younger forests such as black twinberry, scrub birch and willows. Herbs are rather sparse and always include bunchberry, palmate-leaved coltsfoot, with scattered fireweed and Sitka burnet. Mosses, including red-stemmed feathermoss, knight's plume, and step moss form a carpet. Freckle pelt is scattered.
Associated Vegetation		Subalpine fir and white spruce are sometimes in the tree and shrub layers. Bluejoint and northern bedstraw. Step moss and freckled pelt sometimes occur.	Subalpine fir and white spruce are sometimes in the tree and shrub layers. Bluejoint and northern bedstraw. Step moss and freckled pelt sometimes occur.	Twinflower, one sided wintergreen, common horsetail, and stiff clubmoss will start to appear.	Twinflower, one sided wintergreen, common horsetail, and stiff clubmoss occurred in the old forest sampled.
Plots	No Plot Data	No Plot Data	**GS125, VJ272**	No Plot Data	**GJ226**

5.4.10.2 03: LC: Pl – Feathermoss - Cladina

(Sub-Boreal Spruce (SBSmk1): Forested Ecosystem Units)

General Description and Distribution: These lodgepole pine stands are quite consistent in their range of species throughout the different structural stages. The shrub and herb layers are often sparse so that there is very good visibility in the stands. The cryptogam layer is very well developed and varied. All stands visited occurred on fluvio-glacial deposits.

Assumed Site Modifiers under the Typical Situation: c, d

Site Modifiers Used: h, k, t, v, w

Structural Stages Mapped: 3, 4, 5, 6

Typical Situation: Level sites on deep, coarse-textured soils.

Photo 44: LC6 (plot GJ223) with noticeable lichen cover.

Map Symbol	LC3	LC4	LC5	LC6	LC7
% Mean Tree Cover and Range	5 (0-5)	25	19 (5-35)		
% Mean Shrub Cover and Range	23 (20-25)	3 (1-8)	8 (1-19)		
% Mean Herb Cover and Range	3 (1-4)	19 (4-50)	34 (0.1-55)		
% Mean Cryptogam Cover and Range	70 (60-80)	53 (10-80)	66 (30-90)		
Dominant Vegetation	Lodgepole pine is the only species in the tall shrub layer. The low shrub layer is very poorly developed with no consistent species. Twinflower, dwarf blueberry, and kinnikinnick are scattered. The cryptogam layer forms a carpet of primarily Cladina and Cladonia species. Green reindeer lichen is the most common but brown pixie cup and *Cladonia gracilis* are also present. Juniper haircap moss and curly heron's bill mosses also occur.	Lodgepole pine is the only species in the tree and tall shrub layers. The low shrub layer is very poorly developed with no consistent species. Kinnikinnick dominates the herb layer. Cryptogams are really varied and are dominated by Cladina and Cladonia species. Green reindeer lichen and horn cladonia are the most common. Red-stemmed feathermoss and curly heron's bill moss usually occur.	Lodgepole pine is the only species in the main tree canopy. Subalpine fir and white spruce are now present in the shrub layer together with lodgepole pine but the shrub layer is generally sparse. Kinnikinnick, crowberry, and dwarf blueberry are usually present. Crowberry can form extensive patches or the herb layer can be sparse. Green reindeer lichen and *Cladonia gracilis* are abundant.	**Speculation:** Lodgepole pine is the only species in the main tree canopy. Subalpine fir and white spruce are now present in the shrub layer together with lodgepole pine but the shrub layer is generally sparse. Kinnikinnick, crowberry, and dwarf blueberry are usually present. Crowberry can form extensive patches or the herb layer can be sparse. Green reindeer lichen and Cladonia gracilis are abundant.	**Speculation:** If this structural stage ever developed, there would be scattered subalpine fir and white spruce in the tree canopy with the lodgepole pine. All three tree species would be regenerating in the shrub layers. Low shrubs would be generally lacking. Herb and cryptogams would be similar to earlier structural stages as the range of species is quite limited in this site series and they appear consistently through all structural stages.
Associated Vegetation	Willow and black huckleberry can occur in all structural stages. Other scattered herbs that also occur in all structural stages include bunchberry, crowberry, lingonberry, bluejoint, and fireweed. Freckle pelt can be present.	Lodgepole pine may also occur in the low shrub layer. Other herbs that may be sparse include lingonberry, dwarf blueberry, bunchberry and twinflower. Other cryptogams include *Stereocaulon tomentosum, Cladonia gracilis,* grey reindeer lichen, brown pixie cup, freckle pelt and haircap mosses.	Palmate-leaved coltsfoot may occur. Red-stemmed feathermoss and curly heron's bill moss can be locally abundant. *Stereocaulon tomentosum,* grey reindeer lichen, brown pixie cup and horned cladonia can all occur.	Palmate-leaved coltsfoot may occur. Red-stemmed feathermoss and curly heron's bill moss can be locally abundant. *Stereocaulon tomentosum,* grey reindeer lichen, brown pixie cup and horned cladonia can all occur.	
Plots	**GJ221, GK204 GK156, VJ264**	**GJ222, GJ237, GK208**	**GJ218, GJ223, GK207, GK250**	No Plot Data	No Plot Data
Comments	Not common. Result of recent burn	Commonly mapped structural stage	Most commonly mapped structural stage	Rare in the study area and assumed to be similar to SS5.	Not mapped. Probably does not exist in the study area as past fire disturbance

5.4.10.3 05: ST SxwFd – Toad-flax

(Sub-Boreal Spruce (SBSmk1): Forested Ecosystem Units)

General Description and Distribution: This ecosystem unit is the only one observed to have variable stand composition within the study area. The stand composition (B for broad-leaved, M for mixed and C for coniferous cover) is added to the database. Broad-leaved stands are dominated by trembling aspen, while coniferous stands are dominated by lodgepole pine. At early seral shrub stages only mixed or aspen stands occur. As the stands age, lodgepole pine becomes more dominant so that in mature forests, only coniferous stands occur.

Assumed Site Modifiers under the Typical Situation: d, m, w

Site Modifiers Used: j, k, s, v

Structural Stages Mapped: 3, 4, 5, 6

Typical Situation: Significant warm slopes on deep, medium-textured soils.

Photo 45: ST3 (plot GJ148) on warm south facing slope

Map Symbol	ST3B and M	ST4B,M and C	ST5M and C	ST6C	ST7
% Mean Tree Cover and Range	1(0-2)	50	45(40-50)		
% Mean Shrub Cover and Range	55 (50-60)	40	11(8-15)		
% Mean Herb Cover and Range	10(5-15)	10	17(10-25)		
% Mean Cryptogam Cover and Range	0	15	35(30-40)		
Dominant Vegetation	Trembling aspen, either as pure stands or mixed with lodgepole pine, form the main shrub layer. Bebb's willow and subalpine fir may also occur as tall shrubs. Scattered lodgepole pine may occur in the tree layer. Saskatoon and common juniper form the low shrub layer. Herbs are rather sparse and include western meadowrue, twinflower, and bunchberry. The moss layer is lacking.	Pure stands of lodgepole pine, mixed stands of lodgepole pine and aspen or pure stands of aspen can all occur as the main tree canopy. Subalpine fir may also occur. Prickly rose and soopolallie will be the main shrubs occurring. Bunchberry and twinflower are the most consistent and noticeable herbs. The moss layer will be poorly developed	Pure stands of lodgepole pine or mixed stands of lodgepole pine and aspen form the main tree canopy of these young forests. Prickly rose and soopolallie are the main shrubs occurring. Bunchberry and twinflower are the most consistent and noticeable herbs. The moss layer is varied.	**Speculation:** Pure stands of lodgepole pine form the main tree canopy of these mature forests. Prickly rose and soopolallie are the main shrubs occurring. Bunchberry and twinflower are the most consistent and noticeable herbs. The moss layer is varied.	Not mapped and probably does not exist.
Associated Vegetation	Soopalallie can also occur.	One-sided wintergreen may occur.	Lodgepole pine, subalpine fir, and white spruce may occur in the shrub layers. Common juniper may be scattered while black huckleberry seems to occur in the coniferous stands. Fireweed and one-sided wintergreen can occur. Heart-leaved arnica and clubmoss appears to be more likely in the coniferous stands. Knight's plume is the most frequently occurring moss.	Lodgepole pine, subalpine fir, and white spruce will probably occur in the shrub layers together with black huckleberry. Fireweed, one-sided wintergreen, heart-leaved arnica, and clubmoss are in these coniferous stands. Knight's plume is the most frequently occurring moss.	-
Plots	*GJ148, VJ147, VJ150*	**VJ152**	**GJ151, GJ225, VJ154,VK245**	No plots	Not mapped
Comments					Probably does not exist, as disturbance by fire will have occurred.

5.4.10.4 06: BH Sb – Huckleberry - Spiraea

(Sub-Boreal Spruce (SBSmk1): Forested Ecosystem Units)

General Description and Distribution: The vegetation in this site series is not the same as that listed in the field guide. Lodgepole pine is the main tree species in the young forest canopies, and it is also common in the understory as the stand ages and becomes more open. Black spruce is lacking. The most abundant and consistently occurring shrub species is scrub birch. The herb and moss layers are similar to the field guide. This ecosystem unit commonly occurs adjacent to wetlands along Moosmoos Creek and its tributaries.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: k, t

Structural Stages Mapped: 4, 5, 6, 7

Typical Situation: Gentle slopes on medium-textured soils with a poor nutrient regime.

Photo 46: BH4 (plot ES124) showing pine stand with well developed moss layer.

Map Symbol	**BH3**	**BH4**	**BH5**	**BH6**	**BH7**
% Mean Tree Cover and Range		37 (30-45)	29 (20-40)		
% Mean Shrub Cover and Range		7 (4-10)	27 (5-40)		
% Mean Herb Cover and Range		25 (15-40)	38 (22-60)		
% Mean Cryptogam Cover and Range		77 (65-95)	65 (45-90)		
Dominant Vegetation	**Speculation:** Disturbance would probably result in lodgepole pine regeneration in quite a dense shrub layer of scrub birch. Fir and spruce would also regenerate. Willows might be quite common. Herbs and mosses would be similar to SS4	The tree canopy of lodgepole pine is quite dense at this stage and lodgepole pine is not common in the understory. Scrub birch as a low shrub is consistent. Sparse white-flowered rhododendron occurred in all the sites visited. Dwarf blueberry is abundant, as is bunchberry. Palmate-leaved coltsfoot and fireweed are more scattered. The moss carpet is often dominated by red-stemmed feathermoss.	The tree canopy of lodgepole pine is less dense as the stand ages and lodgepole pine is common in the understory. Scrub birch as a low shrub is consistent. Dwarf blueberry is abundant, as is bunchberry. Palmate-leaved coltsfoot and fireweed are more scattered. The moss carpet is often dominated by red-stemmed feathermoss.	**Speculation:** The tree canopy of lodgepole pine is less dense as the stand ages and lodgepole pine is common in the understory. Scrub birch as a low shrub is consistent. Dwarf blueberry is abundant, as is bunchberry. Palmate-leaved coltsfoot and fireweed are more scattered. The moss carpet is often dominated by red-stemmed feathermoss.	**Speculation:** The stand may have a mixed canopy of lodgepole pine and spruce with a minor component of subalpine fir. Scrub birch will be the main low shrub. Dwarf blueberry and bunchberry will be abundant. Palmate-leaved coltsfoot and fireweed will be more scattered. The moss carpet will be often dominated by red-stemmed feathermoss.
Associated Vegetation		White spruce, subalpine fir, and willows are often in the understory. Other shrubs may include black huckleberry, soopolallie, and black twinberry. Twinflower, crowberry, bluejoint, five-leaved bramble, one-sided wintergreen, and clubmosses may also occur. Freckle pelt, Knight's plume, and Barbilophozia lycopodioides can be scattered.	White spruce, subalpine fir, and willows are often in the understory. Other shrubs may include black huckleberry, soopolallie, and black twinberry. Twinflower, crowberry, bluejoint, five-leaved bramble, one-sided wintergreen, and clubmosses may also occur. Freckle pelt, Knight's plume, and Barbilophozia lycopodioides can be scattered.	White spruce, subalpine fir, and willows are often in the understory. Other shrubs may include black huckleberry, soopolallie, and black twinberry. Twinflower, crowberry, bluejoint, five-leaved bramble, one-sided wintergreen, and clubmosses may also occur. Freckle pelt, Knight's plume, and Barbilophozia lycopodioides can be scattered.	Other shrubs may include black huckleberry, soopolallie, and black twinberry. Twinflower, crowberry, bluejoint, five-leaved bramble, one-sided wintergreen, and clubmosses may also occur. Freckle pelt, Knight's plume, and Barbilophozia lycopodioides could be scattered.
Plots	No Plot Data	**9801880, GK209, GS197**	**9801884, GK210, GS128, GS131, GS196**	No Plot Data	No Plot Data
Comments				Described from SS5	Described from SS5 and the field guide.

5.4.10.5 07: SO Sxw – Oak Fern

(Sub-Boreal Spruce (SBSmk1): Forested Ecosystem Units)

General Description and Distribution: These nutrient rich forests occur on active floodplains and floodplain benches as well as streamside locations and fluvial fans. The 08 Sxw-Devil's club site series has not been mapped in the study area, and no devil's club was observed; however, this type of moister site may be included in the SO (07) map units.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: k, n, w

Structural Stages Mapped: 3, 4, 5, 6, 7

Typical Situation: Gentle, lower slopes in receiving sites on deep, medium-textured soils with a rich nutrient regime.

Photo 47: SO6 (plot GK152). Spruce stands with varied herb and moss layers.

Map Symbol	SO3	SO4	SO5	SO6	SO7
% Mean Tree Cover and Range				47 (40-60)	20
% Mean Shrub Cover and Range				15 (5-25)	35
% Mean Herb Cover and Range				20 (15-25)	30
% Mean Cryptogam Cover and Range				90 (85-95)	90
Dominant Vegetation	**Speculation:** Spruce, fir, and lodgepole pine may all be present in the regeneration. Willows will probably be denser than in the older forests. The herb species present in the older forests will also occur.	**Speculation:** Lodgepole pine may be more common in the tree canopy at this early seral stage. Spruce and fir will be present. Willows may be denser than in the older forests. Herb and moss species may be similar to stage 5.	**Speculation:** Engelmann spruce and subalpine fir are both common in the main tree canopy while lodgepole pine is a very minor component. Spruce and fir are common in the understory. Black twinberry and willows are the main shrubs. Herbs are diverse but include subalpine daisy, Sitka burnet, fireweed, five-leaved bramble, bunchberry, palmate-leaved coltsfoot, and western meadowrue. Step moss red-stemmed feathermoss and scattered freckle pelt always occur.	Engelmann spruce and subalpine fir are both common in the main tree canopy while lodgepole pine is a very minor component. Spruce and fir are common in the understory. Black twinberry and willows are the main shrubs. Herbs are diverse but include subalpine daisy, Sitka burnet, fireweed, five-leaved bramble, bunchberry, palmate-leaved coltsfoot, and western meadowrue. Step moss red-stemmed feathermoss and scattered freckle pelt always occur.	Engelmann spruce and subalpine fir are both common in the main tree canopy while lodgepole pine is a very minor component. Spruce and fir are common in the understory. Black twinberry and willows are the main shrubs. Herbs are diverse but include subalpine daisy, Sitka burnet, fireweed, five-leaved bramble, bunchberry, palmate-leaved coltsfoot, and western meadowrue. Step moss red-stemmed feathermoss and scattered freckle pelt always occur.
Associated Vegetation			Black huckleberry may be scattered. Other possible herbs include bluejoint, dwarf blueberry, common horsetail, twinflower and heart-leaved arnica. Knight's plume and glow mosses may also occur.	Black huckleberry may be scattered. Other possible herbs include bluejoint, dwarf blueberry, common horsetail, twinflower and heart-leaved arnica. Knight's plume and glow mosses may also occur.	Black huckleberry may be scattered. Other possible herbs include bluejoint, dwarf blueberry, common horsetail, twinflower and heart-leaved arnica. Knight's plume and glow mosses may also occur.
Plots	No Plot Data	No Plot Data	No Plot Data	**GK152, GK253, GS134**	**GK254**

5.4.10.6 09: SH: Sxw - Horsetail

(Sub-Boreal Spruce (SBSmk1): Forested Ecosystem Units)

General Description and Distribution: Most of the ecosystem units visited were in the fluvial phase of this site series. The organic phase occurs when p has been used as a site modifier. These sites are usually associated with drainage channels and the edges of waterways.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: n, p

Structural Stages Mapped: 3b, 3, 4, 5, 6, 7

Typical Situation: Hygric, gentle to level slopes on deep, medium-textured soils.

Photo 48: SH6 (plot GK157) showing abundant horsetails.

Map Symbol	SH3b	SH3	SH4	SH5	SH6	SH7
% Mean Tree Cover and Range		0		30	30	
% Mean Shrub Cover and Range		50		40	15	
% Mean Herb Cover and Range		50		35	90	
% Mean Cryptogam Cover and Range		75		20	80	
Dominant Vegetation	These sites will be stunted mature forests in poorer nutrient conditions and wetter moisture regimes than the treed stands. Species will probably be similar to the open structural stage 3 with willows and sedges.	After a burn lodgepole pine, spruce and black spruce will all regenerate in the shrub layer. Willows can be quite abundant. Sitka burnet, bunchberry, common and meadow horsetails, sedges, and fireweed are the main species in the herb layer. Mosses can be varied.	**Speculation:** Lodgepole pine or spruce can form the main tree canopy with spruce in the understory. Black gooseberry and black twinberry are scattered as low shrubs. Common horsetail is usually abundant with bunchberry, fireweed, Sitka burnet, tall bluebells, and bluejoint with less cover. Moss cover is not very well developed but Knight's plume is the most common species.	Lodgepole pine or spruce can form the main tree canopy with spruce in the understory. Black gooseberry and black twinberry are scattered as low shrubs. Common horsetail is usually abundant with bunchberry, fireweed, Sitka burnet, tall bluebells, and bluejoint with less cover. Moss cover is not very well developed but Knight's plume is the most common species.	Lodgepole pine or spruce can form the main tree canopy with spruce in the understory. Black gooseberry and black twinberry are scattered as low shrubs. Common horsetail is usually abundant with bunchberry, fireweed, Sitka burnet, tall bluebells, and bluejoint with less cover. Moss cover is not very well developed but Knight's plume is the most common species.	**Speculation:** Lodgepole pine or spruce can form the main tree canopy with spruce in the understory. Black gooseberry and black twinberry are scattered as low shrubs. Common horsetail is usually abundant with bunchberry, fireweed, Sitka burnet, tall bluebells, and bluejoint with less cover. Moss cover is not very well developed but Knight's plume is the most common species.
Associated Vegetation		Black twinberry will often occur. On organic sites, scrub birch will be present. Twinflower can be locally common. Red-stemmed feather moss and Sphagnum species are often abundant.	Trembling aspen may form a minor component in the understory. Willows can occur, Other herb species may include oak fern, clasping twistedstalk and trailing raspberry.	Trembling aspen may form a minor component in the understory. Willows can occur, Other herb species may include oak fern, clasping twistedstalk and trailing raspberry.	Trembling aspen may form a minor component in the understory. Willows can occur, Other herb species may include oak fern, clasping twistedstalk and trailing raspberry.	Trembling aspen may form a minor component in the understory. Willows can occur, Other herb species may include oak fern, clasping twistedstalk and trailing raspberry.
Plots	No Plot Data	**9801882**	No Plot Data	**9801883**	**GK-157**	No Plot Data
Comments					This is the most commonly mapped structural stage.	

5.4.10.7 10: BB Sb – Scrub birch - Sedge

(Sub-Boreal Spruce (SBSmk1): Forested Ecosystem Units)

General Description and Distribution: These are stunted, open black spruce stands that occur adjacent to treeless wetlands in back swamp locations, primarily within the floodplains of Klawli River and Moosmoos Creek. Although this unit is a SBSmk1 plant community, it was occasionally mapped in the ESSFmv3 close to the SBSmk1 boundary; when this occurred it was mapped as BS3a. The BS unit in the ESSFmv3 and the BB unit in the SBSmk1 are very similar in terms of typical situation, vegetation, and appearance.

Assumed Site Modifiers under the Typical Situation: p

Site Modifiers Used: None

Structural Stages Mapped: 3a, 3b

Typical Situation: Organic bog wetland.

Photo 49: BB3a (plotGJ155) in Klawli River floodplain.

Map Symbol	BB3a	BB3b
% Mean Tree Cover and Range	2 (0-4)	2
% Mean Shrub Cover and Range	23 (20-25)	25
% Mean Herb Cover and Range	55 (45-65)	30
% Mean Cryptogam Cover and Range	88 (80-95)	95
Dominant Vegetation	Black spruce is scattered in the tree, tall, and low shrub layers. Scrub birch is the main low shrub but it is not dense. Sedges, especially along water edges are the main herb species. Sphagnum spp. are dominant as mosses.	Black spruce is scattered in the tree, tall, and low shrub layers. Scrub birch is the main low shrub but it is not dense. Sedges, especially along water edges are the main herb species. Sphagnum spp. are dominant as mosses.
Associated Vegetation	Lodgepole pine is sometimes scattered in the tree and shrub layers. Labrador tea can occur. Crowberry and bluejoint may be present in the herb layer.	Lodgepole pine is sometimes scattered in the tree and shrub layers. Labrador tea can occur. Crowberry and bluejoint may be present in the herb layer.
Plots	**9801881, GJ155**	**GS183**

5.4.11 Sub-Boreal Spruce (SBSmk1): Shrub and Herb Ecosystem Units

5.4.11.1 00: BS Scrub birch – Sedge poor fen

(Sub-Boreal Spruce (SBSmk1): Shrub and Herb Ecosystem Units)

General Description and Distribution: The Scrub birch – Sedge poor fen unit is common in the floodplains of Klawli River and Moosmoos Creek. These units are usually quite structurally homogenous with shrubs below 80 cm in height.

This unit is analogous to the WB3a unit found in the ESSFmv3.

Assumed Site Modifiers under the Typical Situation: d, j, p

Site Modifiers Used: none

Structural Stages Mapped: 3a

Typical Situation: Level, on deep organic deposits.

Photo 50: BS3a (plotGJ228)

Map Symbol	BS3a
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	41 (12-70)
% Mean Herb Cover and Range	38 (30-50)
% Mean Cryptogam Cover and Range	75 (25-100)
Dominant Vegetation	Scrub birch and various willows form a low somewhat open low shrub layer. Water sedge fills in between the shrubs. The moss layer is usually thick and well developed with a varied specific composition although *Sphagnum* species or golden fuzzy fen mosses are often dominant.
Associated Vegetation	Lodgepole pine trees may be very scattered in the tree layer or spruce, lodgepole pine or fir saplings may occur in the shrub layer but they are very minor components. Shore sedge, bluejoint and nagoonberry may be locally common. Mosses may include glow moss, leafy mosses or common tree moss.
Plots	**GJ228, GS194, VJ156, VJ261**

5.4.11.2 00: SF Sedge – Fuzzy Fen Moss fen

(Sub-Boreal Spruce (SBSmk1): Shrub and Herb Ecosystem Units)

General Description and Distribution: This fen unit is dominated by sedges with minimal shrubs present. It is quite distinct when viewed from the air and appears bright white on airphotos. In areas where it occurs with the Scrub birch – Sedge poor fen unit (BS3a), there is often a zone of transition where shrub cover is higher. SF is almost always found on organic soils and is not as common as the BS3a fen unit.

Assumed Site Modifiers under the Typical Situation: d, p

Site Modifiers Used: None

Structural Stages Mapped: 2b

Typical Situation: Deep organic deposits

No photograph available but a very similar unit, also mapped as 'SF', is found in the ESSFmv3.

Map Symbol	SF2b
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	0
% Mean Herb Cover and Range	90
% Mean Cryptogam Cover and Range	10
Dominant Vegetation	Ross' and water sedge are the most common and abundant sedges in this unit. Together they have a cover of up to 90. Bluejoint is often scattered conspicuously throughout.
Associated Vegetation	Arrow-leaved groundsel, marsh cinquefoil, and alpine speedwell may occur. Common tree moss was present in the plot.
Plots	**GS192**
Comments	This is essentially the same unit as the sedge fen unit in the ESSFmv3.

5.4.11.3 00: SM Sedge – Moss bog wetland

(Sub-Boreal Spruce (SBSmk1): Shrub and Herb Ecosystem Units)

General Description and Distribution: A continuous moss cover is the most conspicuous feature of this unit. Herbs are rather scattered, and there are no trees. This unit is rare in the study area and only occurs in the Klawli River and Moosmoos Creek floodplains.

Based on very limited plot data, the SM unit may be analogous to the SB unit in the ESSFmv3.

Assumed Site Modifiers under the Typical Situation: p

Site Modifiers Used: None

Structural Stages Mapped: 1b

Typical Situation: Organic bog wetland.

Photo 51: SM1b (plot GJ238) in Moosmoos meadows area

Map Symbol	SM1b
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	3 (0-9)
% Mean Herb Cover and Range	33(15-45)
% Mean Cryptogam Cover and Range	95(85-100)
Dominant Vegetation	Sedges form very open herb layer on a continuous carpet of moss. Shore sedge is the dominant herb species. Buckbean grows in the wettest parts.
Associated Vegetation	Scattered scrub birch, lodgepole pine and Labrador tea can occur. Indicators of bog conditions, western bog laurel, bog cranberry, bog-rosemary and crowberry occurred at one site. *Sphagnum* spp. may be the only mosses present but sickle moss formed the main species at one site.
Plots	**GJ219, GJ238, 9801886**

5.4.11.4 00: TC Timothy – Sedge herb meadow

(Sub-Boreal Spruce (SBSmk1): Shrub and Herb Ecosystem units)

General Description and Distribution: These meadow units are vegetated by low grasses, sedges, and herbs that represent considerable floristic diversity. Trees and taller shrubs, when they occur, tend to be clumped within the unit to form a mosaic of ecosystem units. This unit occurs on the floodplains of the Klawli River and Moosmoos Creek.

Assumed Site Modifiers under the Typical Situation: d, j, m

Site Modifiers Used: p

Structural Stages Mapped: 2b

Typical Situation: Level to gently sloping meadows on deep medium-textured soils, fluvial and lacustrine deposits.

Photo 52: TC2b(plot VJ263) extensive herbaceous meadows bordered by fluvial willow shrub.

Map Symbol	TC2b
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	6 (2.1-10)
% Mean Herb Cover and Range	77 (50-100)
% Mean Cryptogam Cover and Range	33 (15-50)
Dominant Vegetation	Dominant herbs include the grasses such as alpine timothy and bluejoint, as well as yarrow, northern bedstraw, Sitka burnet, western meadowrue, diverse-leaved cinquefoil, sedges, and nagoonberry. Cryptogams are not as abundant as in other treeless units, and there are none that are clearly dominant, although juniper haircap moss commonly occurs.
Associated Vegetation	A few plots had scattered lodgepole pine in the shrub layer. The diverse herb layer includes subalpine daisy, fireweed, mountain monkshood, sorrel, and wood strawberry. Glow moss may also occur.
Plots	**98018877, GJ231, GJ271, GK205, VK202**
Comments	

5.4.11.5 00: WB Willow – Bluejoint floodplain

(Sub-Boreal Spruce (SBSmk1): Shrub and Herb Ecosystem units)

General Description and Distribution: This unit is characterized by tall willows with a diverse assortment of other shrubs and herbs. Mosses are not very diverse or very abundant. A few plots had willows that were more than 2 m tall (the cut-off for 3a *vs.* 3b), but for the WB unit, structural stage 3a was more common and more commonly mapped than structural stage 3b. This unit was usually found on fluvial deposits, occasionally with a thin organic veneer. This unit is similar to the WF unit in the ESSFmv3, albeit typically with lower shrubs.

Assumed Site Modifiers under the Typical Situation: a, d, m

Site Modifiers Used: None

Structural Stages Mapped: 3a, 3b

Typical Situation: Level to gently sloping sites on medium-textured soils. Regular flooding.

Photo 53: WB3a (adjacent to plot GK211) along Moosmoos Creek.

Map Symbol	WB3a/3b
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	63 (20-90)
% Mean Herb Cover and Range	41 (25-60)
% Mean Cryptogam Cover and Range	12 (7-30)
Dominant Vegetation	This unit is characterized by dense, low willow although some sites have a significant tall willow component also. Scrub birch occurs with less cover. The herb layer is dominated by bluejoint, water sedge, and fireweed. Mosses are not very abundant in the strongly shaded and periodically inundated cryptogam layer
Associated Vegetation	Additional shrubs may include black twinberry. Herbs are diverse, but typically not too abundant, and may include Sitka burnet, nagoonberry and subalpine daisy,
Plots	**GJ229, GK211, GK256, GS195**
Comments	This unit is similar to the WF willow unit in the ESSFmv3 but is usually a low shrub rather than tall shrub unit.

5.4.12 Alpine Tundra (AT)

5.4.12.1 00: CF: Cryptogam - Altai Fescue

(Alpine Tundra (AT): All Ecosystem Units)

General Description and Distribution: This community is present on some steep, rubbly talus slopes at high elevation. These sites have abundant boulders and rubble (unvegetated except for crustose lichens), thus CF is often complexed with the TA (Talus) unit. CF itself is usually dominated by a diversity of stunted and dwarf shrubs along with various xeric-site species. Dwarf shrubs were usually marginally more abundant than the other herbs and grasses, hence the designation as structural stage 3a. CF2b communities do occur, but photo-interpretation of these structural stages is not readily possible.

CF ecosystems occurred at high elevation sites within the ESSFmv3 (as low as c. 1680m) as well as in the ESSFmvp3 and AT. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project. The label 'CF' has been maintained from that project to this project.

Assumed Site Modifiers under the Typical Situation: c, s

Site Modifiers Used: d, k, v, w

Structural Stages Mapped: 3a

Typical Situation: Xeric to subxeric sites on steep, rugged terrain; coarse, shallow soils; colluvial veneers over bedrock.

No photograph available: Similar to sites in Section 5.4.8.1

Map Symbol	CF3a
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	12 (10 & 15)
% Mean Herb Cover and Range	13 (8 & 18)
% Mean Cryptogam Cover and Range	17 (15 & 20)
Dominant Vegetation	Stunted and dwarf shrubs are scattered throughout these communities, and include subalpine fir, black huckleberry, common juniper, and *Salix* spp. Mountain sagewort and altai fescue are scattered amongst the shrubs and boulders. Common, but not abundant, cryptogams include red-stemmed feathermoss, *Cetraria, Dicranum* and *Polytrichum* spp.
Associated Vegetation	Spreading stonecrop, three-toothed saxifrage, and a variety of other alpine herbs and grasses may occur at less than 1% percent cover. Freckle pelt is typical lichen, and there are many crustose lichens on the exposed boulders.
Plots	*9801857, GS90*
Comments	Many rocks and much exposed soil in this unit.

5.4.12.2 00: FK: Subalpine fir Krummholz

(Alpine Tundra (AT): All Ecosystem Units)

General Description and Distribution: This unit is characterized by continuous cover of extremely stunted subalpine fir, low herb cover, and high cryptogam (mostly *Barbilophozia* spp.) cover. When the FK unit occurs in the AT zone, it occurs as small, scattered clumps of subalpine fir, typically complexed with rubble or Fescue-Willow (FW) grassland. The large, homogenous expanses of FK common in the ESSFmv3 and ESSFmvp3 do not occur in the AT. A few anomalous plots (9801835 and GS222) represent plots with a richer herb flora; these sites are not representative of what might be expected to occur in the AT zone

Plot data from the ESSFmv3, ESSFmvp3, and the AT was combined to generate the vegetation descriptions below. This unit was previously mapped and described in the *Omineca Biophysical Mapping Project Legend* (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: j, m, s

Site Modifiers Used: k, r, w

Structural Stages Mapped: 3a

Typical Situation: Subxeric to mesic sites on gentle slopes; shallow, medium-textured soils; colluvial (and morainal) slopes.

Photo 54: FK3a clump beside Jason Hindson on ridge crest (VK13)

Map Symbol	FK3a
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	74 (35-95)
% Mean Herb Cover and Range	26 (2-65)
% Mean Cryptogam Cover and Range	48 (5-95)
Dominant Vegetation	Stunted alpine fir krummholz typically forms a very dense shrub layer. Black huckleberry is usually also present (from 0.1 to 8% cover). Herbs in the understory are usually dwarf shrubs, including crowberry, white mountain heather, dwarf blueberry and five leaved brambles. *Barbilophozia* spp. are very common and abundant in the cryptogam layer, sometimes almost forming a mono-species carpet
Associated Vegetation	Common juniper may sometimes occur, especially on south-facing slopes. Scattered mountain sagewort, altai fescue and *Phyllodoce* spp. may occur in the herb layer. Red-stemmed feathermoss and *Dicranum* spp. are possible associated mosses.
Plots	*9801835, 9801865, 9801872, GJ33, GK33*, **GS32**, *GS222*
Comments	

5.4.12.3 00: FW: Altai Fescue - Dwarf willow

(Alpine Tundra (AT): All Ecosystem Units)

General Description and Distribution: This dry alpine meadow unit is characterized by an abundance of grasses (especially Altai fescue) occurring with mountain sagewort, purple mountain saxifrage, occasional dwarf willow, and abundant *Stereocaulon tomentosum.* Cryoturbation and gelifluction usually result in abundant exposed soil and stones on the surface. The FW2d unit, present in the parkland, was not mapped in the AT.

FW is the most common ecosystem unit in the AT zone, found on ridge crests, mountain tops, and exposed upper slopes. It also occurs on crests at the upper elevations of the ESSFmv3, as well as in the ESSFmvp3. Plots from all three subzones were combined to generate the vegetation description below. This unit was previously mapped and described in the Omineca Biophysical Mapping Project Legend (McKenzie 1993) and has been adapted for use in this project.

Assumed Site Modifiers under the Typical Situation: j, m, r, s

Site Modifiers Used: k, v, w

Structural Stages Mapped: 2b

Typical Situation: Xeric to submesic sites on gentle to moderate slopes; shallow, medium-textured soils; ridge, crest, or upper slope positions.

Photo 55: FW2b (plot 9801873) with Jason Hindson

Map Symbol	FW2b
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	0.4 (0-3)
% Mean Herb Cover and Range	40 (20-60)
% Mean Cryptogam Cover and Range	33 (19-45)
Dominant Vegetation	Altai fescue is present in all plots (10% mean cover) as is mountain sagewort (2.4% mean cover). Purple mountain saxifrage is common but not overly abundant, and crowberry is occasionally abundant. Dominant cryptogams include *Stereocaulon tomentosum* and green reindeer lichen
Associated Vegetation	Stunted, scattered subalpine fir is found in some plots. Arctic willow is occasionally abundant (up to 35% cover) but not found in all plots. Other associated herbs may include inky gentian, *Aster, Phyllodoce,* and *Selaginella* spp.
Plots	*9801828, 9801834*, **9801873**, **GJ120**, *GK27, GK174*, **GS105**, *GS109*, *GS156, VJ180*

5.4.12.4 00: MH: Mountain heather – Leafy liverwort snow bed community

General Description and Distribution: This community occurs in areas where heavy winter snow accumulation and slow melting in the spring retards the development of most species. The flora of this unit is rather species poor, consisting primarily of a carpet of white mountain heather with a few dwarf shrubs, grasses, and liverworts (especially *Barbilophozia* spp.). When this unit is in wet depression, however, the species diversity increases and may include more herbs, sedges, and mosses. These wetter sites are rare in the ESSFmvp3 and likely not present at all in the AT zone.

Plot data for the MH unit was limited and consisted of only one plot in the ESSFmvp3. The MH unit was inferred to be present in the AT based on airphoto interpretation.

Assumed Site Modifiers under the Typical Situation: j, m, s

Site Modifiers Used: g, k

Structural Stages Mapped: 2d

Typical Situation: Submesic to subhygric sites in receiving positions; gentle to moderate slope; deep, medium-textured soils; areas of snow accumulation and late melting.

No photograph of MH2d is available, but the unit is visually similar to those in ESSFmvp3.

Map Symbol	MH2d
% Mean Tree Cover and Range	0
% Mean Shrub Cover and Range	15
% Mean Herb Cover and Range	55
% Mean Cryptogam Cover and Range	70
Dominant Vegetation	White mountain heather is the dominant plant species, with covers ranging from about 30% in the wetter plot to about 80% in the drier plot. The only other dominant species in drier MH communities are *Barbilophozia* spp.
Associated Vegetation	Associated vegetation depends to some extent on the moisture regime, but might include pink mountain heather, altai fescue and mountain sagewort.
Plots	*9801866 (VS165)*
Comments	Plot VS165 is representative of the typical, gently sloping snowpack unit; plot 9801866 represents a rarer, wetter unit found mainly in depressions and probably less representative of the MH unit in the AT zone

5.4.13 Sparsely Vegetated, Non-Vegetated, and Anthropogenic Units: All Zones And Subzones

5.4.13.1 BE: Beach (1)

Site Modifiers Mapped: None

The area that expresses sorted sediments reworked in recent time by wave action. It may be formed at the edge of fresh or saltwater bodies.

Beaches occur only along the edge of Klawli Lake in the SBS mk1.

5.4.13.2 CL: Cliff (1)

Site Modifiers Mapped: q

A steep, vertical, or overhanging rock face.

Cliffs are only mapped in the alpine (AT) and parkland subzone (ESSFmvp3).

5.4.13.3 ES: Exposed Soil (1)

Site Modifiers Mapped: k, w

Any area of exposed soil that is not included in any of the other definitions. It includes areas of recent disturbance, such as mudslides, debris torrents, avalanches, and human-made disturbances (e.g. pipeline rights-of-way) where vegetation cover is less than 5%.

This unit is only mapped in the ESSFmv3 and SBSmk1. They are either steep open slopes or flat, unvegetated mineral surfaces.

5.4.13.4 GB: Gravel Bar (1)

Site Modifiers Mapped: None

An elongated landform generated by waves and currents and usually running parallel to the shore. It is composed of unconsolidated, small, rounded cobbles, pebbles, stones, and sand.

Most of the gravel bars occur in the SBSmk1 along the Klawli River.

5.4.13.5 LA: Lake

A naturally occurring static body of water, greater than 2 m deep in some portion and larger than 50 ha in size. The boundary for the lake is the natural high water mark.

Klawli Lake in the SBSmk1 and a few bodies of water in the ESSFmv3 are large enough to be mapped as lakes.

5.4.13.6 OW: Shallow Open Water

A wetland composed of permanent shallow open water and lacking extensive emergent plant cover. The water is less than 2 m deep.

Shallow open water occurs in the ESSFmv3 and SBSmk1.

5.4.13.7 PD: Pond

A small body of water greater than 2 m deep but not large enough to be classified as a lake (e.g. less than 50 ha).

These are scattered throughout the study area.

5.4.13.8 RI: River

A watercourse formed when water flows between continuous, definable banks. The flow may be intermittent or perennial. An area that has an ephemeral flow and no channel with definable banks is not considered a river.

Rivers are large enough to be mapped in all the lower elevation areas. The main rivers mapped are the Klawli and South Germansen Rivers, as well as Gillis, Moosmoos, and Tsaydaychi Creeks.

5.4.13.9 RO: Rock Outcrop (1)

Site Modifiers Mapped: h, k, r, w

A gentle to steep, bedrock escarpment or outcropping with little soil development and sparse vegetative cover.

These units occur throughout the ESSFmv3, ESSFmvp3, and AT. They are infrequent in the SBSmk1.

5.4.13.10 RP: Road Surface

An area cleared and compacted for the purpose of transporting goods and services by vehicles.

5.4.13.11 RR: Rural

Any area in which residences and other human developments are scattered and intermingled with forest, range, farm land, and native vegetation or cultivated crops.

5.4.13.12 RU: Rubble (1)

Site Modifiers Mapped: k, r

Rubble is common on the ground surface in and adjacent to alpine areas, on ridgetops, gentle slopes, and flat areas due to the effects of frost heaving.

They are mapped at higher elevations within the ESSFmv3, mvp3, and the AT.

5.4.13.13 TA: Talus Slope

Site Modifiers Mapped: k, w

Angular rock fragments of any size accumulated at the foot of steep rock slopes as a result of successive rock falls. It is a type of colluvium.

TA was also used to describe boulder fields that occasionally occurred in mid-slope, surrounded by forest with no signs of having been deposited via landslide or rockfall. It was assumed that these boulder fields were the remnants of till deposits that had had all the fines washed out.

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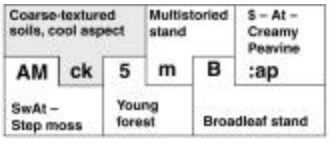
7.0 APPENDICES

7.1 Site Modifiers

Site modifiers from RIC (1998)



Each site series within the Ministry of Forests biogeoclimatic ecosystem classification has been described by a "typical" set of environmental conditions focusing specifically on important site, soils, and terrain characteristics (see *Provincial Site Series Mapping Codes and Typical Environmental Conditions* TEM website in Appendix B). The variation within some site series may be well described by the typical conditions; for others, the typical conditions may describe only one possible set. In TEM, site modifiers (presented in Table 3.2) are used to describe these atypical conditions for each ecosystem. Site modifiers provide additional descriptors for an ecosystem, and, if applicable, are displayed as the second component of an ecosystem unit.

If a site series occurs over a considerable range of site conditions in the landscape, site modifiers will be used for mapping the entire range of sites that do not meet the typical situation for that site series, within the limits of the modifiers described in Table 3.2. For example, the zonal site series for a particular biogeoclimatic unit usually occurs on gentle slopes with deep, medium-textured soils and mesic moisture regime. As an example, the symbol FR would be used for the Bl-Rhododendron site series in the ESSFmv3 biogeoclimatic subzone. If this site series was found to occur on cool aspects with deep soils, it would be mapped as FRk (Figure 3.6). If it also occurred on shallow soils of cool aspects, it would then be mapped as FRks. Up to two site modifiers can be used in defining an ecosystem unit in the map labels. If more site modifiers are applicable, they can be added in the database comments field. Site modifiers should be listed alphabetically in map symbols.

Code	Criteria
Topography	
a	active floodplain[1] – the site series occurs on an active fluvial floodplain (level or very gently sloping surface bordering a river that has been formed by river erosion and deposition), where evidence of active sedimentation and deposition is present.
g	gullying[1] occurring – the site series occurs within a gully, indicating a certain amount of variation from the typical, or the site series has gullying throughout the area being delineated.
h	hummocky[1] terrain (optional modifier) – the site series occurs on hummocky terrain, suggesting a certain amount of variability. Commonly, hummocky conditions are indicated by the terrain surface expression but occasionally they occur in a situation not described by terrain features.
j	gentle slope – the site series occurs on gently sloping topography (less than 25% in the interior, less than 35% in the CWH, CDF, and MH zones).
k	cool aspect – the site series occurs on cool, northerly or easterly aspects (285°–135°), on moderately steep slopes (25%–100% slope in the interior and 35%–100% slope in the CWH, CDF and MH zones).
n	fan[1] – the site series occurs on a fluvial fan (most common), or on a colluvial fan or cone.
q	very steep cool aspect – the site series occurs on very steep slopes (greater than 100%

Code	Criteria
	slope) with cool, northerly or easterly aspects (285°–135°).
r	ridge[1](optional modifier) – the site series occurs throughout an area of ridged terrain, or it occurs on a ridge crest.
t	terrace[1] – the site series occurs on a fluvial or glaciofluvial terrace, lacustrine terrace, or rock cut terrace.
w	warm aspect – the site series occurs on warm, southerly or westerly aspects (135°–285°), on moderately steep slopes (25%–100% slope in the interior and 35%–100% slope in the CWH, CDF and MH zones).
z	very steep warm aspect – the site series occurs on very steep slopes (greater than 100%) on warm, southerly or westerly aspects (135°–285°).
Moisture	
x	drier than typical (optional modifier) – describes part of the range of conditions for circummesic ecosystems with a wide range of soil moisture regimes or significantly different site conditions. For example, SBSmc2/01 (Sxw–Huckleberry) has three site phases described, and the submesic phase can be labeled with the "drier than average" modifier (e.g., SBx). This code should be applied only after consultation with the Regional Ecologist.
y	moister than typical (optional modifier) – describes part of the range of conditions for circummesic ecosystems with a wide range of soil moisture regimes or significantly different site conditions. For example, SBSmk1/06 (Sb–Huckleberry–Spirea) is "typically" described as submesic to mesic. When this site series is found on subhygric or hygric sites, the "y" modifier is used (e.g., BHy). This code should be applied only after consultation with the Regional Ecologist.
Soil	
c	coarse-textured soils[2] – the site series occurs on soils with a coarse texture, including sand and loamy sand; and also sandy loam, loam, and sandy clay loam with greater than 70% coarse fragment volume.
d	deep soil – the site series occurs on soils greater than 100 cm to bedrock.
f	fine-textured soils[2] – the site series occurs on soils with a fine texture including silt and silt loam with less than 20% coarse fragment volume; and clay, silty clay, silty clay loam, clay loam, sandy clay and heavy clay with less than 35% coarse fragment volume.
m	medium-textured soils – the site series occurs on soils with a medium texture, including sandy loam, loam and sandy clay loam with less than 70% coarse fragment volume; silt loam and silt with more than 20% coarse fragment volume; and clay, silty clay, silty clay loam, clay loam, sandy clay and heavy clay with more than 35% coarse fragment volume.
p	peaty material – the site series occurs on deep organics or a peaty surface (15–60 cm)[3] over mineral materials (e.g., on organic materials of sedge, sphagnum, or decomposed wood).
s	shallow soils – the site series occurs where soils are considered to be shallow to bedrock (20–100 cm).
v	very shallow soils – the site series occurs where soils are considered to be very shallow to bedrock (less than 20 cm).

[1] Howes and Kenk 1997
[2] Soil textures have been grouped specifically for the purposes of ecosystem mapping.
[3] Canada Soils Survey Committee, 1987

7.2 Structural Stages and Codes

Structural stage descriptions from RIC (1998)

Structural Stage	Description
Post-disturbance stages or environmentally induced structural development	
1 Sparse/bryoid[2]	Initial stages of primary and secondary succession; bryophytes and lichens often dominant, can be up to 100%; time since disturbance less than 20 years for normal forest succession, may be prolonged (50–100+ years) where there is little or no soil development (bedrock, boulder fields); total shrub and herb cover less than 20%; total tree layer cover less than 10%.
Substages	
1a Sparse[2]	Less than 10% vegetation cover;
1b Bryoid[2]	Bryophyte- and lichen-dominated communities (greater than 1/2 of total vegetation cover).
Stand initiation stages or environmentally induced structural development	
2 Herb[2]	Early successional stage or herbaceous communities maintained by environmental conditions or disturbance (e.g., snow fields, avalanche tracks, wetlands, grasslands, flooding, intensive grazing, intense fire damage); dominated by herbs (forbs, graminoids, ferns); some invading or residual shrubs and trees may be present; tree layer cover less than 10%, shrub layer cover less than or equal to 20% or less than 1/3 of total cover, herb-layer cover greater than 20%, or greater than or equal to 1/3 of total cover; time since disturbance less than 20 years for normal forest succession; many herbaceous communities are perpetually maintained in this stage.
Substages	
2a Forb-dominated[2]	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by non-graminoid herbs, including ferns.
2b Graminoid-dominated[2]	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by grasses, sedges, reeds, and rushes.
2c Aquatic[2]	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by floating or submerged aquatic plants; does not include sedges growing in marshes with standing water (which are classed as 2b).
2d Dwarf shrub[2]	Communities dominated (greater than 1/2 of the total herb cover) by dwarf woody species such as *Phyllodoce empetriformis, Cassiope mertensiana, Cassiope tetragona, Arctostaphylos arctica, Salix reticulata,* and *Rhododendron lapponicum.* (See list of dwarf shrubs assigned to the herb layer in the *Field Manual for Describing Terrestrial Ecosystems)*.
3 Shrub/Herb[3]	Early successional stage or shrub communities maintained by environmental conditions or disturbance (e.g., snow fields, avalanche tracks, wetlands, grasslands, flooding, intensive grazing, intense fire damage); dominated by shrubby vegetation; seedlings and advance regeneration may be abundant; tree layer cover less than 10%, shrub layer cover greater than 20% or greater than or equal to 1/3 of total cover.

Structural Stage	Description
Substages	
3a Low shrub[3]	Communities dominated by shrub layer vegetation less than 2 m tall; may be perpetuated indefinitely by environmental conditions or repeated disturbance; seedlings and advance regeneration may be abundant; time since disturbance less than 20 years for normal forest succession.
3b Tall shrub[3]	Communities dominated by shrub layer vegetation that are 2–10 m tall; may be perpetuated indefinitely by environmental conditions or repeated disturbance; seedlings and advance regeneration may be abundant; time since disturbance less than 40 years for normal forest succession.
Stem exclusion stages	
4 Pole/Sapling[4]	Trees greater than 10 m tall, typically densely stocked, have overtopped shrub and herb layers; younger stands are vigorous (usually greater than 10–15 years old); older stagnated stands (up to 100 years old) are also included; self-thinning and vertical structure not yet evident in the canopy – this often occurs by age 30 in vigorous broadleaf stands, which are generally younger than coniferous stands at the same structural stage; time since disturbance is usually less than 40 years for normal forest succession; up to 100+ years for dense (5000–15 000+ stems per hectare) stagnant stands.
5 Young Forest[4]	Self-thinning has become evident and the forest canopy has begun differentiation into distinct layers (dominant, main canopy, and overtopped); vigorous growth and a more open stand than in the pole/sapling stage; time since disturbance is generally 40–80 years but may begin as early as age 30, depending on tree species and ecological conditions.
Understory reinitiation stage	
6 Mature Forest[4]	Trees established after the last disturbance have matured; a second cycle of shade tolerant trees may have become established; understories become well developed as the canopy opens up; time since disturbance is generally 80–140 years for biogeoclimatic group A[5] and 80–250 years for group B.[6]
Old-growth stage	
7 Old Forest[4]	Old, structurally complex stands composed mainly of shade-tolerant and regenerating tree species, although older seral and long-lived trees from a disturbance such as fire may still dominate the upper canopy; snags and coarse woody debris in all stages of decomposition typical, as are patchy understories; understories may include tree species uncommon in the canopy, due to inherent limitations of these species under the given conditions; time since disturbance generally greater than 140 years for biogeoclimatic group A[5] and greater than 250 years for group B.[6]

1 In the assessment of structural stage, structural features and age criteria should be considered together. Broadleaf stands will generally be younger than coniferous stands belonging to the same structural stage.

2 Substages 1a, 1b and 2a–d should be used if photo interpretation is possible, otherwise, stage 1 and 2 should be used.

3 Substages 3a and 3b may, for example, include very old krummholz less than 2 m tall and very old, low productivity stands (e.g., bog woodlands) less than 10 m tall, respectively. Stage 3, without additional substages, should be used for regenerating forest communities that are herb or shrub dominated, including shrub layers consisting of only 10–20% tree species, and undergoing normal succession toward climax forest (e.g., recent cut-over

7.3 Conservation Data Centre Lists

B.C. Conservation Data Centre: Rare Plant Association Tracking List
Mackenzie Forest District
August 18, 1999

This list is incomplete, especially with respect to wetland, alpine, and grassland plant associations. Please note that the ranks below reflect the rarity of plant association occurrences that have not been disturbed by humans or domestic animals, and are in a natural or "climax" state. Some plant associations are often confused with more common successional plant associations (e.g. *Pseudotsuga menziesii / Gaultheria shallon*), or they may occur commonly in degraded conditions (e.g. *Elymus spicata - Koeleria macrantha*), but undisturbed occurrences are rare. Please consult our website or contact the CDC for more information on rare plant associations.

SCIENTIFIC NAME	COMMON NAME	BEC UNIT*	PROV RANK	PROV LIST
ABIES LASIOCARPA - PICEA MARIANA / LEDUM GROENLANDICUM	SUBALPINE FIR - BLACK SPRUCE / LABRADOR TEA	ESSFmv2/03 ESSFmv3/03 ESSFmv4/03	S3	BLUE
ABIES LASIOCARPA / ALNUS / EQUISETUM	SUBALPINE FIR / ALDER / HORSETAIL	ESSFmv4/05	S3?	BLUE
PICEA MARIANA / VACCINIUM MEMBRANACEUM / PETASITES	BLACK SPRUCE / BLACK HUCKLEBERRY / COLTSFOOT	SBPSmc/03 SBSmc3/06 SBSmc2/03 SBSwk2/04 SBSmc3/05 SBSmk1/06 SBSmk2/04	S3	BLUE

3 PLANT ASSOCIATIONS LISTED

B.C. Conservation Data Centre: Rare Vascular Plant Tracking List
Mackenzie Forest District
November 6, 1998

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	PROV. RANK	PROV. LIST
APOCYNUM MEDIUM	WESTERN DOGBANE	G5?	S2S3	BLUE
ASTRAGALUS UMBELLATUS	TUNDRA MILK-VETCH	G4	S2S3	BLUE
CAREX SCOPULORUM VAR BRACTEOSA	HOLM'S ROCKY MOUNTAIN SEDGE	G5T?	S2S3	BLUE
CASTILLEJA FULVA	BOREAL PAINTBRUSH	G1?	SH	RED
DRABA CINEREA	GRAY-LEAVED DRABA	G5	S2S3	BLUE
EPILOBIUM LEPTOCARPUM	SMALL-FLOWERED WILLOWHERB	G5	S2S3	BLUE
ERIGERON UNIFLORUS VAR ERIOCEPHALUS	NORTHERN DAISY	G5T4	S1?	BLUE
JUNCUS STYGIUS	BOG RUSH	G5	S2S3	BLUE
MINUARTIA AUSTROMONTANA	ROCKY MOUNTAIN SANDWORT	G4	S1?	BLUE
OXYTROPIS MAYDELLIANA	MAYDELL'S LOCOWEED	G5	S2S3	BLUE
PAPAVER ALBOROSEUM	PALE POPPY	G3	S1?	BLUE
POLYPODIUM VIRGINIANUM	VIRGINIA POLYPODY	G5	SH	RED
POTENTILLA NIVEA VAR PENTAPHYLLA	FIVE-LEAVED CINQUEFOIL	G5T4	S2S3	BLUE
RANUNCULUS PEDATIFIDUS	BIRDFOOT BUTTERCUP	G5	S2S3	BLUE
SAGINA NIVALIS	SNOW PEARLWORT	G5	S1?	BLUE
SAXIFRAGA NELSONIANA SSP CARLOTTAE	CORDATE-LEAVED SAXIFRAGE	G5T2	S2	RED
STELLARIA UMBELLATA	UMBELLATE STARWORT	G5	S1?	BLUE

17 TAXA LISTED

7.4 Plant Species Identified in Klawli

Common Name	Latin Name
Alaska clubmoss	*Lycopodium sitchense*
alpine arnica	*Arnica angustifolia*
alpine bentgrass	*Agrostis humilis*
alpine bistort	*Polygonum viviparum*
alpine bluegrass	*Poa alpina*
alpine pussytoes	*Antennaria alpina*
alpine speedwell	*Veronica wormskjoldii*
alpine timothy	*Phleum alpinum*
alpine willowherb	*Epilobium anagallidifolium*
alpine-wintergreen	*Gaultheria humifusa*
Altai fescue	*Festuca altaica*
alumroot	*Heuchera sp.*
American bistort	*Polygonum bistortoides*
anemone	*Anemone sp.*
arctic lupine	*Lupinus arcticus*
arctic willow	*Salix arctica*
arctic woodrush	*Luzula arctica*
arrow-leaved groundsel	*Senecio triangularis*
aster	*Aster sp.*
avens	*Geum sp.*
awned haircap moss	*Polytrichum piliferum*
baneberry	*Actaea rubra*
Barclay's willow	*Salix barclayi*
bastard toad-flax	*Geocaulon lividum*
Bebb's willow	*Salix bebbiana*
Bellard's kobresia	*Kobresia myosuroides*
birch	*Betula sp.*
black alpine sedge	*Carex nigricans*
black cottonwood	*Populus balsamifera*
black gooseberry	*Ribes lacustre*
black huckleberry	*Vaccinium membranaceum*
black spruce	*Picea mariana*
black twinberry	*Lonicera involucrata*
blistered rocktripe	*Umbilicaria hyperborea*
blue wildrye	*Elymus glaucus*
blueberry, huckleberry	*Vaccinium sp.*
bluegrass	*Poa sp.*
bluejoint	*Calamagrostis canadensis*
blunt-fruited sweet-cicely	*Osmorhiza depauperata*
bog blueberry	*Vaccinium uliginosum*
bog cranberry	*Oxycoccus oxycoccos*
bog willow	*Salix pedicellaris*
bog-rosemary	*Andromeda polifolia*
bracted lousewort	*Pedicularis bracteosa*
bristly-stalked sedge	*Carex leptalea*

Common Name	Latin Name
brome	*Bromus sp.*
brown pixie cup	*Cladonia pyxidata*
buckbean	*Menyanthes trifoliata*
bunchberry	*Cornus canadensis*
buttercup	*Ranunculus sp.*
Chamisso's cotton-grass	*Eriophorum chamissonis*
chocolate chip	*Solorina crocea*
clasping twistedstalk	*Streptopus amplexifolius*
cloudberry	*Rubus chamaemorus*
clubmoss	*Lycopodium sp.*
columbine	*Aquilegia sp.*
common green sphagnum	*Sphagnum girgensohnii*
common horsetail	*Equisetum arvense*
common juniper	*Juniperus communis*
common leafy moss	*Plagiomnium medium*
common mitrewort	*Mitella nuda*
common red paintbrush	*Castilleja miniata*
common tree moss	*Climacium dendroides*
copperbush	*Cladothamnus pyroliflorus*
cotton-grass	*Eriophorum sp.*
cow parsnip	*Heracleum lanatum*
Crawford's sedge	*Carex crawfordii*
crowberry	*Empetrum nigrum*
curly heron's-bill moss	*Dicranum fuscescens*
currant or gooseberry	*Ribes sp.*
dandelion	*Taraxacum sp.*
diverse-leaved cinquefoil	*Potentilla diversifolia*
Drummond's rush	*Juncus drummondii*
dwarf blueberry	*Vaccinium caespitosum*
dwarf scouring-rush	*Equisetum scirpoides*
Engelmann spruce	*Picea engelmannii*
evergreen huckleberry	*Vaccinium ovatum*
Falkland Island sedge	*Carex macloviana*
false azalea	*Menziesia ferruginea*
false Solomon's-seal	*Smilacina racemosa*
false-polytrichum	*Timmia austriaca*
fescue	*Festuca sp.*
few-finger lichen	*Dactylina arctica*
few-flowered sedge	*Carex pauciflora*
few-flowered spike rush	*Eleocharis quinqueflora*
field pussytoes	*Antennaria neglecta*
five-leaved bramble	*Rubus pedatus*
five-stamened mitrewort	*Mitella pentandra*
fleabane	*Erigeron sp.*
four-angled mountain-heather	*Cassiope tetragona*
freckle pelt	*Peltigera aphthosa*

Common Name	Latin Name
fringed brome	*Bromus ciliatus*
fringed grass-of-Parnassus	*Parnassia fimbriata*
fuzzy-spiked wildrye	*Elymus innovatus*
gentian	*Gentiana sp.*
glaucous gentian	*Gentiana glauca*
glow moss	*Aulacomnium palustre*
golden fuzzy fen moss	*Tomentypnum nitens*
gray reindeer lichen	*Cladina rangiferina*
great northern aster	*Aster modestus*
great sundew	*Drosera anglica*
green alder	*Alnus crispa*
green map	*Rhizocarpon geographicum*
green paw	*Nephroma arcticum*
green reindeer lichen	*Cladina mitis*
green sorrel	*Rumex acetosa*
green wintergreen	*Pyrola chlorantha*
ground-pine	*Lycopodium dendroideum*
groundsel	*Senecio sp.*
grouseberry	*Vaccinium scoparium*
hairgrass	*Aira sp.*
hairy arnica	*Arnica mollis*
harebell	*Campanula sp.*
hawkweed	*Hieracium sp.*
heart-leaved arnica	*Arnica cordifolia*
heart-leaved twayblade	*Listera cordata*
highbush-cranberry	*Viburnum edule*
honeysuckle	*Lonicera sp.*
hooded ladies' tresses	*Spiranthes romanzoffiana*
horn cladonia	*Cladonia cornuta*
horsetail	*Equisetum sp.*
horseweed	*Conyza canadensis*
Hudson Bay bulrush	*Scirpus hudsonianus*
hybrid white spruce	*Picea engelmannii x glauca*
Idaho bentgrass	*Agrostis idahoensis*
Indian hellebore	*Veratrum viride*
Jacob’s ladder	*Polemonium sp.*
juniper haircap moss	*Polytrichum juniperinum*
kalmia	*Kalmia sp.*
kidney-leaved violet	*Viola renifolia*
kinnikinnick	*Arctostaphylos uva-ursi*
Labrador lousewort	*Pedicularis labradorica*
Labrador tea	*Ledum groenlandicum*
lady fern	*Athyrium filix-femina*
lance-leaved moonwort	*Botrychium lanceolatum*
large-leaved avens	*Geum macrophyllum*
leafy moss	*Mnium sp.*

Common Name	Latin Name
leatherleaf saxifrage	*Leptarrhena pyrolifolia*
lens-fruited sedge	*Carex lenticularis*
lesser wintergreen	*Pyrola minor*
lingonberry	*Vaccinium vitis-idaea*
locoweed	*Oxytropis sp.*
lodgepole pine	*Pinus contorta*
long-stalked starwort	*Stellaria longipes*
lousewort	*Pedicularis sp.*
low birch	*Betula pumila*
lupine	*Lupinus sp.*
maple liverwort	*Barbilophozia lycopodioides*
marsh cinquefoil	*Potentilla palustris*
meadow arnica	*Arnica chamissonis*
meadow horsetail	*Equisetum pratense*
meadowrue	*Thalictrum sp.*
Miyoshi-no fir clubmoss	*Huperzia miyoshiana*
monkshood	*Aconitum sp.*
mountain alder	*Alnus tenuifolia*
mountain ash	*Sorbus sp.*
mountain bentgrass	*Agrostis variabilis*
mountain hairgrass	*Deschampsia atropurpurea*
mountain harebell	*Campanula lasiocarpa*
mountain monkshood	*Aconitum delphiniifolium*
mountain sagewort	*Artemisia norvegica*
mountain sorrel	*Oxyria digyna*
mountain sweet-cicely	*Osmorhiza chilensis*
mountain willow	*Salix monticola*
mountain-heather	*Cassiope sp.*
mountain-heather	*Phyllodoce sp.*
mustard	*Brassica sp.*
nagoonberry	*Rubus arcticus*
narrow-leaved cotton-grass	*Eriophorum polystachion*
netted willow	*Salix reticulata*
northern bedstraw	*Galium boreale*
northern bog sedge	*Carex dioica ssp. gynocrates*
northern bush willow	*Salix arbusculoides*
northern gentian	*Gentianella amarella*
northern goldenrod	*Solidago multiradiata*
northern scouring-rush	*Equisetum variegatum*
northern starflower	*Trientalis arctica*
northern starwort	*Stellaria calycantha*
northwestern twayblade	*Listera caurina*
Norwegian cinquefoil	*Potentilla norvegica*
oak fern	*Gymnocarpium dryopteris*
one-leaved foamflower	*Tiarella trifoliata var. unifoliata*
one-sided wintergreen	*Orthilia secunda*

Common Name	Latin Name
orange agoseris	*Agoseris aurantiaca*
orange-foot lichen	*Cladonia ecmocyna*
orchid	*Platanthera sp.*
oval-leaved blueberry	*Vaccinium ovalifolium*
paintbrush	*Castilleja sp.*
palmate-leaved coltsfoot	*Petasites frigidus var. palmatus*
Parry's rush	*Juncus parryi*
parsley fern	*Cryptogramma crispa var. macrostichoides*
pearly everlasting	*Anaphalis margaritacea*
pellia	*Pellia sp.*
pink mountain-heather	*Phyllodoce empetriformis*
pink wintergreen	*Pyrola asarifolia*
Piper's woodrush	*Luzula piperi*
pointed broom sedge	*Carex scoparia*
polar willow	*Salix polaris*
poor sedge	*Carex magellanica*
prickly rose	*Rosa acicularis*
pumpelly brome	*Bromus pumpellianus*
purple mountain saxifrage	*Saxifraga oppositifolia*
purple-leaved willowherb	*Epilobium ciliatum*
purple-sweet cicely	*Osmorhiza purpurea*
pussytoes	*Antennaria sp.*
racemose pussytoes	*Antennaria racemosa*
ragged snow	*Flavocetraria nivalis*
rattlesnake-plantain	*Goodyera oblongifolia*
red columbine	*Aquilegia formosa*
red elderberry	*Sambucus racemosa*
red raspberry	*Rubus idaeus*
red swamp currant	*Ribes triste*
red-stemmed feathermoss	*Pleurozium schreberi*
red-stemmed saxifrage	*Saxifraga lyallii*
ring pellia	*Pellia neesiana*
rose	*Rosa sp.*
Ross' sedge	*Carex deflexa var. rossii*
rosy pussytoes	*Antennaria microphylla*
rough-leaved ricegrass	*Oryzopsis asperifolia*
running clubmoss	*Lycopodium clavatum*
rush	*Juncus sp.*
russet sedge	*Carex saxatilis*
ryegrass sedge	*Carex loliacea*
sagewort	*Artemisia sp.*
saskatoon	*Amelanchier alnifolia*
saxifrage	*Saxifraga sp.*
Scouler's willow	*Salix scouleriana*
scouring-rush	*Equisetum hyemale*
scrub birch	*Betula glandulosa*

Common Name	Latin Name
sedge	*Carex sp.*
sheathed sedge	*Carex vaginata*
sheep sedge	*Carex illota*
shore sedge	*Carex limosa*
short-fruited willow	*Salix brachycarpa*
showy sedge	*Carex spectabilis*
sibbaldia	*Sibbaldia procumbens*
Siberian wheatgrass	*Agropyron fragile*
sickle moss	*Drepanocladus uncinatus*
single delight	*Moneses uniflora*
sitka alder	*Alnus viridis ssp. sinuata*
Sitka burnet	*Sanguisorba canadensis*
Sitka mountain-ash	*Sorbus sitchensis*
Sitka sedge	*Carex aquatilis var. sitchensis*
Sitka valerian	*Valeriana sitchensis*
slender bog-orchid	*Habenaria stricta*
slender hawkweed	*Hieracium gracile*
small bedstraw	*Galium trifidum*
small flowered grass-of-Parnassus	*Parnassia palustris*
small-flowered lousewort	*Pedicularis parviflora*
small-flowered woodrush	*Luzula parviflora*
snow-mat liverwort	*Barbilophozia floerkei*
soft-leaved sedge	*Carex disperma*
soopolallie	*Shepherdia canadensis*
sparse-leaved sedge	*Carex tenuiflora*
spike trisetum	*Trisetum spicatum*
spiked woodrush	*Luzula spicata*
spraypaint	*Icmadophila ericetorum*
spreading stonecrop	*Sedum divergens*
spring moss	*Philonotis fontana*
spruce	*Picea sp.*
step moss	*Hylocomium splendens*
stiff clubmoss	*Lycopodium annotinum*
stiff-leaved haircap moss	*Polytrichum alpinum*
stink currant	*Ribes bracteosum*
straw-coloured water moss	*Calliergon stramineum*
subalpine buttercup	*Ranunculus eschscholtzii*
subalpine daisy	*Erigeron peregrinus*
subalpine fir	*Abies lasiocarpa*
Sudeten lousewort	*Pedicularis sudetica*
sweet-cicely	*Osmorhiza sp.*
sweetgrass	*Hierochloe sp.*
sweet-scented bedstraw	*Galium triflorum*
tall bluebells	*Mertensia paniculata*
tall larkspur	*Delphinium glaucum*
thistle	*Cirsium sp.*

Common Name	Latin Name
thread rush	*Juncus filiformis*
three-leaved foamflower	*Tiarella trifoliata var. trifoliata*
three-toothed saxifrage	*Saxifraga tricuspidata*
timber oatgrass	*Danthonia canadensis*
timothy	*Phleum sp.*
trailing black currant	*Ribes laxiflorum*
trailing raspberry	*Rubus pubescens*
trembling aspen	*Populus tremuloides*
twinflower	*Linnaea borealis*
two-toned sedge	*Carex albonigra*
variable willow	*Salix commutata*
violet	*Viola sp.*
water sedge	*Carex aquatilis*
western bluegrass	*Poa paucispicula*
western bog-laurel	*Kalmia microphylla*
western meadowrue	*Thalictrum occidentale*
western mountain-ash	*Sorbus scopulina*
western paintbrush	*Castilleja occidentalis*
white bog orchid	*Platanthera dilatata*
white hawkweed	*Hieracium albiflorum*
white marsh-marigold	*Caltha leptosepala*
white mountain-heather	*Cassiope mertensiana*
white spruce	*Picea glauca*
white water-buttercup	*Ranunculus aquatilis*
white-flowered rhododendron	*Rhododendron albiflorum*
wild strawberry	*Fragaria virginiana*
wildrye	*Elymus sp.*
willow	*Salix sp.*
willowherb	*Epilobium sp.*
wintergreen	*Gaultheria sp.*
wintergreen	*Pyrola sp.*
wolf lichen	*Letharia vulpina*
wood horsetail	*Equisetum sylvaticum*
wood strawberry	*Fragaria vesca*
woodrush	*Luzula sp.*
yarrow	*Achillea millefolium*
yellow anemone	*Anemone richardsonii*
	Actinogyra sp.
	Agoseris sp.
	Alectoria ochroleuca
	Andromeda sp.
	Aulacomnium turgidum
	Barbilophozia sp.
	Boykinia sp.
	Brachythecium sp.
	Cetraria sp.

Common Name	Latin Name
	Cetrariella sp.
	Chamaenerion angustifolium
	Chamaenerion latifolium
	Chiogenes hispidula
	Cladina sp.
	Cladina stellaris
	Cladonia gracilis
	Cladonia multiformis
	Cladonia phyllophora
	Cladonia pseudostellata
	Cladonia sp.
	Dicranella palustris
	Dicranella sp.
	Dicranum sp.
	Diphasiastrum alpinum
	Diphasiastrum complanatum
	Drepanocladus sp.
	Erigeron peregrinus ssp. callianthemus var. scaposus
	Eriogonum sp.
	Leucolepis sp.
	Lichenochora sp.
	Lophozia sp.
	Lycopus sp.
	Marchantia sp.
	Rhizomnium nudum
	Mnium punctatum var. elatum
	Multiclavula sp.
	Oryzopsis sp.
	Oxycoccus sp.
	Peltigera sp.
	Plagiochila porelloides
	Plagiomnium sp.
	Polytrichum commune
	Polytrichum sp.
	Potentilla sp.
	Ptilium crista-castrensis
	Rhizocarpon grande
	Rhizomnium sp.
	Rubus sp.
	Rumex sp.
	Saxifraga newcombei
	Selaginella sp.
	Sibbaldia sp.
	Sphagnum capillaceum
	Sphagnum recurvum var. tenue

Common Name	Latin Name
	Sphagnum sp.
	Sphagnum warnstorfii
	Stereocaulon sp.
	Stereocaulon tomentosum
	Timmia sp.
	Trichophorum sp.
	Trientalis sp.

7.5 Moisture Regime/Nutrient Regime/Drainage Classes/Slope Position

Following from *Field Manual for Describing Terrestrial Ecosystems.* (BC Ministry of Forests 1998)

TABLE 1.1. Soil moisture regime classes

Code	Class	Description	Primary water source
0	Very xeric	Water removed extremely rapidly in relation to supply; soil is moist for a negligible time after precipitation	precipitation
1	Xeric	Water removed very rapidly in relation to supply; soil is moist for brief periods following precipitation	precipitation
2	Subxeric	Water removed rapidly in relation to supply; soil is moist for short periods following precipitation	precipitation
3	Submesic	Water removed readily in relation to supply; water available for moderately short periods following precipitation	precipitation
4	Mesic	Water removed somewhat slowly in relation to supply; soil may remain moist for a significant, but sometimes short period of the year. Available soil moisture reflects climatic inputs	precipitation in moderate-to fine-textured soils and limited seepage in coarse-textured soils
5	Subhygric	Water removed slowly enough to keep soil wet for a significant part of growing season; some temporary seepage and possibly mottling below 20 cm	precipitation and seepage
6	Hygric	Water removed slowly enough to keep soil wet for most of growing season; permanent seepage and mottling; gleyed colours common	seepage
7	Subhydric	Water removed slowly enough to keep water table at or near surface for most of year; gleyed mineral or organic soils; permanent seepage <30 cm below surface	seepage or permanent water table
8	Hydric	Water removed so slowly that water table is at or above soil surface all year; gleyed mineral or organic soils	permanent water table

a More detailed descriptions and keys are given in the DEIF manual (Luttmerding et al. 1990) and in MOF field guides to site identification and interpretation.

TABLE 1.2. Nutrient regime classes and relationships between nutrient regime and site properties

	Oligotrophic	Submesotrophic	Mesotrophic	Permesotrophic	Eutrophic	Hypereutrophic
	A Very poor	**B Poor**	**C Medium**	**D Rich**	**E Very rich**	**F Saline**
Available nutrients	very low	low	average	plentiful	abundant	excess salt accum.
Humus form	Mor					
				Moder		
					Mull	
A horizon	Ae horizon present					
			A horizon absent			
				Ah horizon present		
Organic matter content	low (light coloured)					
		medium (inter. in colour)				
				high (dark coloured)		
C:N Ratio	high					
			moderate			
				low		
Soil depth	extremely shallow					
		very shallow to deep				
Soil texture	coarse textured					
		medium to fine textured				
% Coarse fragments	high					
		moderate to low				
Parent material mineralogy	base-low					
		base-medium				
				base-high		
Soil pH	extremely – mod. acid					
		moderately acid – neutral				
				slightly acid – mildly alk.		
Water pH (wetlands)	< 4–5	4.5–5.5	5.5–6.5	6.5–7.4	7.4+	
Seepage			temporary	→	permanent	

TABLE 2.15. Drainage classes and codes

Code	Class	Description
x	Very rapidly drained	Water is removed from the soil very rapidly in relation to supply. Water source is precipitation and available water storage capacity following precipitation is essentially nil. Soils are typically fragmental or skeletal, shallow, or both.
r	Rapidly drained	Water is removed from the soil rapidly in relation to supply. Excess water flows down-ward if underlying material is pervious. Subsurface flow may occur on steep gradients during heavy rainfall. Water source is precipitation. Soils are generally coarse textured.
w	Well drained	Water is removed from the soil readily, but not rapidly. Excess water flows downward readily into underlying pervious material or laterally as subsurface flow. Water source is precipitation. On slopes, subsurface flow may occur for short durations, but additions are equalled by losses. Soils are generally intermediate in texture and lack restricting layers.
m	Moderately well drained	Water is removed from the soil somewhat slowly in relation to supply because of imperviousness or lack of gradient. Precipitation is the dominant water source in medium- to fine-textured soils; precipitation and significant additions by subsurface flow are necessary in coarse-textured soils.
i	Imperfectly drained	Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is the major source. If subsurface water or groundwater (or both) is the main source, the flow rate may vary but the soil remains wet for a significant part of the growing season. Precipitation is the main source if available water storage capacity is high; contribution by subsurface or groundwater flow (or both) increases as available water storage capacity decreases. Soils generally have a wide range of texture, and some mottling is common.
p	Poorly drained	Water is removed so slowly in relation to supply that the soil remains wet for much of the time that it is not frozen. Excess water is evident in the soil for a large part of the time. Subsurface or groundwater flow (or both), in addition to precipitation, are the main water sources. A perched water table may be present. Soils are generally mottled and/or gleyed.
v	Very poorly drained	Water is removed from the soil so slowly that the water table remains at or near the surface for most of the time the soil is not frozen. Groundwater flow and subsurface flow are the major water sources. Precipitation is less important, except where there is a perched water table with precipitation exceeding evapotranspiration. Typically associated with wetlands. For organic wetlands, also evaluate the soil moisture subclass, and when entering on the form, separate from drainage by a slash. For example, v/ac.

Mesoslope Position

CR Crest The generally convex uppermost portion of a hill; usually convex in all directions with no distinct aspect.

UP Upper Slope The generally convex upper portion of the slope immediately below the crest of a hill; has a specific aspect.

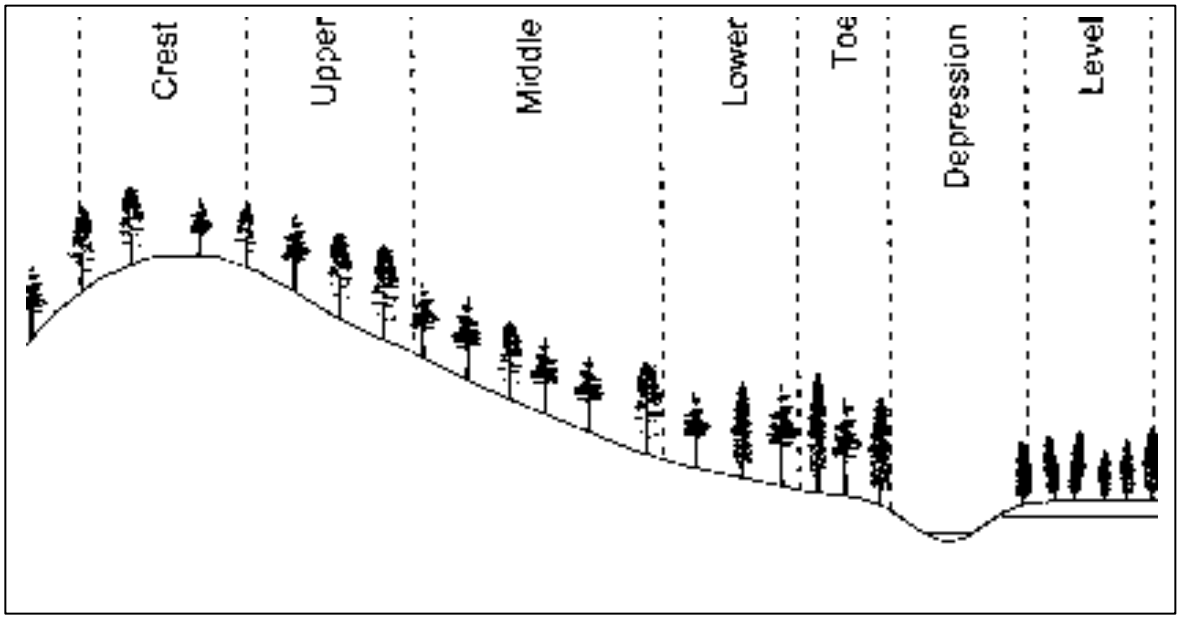
MD Middle Slope Area between the upper and lower slope; the surface profile is generally neither distinctly concave nor convex; has a straight or somewhat sigmoid surface profile with a specific aspect.

LW Lower Slope The area toward the base of a slope; generally has a concave surface profile with a specific aspect.

TO Toe The area demarcated from the lower slope by an abrupt decrease in slope gradient; seepage is typically present.

DP Depression Any area concave in all directions; may be at the base of a meso-scale slope or in a generally level area.

LV Level Any level meso-scale area not immediately adjacent to a meso-scale slope; the surface profile is generally horizontal and straight with no significant aspect.



7.6 Terrain and Soil Classification

SURFICIAL MATERIAL TERMS AND SYMBOLS

Material Name	*Map Symbol*
Anthropogenic Material	**A**
Colluvium	**C**
Weathered Bedrock (in situ)	**D**
Eolian Material	**E**
Fluvial Material	**F**
Glaciofluvial Material	**F^G**
Ice	**I**
Lacustrine Material	**L**
Glaciolacustrine Material	**L^G**
Morainal Material (Till)	**M**
Organic Material	**O**
Bedrock	**R**
Undifferentiated materials	**U**
Volcanic Material	**V**
Marine Material	**W**
Glaciomarine Material	**W^G**

Adapted from *Terrain Classification System for British Columbia, Version 2.* 1997. B.C. Ministry of Environment

SURFACE EXPRESSION TERMS AND SYMBOLS

Surface Expression Name	*Map Symbol*
moderate slope	**a**
blanket	**b**
cone(s)	**c**
depression(s)	**d**
fan(s)	**f**
hummock	**h**
gentle slope	**j**
moderately steep slope	**k**
rolling	**m**
plain	**p**
ridge(s)	**r**
steep slope	**s**
terrace(s)	**t**
undulating	**u**
veneer	**v**
mantle of variable thickness	**w**
thin veneer	**x**

Adapted from *Terrain Classification System for British Columbia, Version 2.* 1997. B.C. Ministry of Environment

SOIL CLASSIFICATION

Soil Classification	
Brunisolic Order	
DYB	Dystric Brunisol
E.DYB	Eluviated Dystric Brunisol
GL.DYB	Gleyed Dystric Brunisol
O.DYB	Orthic Dystric Brunisol
SB	Sombric Brunisol
Gleysolic Order	
G	Gleysol
Luvisolic Order	
GL	Gray Luvisol
GL.GL	Gleyed Gray Luvisol
Organic Order	
HU.M	Humic Mesisol
TY.F	Typic Fibrisol
TY.H	Typic Humisol
TY.M	Typic Mesisol
Podzolic Order	
FHP	Ferro-Humic Podzol
HFP	Humo-Ferric Podzol

7.7 Plot Vegetation Summary Tables

Supplied as digital files.