LAND MANAGEMENT HANDBOOK

54

A Field Guide to Site Identification and Interpretation for the North Central Portion of the Northern Interior Forest Region

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BRITISH COLUMBIA

Ministry of Forests
Forest Science Program

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Preliminary ecological classifications, description and interpretation of units, and biogeoclimatic boundary refinement were developed in part by C. Delong, A. MacKinnon, A. McLeod, D. Meidinger, and D. Tanner. In addition to these individuals, many others collected field data that form the basis of the classification presented in this guide. G. Argus, F. Boas, T. Goward, and W. Noble identified difficult vascular, bryophyte, and lichen specimens.

This field guide is based on the provincially correlated ecological classification made possible by the Ministry of Forests Ecological Classification Correlation Program. D. Meidinger directed this correlation effort and worked closely with all forest regions in the provincial synthesis of ecological classification data and contributed significantly to the evolution of this guide. T. Lee, T. Fleming, C. Jones, S. Mah, C. Cadrin, A. Inselberg, and K. Yearsley provided data analyses and interpretations for the provincial correlation project. A. Banner was helpful in resolving correlation issues with the Cariboo region on shared ecosystems.

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1 INTRODUCTION

1.1 Objectives/Scope

This guide presents site identification and interpretation information for forest ecosystems of the north central portion of the Northern Interior Forest Region (Figure 1.1).

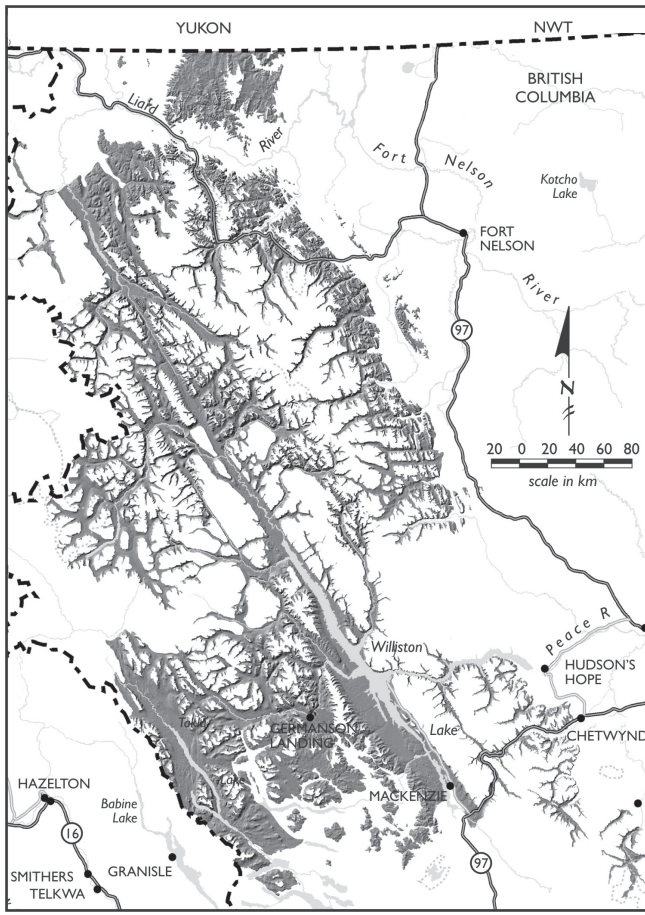


FIGURE 1.1 *Map outlining the area covered by the guide.*

The classification system used follows the biogeoclimatic ecosystem classification (BEC) developed for the province by the B.C. Ministry of Forests (Pojar et al. 1987). The principles have evolved from the work of V.J. Krajina (1965, 1969) and are described in Section 2. The objectives of this classification are:

- to provide a framework for organizing ecological information and management experience about ecosystems;
- to promote further understanding of identified ecosystems and the relationships among them;
- to supply resource managers with a common language to describe forest sites; and
- to improve the user's ability to prescribe and monitor treatment regimes on a site-specific (ecosystem) basis.

The guide has two main goals:

- to assist the user in classifying sample sites in the field; and
- to provide interpretations for these site units that will assist the user in preparing management prescriptions.

This version of the guide results from the recent completion of an inter-regional correlation of the BEC system. The correlation project was completed to ensure the consistency and quality of the ecological information base across the province. This guide replaces the Draft Field Guide Insert for the *Identification and Interpretation for the Northwest Portion of the Prince George Forest Region* produced in 2000.

The Forest Practices Code of British Columbia Act (brought into force on June 15, 1995) requires that a silviculture prescription (SP) be prepared prior to timber harvesting and prior to activities taking place on areas where timber has been cut, removed, damaged, or destroyed by natural causes or by unauthorized harvest. The attendant Operational Planning Regulation requires that the SP specify the BEC and that it be accompanied by a map that illustrates the BEC. In one form or another, this requirement to describe and map the BEC has been a part of silviculture regulations from 1988 to the present.

The *Silviculture Prescription Guidebook* (B.C. Ministry of Forests 2000) provides recommended "best practices" for, among other things, the description and mapping of BEC. The guidebook states,

"The silviculture prescription must contain the following ecological information: biogeoclimatic zone(s), subzone(s), variant(s), and phase(s), where applicable and the site series and (where applicable) phase(s)."

With respect to stratification of site series, the guidebook states, "The BEC site series must be indicated on the silviculture prescription map and described in the silviculture prescription document. Minimum polygon size on the map will depend on its relevance to management objectives for the site. One hectare is generally accepted as a minimum size." The level of mapping detail will depend on the complexity of management proposed. Whether it is necessary to delineate very small units depends on their impact on the prescription.

1.2 Other Sources of Information

Numerous reports on vegetation, soils, wildlife, and ecosystem description and classification exist for the north central portion of the Northern Interior Forest Region and adjoining area. Some of these references can be found in Section 14 (Literature Cited).

A more comprehensive discussion of the BEC system and more complete descriptions of units at broader levels within the hierarchical structure, particularly site associations and site groups, will be available in a series of biogeoclimatic zone reports to be published by the B.C. Ministry of Forests, Research Branch. Information at the biogeoclimatic zone level is available in *Ecosystems of British Columbia* (Meidinger and Pojar [editors] 1991).

An excellent reference for plant identification is *Plants of Northern British Columbia* (MacKinnon et al. [editors] 1992[1]). Page numbers for plants used in site unit identification keys found in each biogeoclimatic unit subsection refer to this publication.

1.3 Guide Contents

This guide consists of 14 sections. Following the introduction is a brief discussion of the classification system (Section 2). Chapter 3 provides procedures for site description, identification, mapping,

1 Second edition published in 1999.

and interpretation. Sections 4–11 contain information about the biogeoclimatic units within the guide area, tools for identification of biogeoclimatic and site units, descriptions of the site units, and direct management interpretations. Section 12 presents indirect interpretations for site preparation options. Wildlife interpretations are given in Section 13. The literature is cited in Section 14.

Biogeoclimatic unit maps (1:300 000 scale) with a LANSAT image base are available to government agencies through the Forest Resources Section, Northern Interior Forest Region, and for others through Spatial Mapping Ltd. BCG maps of each forest district with topographic base are available at http://www.for.gov.bc.ca/bcweb/mapping.htm.

The classification is based on approximately 800 plots located in the north central portion of the Northern Interior Forest Region. These plots are generally well distributed geographically (proportional to the size of the biogeoclimatic unit) except in units with difficult access, such as those within the Engelmann Spruce – Subalpine Fir (ESSF) zone. Most site units are characterized by at least five plots, although certain less common sites (i.e., very dry and wet sites) may be characterized by fewer plots.

1.4 Training Courses

It is assumed that the user of this guide is familiar with the basic concepts and methods of site, soil, and vegetation evaluation and has completed the training programs offered by the Forest Resources Section. These courses are offered annually in various locations within the forest region. For information about such training courses, please contact the Forest Resources Section, Northern Interior Forest Region, or the University of Northern British Columbia Continuing Studies Network.

2 THE BIOGEOCLIMATIC ECOSYSTEM CLASSIFICATION (BEC) SYSTEM

This section briefly describes the biogeoclimatic classification system. For a more complete description refer to *Ecosystems of British Columbia* (Meidinger and Pojar [editors] 1991) or *Biogeoclimatic Ecosystem Classification in British Columbia* (Pojar et al. 1987).

2.1 Classification System

The BEC system is a hierarchical classification scheme that combines three classifications: climatic (or zonal), vegetation, and site. For practical purposes, users need only be concerned with the zonal and site classifications (Figure 2.1). The information presented in this guide will allow the user to apply BEC in the field.

2.2 Zonal (Climatic) Classification

Biogeoclimatic units are groups of ecosystems that have developed under the influence of the same regional climate. In the hierarchy of climatic units, the biogeoclimatic subzone is the basic unit. Subzones are grouped into zones, and divided into variants. Each biogeoclimatic subzone has a distinct climax (or near-climax) plant association on zonal sites. Zonal sites are defined as being those located in midslope positions, with deep, broadly loamy soils and mesic moisture regimes. The climax vegetation on zonal sites is considered to best reflect the regional climatic conditions of the subzone.

Each subzone has a distinctive sequence of related ecosystems ranging from dry to wet sites. Sites that are wetter or drier than the zonal ecosystem are influenced not only by the regional climate, but also by soil and topographic features. For example, in a wet cool subzone of the Sub-Boreal Spruce zone (SBS), zonal sites are dominated by a hybrid white spruce and subalpine fir canopy with a diverse, well developed understorey of shrubs and herbs; dry sites are dominated by a lodgepole pine canopy with an understorey dominated by shrub and moss layers; and wet sites in the same subzone (climate) have hybrid white spruce and subalpine fir overstoreys with an understorey dominated by devil's club and a variety of herbs (e.g., oak fern, lady fern, horsetails).

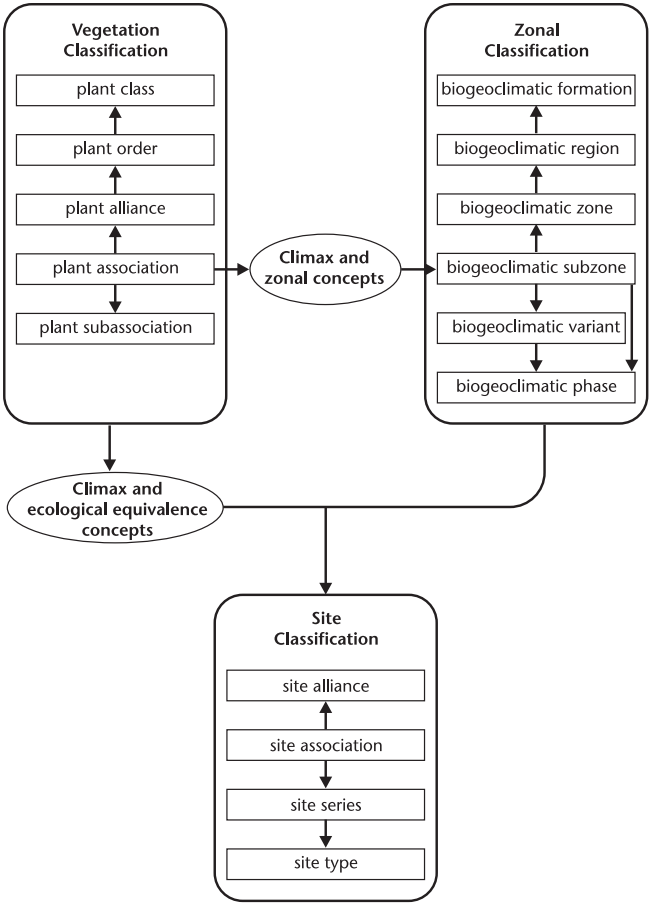


FIGURE 2.1 *Hierarchical relationship between climatic-level (zonal) and site-level classifications. Taken from Pojar et al. 1987. The highlighted classifications are described in this guide.*

The biogeoclimatic variant was defined because subzones contain considerable geographic variation. Variants reflect further differences in regional climate and are generally recognized for areas that are slightly drier, wetter, snowier, warmer, or colder than other areas in the subzone. For example, the Finlay-Peace Wet Cool variant (SBSwk2) of the SBS is cooler and wetter than the Takla Wet Cool variant (SBSwk3) of the SBS. These climatic differences result in corresponding differences in vegetation, soil, and ecosystem productivity. The differences in vegetation are evident as distinct zonal climax plant subassociations.

Subzones with similar climatic characteristics and zonal ecosystems are grouped into biogeoclimatic zones. A zone is a large geographic area with a broadly similar type of climate. A zone has typical patterns of vegetation and associated similarities in nutrient cycling and soil climate. Zones also have one or more typical zonal climax species of tree, shrub, herb, or moss.

Zones are usually named after one or more of the dominant climax species in zonal ecosystems and a geographic or climatic modifier (e.g., Sub-Boreal Spruce Zone). Zones are given a two- to four-letter code that corresponds to the name. For example, the Sub-Boreal Spruce zone code is SBS.

Subzone names are derived from classes of relative precipitation and temperature. Subzone codes correspond to the climatic modifiers (Table 2.1). For example, the SBSmc refers to the Moist Cold (mc) subzone of the Sub-Boreal Spruce (SBS) zone. Variants are named by geographic area and numbered from south to north and from west to east. Hence, the SBSwk2 variant is more southerly than the SBSwk3 variant.

TABLE 2.1 *System of naming and coding interior biogeoclimatic units*

ZONE ab					
a =	precipitation regime		b =	temperature regime	
x	=	very dry	h	=	hot
d	=	dry	w	=	warm
m	=	moist	m	=	mild
w	=	wet	k	=	cool
v	=	very wet	c	=	cold
			v	=	very cold

2.3 Site Classification

Site series are the most commonly used units of site classification (Figure 2.1). Site series occur within a biogeoclimatic subzone or variant. They are defined by using late seral or climax vegetation and result in site units having similar environmental properties and vegetation. The potential vegetation and selected environmental properties are used in this guide to characterize site series.

Each biogeoclimatic unit has a characteristic sequence of site series according to soil moisture regime (SMR) and, to a lesser degree, soil nutrient regime (SNR).[1] Soil moisture regime is a relative scale of "available water" for plant growth within the climate of the biogeoclimatic unit. An eight-class scale is used; it ranges from 0 or very xeric (bare rock) to 7 or subhydric (water tables at or near the surface year-round). Soil nutrient regime is a relative scale of "available nutrients" for plant growth. A five-class scale ranging from A (very poor) to E (very rich) is used.

English names of one to four species are used to name site series, and tree species codes are usually substituted to shorten the name (e.g., SxwFd – Feathermoss site series).

Similar plant communities can occur in different biogeoclimatic units, but the relative moisture regime that they represent may differ between subzones. These communities belong to the same grouping of site series that is collectively called a site association,[2] such as:

SBSmk2/Sxw – Oak fern site series = SBSmk2/05
SBSwk2/Sxw – Oak fern site series = SBSwk2/01.

Both of these site series belong to the same site association, so their climax vegetation is similar, but their occurrence in the landscape, site conditions, and seral vegetation patterns differ between the two biogeoclimatic units.

[1] The Site Identification section (Section 3.4) contains soil moisture and soil nutrient regime identification information.

[2] Site associations are not used in the classification presented in this manual. They are defined in Pojar et al. (1987).

Each site series is given a two-digit numeric code that relates to its position on the relative moisture and nutrient regime scales. Within a biogeoclimatic unit, the forested units are numbered as follows: the 01 site series is the zonal or mesic site, with the rest ranked from driest (02) to wettest (generally 09 to 12) and, secondarily, poorest to richest. Non-forested wetlands are numbered from 31 to 49, shrublands from 51 to 59, meadows from 61 to 69, specialized ecosystems (e.g., talus, avalanche tracks) from 70 to 79, and non-forested grasslands from 81 to 89. Names of seral units are preceded by a $.

Management interpretations are often made directly at the site series level. In some cases, however, interpretations are most efficiently dealt with at broader or finer levels of the classification, such as those less sensitive to site-level differences (e.g., wildlife) or those affected more by variations in site and soil conditions than by climate or vegetation (e.g., site preparation) (see Section 12).

3 PROCEDURES FOR SITE DESCRIPTION, IDENTIFICATION, MAPPING, AND INTERPRETATION

3.1 Introduction

This section outlines the steps involved and the tools that can be used to describe and identify site units (Figure 3.1). Correctly identifying the site unit and having key site information such as slope gradient and soil textures are prerequisites to the development of appropriate management prescriptions.

There is much natural variability in ecosystems, and it is important to approach site classification with that understanding. Not every ecosystem can be easily "pigeonholed" into a classification unit. This field guide provides the information and tools in support of ecological thinking, and should not be used in a "cookbook" fashion.

It is assumed that the user of this guide is familiar with the basic concepts and methods of site, soil, and vegetation evaluation and has completed the training programs offered by the Forest Resources Section. These courses are offered annually in various locations within the forest region. For information about such training courses, please contact the Forest Resources Section, Northern Interior Forest Region, or the University of Northern British Columbia Continuing Studies Network.

Regional Forest Resources staff are available to assist with problems associated with field descriptions, identification, and management interpretations. Sections 3.2 and 3.3 provide tools for biogeoclimatic and site unit identification. Once on-site information has been gathered, a site can be identified using the step-by-step procedures outlined in the Site Identification section (Section 3.4). Information for identifying seral ecosystems and using the interpretations portions of the guide is discussed in Sections 3.5 and 3.6, respectively.

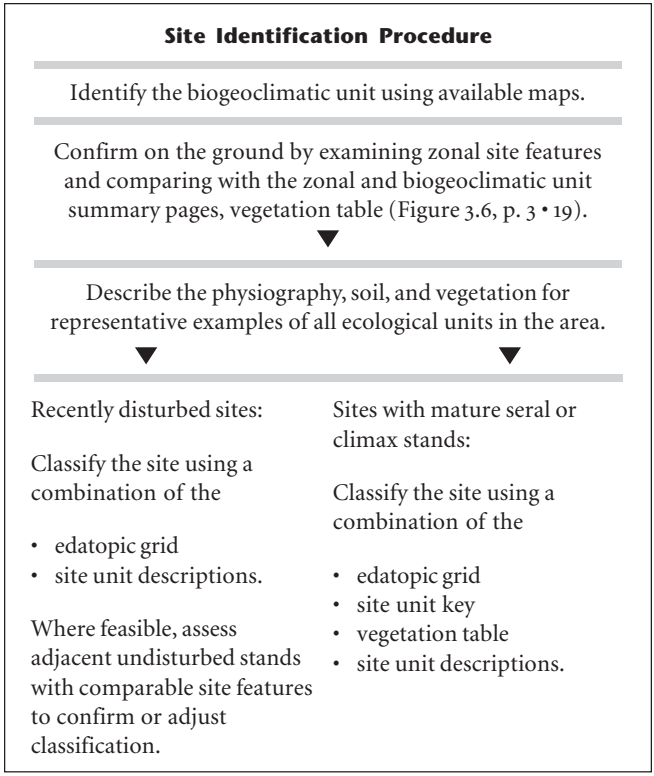


FIGURE 3.1 *A flowchart outlining the procedure for identifying site units.*

3.2 Identifying Biogeoclimatic Units (Subzone/Variant)

The following is a list of the tools available for assisting the user in identifying and describing biogeoclimatic units.

Biogeoclimatic maps: Available at a scale of 1:300 000 these maps provide a relatively detailed portrayal of the geographic distribution of the biogeoclimatic units. This information will also be available in digital format within the inventory database so that it can be accessed in a variety of ways using geographic information system (GIS) capabilities. The biogeoclimatic map should be

referred to before leaving the office, but should not be relied on totally, especially if the area is near biogeoclimatic unit boundaries, in complex mountainous terrain, or in areas only recently accessible by ground.

Biogeoclimatic/Vegetation summary table: This table displays important vegetative differences between the biogeoclimatic units described, as well as for bordering units not described in the guide. This table compares vegetation that is found on zonal sites (refer to Section 2.2). Once a zonal site has been identified, this table can be used either to identify or to reaffirm the identification of a biogeoclimatic unit.

Biogeoclimatic unit summary page: This page, located at the front of each biogeoclimatic unit subsection, contains a brief summary of geographic location, elevation range, climate, distinguishing vegetation features from other adjoining biogeoclimatic units, forests, and wildlife. The distinguishing features, location, and elevation range information can assist in the identification of a biogeoclimatic unit. The remainder of the information is useful as background material in documents related to the particular biogeoclimatic unit.

3.3 Identifying Site Units

The following is a list of the tools available for assisting the user in identifying site units.

Edatopic grid: The edatopic grid displays how the site series relate to each other along the relative gradients of moisture and nutrient regime. Once relative moisture and nutrient regimes are determined (see Section 3.4), the unit(s) generally associated with that moisture and nutrient regime can be identified from the grid.

Vegetation table: This table indicates the prominence of widespread diagnostic species by site series for each biogeoclimatic unit. Prominence values (PVs) are derived by multiplying the square root of the constancy by mean cover. For example, when a species is present in 100% of sample plots (i.e., constancy = 100) and has a mean cover of 5%, the prominence equals 50. Five prominence value classes are displayed by different-sized bars within the tables.

Prominence value	Prominence class	Schematic
0–4	0	
5–15	1	
16–50	2	
51–100	3	
101–200	4	
201+	5	

In general, the vegetation tables contain species that are useful in differentiating between different site units. The actual abundance of plant species on any given site depends on several factors, including the successional status of the site and the type and degree of disturbance that initiated succession. The table values are derived from plots in mature forests (80 years or older). These tables should not be used in seral (i.e., early successional) stands that do not have a closed canopy (see Section 3.5). A possible solution is to find a mature stand adjacent to the seral stand, but the user must be fairly certain that this stand represents the same ecological unit as the site being assessed (e.g., same slope position and soil texture).

Site series key: The dichotomous key uses a series of paired statements containing a combination of site, soil, and vegetation features to direct the user to a site series identification. Since the lead statements often refer to the tree canopy, and any understorey vegetation comments relate to mature sites, the keys work best on sites that have achieved crown closure. When attempting to use the keys on disturbed sites, the user must have some knowledge of the canopy dominance prior to disturbance and must not rely on the understorey vegetation features described in the key. Alternatively, an adjacent mature stand could be used, though the user must be fairly certain that the stand represents the same ecological unit as the site being assessed (e.g., same slope position and soil texture).

Site series summary page: Each site series has a one-page summary of vegetation, site, and soil features. The vegetation list contains species that are found consistently (high constancy). They are listed in order of constancy, and then in order of percent cover within the same level of constancy. Species in square brackets do

not occur consistently, but when they do occur they have high cover. Three plants that generally characterize the unit are illustrated along the left-hand margin. Plant species names generally follow MacKinnon et al. (editors, 1992), which is the manual most commonly used for plant identification in the area. For each site and soil feature, the range in conditions encountered during BEC sampling is indicated. Note that the range indicated may not express the true range of variability that may be encountered. Soil texture classes refer to those displayed on the soil texture triangle in Figure 3.3 (p. 3 • 12). Features preceded by an asterisk (*) are ones that can generally be relied on to differentiate or characterize the site. Distribution is subjectively described in terms of occurrence and size. Occurrence is categorized as very common (dominates landscape, often >50% of area), common (frequently encountered but generally <50% of area), uncommon (not often encountered), or rare (few sites encountered). Size describes the common size of sites from large (often >10 ha) to moderate (often 1–10 ha) to small (generally <1 ha).

3.4 Site Identification

This section outlines a step-by-step procedure to identify a site series. This procedure should be used until users become intimately familiar with the site identification process and the site units in their area of operation.

Step 1
Locate an area for your assessment that appears to be representative of the unit being sampled, and is as homogeneous in plant cover and overstorey canopy condition as possible. Avoid locating the sample area on sites that have recently received significant natural or artificial disturbance (e.g., landings).

Step 2
Determine and record site and soil information important for site identification and the prescription process. Table 3.1 lists some of the more important site and soil factors to be collected. Note that more detailed site and soil information may be required for certain purposes. Tools to assist you include the slope position diagram (Figure 3.2), soil texturing tools (Section 3.4.1), and the humus form description table (Table 3.4, p. 3 • 10).

3.4.1 Hand texturing guides

Soil texture refers to the relative proportions of the sand, silt, and clay separates within a soil. These separates have their own distinctive properties of "feel," allowing one to estimate their proportions in a sample of soil by hand texturing. To obtain accurate results, texturing must be done with a sample that has the correct moisture content, as described on pages 3 • 8 and 3 • 9. Both a table and a key procedure are provided. The user should become familiar with both methods and use the procedure that feels most comfortable.

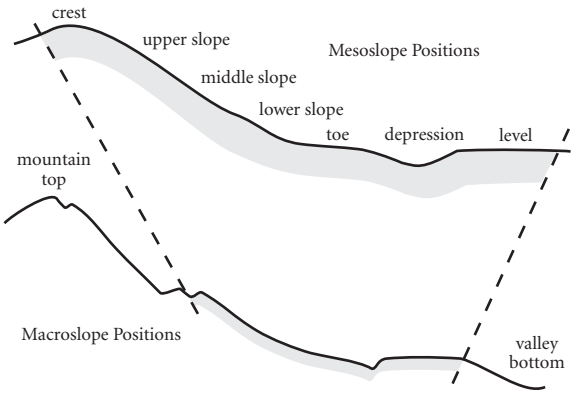


FIGURE 3.2 *Slope position diagram (from Banner et al. 1993).*

TABLE 3.1 *Site and soil factors to be collected*

Factor	Definition
Slope gradient (%):	– measure of a slope's incline; equals vertical rise divided by horizontal distance (100% slope = 45° angle).
Aspect (°):	– the compass direction that a slope is facing.
Mesoslope position:	– relative position of sampling site within a catchment area (e.g., between slope breaks affecting surface water flow; see Figure 3.2).
Soil texture:	– relative proportion of sand, silt, and clay; defined proportions comprising textural classes (see Section 3.4.1).
Coarse fragments (%):	– % by volume of mineral soil fragments >2 mm in diameter.
Effective rooting depth (cm):	– subjective assessment indicating the great -est depth to which root systems of forest trees freely penetrate; depth at which rooting abundance classes drop to "few" (see Province of British Columbia 1998).
Depth to a restricting layer (cm):	– depth to a soil layer or condition that severely restricts root penetration (e.g., compact parent material or bedrock).
Depth to seepage water (gleying) (cm):	– depth to area in soil profile from which water is seeping out; evidence of periodic seepage during the growing season may be indicated by gleying (orange-coloured mottles within a generally olive- to blue-coloured soil matrix).
Humus depth (cm):	– depth of group of horizons located at the soil surface that have formed primarily from organic materials, and that may include mineral soil intermixed with organic material.
Humus form:	– the quality of the humus layer classed into three main orders (mor, moder, mull) based on the rate at which decomposition occurs within the layer (Table 3.4, p. 3 • 10).

Procedure for Hand Texturing Using Table 3.2

1. Crush a small handful of soil in the hand, and remove coarse fragments (particles >2 mm in diameter).
2. Gradually add water to the soil and, with a soil knife or fingers, work it into a moist putty. The correct moisture content is important. If the putty flows with the force of gravity, it is too wet. If it crumbles when rolled, it is too dry. It should have the consistency of filler putty.
3. Determine stickiness of the soil putty by working it between the thumb and forefinger, pressing and then separating the digits. An estimate of clay content (Table 3.3) can be made in this way. (Clay limits below are approximate.)
   non-sticky: Practically no soil material adheres to the thumb and forefinger (<10% clay).
   slightly sticky: Soil material adheres to only one of the digits and comes off the other rather cleanly. The soil does not stretch appreciably when digits are separated (10–25% clay).
   sticky: Soil material adheres to both digits and stretches slightly before breaking when digits are pulled apart (25–40% clay).
   very sticky: Soil material adheres strongly to both digits and stretches distinctly before breaking (>40% clay).
4. Determine the graininess of the soil putty by rubbing it between thumb and forefinger. An estimate of sand content (Table 3.3) can be made in this way. (Sand limits below are approximate.)
   non-grainy: Little or no graininess can be felt (<20% sand).
   slightly grainy: Some graininess is felt, but non-grainy material (silt and clay) is dominant (20–50% sand).
   grainy: Sand is felt as the dominant material. Some non-grainy material can be felt between sand grains (50–80% sand).
   very grainy: Sand is the only material felt. Little or no non-grainy material is present (>80% sand).
5. After stickiness and graininess have been determined, use the hand texturing guide (Table 3.2) as an approximate guide to the textural class of the soil. The textural triangle found with Figure 3.3 can be used for more accurately determining the textural class; it also displays the textural class used in the site unit descriptions.

TABLE 3.2 *Hand texturing guide*[a]

	Non-grainy (<20% sand)	**Slightly grainy** (20–50% sand)	**Grainy** (50–80% sand)	**Very grainy** (>80% sand)
Very sticky (>40% clay)	Silty clay	Clay	Sandy clay	–
Sticky (25–40% clay)	Silty clay loam	Clay loam	Sandy clay loam	–
Slightly sticky (10–25% clay)	Silt loam or silt	Loam[b]	Sandy loam	–
Non-sticky (<10% clay)	–	–	–	Loamy sand or sand

[a] Sand and clay limits are approximate.

[b] Loams contain balanced proportions of sand, silt and clay and exhibit physical properties intermediate between them.

TABLE 3.3 *Properties of soil separates*

Properties of fine fraction	
Clay:	– very hard when dry; feels smooth and is very sticky when wet; feels smooth when placed between teeth.
Silt:	– slightly hard to soft when dry; powder is floury when dry; feels slippery or soapy and only slightly sticky or non-sticky when wet; silt cannot be felt as grains between thumb and forefinger, but can be felt as a fine graininess when placed between teeth.
Sand:	– loose grains when dry; very grainy when felt between thumb and forefinger; non-sticky when wet.

Procedure for Using Key for Hand Texturing

The field tests (outlined below and used in sequence with the accompanying key) are provided as another means to assist in the field determination of soil texture.

1. **Organic matter test:** Well-decomposed organic matter (humus) imparts silt-like properties to the soil. It feels floury when dry and slippery or spongy when moist, but not sticky and not plastic. However, when subjected to a taste test (see below), it

feels non-gritty. It is generally very dark when moist or wet, and stains the hands brown or black.

2. **Graininess test:** Rub the soil between your fingers. If sand is present, it will feel "grainy." Determine whether sand comprises more or less than 50% of the sample. Sandy soils often sound gritty when worked in the hand.

TABLE 3.4 *Identification of upland humus forms*

Mors	– matted F horizon[a] – fungal mycelia common – little or no intermixing of organic and mineral materials – abrupt boundary between organic and mineral horizons
Moders	– loosely arranged F horizon and plentiful insect droppings, especially in the interior. It is common to find Mor humus forms that have loosely structured F horizons because they have been partially burned in the past. These should still be considered mors rather than moders, unless there are plentiful insect droppings present in addition to a loose structure. – fungal mycelia and soil organisms (arthropods and occasional earthworms) – intermixing of organic and mineral horizons – gradual transition between mineral and organic horizons
Mulls	– presence of well-developed Ah horizon[b] – often no F or H horizons[c] (thin if present) – usually many soil organisms, but may form from decomposition of a dense network of roots (usually abundant earthworms)

[a] F horizon: horizon in which partial (rather than entire) macroscopically recogniz-able vegetative structures are dominant (i.e., the horizon is partially decomposed).
[b] Ah horizon: surface mineral horizon enriched with organic matter (characteristically darker in colour than lower soil layers).
[c] H horizon: horizon of highly decomposed organic matter in which original plant vegetative structures are no longer identifiable.

3. **Moist cast test:** Compress some moist (not wet) soil by clenching it in your hand. If the soil holds together (i.e., forms a

"cast"), then test the durability of the cast by tossing it from hand to hand. The more durable it is (e.g., like Plasticine), the more clay is present.

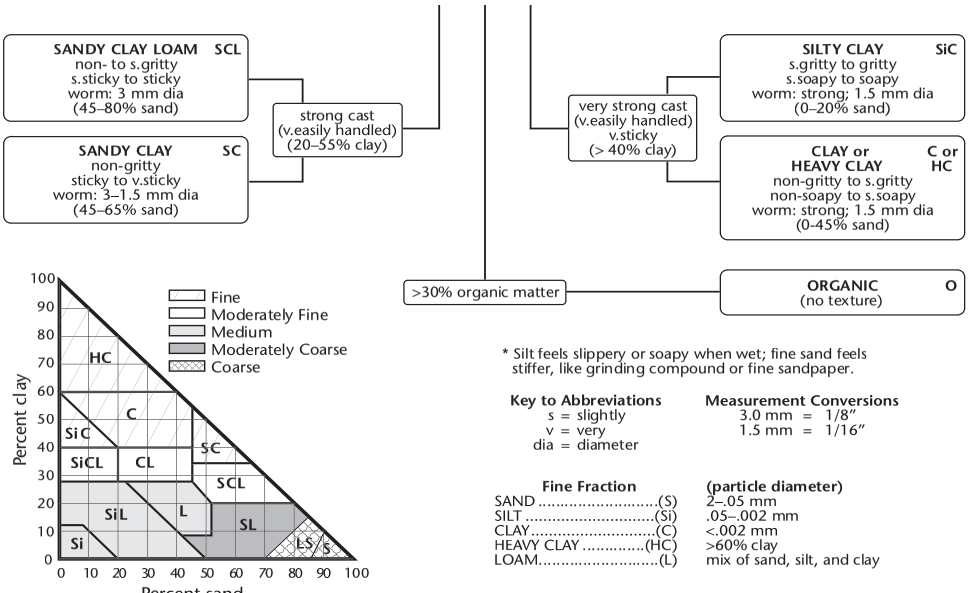
4. **Stickiness test:** Wet the soil thoroughly and compress between thumb and forefinger. Determine the degree of stickiness by noting how strongly the soil adheres to the thumb and forefinger when you release the pressure, and by how much it stretches. Stickiness increases with clay content.
5. **Taste test:** Work a small amount of soil between your front teeth. Silt particles are distinguished as fine "grittiness" (e.g., like driving on a dusty road), unlike sand, which is distinguished as individual grains (i.e., graininess). Clay has absolutely no grittiness.
6. **Soapiness test:** Slide thumb and forefinger over wet soil. Degree of soapiness is determined by how soapy/slippery it feels and how much resistance to slip there is (i.e., from clay and sand particles).
7. **Worm test:** Roll some moist soil on your palm with your finger to form the longest, thinnest "worm" possible. The more clay there is in the soil, the longer, thinner, and more durable the worm will be. Try with wetter or drier soil to ensure that you have the correct moisture content (best worm).

Step 3

Using the site and soil factors recorded, determine the relative moisture regime and relative nutrient regime using the keys provided (Figures 3.4 and 3.5, and Table 3.6), and then proceed to Step 4.

Relative soil moisture regimes: Figure 3.4 is intended to assist the user in identifying relative soil moisture regimes using readily observable environmental features. This information should be applied with caution on ridge crests, upper slopes, and middle slopes that have soils with thick (>20 cm) organic layers, and on steep, northerly facing slopes. Moisture regime in these cases will generally be higher than indicated. The soil moisture regime classes 0–7, shown in the key, correspond to the terms very xeric (0) to subhydric (7) displayed on the edatopic grids. Table 3.5 provides definitions for the categories used in the key shown in Figure 3.4. Ensure that you read these definitions before using the key.

FIGURE 3.3 *Soil texturing key (from Braumandl and Curran [editors] 1992).*

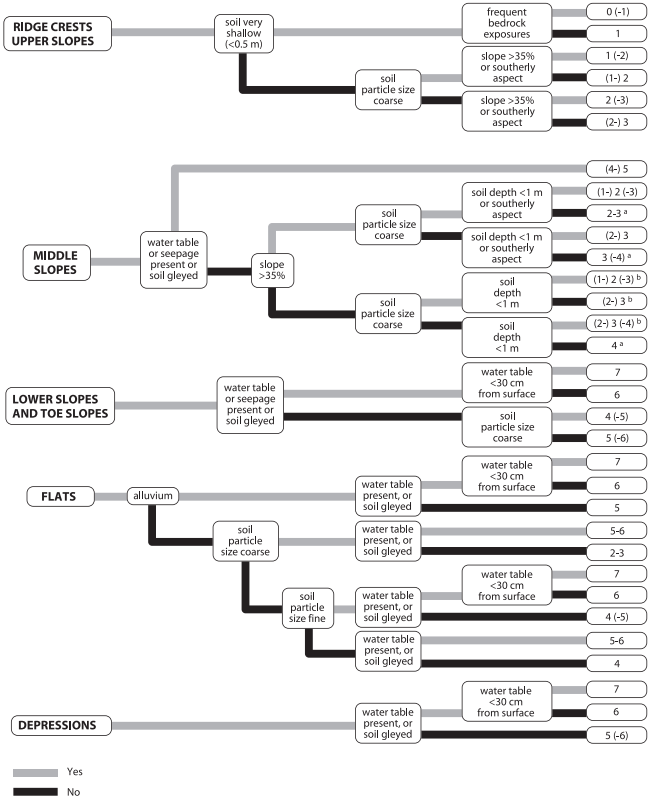


* Silt feels slippery or soapy when wet; fine sand feels stiffer, like grinding compound or fine sandpaper.

Key to Abbreviations
s = slightly
v = very
dia = diameter

Measurement Conversions
3.0 mm = 1/8"
1.5 mm = 1/16"

Fine Fraction	(particle diameter)
SAND .....(S)	2–.05 mm
SILT .....(Si)	.05–.002 mm
CLAY.....(C)	<.002 mm
HEAVY CLAY .....(HC)	>60% clay
LOAM.....(L)	mix of sand, silt, and clay



[a] Generally moister if aspect is N or NE

[b] Generally drier if aspect is S or SW

FIGURE 3.4 *A key to the identification of relative soil moisture regimes. (Caution: read the definintions of particle size and gleying in Table 3.5.)*

TABLE 3.5 *Definitions of terms used in the identification of relative soil moisture regimes*[a]

Category		Definition
Ridge crest:	–	height of land; usually convex slope shape.
Upper slope:	–	the generally convex-shaped, upper portion of a slope.
Middle slope:	–	the portion of a slope between the upper and lower slopes; the slope shape is usually straight.
Lower slope:	–	the area towards the base of a slope; the slope shape is usually concave. It includes toe slopes, which are generally level areas located directly below and adjacent to the lower slope.
Flat:	–	any level area (excluding the slopes); the surface shape is generally horizontal with no significant aspect.
Alluvium:	–	post-glacial, active floodplain deposits along rivers and streams in valley bottoms; usually a series of low benches and channels.
Depression:	–	any area that is concave in all directions; usually at the foot of a slope or in flat topography.
Soil depth:	–	depth from the mineral soil surface to a restricting layer, such as bedrock, strongly compacted materials, or strongly cemented materials (e.g., "hardpan").
Gleyed:	–	soils that have orange-coloured mottles indicative of a fluctuating water table. Permanently gleyed soils are dull yellowish, blue, or olive in colour.
Soil particle size coarse:	–	sandy[b] with >35% volume of coarse fragments, or loamy[b] with >70% volume of coarse fragments.
Soil particle size fine:	–	silty[b] or clayey[b] with <20% volume of coarse fragments.

[a] Adapted from Lloyd et al. (1990) and Green et al. (1984).
[b] Sandy – LS, S; loamy – SL, L, SCL; clayey – SiCL, CL, SC, SiC, C; silty – SiL, Si.

1a Coarse textured[1]
- 2a High coarse fragments (>50%), very shallow soil (<30 cm), and/or shallow rooting depth (<15 cm)
  - 3a Mor humus form — *Very Poor*
  - 3b Moder humus form — *Poor–Medium*
- 2b Moderate to low coarse fragments without restricted rooting depth
  - 4a Mor humus form — *Poor*
  - 4b Moder humus form — *Medium*
  - 4c Mull humus form — *Rich–Very Rich*

1b Moderately coarse and medium textured
- 5a High coarse fragments (>50%), very shallow soil (<30 cm), and/or shallow rooting depth (<15 cm)
  - 6a Mor humus form — *Poor*
  - 6b Moder humus form — *Medium*
- 5b Moderate to low coarse fragments without restricted rooting depth
  - 7a Mor humus form — *Poor–Medium*
  - 7b Moder humus form — *Medium–Rich*
  - 7c Mull humus form — *Very Rich*

1c Moderately fine and fine textured
- 8a High coarse fragments (rare), very shallow soil (<30 cm), and/or shallow rooting depth (<15 cm)
  - 9a Mor humus form — *Poor–Very Poor*
  - 9b Moder humus form — *Poor–Medium*
  - 9c Mull humus form — *Rich*
- 8b Moderate to low coarse fragments without restricted rooting depth
  - 10a Mor humus form — *Medium*
  - 10b Moder or Mull humus form — *Rich*

FIGURE 3.5 *Key for estimating relative soil nutrient regimes. Note: presence of base-rich parent material (limestone, shale, basalt) may improve nutrient status.*

[1] Refer to soil textural triangle (p. 3 • 13) for derivation of soil textures.

TABLE 3.6 *Table for estimation of soil nutrient regime*

	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 (intermediate)				
				high (dark colour)		
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	

Step 4
From a plot area of at least 0.04 ha (20 × 20 m), identify and record as many of the plant species (including tree species) in the plot as possible. Estimate the percent cover of each of the dominant species (i.e., species covering >5% of the plot). Attempt to adjust the list and coverage estimates according to what you have seen over the remainder of the area covered by the same unit.

Step 5
If the biogeoclimatic unit has previously been determined, proceed to the appropriate biogeoclimatic unit subsection (Table 3.7). If not, use the key following Table 3.7 or the vegetation table (Figure 3.6) to determine it. Note that the vegetation used in Figure 3.6 is that occurring on zonal sites (e.g., edatopic grid 4-C) (see Section 2.2). If the site unit is other than zonal, try to locate a zonal site in the area and note the general floristic features (e.g., dominant tree and understorey species), and compare this information with that found in Figure 3.6 or use the key to identify the biogeoclimatic unit. If the area in question is near a biogeoclimatic unit boundary and doubt remains after the verification step, then identify the site unit for both possible biogeoclimatic units. The descriptions and interpretations for both units should then be compared, and the most appropriate information applied.

TABLE 3.7 *Sections and page numbers of biogeoclimatic unit subsections*

Biogeoclimatic unit	Section	Page number
BWBSdk1	5	5 • 1
ESSFmv3	6	6 • 1
SBSmk2	7	7 • 1
SBSwk2	8	8 • 1
SBSwk3	9	9 • 1
SBSwk3a	10	10 • 1
SWBmk	11	11 • 1

Biogeoclimatic Unit Key for North Central Guide Area

1a Low productivity sparse forests located at higher elevations (>1100m) or in valleys receiving cold air drainage; *Betula nana* (scrub birch) (p. 39)[2] and/or *Festuca altaica* (Altai fescue) (p. 247) common.

SWBmk

1b Forest not low productivity and sparse or if so then *Betula nana* and/or *Festuca altaica* very low cover (<1%) or absent.

2a Generally >1050 m in elevation; tree canopy dominated by subalpine fir and Engelmann spruce; or *Rhododendron albiflorum* (white-flowered rhododendron) (p.41) and/or *Valeriana sitchensis* (Sitka valerian) (p.221) present, and often >5% cover.

ESSFmv3

2b Generally <1050 m in elevation; tree canopy sometimes dominated by supalpine fir and Engelmann spruce; *Rhododendron albiflorum* and *Valeriana sitchensis* low cover (<5%) or absent.

3a Tree canopy generally a mixture of lodgepole pine and hybrid white spruce on mesic sites; *Rosa acicularis* (prickly rose) (p. 27) present and *Oplopanax horridus* (devil's club) (p. 36) and *Gymnocarpium dryopteris* (oak fern) (p. 293) absent on mesic sites.

SBSmk2

3b Tree canopy composition variable, but often dominated by hybrid white spruce on mesic sites; *Oplopanax horridus* and/or *Gymnocarpium dryopteris* present and *Rosa acicularis* absent on mesic sites.

[2] Page numbers refer to the publication *Plants of Northern British Columbia* (MacKinnon et al. 1992).

4a Restricted to the upper valley slopes along Williston Reservoir and some valley bottoms of the Rocky Mountains; *Lonicera involucrata* (black twinberry) (p. 48) often very low cover (<1%) or absent on mesic sites.

SBSwk2

4b Geographic distribution not as in 4a; *Lonicera involucrata* (black twinberry) usually present on mesic sites.

5a Douglas-fir often a component of the canopy; *Cornus stolonifera* (red-osier dogwood) (p. 48) and *Disporum hookeri* (Hooker's fairybells) (p. 127) present on mesic sites but *Rubus pedatus* (five-leaved bramble) (p. 92) absent on most sites.

SBSwk3a

5b Douglas-fir rare and only found on drier sites; *Cornus stolonifera* (red-osier dogwood) and *Disporum hookeri* (Hooker's fairybells) absent on mesic sites but *Rubus pedatus* (five-leaved bramble) present on mesic sites.

SBSwk3

Layer	Species	BWBS dk1/01	ESSF mc/01	ESSF mv/101	ESSF mv3/01	ESSF mv4/01	ESSF wv/01	ICH mc1/01	SWB mk1/01	
Trees										
	Abies lasiocarpa	1	4	4	4	3	5	3	4	subalpine fir
	Pseudotsuga menziesii									Douglas-fir
	Tsuga heterophylla						1	5		western hemlock
	Picea spp.	4	3	2	3	3	3	1	3	spruce
	Pinus contorta	3	3	4	2	2		3	3	lodgepole pine
Shrubs										
	Shepherdia canadensis	2								soopolallie
	Rosa acicularis	2								prickly rose
	Vaccinium membranaceum		4	3	4	3	4	3	4	black huckleberry
	Rhododendron albiflorum			3	4	5				white-flowered rhododendron
	Menziesia ferruginea		2	1			4	3		false azalea
	Vaccinium ovalifolium		1		1		3	3		oval-leaved blueberry
	Rubus parviflorus							1		thimbleberry
	Vaccinium alaskaense							2		Alaskan blueberry
	Betula nana								5	scrub birch

Prominence Class: 1 2 3 4 5

FIGURE 3.6 *Zonal vegetation of biogeoclimatic units within and adjacent to area covered by the guide.*

Layer	Species	BWBS dk1/01	ESSF mc/01	ESSF mv1/01	ESSF mv3/01	ESSF mv4/01	ESSF wv/01	ICH mc1/01	SWB mk1/01	
Herbs and Dwarf Shrubs										
	Empetrum nigrum	1	1	1	1	1	1			crowberry
	Vaccinium vitis-idaea									lingonberry
	Cornus canadensis									bunchberry
	Linnaea borealis						1			twinflower
	Rubus pedatus	1								five-leaved bramble
	Arnica cordifolia							1		heart-leaved arnica
	Lathyrus nevadensis			1				1		purple peavine
	Orthilia secunda									one-sided wintergreen
	Rubus pubescens	1		1	1	1	1	1		trailing raspberry
	Gymnocarpium dryopteris		1	1		1		1		oak fern
Mosses, Liverworts, and Lichens										
	Hylocomium splendens									step moss
	Pleurozium schreberi									red-stemmed feathermoss
	Ptilium crista-castrensis									knight's plume
	Barbilophozia lycopodioides									leafy liverwort
	Dicranum fuscescens									curly heron's bill moss
	Rhytidiadelphus triquetrus									electrified cat's tail moss
	Rhytidiopsis robusta									pipecleaner moss

Prominence Class: 1 2 3 4 5

FIGURE 3.6 *continued*

Layer	Species	SBS dk/01	SBS dw3/01	SBS mc2/01	SBS mk1/01	SBS mk2/01	SBS wk2/01	SBS wk3/01	SBS wka3/01	
Trees										
	Abies lasiocarpa			■	■		■	■	■	subalpine fir
	Pseudotsuga menziesii		■		■				■	Douglas-fir
	Tsuga heterophylla									western hemlock
	Picea spp.	■	■	■	■	■	■	■	■	spruce
	Pinus contorta	■	■	■	■	■	■	■	■	lodgepole pine
Shrubs										
	Shepherdia canadensis		■	■		■				soopolallie
	Rosa acicularis	■	■	■	■	■			■	prickly rose
	Menziesia ferruginea			■						false azalea
	Vaccinium alaskaense									Alaskan blueberry
	Betula nana									scrub birch
	Vaccinium membranaceum		■	■	■	■	■	■		black huckleberry
	Rhododendron albiflorum						■			white-flowered rhododendron
	Rubus parviflorus	■	■	■	■	■	■	■	■	thimbleberry
	Vaccinium ovalifolium			■	■					oval-leaved blueberry

Prominence Class: 1 ■ 2 ■ 3 ■ 4 ■ 5 ■

FIGURE 3.6 *continued*

Layer	Species	SBS dk/01	SBS dw3/01	SBS mc2/01	SBS mk1/01	SBS mk2/01	SBS wk2/01	SBS wk3/01	SBS wka3/01	
Herbs and Dwarf Shrubs										
	Empetrum nigrum									crowberry
	Vaccinium vitis-idaea			1		1				lingonberry
	Cornus canadensis	3	4	4	4	4	4	3	2	bunchberry
	Linnaea borealis	3	2	2	1	2	2	2	1	twinflower
	Rubus pedatus			3	3		3	4		five-leaved bramble
	Arnica cordifolia	1	1	2	1					heart-leaved arnica
	Lathyrus nevadensis	2								purple peavine
	Orthilia secunda		1	2	1	1	1			one-sided wintergreen
	Rubus pubescens	1	2	1	1	2	1	1		trailing raspberry
	Gymnocarpium dryopteris				2	1	4	3	2	oak fern
Mosses, Liverworts, and Lichens										
	Barbilophozia lycopodioides			1			1	1		leafy liverwort
	Dicranum fuscescens						1			curly heron's bill moss
	Hylocomium splendens	4	2	3	3	4	3	2	2	step moss
	Pleurozium schreberi	4	4	4	4	4	4	4	3	red-stemmed feathermoss
	Ptilium crista-castrensis	4	4	4	4	4	4	4	4	knight's plume
	Rhytidiadelphus triquetrus	1	2		2	1	1	1		electrified cat's tail moss
	Rhytidiopsis robusta									pipecleaner moss

Prominence Class: 1 2 3 4 5

FIGURE 3.6 *continued*

3.5 Identifying Seral Ecosystems

The biogeoclimatic ecological classification was developed based on samples of climax and late seral vegetation (forest stands older than 80 years). Because of this, environmental features must be more heavily relied upon when attempting to assess recently disturbed or seral sites. Since environmental features among site series can overlap considerably, disturbed sites are often difficult to identify. Remnant climax vegetation found in portions of the site not subjected to burning or heavy mechanical site preparation may help in the assessment. Otherwise, vegetation found in an adjacent mature stand with similar environmental features (e.g., same slope position and soil texture) can be used.

3.6 Management Interpretations

Interpretations are provided in two areas of the guide. Within the biogeoclimatic unit sections (5–11) are direct interpretations. These relate to specific site units and are contained on the page facing the appropriate unit. Section 12 contains interpretations that can be made at a more general level than the site series, or that are best handled by indirect interpretation methods that incorporate factors other than moisture and nutrient regime.

3.6.1 Direct interpretations

On the page facing each site unit description is a variety of direct interpretations that have been grouped under the following subheadings.

Site limitations: This section contains statements about ecological conditions that may place limitations on forest productivity or forest operations. The limitations may be either generally applicable to the site unit, or specific to sites with a particular, identified ecological condition. For example, the phrase "sites within this unit with thick organic horizons (>10 cm) will have reduced spring soil temperatures, slowing root development" refers only to sites within the site unit that have organic horizons >10 cm in depth. After each site limitation listed, there are recommended solutions to deal with the limitation. This information is in ***bold italic*** text.

Site preparation: This section contains site preparation options or directs the user to site preparation keys in Section 12. Occasionally, specific comments relating to site preparation are also found here.

Species choice: This section contains species selection information that has been correlated at the site series level across the province. General-use species are shown in normal type. Species that have one or more restrictions are in ***bold italic.*** The restrictions relating to species in bold italic are found in one of three sections: Site limitations, Reforestation, or Concerns. When users encounter a species in bold italic, restrictions applicable to that species should be determined by examining these sections. Species found in square brackets (e.g., [Bl]) are species of secondary choice due to a lower ranking of reliability, productivity, or silvicultural feasibility. Species indicated with round brackets (e.g., (Pl, Sb)) are generally significantly less productive than other ecologically acceptable species on the site unit. These species are restricted to comprising a minor proportion (e.g., 20–30%) of the stand or area. These species could be used in only a few localities or blocks within an area, as a minor component of all plantations, or only in test trials. Broadleaf species shown in brace brackets (e.g., {At}) are limited in productivity, reliability, and/or feasibility. The most recent version of the correlated tree species selection guidelines was used to compile the species choice lists. Minor discrepancies may surface, however, so the user of the guide should attempt to get the most up-to-date guidelines before making final choices.

Vegetation potential: This section subjectively rates the potential of the site to produce non-crop vegetation that may pose a risk to the survival and target growth of the crop tree by limiting light availability. Competition for moisture is not considered. Vegetation species posing the greatest potential threat to the crop tree are listed in round brackets when the potential is rated moderate or greater. Before treatments are prescribed to manage these species, the Wildlife Interpretations section (Section 13) should be used to determine the importance to wildlife of the vegetation species present.

4 BIOGEOCLIMATIC UNIT OVERVIEW

The area covered by this guide extends from the lee slopes of the Rocky Mountains in the east to the westernmost boundaries of the Fort St. James, Mackenzie, and Fort Nelson Forest Districts, and from just south of 55° N latitude in the south to the Yukon Territory border in the north (Figure 1.1). Five biogeoclimatic zones are found within the guide area: the Sub-Boreal Spruce Zone (SBS) in valleys in the south, the Boreal White and Black Spruce Zone (BWBS) in the valleys in the north, the Engelmann Spruce – Subalpine Fir Zone (ESSF) at higher elevations generally above the SBS, the Spruce – Willow – Birch (SWB) at higher elevations generally above the BWBS, and the Alpine Tundra above treeline. This guide covers the following biogeoclimatic subzones and variants: BWBSdk1, ESSFmv3, SBSmk2, SBSwk2, SBSwk3, SBSwk3a, and SWBmk.

The climate within the guide area can be broadly described as continental, and is characterized by seasonal extremes of temperature, severe snowy winters, relatively warm, moist, and short summers, and moderate to high levels of precipitation (Table 4.1). The SBSwk2 is the wettest of the units, the BWBSdk1 is the driest, the SBSmk2 is the warmest, and the SWBmk is the coldest. Few climatic data are available for some of the units, and in some cases they have been collected near the edge of the unit; consequently, the numbers may not adequately represent the climate of the area as a whole.

The study area contains climax forests dominated by white spruce (*Picea glauca*), hybrid white spruce (*Picea engelmannii* x *glauca*) or Engelmann spruce (*Picea engelmannii*), and/or subalpine fir (*Abies lasiocarpa*). Lodgepole pine (*Pinus contorta*), a pioneer species following fire, is common in mature forests. There are extensive seral stands of trembling aspen (*Populus tremuloides*) and lodgepole pine. Black spruce (*Picea mariana*) is commonly found in wetland areas and on upland sites on poorer soils. Other tree species that have more limited ranges within the guide area are discussed in the introductory comments for each biogeoclimatic unit. Figure 3.6 compares characteristic vegetation of each of the biogeoclimatic units described and can be a useful tool in determining biogeoclimatic units in the field, especially near unit boundaries. A list of important wildlife species found in each of the units is given in the Wildlife Interpretations section (Table 13.1).

TABLE 4.1 *Summary of climate data for biogeoclimatic units within the guide area*[a]

Climatic Characteristics		Biogeoclimatic Unit					
		BWBSdk1	**ESSFmv3**	**SBSmk2**	**SBSwk2**	**SBSwk3**	**SWBmk**
Annual precipitation (mm)	Mean	417 (502)[b]	(743)	692 (543)	952 (759)	608 (622)	579 (664)
	Range	326–513	N/A	N/A	518–1916	518–698	459–699
	SD[c]	(123)	(118)	(77)	(260)	(77)	(116)
Growing-season precipitation (mm)	Mean	221	262	249	335	239	341
	Range	130–278	202–316	209–296	198–583	198–293	254–442
Annual snowfall (cm)	Mean	157	N/A	337	786	209	269
	Range	15–269	N/A	N/A	210–1075	N/A	144–395
Annual temperature (°C)	Mean	-0.3 (-0.7)	(0.4)	1.2 (1.6)	1.4 (1.3)	2.4 (1.7)	-1.5 (-1.7)
	Range	-1.9–2.0	N/A	0.7–1.9	-0.1–5.0	N/A	-3.2–0.5
	SD	(1.2)	(0.7)	(0.6)	(0.7)	(0.5)	(0.7)
Growing degree days (>5 °C)	Mean	953	N/A	1110	1139	1188	667
	Range	595–1897	N/A	N/A	984–1139	866–1510	534–933
Frost-free period (days)	Mean	N/A	N/A	75	91	104	58
	Range	N/A	N/A	N/A	88–95	79–128	37–99

[a] Reynolds, G. 1989. Climatic data summaries for the biogeoclimatic zones of British Columbia. B.C. Min. For., Research Branch, Victoria, B.C., unpublished report.

[b] Data in brackets are estimated using an overlay of the biogeoclimatic map and climatic maps modelled using the PRISM process (Daly et al. 1997)

[c] Standard deviation of the mean.

5 STIKINE DRY COOL BOREAL WHITE AND BLACK SPRUCE (BWBSdk1)[1]

Location

The BWBSdk1 occurs in the valley bottoms of the Omineca Mountains and Rocky Mountain Trench as far south as the Germansen River, as far north as the Turnagain River, as far east as the Rocky Mountain divide, and as far west as the divide east of Takla Lake.

Elevation range

700 – 1100 m

Climate

This is the driest biogeoclimatic unit in the guide area (Table 4.1). Estimated mean annual temperature is lower than in all the biogeoclimatic units in the guide area except the SWBmk

Distinguishing the BWBSdk1 from adjoining biogeoclimatic units

ESSFmc and ESSFmv3 have:

- less prickly rose and highbush-cranberry but more black huckleberry and white-flowered rhododendron in the shrub layer on mesic sites; and
- less palmate coltsfoot and tall bluebells but more five-leaved bramble and heart-leaved arnica in the herb layer on mesic sites.

SBSmk1, SBSmk2, and SBSwk3 have:

- less soopolallie but more black huckleberry in the shrub layer on mesic sites;
- little or no heart-leaved arnica in the herb layer but more palmate coltsfoot and/or oak fern on mesic sites; and
- little or no fuzzy-spiked wildrye in the herb layer on drier sites.

SBSmc2 has:

- less prickly rose and highbush-cranberry but more black huckleberry in the shrub layer on mesic sites; and
- less palmate coltsfoot and tall bluebells but more five-leaved bramble in the herb layer on mesic sites.

[1] Formerly BWBSe1; classification adapted from Banner et al. (1993)

SWBmk has:

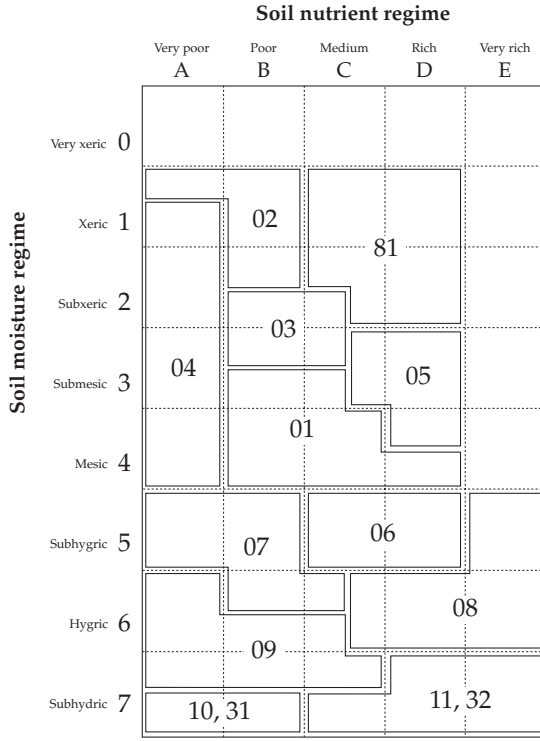
- less prickly rose and highbush-cranberry but more scrub birch in the shrub layer on mesic sites; and
- less palmate coltsfoot and tall bluebells but more lingonberry in the herb layer on mesic sites.

Forests

Due to the fairly extensive fire history, forested areas are often seral forests dominated by lodgepole pine and/or trembling aspen. Hybrid white spruce and subalpine fir dominate in climax forests. Black spruce is common on upland sites with lodgepole pine on gentle slopes with a cool aspect and in wetlands. Black cottonwood occurs along streams and rivers and is often associated with hybrid white spruce.

Wildlife

This variant supports good elk and moose winter range and movement corridors for northern caribou. Aquatic furbearer habitat occurs along major river systems. Waterfowl use wetlands for staging and stop-over during migration.



01 Sw - Knight's plume - Step moss
02 Pl - Lingonberry - Feathermoss
81 Grassland/scrub*
03 Sw - Wildrye - Feathermoss
04 Sb - Lingonberry - Knight's plume
05 SwPl - Soopolallie - T winflower
06 Sw - Scouring-rush - Step moss
07 Sb - Lingonberry - Coltsfoot
08 Sw - Currant - Horsetail
09 Sb - Horsetail - Sphagnum
10 Sb - Labrador tea - Sphagnum (forested bog)*
11 Sw - Willow - Gloss moss (forested swamp)*
31 Non-forested bog*
32 Non-forested fen/marsh*

* Not included in site series descriptions. See *Land Management Handbook 26: A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region* for more discussion of these units.

FIGURE 5.1 *Edatopic grid displaying site units of the BWBSdk1 variant.*

	02	81	03	04	05	01	06	07	08	09	10*	11*	31*	32*	
Trees															
Pinus contorta	■	■	■	■	■	■	■	■	■						lodgepole pine
Populus tremuloides		■	■	■	■	■	■	■	■	■		■	■		trembling aspen
Picea glauca	■		■	■	■	■	■	■	■	■		■		■	white spruce
Abies lasiocarpa	■				■	■		■	■						subalpine fir
Picea mariana				■		■		■		■	■		■		black spruce
Shrubs															
Vaccinium membranaceum	■		■												black huckleberry
Shepherdia canadensis	■		■	■	■	■	■	■							soopolallie
Picea glauca	■		■	■	■	■	■	■	■			■			white spruce
Rosa acicularis		■	■		■	■		■	■			■			prickly rose
Viburnum edule			■		■	■			■						highbush-cranberry
Picea mariana		■		■		■		■		■	■		■		black spruce
Ledum groenlandicum				■	■	■	■	■	■	■	■	■	■		Labrador tea
Salix barclayi												■			Barclay's willow
Salix spp.		■								■		■		■	willow
Betula nana								■		■	■	■	■	■	scrub birch
Alnus tenuifolia									■				■	■	mountain alder
Herbs and Dwarf Shrubs															
Arctostaphylos uva-ursi	■	■			■						■				kinnikinnick
Elymus trachycaulus		■													slender wheatgrass
Artemisia frigida		■													pasture sage
Leymus innovatus	■	■	■	■		■									fuzzy-spiked wildrye
Geocaulon lividum					■			■							bastard toad-flax
Empetrum nigrum				■			■	■		■	■	■	■		crowberry
Linnaea borealis	■		■	■	■	■	■	■	■			■			twinflower
Cornus canadensis	■		■	■		■		■	■			■			bunchberry
Vaccinium vitis-idaea	■		■	■		■	■	■		■	■	■	■		lingonberry
Arnica cordifolia					■	■									heart-leaved arnica

FIGURE 5.2 *BWBSdk1 vegetation table.*

* Not included in site series descriptions. See *Land Management Handbook 26: A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region* for more discussion of these units.

FIGURE 5.2 *continued*

1a Canopy dominated by black spruce; lower slope to toe or depression

2a Mineral soil often present at depth; horsetail low to high cover (>1%)

BWBSdk1/09

2b Mineral soil absent; horsetail very low cover (<1% cover) or absent

BWBSdk1/10

1b Black spruce, if present in canopy, with lodgepole pine; slope position variable

3a Canopy dominated by white spruce

4a Lower slope to toe, level or depression: *Ledum groenlandicum* (p. 40)[2] or *Equisetum* spp. (pp. 281–284) moderate to high cover (>5%)

5a Level or depression; soils fluvial or organic; *Alnus incana* ssp. *tenuifolia* (p. 38) or *Betula nana* (p. 39) present

6a Low-productivity open forest; soils generally organic; *Betula nana* and *Sphagnum* spp. present

BWBSdk1/11

6b Productive forest; soils generally fluvial; *Betula nana* and *Sphagnum* spp. absent

BWBSdk1/08

5b Lower slope to toe; soils variable; black spruce present in canopy; *Ledum groenlanicum* present, *Alnus incana* ssp. *tenuifolia* absent

BWBSdk1/07

[2] Page numbers refer to the publication *Plants of Northern British Columbia* (MacKinnon et al. 1992).

4b Slope position variable; *Ledum groenlandicum* and *Equisetum* spp. very low cover (<1%) or absent

7a Mid to lower slope; fine to medium-textured soils; poorly developed shrub and herb layers
BWBSdk1/06

7b Slope position variable but often mid; medium- to coarse-textured soils; fairly well-developed shrub and herb layers
BWBSdk1/01

3b Canopy dominated by lodgepole pine or lodgepole pine–black spruce

8a Black spruce moderate to high cover (>5%) in tree and/or shrub layer; *Ledum groenlandicum* present and often moderate to high (>5% cover)

9a Mid-slope to crest or level; seepage water usually absent; *Shepherdia canadensis* (p. 49) and *Leymus innovatus* (p. 232) generally present
BWBSdk1/04

9b Generally lower slope to toe; seepage water usually present; *Shepherdia canadensis* and *Leymus innovatus* absent
BWBSdk1/07

8b Black spruce low cover (<5%) or absent in tree or shrub layer; *Ledum groenlandicum* very low cover (<1%) or absent

10a Coarse-textured glaciofluvial soils or shallow soils over bedrock; *Viburnum edule* (p. 35) absent, *Cladina* spp. (pp. 332–334) moderate to high cover (>5%)
BWBSdk1/02

10b Soils variable but never shallow over bedrock; *Viburnum edule* usually present, *Cladina* spp. low cover (<1%) or absent

11a Mid-slope to crest; soils often coarse; *Leymus innovatus* often abundant
BWBSdk1/03

11b Slope position variable; soils variable; *Leymus innovatus* usually low cover (<5%) or absent

12a White spruce often abundant in canopy; *Arctostaphylos uva-ursi* (p. 82) generally absent
BWBSdk1/01

12b Hybrid white spruce generally low cover (<10% cover) or absent from canopy; *Arctostaphylos uva-ursi* generally present
BWBSdk1/05

Viburnum edule

Orthilia secunda

Hylocomium splendens

VEGETATION

Tree Layer: 60% cover
White spruce, lodgepole pine

Shrub Layer: 50% cover

Viburnum edule	(highbush-cranberry)
Rosa acicularis	(prickly rose)
Shepherdia canadensis	(soopolallie)

white spruce, subalpine fir

Herb Layer: 25% cover

Orthilia secunda	(one-sided wintergreen)
Linnaea borealis	(twinflower)
Cornus canadensis	(bunchberry)
Epilobium angustifolium	(fireweed)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Mertensia paniculata	(tall bluebells)
Pyrola asarifolia	(rosy wintergreen)

Moss Layer: 90% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Ptilium crista-castrensis	(knight's plume)
Peltigera spp.	(pelt lichens)

SOIL AND SITE

Moisture Regime:	3–4(–5) (submesic–mesic (–subhygric)
Nutrient Regime:	B–C(–D) (poor–medium (–rich))
Slope Gradient (%):	0–85, usually less than 30
Slope Position:	upper–lower or level
Parent Material:	variable but usually morainal or glaciofluvial
* Soil Texture:	medium–coarse
Coarse Fragments (%):	0–75

DISTRIBUTION: very common

INTERPRETATIONS

Site limitations:
- sites within this unit with medium- to fine-textured lacustrine soils often have poor soil structure, leading to poor root growth; ***plant stock that will achieve better lateral root development (e.g., Cu-treated), prescribe natural regeneration, or protect advance regeneration.***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- see Section 12.

Species choice:
- Pl, Sw, [***Bl***], (***Sb***)
  {At, Ep}

Vegetation potential:
- moderate (trembling aspen, prickly rose, fireweed)

Reforestation:
- attempt to regenerate naturally if potential exists.
- help maintain stand diversity on sites to be planted with Pl by mapping aspen patches prior to harvest and planting these areas to spruce.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
- Sb is generally less productive than other species on these sites.

Concerns:
- sites with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict traffic to winter operations or dry soil conditions.***

lodgepole pine

Shepherdia canadensis

Vaccinium vitis-idaea

VEGETATION

Tree Layer: 20% cover
Lodgepole pine, white spruce

Shrub Layer: 20% cover

Shepherdia canadensis	(soopolallie)

lodgepole pine, white spruce, subalpine fir

Herb Layer: 10% cover

Linnaea borealis	(twinflower)
Vaccinium vitis-idaea	(lingonberry)
Arctostaphylos uva-ursi	(kinnikinnick)
Vaccinium caespitosum	(dwarf blueberry)
Cornus canadensis	(bunchberry)

Moss Layer: 70% cover

Cladina spp.	(reindeer lichens)
Pleurozium schreberi	(red-stemmed feathermoss)
Cladonia spp.	(cladonia lichens)
Peltigera aphthosa	(freckle pelt lichen)
Stereocaulon tomentosum	(eyed foam lichen)
Polytrichum juniperinum	(juniper haircap moss)

SOIL AND SITE

Moisture Regime:	1–2 (xeric–subxeric)
Nutrient Regime:	A–B (very poor–poor)
Slope Gradient (%):	0–30
Slope Position:	variable
* Parent Material:	glaciofluvial or colluvium over rock
* Soil Texture:	coarse(–medium)
Coarse Fragments (%):	30–80

DISTRIBUTION: uncommon

INTERPRETATIONS

Site limitations:
- the combination of poor productivity and high wildlife value means that these sites should be protected from harvesting.

Species choice:
- Pl, (***Bl***, ***Sb***, ***Sw***)
  {At}

Reforestation:
- Bl, Sb and Sw are significantly less productive than Pl on these sites.
- At is not consistently productive on these sites.

Concerns:
- conserving the humus layer is critical for moisture and nutrient retention.
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site and soil conditions of this unit result in drought hazard for a significant portion of the growing season; ***natural regeneration is generally better adapted to surviving these conditions, especially during establishment.***

Rosa acicularis

Shepherdia canadensis

Leymus innovatus

VEGETATION

Tree Layer: 35% cover
Lodgepole pine, white spruce

Shrub Layer: 30% cover

Rosa acicularis	(prickly rose)
Viburnum edule	(highbush-cranberry)
Shepherdia canadensis	(soopolallie)

white spruce

Herb Layer: 20% cover

Linnaea borealis	(twinflower)
Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided wintergreen)
Epilobium angustifolium	(fireweed)
Leymus innovatus	(fuzzy-spiked wildrye)
Mertensia paniculata	(tall bluebells)

Moss Layer: 80% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium spendens	(step moss)
Ptilium crista-castrensis	(knight's plume)
Peltigera aphthosa	(freckle pelt lichen)

SOIL AND SITE

Moisture Regime:	2–3 (subxeric–submesic)
Nutrient Regime:	B–(C) (poor– (medium))
* Slope Gradient (%):	5–90 usually less than 30
* Slope Position:	mid to crest or level
Parent Material:	glaciofluvial or morainal
* Soil Texture:	coarse to medium
Coarse Fragments (%):	0–75

DISTRIBUTION: common

INTERPRETATIONS

Site limitations:
- sites within this unit with high coarse fragment content (>70%) will have significantly reduced soil moisture retention and will be extremely difficult to plant; ***attempt to regenerate naturally by retaining Pl cones.***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- light scarification for seedbed preparation or summer logging with no site preparation.

Species choice:
- Pl, [***Sw***]
  {At}

Vegetation potential:
- low

Reforestation:
- attempt to regenerate naturally if potential exists.
- if natural regeneration is not feasible, plant Pl without site preparation.
- Sw should be planted only on moister microsites.
- At is not consistently productive on these sites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site and soil conditions of this unit result in drought hazard for a significant portion of the growing season; ***natural regeneration is generally better adapted to surviving these conditions, especially during establishment.***

black spruce

Ledum groenlandicum

Vaccinium vitis-idaea

VEGETATION

Tree Layer: 35% cover
Lodgepole pine, white spruce, black spruce

Shrub Layer: 35% cover

Ledum groenlandicum	(Labrador tea)
Shepherdia canadensis	(soopolallie)
black spruce	

Herb Layer: 15% cover

Vaccinium vitis-idaea	(lingonberry)
Cornus canadensis	(bunchberry)
Linnaea borealis	(twinflower)
Empetrum nigrum	(crowberry)
Leymus innovatus	(fuzzy-spiked wildrye)

Moss Layer: 90% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium spendens	(step moss)
Peltigera aphthosa	(freckle pelt lichen)
Ptilium crista-castrensis	(knight's plume)
Cladina spp.	(reindeer lichens)

SOIL AND SITE

Moisture Regime:	2–3(–4) (subxeric–submesic (–mesic))
Nutrient Regime:	A–(B) (very poor–(poor))
Slope Gradient (%):	0–10
* Aspect:	usually north if sloping
* Slope Position:	mid to crest or level
Parent Material:	glaciofluvial or morainal
* Soil Texture:	medium to coarse
Coarse Fragments (%):	0–80

DISTRIBUTION: common

INTERPRETATIONS

Site limitations:
- sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, which slows root development; ***reduce organic horizon thickness during site preparation.***
- soils are saturated in the spring, but may experience drought in summer, both resulting in poor root development; ***poor productivity resulting from these limitations should dictate a limited intensive silvicultural investment.***
- sites within this unit with high coarse fragment content (>70%) will have significantly reduced soil moisture retention and will be extremely difficult to plant; ***attempt to regenerate naturally by retaining Pl cones.***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- light scarification for seedbed preparation or summer logging with no site preparation.

Species choice:
- Pl, (***Sw***, ***Sb***)
  {At}

Vegetation potential:
- low

Reforestation:
- attempt to regenerate naturally if potential exists.
- plant Pl with no site preparation if natural regeneration is not feasible.
- Sw and Sb are significantly less productive than Pl.
- At is not consistently productive on these sites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- frost will cause regeneration damage, especially in any naturally occurring or artificially created depressions; ***leaving a partial canopy and/or planting a frost-resistant species (e.g., Pl) is advised.***
- trafficability may be a problem on these sites during the summer.

lodgepole pine

Shepherdia canadensis

Linnaea borealis

VEGETATION

Tree Layer: 60% cover
Lodgepole pine

Shrub Layer: 45% cover

Shepherdia canadensis	(soopolallie)
Rosa acicularis	(prickly rose)
Viburnum edule	(highbush-cranberry)
lodgepole pine	

Herb Layer: 70% cover

Linnaea borealis	(twinflower)
Geocaulon lividum	(bastard toad-flax)
Arnica cordifolia	(heart-leaved arnica)
Cornus canadensis	(bunchberry)
Galium boreale	(northern bedstraw)
[*Arctostaphylos uva-ursi*	(kinnikinnick)]

Moss Layer: 20% cover

Polytrichum spp.	(hair-cap mosses)
Pleurozium schreberi	(red-stemmed feathermoss)

SOIL AND SITE

Moisture Regime:	3 (–4) (submesic (–mesic))
Nutrient Regime:	C–D (medium–rich)
Slope Gradient (%):	0–25
* Slope Position:	variable
Parent Material:	(glacio–) fluvial
Soil Texture:	medium–moderately coarse
Coarse Fragments (%):	variable

DISTRIBUTION: uncommon

INTERPRETATIONS

Site limitations:	– sites within this unit with medium- to fine-textured lacustrine soils often have poor soil structure, leading to poor root growth; ***plant stock that will achieve better lateral root development (e.g., Cu-treated), prescribe natural regeneration, or protect advance regeneration.***
Site preparation:	– minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard. – see Section 12.
Species choice:	– Pl, Sw, [***Bl***], (***Sb***) At, Ep
Vegetation potential:	– moderate (trembling aspen, prickly rose , fireweed)
Reforestation:	– attempt to regenerate naturally if potential exists. – help maintain stand diversity on sites to be planted with Pl by mapping aspen patches prior to harvest and planting these areas to spruce. – young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose. – Sb is generally less productive than other species on these sites.
Concerns:	– see Site limitations

Arctostaphylos rubra

Equisetum scirpoides

Hylocomium splendens

VEGETATION

Tree Layer: 40% cover
white spruce

Shrub Layer: 10% cover

Salix spp.	(willows)
white spruce	

Herb Layer: 70% cover

Linnaea borealis	(twinflower)
Equisetum scirpoides	(dwarf scouring-rush)
Arctostaphylos rubra	(red bearberry)
Mertensia paniculata	(tall bluebells)
Festuca altaica	(Altai fescue)
Empetrum nigrum	(crowberry)
Geocaulon lividum	(bastard toadflax)
[*Vaccinium vitis-idaea*	(lingonberry)]

Moss Layer: 90% cover

Hylocomium splendens	(step moss)
Peltigera spp.	(pelt lichens)
Pleurozium schreberi	(red-stemmed feathermoss)
Dicranum spp.	(curly mosses)

SOIL AND SITE

Moisture Regime:	5 (subhygric)
Nutrient Regime:	C–D (medium–rich)
Slope Gradient (%):	5–15
* Slope Position:	lower to mid
Parent Material:	morainal, glaciofluvial
* Soil Texture:	variable but often medium
Coarse Fragments (%):	0–75

DISTRIBUTION: uncommon

INTERPRETATIONS

Site limitations:
- sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, which slows root development; ***reduce organic horizon thickness during site preparation.***
- sites within this unit with medium- to fine-textured lacustrine soils often have poor soil structure, leading to poor root growth; ***plant stock that will achieve better lateral root development (e.g., Cu-treated), prescribe natural regeneration, or protect advance regeneration.***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- see Section 12.

Species choice:
- Pl, Sw, [***Bl***], (***Sb***)
  {Acb, At, Ep}

Vegetation potential:
- moderate (trembling aspen, fireweed)

Reforestation:
- attempt to regenerate naturally if potential exists.
- plant mix of Pl and Sw if natural regeneration is not feasible.
- help maintain stand diversity on sites to be planted with Pl by mapping aspen patches prior to harvest and planting these areas to spruce.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
- Sb is generally less productive than other species on these sites.
- Acb, At, and Ep are not consistently productive on these sites.

Concerns:
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression***; leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***
- sites with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict traffic to winter operations or dry soil conditions.***

black spruce

Ledum groenlandicum

Vaccinium vitis-idaea

VEGETATION

Tree Layer: 30% cover
Lodgepole pine, white spruce, black spruce

Shrub Layer: 30% cover

Ledum groenlandicum	(Labrador tea)
Rosa acicularis	(prickly rose)
Salix spp.	(willows)
black spruce	

Herb Layer: 15% cover

Vaccinium vitis-idaea	(lingonberry)
Cornus canadensis	(bunchberry)
Linnaea borealis	(twinflower)
Mertensia paniculata	(tall bluebells)
Equisetum scirpoides	(dwarf scouring-rush)
Orthilia secunda	(one-sided wintergreen)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Empetrum nigrum	(crowberry)

Moss Layer: 95% cover

Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)
Cladina spp.	(reindeer lichens)
Peltigera aphthosa	(freckle pelt lichen)

SOIL AND SITE

Moisture Regime:	5–6 (subhygric–hygric)
Nutrient Regime:	A–C (very poor–medium)
Slope Gradient (%):	0–45
* Slope Position:	lower–toe, occasionally mid
* Aspect:	often northerly
Parent Material:	morainal, fluvial or organic
* Soil Texture:	medium–coarse
Coarse Fragments (%):	0–80

DISTRIBUTION: uncommon

INTERPRETATIONS

Site limitations:
- very difficult sites to manage; ***serious consideration should be given to managing these sites as wildlife corridors.***
- sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, which slows root development; ***reduce organic horizon thickness during site preparation.***
- sites with saturated soils are poorly aerated, which slows root development; ***plant seedlings on naturally or artificially raised microsites.***

Site preparation:
- creating an excessive number of mounds (i.e., >300/ha) should be avoided, especially on sites within this unit with a water table <30 cm from the surface.
- see Section 12.

Species choice:
- ***Pl***, ***Sw***, ***Sb***, (***Bl***)
  {At}

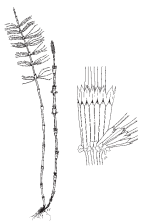
Vegetation potential:
- high (willows, grasses)

Reforestation:
- advance regeneration should be preserved.
- supplement advance regeneration by planting sturdy stock in groups, using available raised microsites.
- plant mix of Pl and Sw on raised microsites.
- At is not consistently productive on these sites.

Concerns:
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***
- sites with thick organic horizons (>10 cm) have extreme windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***
- water table will likely rise above the ground surface in the spring, causing seedling mortality on non-elevated sites.

Alnus incana ssp. *tenuifolia*

Ribes triste



Equisetum pratense

VEGETATION

Tree Layer: 40% cover
White spruce

Shrub Layer: 25% cover

Rosa acicularis	(prickly rose)
Ribes lacustre	(black gooseberry)
Viburnum edule	(highbush-cranberry)
Ribes triste	(red swamp currant)
[*Alnus incana* ssp. *tenuifolia*[**]	(mountain alder)]

white spruce

Herb Layer: 60% cover

Equisetum spp. (*pratense, arvense*)	(horsetails)
Cornus canadensis	(bunchberry)
Linnaea borealis	(twinflower)
Mertensia paniculata	(tall bluebells)
Mitella nuda	(common mitrewort)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Orthilia secunda	(one-sided wintergreen)
Calamagrostis canadensis	(bluejoint)

Moss Layer: 95% cover

Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Mnium spp.	(leafy mosses)

SOIL AND SITE

Moisture Regime:	5–6 (subhygric–hygric)
Nutrient Regime:	C–E (medium–very rich)
* Slope Gradient (%):	0–3
* Slope Position:	level or toe
* Parent Material:	fluvial or organic
Soil Texture:	medium to coarse
Coarse Fragments (%):	0

DISTRIBUTION: rare

[**] The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- very difficult sites to manage; ***serious consideration should be given to managing these sites as wildlife corridors.***
- sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, which slows root development; ***reduce organic horizon thickness during site preparation.***
- sites with saturated soils are poorly aerated, which slows root development; ***plant seedlings on naturally or artificially raised microsites.***

Site preparation:
- creating an excessive number of mounds (i.e., >300/ha) should be avoided, especially on sites within this unit with a water table <30 cm from the surface.
- see Section 12.

Species choice:
- ***Sw***, [***Pl***], (***Sb***, ***Bl***)
  Acb, {At, Ep}

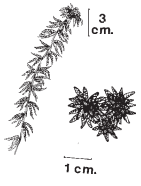
Vegetation potential:
- high (mountain alder, balsam poplar, willows, grasses)

Reforestation:
- advance regeneration should be preserved.
- supplement advance regeneration by planting sturdy stock in groups, using available raised microsites.
- plant mix of Pl and Sw on raised microsites.
- At and Ep may not be consistently productive on these sites.

Concerns:
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***
- sites with thick organic horizons (>10 cm) have extreme windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***
- water table will likely rise above the ground surface in the spring, causing seedling mortality on non-elevated sites.
- these units represent important wildlife habitat; ***discuss prescription with fish and wildlife personnel.***
- this unit is critical to the control of runoff streamflow.

Ledum groenlandicum

Equisetum arvense



Sphagnum spp.

VEGETATION

Tree Layer: 15% cover
Black spruce

Shrub Layer: 70% cover

Ledum groenlandicum	(Labrador tea)
Salix spp.	(willows)
black spruce	

Herb Layer: 70% cover

Equisetum spp. (*arvense, scirpoides*)	(horsetails)
Arctostaphylos rubra	(red bearberry)
Carex spp.	(sedges)
Empetrum nigrum	(crowberry)

Moss Layer: 90% cover

Sphagnum spp.	(sphagnum mosses)
Hylocomium splendens	(step moss)
Aulacomnium palustre	(glow moss)
Tomenthypnum nitens	(golden fuzzy fen moss)

SOIL AND SITE

Moisture Regime:	6–7 (hygric–subhydric)
Nutrient Regime:	A–C (very poor–medium)
* Slope Gradient (%):	0–12 (usually less than 5)
* Slope Position:	level, toe or depression
* Parent Material:	organic
Soil Texture:	fibric or humic
Coarse Fragments (%):	0

DISTRIBUTION: common

INTERPRETATIONS

Site limitations:
- the combination of poor productivity and high wildlife value means that these sites should be protected from harvesting.

Site preparation:
- creating an excessive number of mounds (i.e., >300/ha) should be avoided, especially on sites within this unit with a water table <30 cm from the surface.
- see Section 12.

Species choice:
- ***Pl***, ***Sb***, ***Sw***

Reforestation:
- advance regeneration should be preserved.
- supplement advance regeneration by planting sturdy stock in groups, using available raised microsites.
- plant mix of Pl and Sw on raised microsites.

Concerns:
- sites with thick organic horizons (>10 cm) have extreme windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***
- water table will likely rise above the ground surface in the spring, causing seedling mortality on non-elevated sites.
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***

6 OMINECA MOIST VERY COLD ENGELMANN SPRUCE – SUBALPINE FIR (ESSFmv3)[1]

Location
The ESSFmv3 occurs in the Omineca Mountains as far south as Mt. Mackinnon, as far north as the Ingenika River, as far east as Williston Lake and as far west as Babine Lake.

Elevation range
900 – 1300 m

Climate
The ESSFmv3 has a subalpine climate so much of the precipitation falls as snow. Estimated mean annual precipitation is similar to that for the SBSwk2 (Table 4.1). Growing-season precipitation is intermediate between the SBSmk2 and SBSwk2. Estimated mean annual temperature is lower than that in all the SBS biogeoclimatic units in the guide area but higher than in the BWBSdk1 and SWBmk.

Distinguishing the ESSFmv3 from adjoining biogeoclimatic units

BWBSdk1, SBSmk1, SBSwk2, and SBSwk3 have:
- less white-flowered rhododendron but more black twinberry, highbush-cranberry and/or prickly rose in the shrub layer on mesic sites; and
- little or no heart-leaved arnica but more palmate coltsfoot and/or oakfern in the herb layer on mesic sites.

ESSFmc has:
- less white-flowered rhododendron but more false azalea in the shrub layer on mesic sites; and
- less stiff clubmoss but more five-leaved bramble in the herb layer on mesic sites.

SBSmc2 has:
- less white-flowered rhododendron but more black twinberry and/or prickly rose in the shrub layer on mesic sites; and

[1] Formerly ESSFn3

- less stiff clubmoss but more five-leaved bramble in the herb layer on mesic sites.

SWBmk has:
- less white-flowered rhododendron but more scrub birch in the shrub layer on mesic sites; and
- less heart-leaved arnica but more lingonberry in the herb layer on mesic sites.

Forests

Due to the longer periodicity of stand replacement events in this variant, forested areas are often climax forests dominated by hybrid white spruce and subalpine fir. Lodgepole pine is generally only common on sites drier than mesic. Black spruce may occur on upland sites with lodgepole pine on gentle slopes with a cool aspect and in wetlands. Deciduous species are limited to the lower elevations of this variant and then generally only on warmer slopes.

Wildlife

This variant supports good grizzly bear summer habitat and moderate to good mountain caribou habitat. Wolverine use this variant throughout the year. Moose and mule deer use the ESSFmv3 in summer.

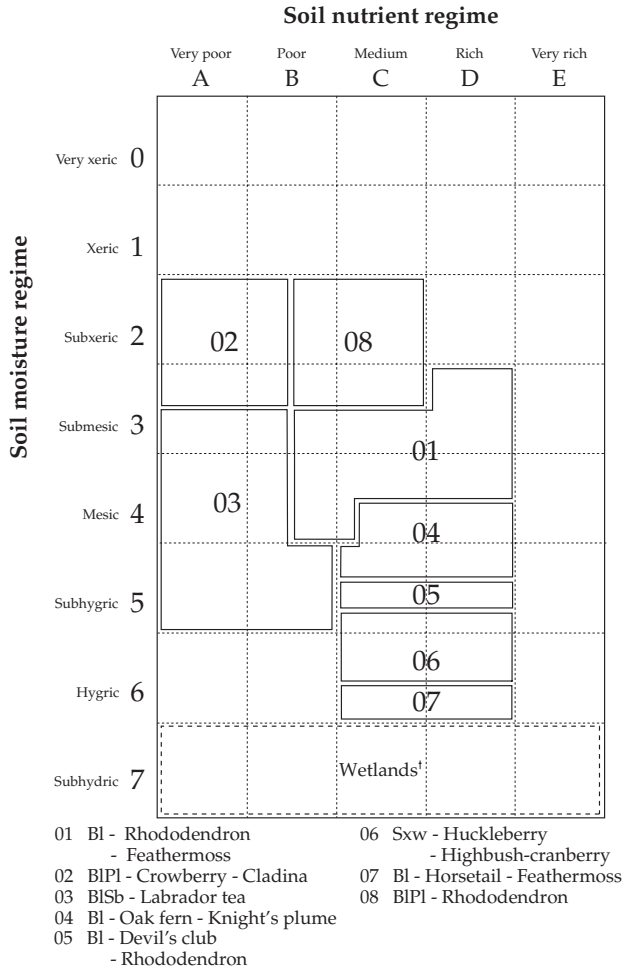


FIGURE 6.1 *Edatopic grid displaying site units of the ESSFmv3 variant.*

Site Series	02	03	08	01	04	05	06	07	
Trees									
Pinus contorta	■	■	■	■					lodgepole pine
Picea mariana		■							black spruce
Abies lasiocarpa			■	■	■	■	■	■	subalpine fir
Picea engelmannii		■		■	■	■	■	■	Engelmann spruce
Shrubs									
Shepherdia canadensis		■							soopolallie
Alnus viridis spp. *sinuata*	■	■	■	■	■	■	■	■	Sitka alder
Vaccinium membranaceum	■		■	■	■	■	■	■	black huckleberry
Rhododendron albiflorum	■	■	■	■	■	■	■	■	white-flowered rhododendron
Ledum groenlandicum		■							Labrador tea
Ribes lacustre				■	■	■	■	■	black gooseberry
Oplopanax horridus						■			devil's club
Viburnum edule					■	■	■	■	highbush-cranberry
Herbs and Dwarf Shrubs									
Empetrum nigrum	■								crowberry
Arctostaphylos uva-urs	■								kinnikinnick
Lycopodium annotinum			■	■	■	■	■	■	stiff clubmoss
Cornus canadensis		■	■	■	■	■	■	■	bunchberry
Arnica cordifolia		■	■	■			■		heart-leaved arnica
Linnaea borealis		■	■	■			■	■	twinflower
Rubus pedatus				■	■	■		■	five-leaved bramble
Gymnocarpium dryopteris					■	■		■	oak fern
Rubus pubescens						■	■	■	trailing raspberry
Galium boreale							■	■	northern bedstraw
Equisetum arvense								■	common horsetail
Mosses and Lichens									
Cladina spp.	■		■						cladina lichens
Pleurozium schreberi	■	■	■	■	■	■	■	■	red-stemmed feathermoss
Barbilophozia lycopodioides				■	■			■	common leafy liverwort
Dicranum polysetum			■					■	wavy-leaved moss

Prominence class: ■ 1 ■ 2 ■ 3 ■ 4 ■ 5

FIGURE 6.2 *ESSFmv3 vegetation table.*

1a Canopy dominated by black spruce and lodgepole pine; sites level

ESSFmv3/03

1b Canopy dominated by lodgepole pine or Engelmann spruce, black spruce minor or absent; sites of any slope

2a Canopy generally dominated by lodgepole pine in old stands (>140 yrs) or if not stand open; soil texture coarse to moderately coarse; *Empetrum nigrum* (p. 79)[2] abundant (>5% cover); *Cladonia* or *Cladina* lichens abundant (> 5% cover)

ESSFmv3/02

2b Canopy often dominated by Engelmann spruce or subalpine fir in old stands (> 140 yrs), *Empetrum nigrum* low cover (< 5% cover) or absent; *Cladonia* or *Cladina* lichens low cover (< 5%) or absent

3a Site level or nearly so (slope 0–5%); water table near surface; horsetails (*Equisetum* spp., pp. 281–284) abundant (>10% cover)

ESSFmv3/07

3b Site level or sloping; water table usually below 50 cm; horsetails low cover (<2%) or absent

4a Soils organic rather than mineral; usually lower slope; *Oplopanax horridus* (p. 36) low cover (<5%) or absent

ESSFmv3/06

4b Soils mineral; slope position variable; *Oplopanax horridus* cover variable

[2] Page numbers refer to the publication *Plants of Northern British Columbia* (MacKinnon et al. 1992).

5a Usually lower slope or level; *Oplopanax horridus* moderate cover (>5%)

ESSFmv3/05

5b Upper to lower slope or level; *Oplopanax horridus* low cover (<1%) or absent

6a Mid to lower slope; *Gymnocarpium dryopteris* moderate to high cover (>5%)

ESSFmv3/04

6b Mid to upper slope; *Gymnocarpium dryopteris* low cover (<5%) or absent

7a Generally upper slope or if not then on warm slope; *Sorbus* spp. (p. 28) and *Rubus pedatus* (p. 92) low cover (<1%) or absent

ESSFmv3/08

7b Mid to upper slope; *Sorbus* spp. (p. 28) and/or *Rubus pedatus* (p. 92) moderate cover (>1%)

ESSFmv3/01

Vaccinium membranaceum

Rhododendron albiflorum

Sorbus scopulina

VEGETATION

Tree Layer: 30% cover
Engelmann spruce, subalpine fir

Shrub Layer: 45% cover

Vaccinium membranaceum	(black huckleberry)
Rhododendron albiflorum	(white-flowered rhododendron)
Ribes lacustre	(black gooseberry)
Sorbus scopulina	(western mountain-ash)
[*Alnus viridis* ssp. *sinuata*[**]	(Sitka alder)]
[*Vaccinium ovalifolium*	(oval-leaved blueberry)]

subalpine fir, Engelmann spruce

Herb Layer: 25% cover

Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided wintergreen)
Lycopodium annotinum	(stiff clubmoss)
Arnica cordifolia	(heart-leaved arnica)
Rubus pubescens	(trailing raspberry)
Linnaea borealis	(twinflower)
Streptopus amplexifolius	(clasping twistedstalk)

Moss Layer: 90% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Peltigera aphthosa	(freckle pelt lichen)
Hylocomium splendens	(step moss)

SOIL AND SITE

Moisture Regime:	(3-) 4 (–5) ((submesic–) mesic (–subhygric))
Nutrient Regime:	B–(C) (medium (–rich))
Slope Gradient (%):	26 (2–60)
* Slope Position:	(lower–) mid (–upper)
Parent Material:	usually morainal or glaciofluvial
Soil Texture:	variable; usually medium
Coarse Fragments (%):	32 (3–77)

DISTRIBUTION: common and widespread

[**] The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, slowing root development; ***reduce organic horizon thickness during site preparation***

Silviculture system:
- log on firm snowpack if considering use of advance regeneration.
- if using a partial cutting system, patches of mineral soil should be exposed to promote natural spruce regeneration.
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.

Site preparation:
- see Section 12.

Species choice:
- Bl, Se, [***Pl***]

Vegetation potential:
- moderate to high (white-flowered rhododendron, fireweed)

Reforestation:
- try to preserve advance regeneration if it is abundant and likely to release and form an acceptable stand.
- young advance Se and Bl regeneration can be protected by a firm snowpack and should be considered if it is abundant and well distributed.
- plant in summer with stock that has already set bud.

Concerns:
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised***.
- heavy snowpack may cause stem deformity, especially on steep slopes; ***obstacle planting is advised.***
- risk of stem deformity for Pl; ***chose provenances from high elevation, high snowpack areas to reduce risk.***

lodgepole pine

Empetrum nigrum

Cladina spp.

VEGETATION

Tree Layer: 25% cover
Lodgepole pine

Shrub Layer: 35% cover
Vaccinium membranaceum (black huckleberry)
subalpine fir, lodgepole pine

Herb Layer: 40% cover
Empetrum nigrum (crowberry)
Arctostaphylos uva-ursi (kinnikinnick)
Vaccinium caespitosum (dwarf blueberry)

Moss Layer: 75% cover
Cladina spp. (reindeer lichens)
Dicranum spp.
Cladonia spp. (cladonia lichens)
Pleurozium schreberi (red-stemmed feathermoss)
Stereocaulon tomentosum (eyed foam lichen)

SOIL AND SITE

Moisture Regime:	2–3 (subxeric–submesic)
Nutrient Regime:	A–B (very poor–poor)
Slope Gradient (%):	9 (8–15)
* Slope Position:	mid to upper (or level)
Parent Material:	variable
* Soil Texture:	usually moderately coarse to coarse
Coarse Fragments (%):	33 (23–50)

DISTRIBUTION: rare

INTERPRETATIONS

Site limitations:
- the combination of very poor productivity and high wildlife value means that these sites should be protected from harvesting.

Site preparation:
- light scarification for seedbed preparation or summer logging with no site preparation.

Species choice:
- ***Pl***, [***Bl***, ***Se***]

Vegetation potential:
- low

Reforestation:
- attempt to regenerate naturally if potential exists.
- Bl and Se acceptable only on moist microsites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- heavy snowpack may cause stem deformity, especially on steep slopes; ***obstacle planting is advised.***
- risk of stem deformity for Pl; ***chose provenances from high elevation, high snowpack areas to reduce risk.***

black spruce

Shepherdia canadensis

Ledum groenlandicum

VEGETATION

Tree Layer: 20% cover
Lodgepole pine, black spruce

Shrub Layer: 50% cover

Shepherdia canadensis	(soopolallie)
Ledum groenlandicum	(Labrador tea)
Rhododendron albiflorum	(white-flowered rhododendron)

black spruce, Engelmann spruce, subalpine fir

Herb Layer: 15% cover

Cornus canadensis	(bunchberry)
Arnica cordifolia	(heart-leaved arnica)
Linnaea borealis	(twinflower)
Vaccinium vitis-idaea	(lingonberry)
Vaccinium caespitosum	(dwarf blueberry)
Gaultheria hispidula	(creeping-snowberry)
Empetrum nigrum	(crowberry)

Moss Layer: 90% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)

SOIL AND SITE

Moisture Regime:	3–5 (submesic–subhygric)
Nutrient Regime:	A–B (very poor–poor)
* Slope Gradient (%):	0
* Slope Position:	level
* Parent Material:	glaciofluvial, morainal
Soil Texture:	variable
Coarse Fragments (%):	51 (24–78)

DISTRIBUTION: uncommon and restricted to lower elevational limits of the unit

INTERPRETATIONS

Site limitations:
- sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, which slows root development; ***reduce organic horizon thickness during site preparation.***
- soils are saturated in the spring, but may experience drought in summer, both resulting in poor root development; ***poor productivity resulting from these limitations should dictate a limited intensive silvicultural investment.***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- light scarification for seedbed preparation or summer logging with no site preparation.
- see Section 12.

Species choice:
- Bl, Se, [***Pl***], (***Sb***)

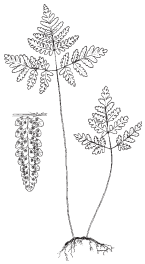
Vegetation potential:
- low

Reforestation:
- attempt to regenerate naturally if potential exists.
- Sb is significantly less productive than other species on these sites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- frost will cause regeneration damage, especially in any naturally occurring or artificially created depressions; ***leaving a partial canopy and/or planting a frost-resistant species is advised.***
- trafficability may be a problem on these sites during the summer.
- risk of stem deformity for Pl; ***chose provenances from high elevation, high snowpack areas to reduce risk.***

Rhododendron albiflorum

Vaccinium membranaceum



Gymnocarpium dryopteris

VEGETATION

Tree Layer: 35% cover
Subalpine fir, Engelmann spruce

Shrub Layer: 45% cover

Rhododendron albiflorum	(white-flowered rhododendron)
Vaccinium membranaceum	(black huckleberry)
Ribes lacustre	(black gooseberry)
Vaccinium ovalifolium	(oval-leaved blueberry)
[*Lonicera involucrata*	(black twinberry)]
subalpine fir	

Herb Layer: 45% cover

Gymnocarpium dryopteris	(oak fern)
Rubus pedatus	(five-leaved bramble)
Orthilia secunda	(one-sided wintergreen)
Streptopus amplexifolius	(clasping twistedstalk)
Lycopodium annotinum	(stiff clubmoss)
Cornus canadensis	(bunchberry)
Valeriana sitchensis	(Sitka valerian)
Tiarella trifoliata	(three-leaved foamflower)
Veratrum viride	(Indian hellabore)

Moss Layer: 95% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)

SOIL AND SITE

Moisture Regime:	4–5 (mesic–subhygric)
Nutrient Regime:	C–D (medium–rich)
* Slope Gradient (%):	18 (0–38)
* Slope Position:	usually mid to lower
Parent Material:	variable (often morainal)
Soil Texture:	variable
Coarse Fragments (%):	23 (5–48)

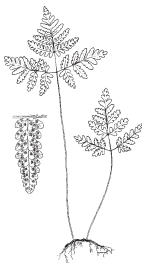
DISTRIBUTION: common

INTERPRETATIONS

Site limitations:	– sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, slowing root development; ***reduce organic horizon thickness during site preparation.***
Silviculture system:	– log on firm snowpack if considering use of advance regeneration. – if using a partial cutting system, patches of mineral soil should be exposed to promote natural spruce regeneration. – minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
Site preparation:	– see Section 12.
Species choice:	– Bl, Se, (***Pl***)
Vegetation potential:	– moderate to high (white-flowered rhododendron, fireweed)
Reforestation:	– try to preserve advance regeneration if it is abundant and likely to release and form an acceptable stand. – young advance Se and Bl regeneration can be protected by harvesting on a firm snowpack and should be considered if it is abundant and well distributed. – plant in summer with stock that has already set bud.
Concerns:	– site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species is advised.*** – sites within this unit with fine-textured soils are vulnerable to compaction under wet conditions***; restrict traffic to winter operations or dry soil conditions.*** – heavy snowpack may cause stem deformity, especially on steep slopes. – risk of stem deformity for Pl; ***chose provenances from high elevation, high snowpack areas to reduce risk.***

Rhododendron albiflorum

Oplopanax horridus



Gymnocarpium dryopteris

VEGETATION

Tree Layer: 40% cover
Engelmann spruce, subalpine fir

Shrub Layer: 30% cover

Rhododendron albiflorum	(white-flowered rhododendron)
Oplopanax horridus	(devil's club)
Ribes lacustre	(black gooseberry)
Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)
Alnus viridis ssp. *sinuata***	(Sitka alder)
Sorbus scopulina	(western mountain-ash)
subalpine fir	

Herb Layer: 50% cover

Gymnocarpium dryopteris	(oak fern)
Rubus pedatus	(five-leaved bramble)
Cornus canadensis	(bunchberry)
Tiarella trifoliata	(three-leaved foamflower)
Lycopodium annotinum	(stiff clubmoss)
Streptopus amplexifolius	(clasping twistedstalk)
Orthilia secunda	(one-sided wintergreen)

Moss Layer: 65% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
[*Mnium* spp.	(leafy mosses)]

SOIL AND SITE

Moisture Regime:	5 (subhygric)
Nutrient Regime:	C–D (medium–rich)
* Slope Gradient (%):	13 (0–25)
* Slope Position:	(mid–) lower–level
Parent Material:	morainal or glaciofluvial
* Soil Texture:	variable (usually moderately fine)
Coarse Fragments (%):	25 (16–39)

DISTRIBUTION: uncommon

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, which slows root development; ***reduce organic horizon thickness during site preparation.***

Silviculture system:
- log on firm snowpack to protect advance regeneration.
- under a partial cutting system, spruce regeneration requires mineral soil exposure and/or planting.
- reduce spruce beetle hazard by avoiding high stumps and shaded slash >15 cm diameter.

Site preparation:
- see Section 12.

Species choice:
- Bl, Se, (***Pl***)

Vegetation potential:
- very high (white-flowered rhododendron, fireweed, thimbleberry)

Reforestation:
- try to preserve advance regeneration if it is abundant and likely to release and form an acceptable stand.
- young advance Se and Bl regeneration can be protected by a firm snowpack and should be considered if it is abundant and well distributed.
- plant stock with large caliper and low shoot-to-root ratio immediately after harvest.

Concerns:
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or preserving advance regeneration is advised.***
- sites within this unit with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict traffic to winter operations.***
- sites within this unit with thick organic horizons (>10 cm) have increased windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***
- risk of stem deformity for Pl; ***chose provenances from high elevation, high snowpack areas to reduce risk.***

Ribes lacustre

Vaccinium membranaceum

Viburnum edule

VEGETATION

Tree Layer: 20% cover
Engelmann spruce, subalpine fir

Shrub Layer: 30% cover

Ribes lacustre	(black gooseberry)
Lonicera involucrata	(black twinberry)
Viburnum edule	(highbush-cranberry)
Vaccinium membranaceum	(black huckleberry)
Alnus viridis ssp. *sinuata***	(Sitka alder)
Sorbus scopulina	(western mountain-ash)

subalpine fir

Herb Layer: 15% cover

Linnaea borealis	(twinflower)
Cornus canadensis	(bunchberry)
Rubus pedatus	(five-leaved bramble)
Mertensia paniculata	(tall bluebells)
Gymnocarpium dryopteris	(oak fern)
Lycopodium annotinum	(stiff clubmoss)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Arnica cordifolia	(heart-leaved arnica)
Orthilia secunda	(one-sided wintergreen)
Delphinium glaucum	(tall larkspur)
Listera cordata	(heart-leaved twayblade)

Moss Layer: 95% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
Peltigera aphthosa	(freckle pelt lichen)
Barbilophozia lycopodioides	(common leafy liverwort)

SOIL AND SITE

Moisture Regime:	5–6 (subhygric–hygric)
Nutrient Regime:	(C)–D ((medium–) rich)
Slope Gradient (%):	13 (3–20)
* Slope Position:	(mid–) lower
* Parent Material:	organic
Coarse Fragments (%):	0

DISTRIBUTION: uncommon

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with saturated soils are poorly aerated, which slows root development; ***plant seedlings on naturally or artificially raised microsites.***
- sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, slowing root development; ***reduce organic horizon thickness during site preparation.***
- very difficult sites to manage; ***serious consideration should be given to managing these sites as wildlife corridors.***

Site preparation:
- see Section 12.
- creating an excessive number of mounds (i.e., >300/ha) should be avoided, especially on sites within this unit with a water table <30 cm from the surface.

Species choice:
- Se, Bl, [***Pl***]

Vegetation potential:
- high (black twinberry, fireweed, bluejoint)

Reforestation:
- plant large planting stock on raised microsites.
- plant stock in groups, using available raised microsites, rather than evenly across the site.
- young advance Se and Bl regeneration can be protected by a firm snowpack and should be considered if it is abundant and well distributed.
- plant stock with large caliper and low shoot-to-root ratio immediately after harvest.
- plant in summer with stock that has already set bud.

Concerns:
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression***; leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***
- sites within this unit with high water tables, combined with thick organic horizons (>10 cm), increase the windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***
- water table will likely rise above the ground surface in the spring, causing seedling mortality on non-elevated sites.
- risk of stem deformity for Pl; ***chose provenances from high elevation, high snowpack areas to reduce risk.***

Ribes lacustre

Equisetum arvense

Rubus pedatus

VEGETATION

Tree Layer: 20% cover
Engelmann spruce, lodgepole pine

Shrub Layer: 35% cover

Ribes lacustre	(black gooseberry)
Viburnum edule	(highbush-cranberry)
Lonicera involucrata	(black twinberry)
Alnus viridis ssp. *sinuata***	(Sitka alder)

subalpine fir

Herb Layer: 80% cover

Equisetum spp. (*arvense, sylvaticum*)	(horsetails)
Galium spp. (*boreale, triflorum*)	(bedstraws)
Rubus pedatus	(five-leaved bramble)
Cornus canadensis	(bunchberry)
Mertensia paniculata	(tall bluebells)
Linnaea borealis	(twinflower)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Epilobium anagallidifolium	(alpine willowherb)
Mitella nuda	(common mitrewort)

Moss Layer: 70% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Dicranum polysetum	(wavy-leaved moss)
[*Hylocomium splendens*	(step moss)]

SOIL AND SITE

Moisture Regime:	6 (hygric)
Nutrient Regime:	C (medium)
* Slope Gradient (%):	4 (2–6)
* Slope Position:	level or depression
Parent Material:	variable
Soil Texture:	usually coarse
Coarse Fragments (%):	30 (3–45)

DISTRIBUTION: uncommon

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- very difficult sites to manage; ***serious consideration should be given to managing these sites as wildlife corridors.***
- sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, which slows root development; ***reduce organic horizon thickness during site preparation.***
- saturated soils are poorly aerated, which slows root development; ***plant seedlings on naturally or artificially raised microsites.***

Site preparation:
- clearcut (winter) or partial cut.
- creating an excessive number of microsites (i.e., >300/ha) should be avoided, especially on sites with a water table <30 cm from the surface.
- see Section 12.

Species choice:
- ***Bl***, ***Se***, [***Pl***]

Vegetation potential:
- very high (white-flowered rhododendron, fireweed)

Reforestation:
- plant stock in groups, using available raised microsites, rather than evenly across the site.
- try to preserve advance regeneration if it is abundant and likely to release and form an acceptable stand.
- young advance Se and Bl regeneration can be protected by a firm snowpack and should be considered if it is abundant and well distributed.
- plant stock with large caliper and low shoot-to-root ratio immediately after harvest.
- plant in summer with stock that has already set bud.

Concerns:
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or preserving advance regeneration is advised.***
- sites within this unit with high water tables, combined with thick organic horizons (>10 cm), have increased windthrow hazard; ***block layouts must have windfirm boundaries.***
- water table will likely rise above the ground surface in the spring, causing seedling mortality on non-elevated sites.
- these units represent important wildlife habitat; ***discuss prescription with fish and wildlife personnel.***
- this unit is critical to the control of runoff streamflow.
- risk of stem deformity for Pl; ***chose provenances from high elevation, high snowpack areas to reduce risk.***

Vaccinium membranaceum

Lycopodium annotinum

Pleurozium schreberi

VEGETATION

Tree Layer: 25% cover
Lodgepole pine, Engelmann spruce, subalpine fir

Shrub Layer: 40% cover

Vaccinium membranaceum	(black huckleberry)
Rhododendron albiflorum	(white-flowered rhododendron)
[*Alnus viridis* ssp. *sinuata*[**]	(Sitka alder)]

subalpine fir, Engelmann spruce

Herb Layer: 15% cover

Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided wintergreen)
Arnica cordifolia	(heart-leaved arnica)
Epilobium angustifolium	(fireweed)
Linnaea borealis	(twinflower)
Lycopodium annotinum	(stiff clubmoss)

Moss Layer: 80% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Cladina spp.	(reindeer lichens)
Dicranum spp.	
Ptilium crista-castrensis	(knight's plume)

SOIL AND SITE

Moisture Regime:	3–4 (submesic–mesic)
Nutrient Regime:	B–C (poor–medium)
Slope Gradient (%):	25 (10–60)
* Slope Position:	mid–upper (level)
Parent Material:	usually morainal or colluvial
Soil Texture:	variable
Coarse Fragments (%):	32 (3–77)

DISTRIBUTION: uncommon

[**] The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:	– sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, slowing root development; ***reduce organic horizon thickness during site preparation.***
Silviculture system:	– log on firm snowpack if considering use of advance regeneration. – if using a partial cutting system, patches of mineral soil should be exposed to promote natural spruce regeneration. – minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
Site preparation:	– see Section 12.
Species choice:	– Bl, Se, [***Pl***]
Vegetation potential:	– moderate (white-flowered rhododendron, fireweed)
Reforestation:	– try to preserve advance regeneration if it is abundant and likely to release and form an acceptable stand. – young advance Se and Bl regeneration can be protected by a firm snowpack and should be considered if it is abundant and well distributed. – plant in summer with stock that has already set bud.
Concerns:	– heavy snowpack may cause stem deformity, especially on steep slopes; ***obstacle planting is advised.*** – risk of stem deformity for Pl; ***chose provenances from high elevation, high snowpack areas to reduce risk.***

7 WILLISTON MOIST COOL SUB-BOREAL SPRUCE (SBSmk2)[1]

Location
The SBSmk2 occurs at lower elevations along Williston Lake and along some of the major drainages feeding into Williston Lake. It generally occurs below the SBSwk2. It reaches its northern extent at Chowika Creek and southern extent approximately 10 km south of Mackenzie.

Elevation range
670 – 800 m

Climate
The SBSmk2 is the driest of the Sub-Boreal Spruce units described in this guide based on the vegetation expressed on zonal sites. It is similar in temperature regime to the other sub-boreal units but warmer than the BWBSdk1, which replaces it to the north at lower elevations.

Distinguishing the SBSmk2 from adjoining biogeoclimatic units

SBSwk2 has:
- more devil's club in the shrub layer on mesic sites; and
- more oak fern in the herb layer on mesic sites.

SBSmk1 has:
- more thimbleberry but less highbush-cranberry in the shrub layer on mesic sites; and
- more queen's cup but less palmate coltsfoot in the herb layer on mesic sites.

BWBSdk1 has:
- less black huckleberry and Sitka alder in the shrub layer on mesic sites;
- less false Solomon's-seal and common mitrewort in the herb layer on mesic sites; and
- less oak fern and devil's club on subhygric and wetter sites.

[1] Formerly SBSo

Forests

Due to the recurrent disturbances in this variant, forested areas are often dominated by lodgepole pine (*Pinus contorta*) and trembling aspen (*Populus tremuloides*). Climax forests have a hybrid white spruce (*Picea glauca* x *engelmannii*) canopy with a subalpine fir (*Abies lasiocarpa*) understorey. Black spruce (*Picea mariana*) occurs on upland sites with lodgepole pine generally on lacustrine or compact till soils and in wetlands. Some fairly homogeneous stands of paper birch (*Betula papyrifera*) occur primarily along the east side of Williston Lake. Black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) occurs along streams and rivers and is often associated with hybrid white spruce.

Wildlife

This variant provides summer range for mule deer and black bear. Waterfowl use wetlands in the variant for staging in migration and breeding. Caribou are found in limited distribution (e.g., near Manson Arm) but there is significant winter range for moose. Mountain goats are found at low elevations in Ospika Arm.

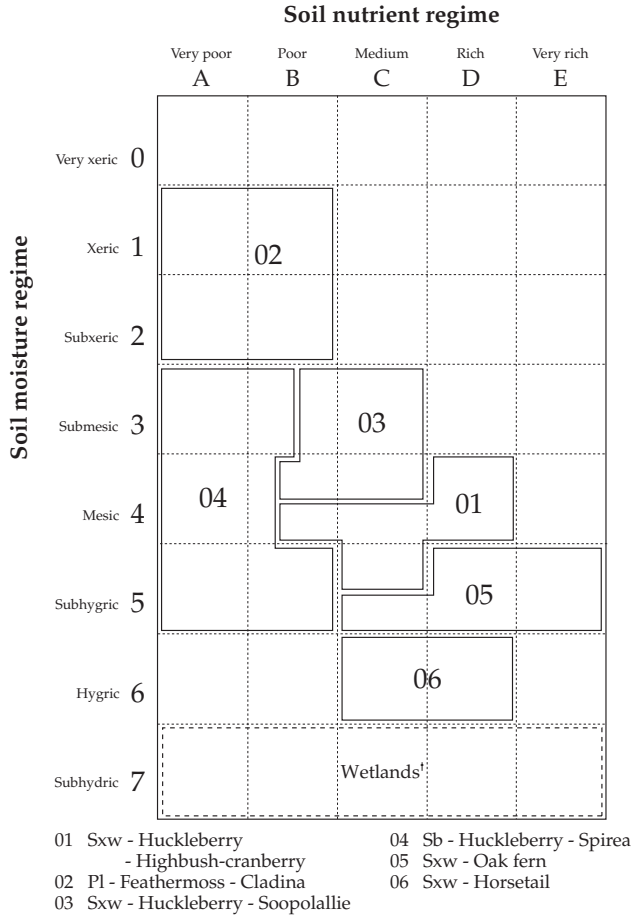


Figure 7.1 *Edatopic grid displaying site units of the SBSmk2 variant.*

Site Series	02	03	04	01	05	06	
Trees							
Pinus contorta	■	■	■	■	■	■	lodgepole pine
Abies lasiocarpa		■		■	■	■	subalpine fir
Picea mariana			■				black spruce
Picea ×glauca × engelmannii		■	■	■	■	■	hybrid white spruce
Shrubs							
Shepherdia canadensis	■	■	■	■			soopolallie
Spiraea betulifolia		■		■			birch-leaved spirea
Alnus viridis ssp. *sinuata*	■	■	■	■	■	■	Sitka alder
Viburnum edule	■	■	■	■	■	■	highbush-cranberry
Ledum groenlandicum			■				Labrador tea
Lonicera involucrata		■		■	■	■	black twinberry
Oplopanax horridus					■	■	devil's club
Cornus stolonifera						■	red-osier dogwood
Herbs and Dwarf Shrubs							
Arctostaphylos uva-ursi	■						kinnikinnick
Oryzopsis asperifolia	■						rough-leaved ricegrass
Vaccinium caespitosum		■	■	■			dwarf blueberry
Cornus canadensis	■	■	■	■	■	■	bunchberry
Geocaulon lividum			■				bastard toadflax
Petasites palmatus		■	■	■			palmate coltsfoot
Lycopodium annotinum				■	■	■	stiff clubmoss
Rubus pubescens		■		■	■	■	trailing raspberry
Gymnocarpium dryopteris					■	■	oak fern
Equisetum arvense					■	■	common horsetail
Mosses and Lichens							
Polytrichum juniperinum	■						juniper haircap moss
Peltigera aphthosa	■		■				freckle pelt lichen
Pleurozium schreberi	■	■	■	■	■	■	red-stemmed feathermoss
Rhytidiadelphus triquetrus	■	■	■	■	■	■	electrified cat's-tail moss

Prominence class: ■ 1 ■ 2 ■ 3 ■ 4 ■ 5

Figure 7.2 *SBSmk2 vegetation table.*

1a Organic soils

Wetland bog ecosystems[2]

1b Non-organic soils

2a Canopy dominated by white spruce

3a Usually level; often adjacent to moving water; *Equisetum* spp. (p. 281–282)[3] moderate to high cover (>5% cover)

SBSmk2/06

3b Slope position variable; often not adjacent to moving water; *Equisetum* spp. very low cover (<1%) or absent

4a Generally lower slope, or level and influenced by water table; *Oplopanax horridus* (p. 36) and *Gymnocarpium dryopteris* (p. 293) moderate to high cover (>5%)

SBSmk2/05

4b Generally not lower slope and if level, not influenced by a water table; *Oplopanax horridus* and *Gymnocarpium dryopteris* low cover (<5%) or absent

5a Generally upper slope or crest, if level then coarse textured; *Lonicera involucrata* (p. 48) very low cover (<1%) or absent

SBSmk2/03

5b Generally mid to toe slope, if level then medium textured; *Lonicera involucrata* generally moderate cover (>5%)

SBSmk2/01

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[2] MacKenzie, W.H. and J.R.Moran. 2004. *Wetlands of British Columbia: a guide to identification.*

[3] Page numbers refer to the publication *Plants of Northern British Columbia* (MacKinnon et al. 1992).

2b Canopy dominated by lodgepole pine

6a Generally lower slope, or level and influenced by water table; *Oplopanax horridus* and *Gymnocarpium dryopteris* moderate to high cover (>5%)

SBSmk2/05

6b Generally not lower slope and if level, not influenced by a water table; *Oplopanax horridus* and *Gymnocarpium dryopteris* very low cover (<1%) or absent

7a Slope gradient <10%, aspect flat or north facing; black spruce present in canopy

SBSmk2/04

7b Slope gradient and aspect variable; black spruce absent from canopy

8a Level or crest slope position; coarse-textured soils; *Arctostaphylos uva-ursi* (p. 82) present

SBSmk2/02

8b Slope position and soil texture variable; *Arctostaphylos uva-ursi* absent

9a Generally upper slope or crest, if level then coarse-textured; *Lonicera involucrata* very low cover (<1%) or absent

SBSmk2/03

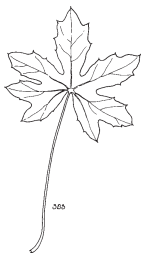
9b Generally mid to toe slope, if level then medium textured; *Lonicera involucrata* generally moderate cover (>5%)

SBSmk2/01

Sxw – Huckleberry – Highbush-cranberry

Viburnum edule

Vaccinium membranaceum



Petasites frigidus var. *palmatus*

VEGETATION

Tree Layer: 40% cover
Hybrid white spruce, lodgepole pine

Shrub Layer: 50% cover

Viburnum edule	(highbush-cranberry)
Rosa acicularis	(prickly rose)
Lonicera involucrata	(black twinberry)
Vaccinium membranaceum	(black huckleberry)
Alnus viridis ssp. *sinuata***	(Sitka alder)
[*Rubus parviflorus*	(thimbleberry)]

subalpine fir, hybrid white spruce

Herb Layer: 70% cover

Cornus canadensis	(bunchberry)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Linnaea borealis	(twinflower)
Rubus pubescens	(trailing rasberry)
*Maianthemum racemosum***	(false Solomon's-seal)
Mitella nuda	(common mitrewort)
Orthilia secunda	(one-sided wintergreen)
Lycopodium annotinum	(stiff clubmoss)
Epilobium angustifolium	(fireweed)
Aralia nudicaulis	(wild sarsaparillia)
Mertensia paniculata	(tall bluebells)
Equisetum arvense	(common horsetail)
Pyrola asarifolia	(rosy wintergreen)

Moss Layer: 90% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)

SOIL AND SITE

Moisture Regime:	4 (–5) (mesic (–subhygric))
Nutrient Regime:	B–D (poor–rich)
* Slope Gradient (%):	0–25
* Slope Position:	mid to toe or level
Parent Materials:	morainal, fluvial, (glaciofluvial)
* Soil Texture:	usually moderately coarse or medium
Coarse Fragments (%):	0–75

DISTRIBUTION: very common and widespread

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with medium- to fine-textured lacustrine soils often have poor soil structure, leading to poor root growth; ***plant stock that will achieve better lateral root development (e.g., Cu-treated), prescribe natural regeneration, or protect advance regeneration.***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- see Section 12.

Species choice:
- Pl, Sx, [***Bl***]
  At, Ep

Vegetation potential:
- moderate (trembling aspen, fireweed, thimbleberry)

Reforestation:
- attempt to regenerate naturally if potential exists.
- help maintain stand diversity on sites to be planted with Pl by mapping aspen patches prior to harvest and planting these areas to spruce.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- sites with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict traffic to winter operations or dry soil conditions.***

Shepherdia canadensis

Arctostaphylos uva-ursi

Cladina spp.

VEGETATION

Tree Layer: 30% cover
Lodgepole pine

Shrub Layer: 30% cover

Shepherdia canadensis	(soopolallie)
Rosa acicularis	(prickly rose)
Viburnum edule	(highbush-cranberry)
Spiraea betulifolia	(birch-leaved spirea)

lodgepole pine, subalpine fir

Herb Layer: 10% cover

Arctostaphylos uva-ursi	(kinnikinnick)
Linnaea borealis	(twinflower)
Oryzopsis asperifolia	(rough-leaved ricegrass)
Epilobium angustifolium	(fireweed)
Cornus canadensis	(bunchberry)
Vaccinium caespitosum	(dwarf blueberry)
Orthilia secunda	(one-sided wintergreen)

Moss Layer: 85% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Polytrichum juniperinum	(juniper haircap moss)
Cladina spp.	(cladina lichens)

SOIL AND SITE

Moisture Regime:	1–2 (xeric–subxeric)
Nutrient Regime:	A–B (very poor–poor)
* Slope Gradient (%):	0–60
Slope Position:	level or crest
Parent Materials:	glaciofluvial, morainal, (fluvial)
* Soil Texture:	usually coarse
Coarse Fragments (%):	0–55

DISTRIBUTION: common, especially in large valley bottoms, but small in area

INTERPRETATIONS

Site limitations:
- sites within this unit with high coarse fragment content (>70%) will have significantly reduced soil moisture retention and will be extremely difficult to plant; ***attempt to regenerate naturally by retaining Pl cones.***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- light scarification for seedbed preparation or summer logging with no site preparation.

Species choice:
- Pl (***Sx***)
  {At}

Vegetation potential:
- low

Reforestation:
- attempt to regenerate naturally if potential exists.
- if natural regeneration is not feasible, plant Pl without site preparation.
- Sx and At will generally be less productive on these sites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site and soil conditions of this unit result in drought hazard for a significant portion of the growing season; ***natural regeneration is generally better adapted to surviving these conditions, especially during establishment.***

Viburnum edule

Rosa acicularis

Shepherdia canadensis

VEGETATION

Tree Layer: 30% cover
Lodgepole pine, hybrid white spruce

Shrub Layer: 45% cover

Viburnum edule	(highbush-cranberry)
Rosa acicularis	(prickly rose)
Shepherdia canadensis	(soopolallie)
Alnus viridis ssp. *sinuata***	(Sitka alder)
Spiraea betulifolia	(birch-leaved spirea)
Vaccinium membranaceum	(black huckleberry)

subalpine fir, hybrid white spruce

Herb Layer: 35% cover

Cornus canadensis	(bunchberry)
Linnaea borealis	(twinflower)
*Maianthemum racemosum***	(false Solomon's-seal)
Orthilia secunda	(one-sided wintergreen)
Epilobium angustifolium	(fireweed)
Rubus pubescens	(trailing raspberry)
Aralia nudicaulis	(wild sarsaparilla)
Geocaulon lividum	(bastard toad-flax)

Moss Layer: 95% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Ptilium crista-castrensis	(knight's plume)
Peltigera spp.	(pelt lichens)
Dicranum polysetum	(wavy-leaved moss)

SOIL AND SITE

Moisture Regime:	3–4 (submesic–mesic)
Nutrient Regime:	B–C (poor–medium)
Slope Gradient (%):	0–45
* Slope Position:	mid to crest or level
Parent Materials:	morainal, glaciofluvial (fluvial)
* Soil Texture:	medium to coarse
Coarse Fragments (%):	0–60

DISTRIBUTION: common

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:	– see Concerns.
Site preparation:	– minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard. – light scarification for seedbed preparation or summer logging with no site preparation. – see Section 12.
Species choice:	– Pl, ***Sx***, (***Bl***) At, Ep
Vegetation potential:	– low
Reforestation:	– attempt to regenerate naturally if potential exists. – if natural regeneration is not feasible, plant Pl or Sx without site preparation. – within this unit, Sx should generally be planted on moister microsites. – Bl will generally be less productive on these sites.
Concerns:	– full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).*** – sites within this unit with shallow and/or coarse-textured soils are vulnerable to nutrient deficiency if forest floors are reduced; ***site preparation methods that reduce forest floor thickness, such as slashburning or brushblading, must be avoided.***

Shepherdia canadensis

Ledum groenlandicum

Gaultheria hispidula

VEGETATION

Tree Layer: 30% cover
Lodgepole pine, black spruce, hybrid white spruce

Shrub Layer: 40% cover

Shepherdia canadensis	(soopolallie)
Ledum groenlandicum	(Labrador tea)
Vaccinium membranaceum	(black huckleberry)
Rosa acicularis	(prickly rose)
Vaccinium myrtilloides	(velvet-leaved blueberry)
[*Spiraea betulifolia*	(birch-leaved spirea)]

subalpine fir, black spruce

Herb Layer: 15% cover

Linnaea borealis	(twinflower)
Cornus canadensis	(bunchberry)
Geocaulon lividum	(bastard toad-flax)
Epilobium angustifolium	(fireweed)
Vaccinium caespitosum	(dwarf blueberry)
Gaultheria hispidula	(creeping-snowberry)
*Diphasiastrum complanatum***	(ground-cedar)
Oryzopsis asperifolia	(rough-leaved ricegrass)
Orthilia secunda	(one-sided wintergreen)
Calamagrostis canadensis	(bluejoint)

Moss Layer: 95% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Peltigera aphthosa	(freckle pelt lichen)
Ptilium crista-castrensis	(knight's plume)
Cladina mitis	(green reindeer lichen)
Dicranum polysetum	(wavy-leaved moss)

SOIL AND SITE

Moisture Regime:	3–5 (submesic–subhygric)
Nutrient Regime:	A–B (very poor–poor)
* Aspect:	northerly or flat
* Slope Gradient (%):	usually <10
Slope Position:	mid to lower or level
* Parent Materials:	glaciofluvial
* Soil Texture:	medium to coarse
Coarse Fragments (%):	0–40

DISTRIBUTION: common in some areas

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- soil drainage and rooting may be impeded by dense basal till layers or poorly structured clay-rich horizons within 30 cm of the soil surface; this results in a shallow rooting zone that is saturated and poorly aerated in the spring following snowmelt, but subject to drought in summer.
- ***the poor productivity resulting from these limitations should dictate a limited investment in intensive silviculture; protect advance regeneration and regenerate naturally whenever possible or if planting then plant stock that will achieve better lateral root development (e.g., Cu-treated).***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- see Section 12.

Species choice:
- Pl, (***Sx***, ***Sb***)
  {At}

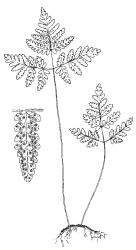
Vegetation potential:
- low

Reforestation:
- attempt to regenerate naturally if potential exists.
- if natural regeneration is not feasible, plant Pl.
- At, Sx and Sb will generally be less productive on these sites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site conditions may lead to frost damage of regeneration, especially in naturally occurring or artificially created depressions; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***

Oplopanax horridus

Ribes lacustre



Gymnocarpium dryopteris

VEGETATION

Tree Layer: 30% cover
Hybrid white spruce, subalpine fir, lodgepole pine

Shrub Layer: 40% cover

Oplopanax horridus	(devil's club)
Ribes lacustre	(black gooseberry)
Lonicera involucrata	(black twinberry)
Viburnum edule	(highbush-cranberry)
Rosa acicularis	(prickly rose)
[*Cornus stolonifera*	(red-osier dogwood)]

subalpine fir, hybrid white spruce

Herb Layer: 60% cover

Gymnocarpium dryopteris	(oak fern)
Cornus canadensis	(bunchberry)
Pyrola asarifolia	(rosy wintergreen)
Streptopus amplexifolius	(clasping twistedstalk)
Galium triflorum	(sweet-scented bedstraw)
Linnaea borealis	(twinflower)
Rubus pubescens	(trailing raspberry)
Lycopodium annotinum	(stiff clubmoss)

Moss Layer: 75% cover

Hylocomium splendens	(step moss)
Ptilium crista-castrensis	(knight's plume)
Pleurozium schreberi	(red-stemmed feathermoss)
Mnium spp.	(leafy mosses)

SOIL AND SITE

Moisture Regime:	5 (subhygric)
Nutrient Regime:	C–(E) (medium–rich (–very rich))
Slope Gradient (%):	0–50
* Slope Position:	usually lower to toe but sometimes level
Parent Material:	variable
Soil Texture	coarse to medium
Coarse Fragments (%):	0–50
* Seepage Water:	may be present below 50 cm

DISTRIBUTION: uncommon and not large in area

INTERPRETATIONS

Site limitations:
- sites within this unit with medium- to fine-textured lacustrine soils often have poor soil structure, leading to poor root growth; ***plant stock that will achieve better lateral root development (e.g., Cu-treated), prescribe natural regeneration, or protect advance regeneration.***

Site preparation:
- see Section 12.

Species choice:
- Sx, Pl, [***Bl***]
  At, Ep, {Act}

Vegetation potential:
- moderate (black twinberry, thimbleberry, fireweed)

Reforestation:
- if vigorous advanced Sx or Bl regeneration is present it should be preserved.
- plant sturdy stock as soon after harvesting as possible.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
- help maintain stand diversity on sites to be planted with Pl by mapping aspen patches prior to harvest and planting these areas to spruce.
- Act may not be consistently productive on these sites.

Concerns:
- sites within this unit with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict traffic to winter operations or dry soil conditions.***
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***

Cornus stolonifera

Rosa acicularis

Equisetum arvense

VEGETATION

Tree Layer: 20% cover
Hybrid white spruce

Shrub Layer: 30% cover

Cornus stolonifera	(red-osier dogwood)
Rosa acicularis	(prickly rose)
Viburnum edule	(highbush-cranberry)
Lonicera involucrata	(black twinberry)
Ribes lacustre	(black gooseberry)
Oplopanax horridus	(devil's club)
subalpine fir	

Herb Layer: 65% cover

Equisetum arvense	(common horsetail)
Equisetum sylvaticum	(wood horsetail)
Equisetum pratense	(meadow horsetail)
Rubus pubescens	(trailing raspberry)
Cornus canadensis	(bunchberry)
Mertensia paniculata	(tall bluebells)
Linnaea borealis	(twinflower)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Mitella nuda	(common mitrewort)
Galium triflorum	(sweet-scented bedstraw)
Gymnocarpium dryopteris	(oak fern)
Calamagrostis canadensis	(bluejoint)
Aralia nudicaulis	(wild sarsaparilla)

Moss Layer: 90% cover

Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Rhytidiadelphus triquetrus	(electrified cat's-tail moss)

SOIL AND SITE

Moisture Regime:	6 (hygric)
Nutrient Regime:	C–D (medium–rich)
* Slope Gradient (%):	0–5
* Slope Position:	usually level
* Parent Material:	usually fluvial
Soil Texture:	medium to coarse
Forest Floor Depth: (cm)	3–70
Coarse Fragments (%):	0–50
* Seepage Water:	usually present at depths greater than 30 cm

DISTRIBUTION: common but small in area, and generally on fluvial floodplains

INTERPRETATIONS

Site limitations:
- very difficult sites to manage; ***serious consideration should be given to managing these sites as wildlife corridors.***
- sites with saturated soils are poorly aerated, which slows root development; ***plant seedlings on naturally or artificially raised microsites.***

Site preparation:
- creating an excessive number of mounds (i.e., >300/ha) should be avoided, especially on sites within this unit with a water table <30 cm from the surface.
- see Section 12.

Species choice:
- ***Sx***, [***Pl***, ***Bl***]
  Act, At

Vegetation potential:
- high (black twinberry, fireweed, bluejoint)

Reforestation:
- advance regeneration should be preserved.
- supplement advance regeneration by planting sturdy stock in groups, using available raised microsites.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.

Concerns:
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***
- sites with thick organic horizons (>10 cm) have extreme windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***
- water table will likely rise above the ground surface in the spring, causing seedling mortality on non-elevated sites.
- these units represent important wildlife habitat; ***discuss prescription with fish and wildlife personnel.***
- this unit is critical to the control of runoff streamflow.

8 FINLAY-PEACE WET COOL SUB-BOREAL SPRUCE (SBSwk2)[1]

Location
The SBSwk2 occurs above the SBSmk2 along Williston Lake and in all major drainages in the Rocky Mountains from the Narraway River in the south to the Peace Arm of Williston Lake in the north.

Elevation range
750 – 1200 m

Climate
The SBSwk2 is the wettest of the units described (Table 4.1). It is similar in temperature regime to the other sub-boreal units but warmer than the BWBSdk1, which replaces it to the north.

Distinguishing the SBSwk2 from adjoining biogeoclimatic units

BWBSdk1, BWBSmw1, BWBSwk1, BWBSwk2, SBSmk1, and SBSmk2, have:
- less devil's club in the shrub layer on mesic sites; and
- less oak fern in the herb layer on mesic sites.

ESSFmv3 has:
- more white-flowered rhododendron but less devil's club in the shrub layer on mesic sites; and
- less oak fern in the herb layer on mesic sites.

Forests
Due to the longer periodicity of stand replacement events in this variant, forested areas are often climax forests dominated by hybrid white spruce and subalpine fir. Lodgepole pine is common on sites drier than mesic. Black spruce occurs on upland sites with lodgepole pine on gentle slopes with a cool aspect and in wetlands. Some fairly homogeneous stands of paper birch occur primarily along the east side of Williston Lake. Black cottonwood occurs along streams and rivers and is often associated with hybrid white spruce.

[1] Formerly SBSj2

Wildlife

This variant provides some winter range for moose and is important to caribou during early winter. It includes summer habitat for black bear, and to a lesser extent, grizzly bear.

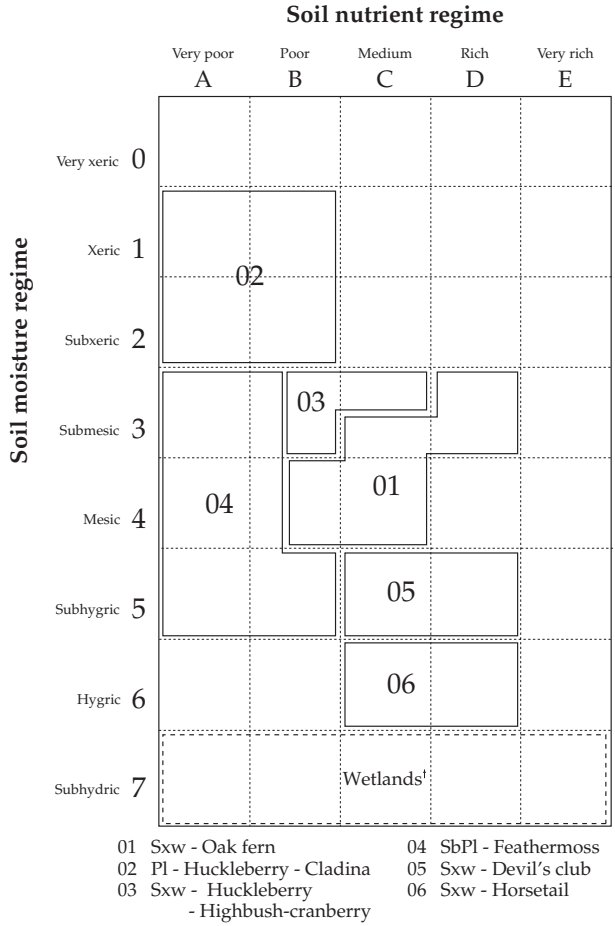


FIGURE 8.1 *Edatopic grid displaying site units of the SBSwk2 variant.*

Site Series	02	03	04	01	05	06	
Trees							
Pinus contorta	■	■	■				lodgepole pine
Picea mariana			■				black spruce
Picea glauca × engelmannii		■	■	■	■	■	hybrid white spruce
Shrubs							
Shepherdia canadensis			■				soopolallie
Vaccinium membranaceum	■	■	■	■	■		black huckleberry
Amelanchier alnifolia			■				saskatoon
Spiraea betulifolia		■		■			birch-leaved spirea
Rubus parviflorus		■		■	■	■	thimbleberry
Lonicera involucrata		■		■	■	■	black twinberry
Salix spp.		■	■				willows
Oplopanax horridus				■	■	■	devil's club
Viburnum edule		■	■	■	■	■	highbush-cranberry
Herbs and Dwarf Shrubs							
Linnaea borealis		■	■	■		■	twinberry
Cornus canadensis	■	■	■	■	■	■	bunchberry
Smilacina racemosum		■		■	■		false Solomon's-seal
Rubus pubescens		■	■	■	■	■	trailing raspberry
Streptopus amplexifolius				■	■	■	clasping twistedstalk
Gymnocarpium dryopteris				■	■	■	oak fern
Equisetum arvense					■	■	common horsetail
Mosses and Lichens							
Cladina spp.	■						cladina lichens
Pleurozium schreberi	■	■	■	■	■	■	red-stemmed feathermoss
Ptilium crista-castrensis	■	■	■	■	■	■	knight's plume
Mnium spp.				■	■	■	leafy mosses

Prominence class: ■ 1 ■ 2 ■ 3 ■ 4 ■ 5

FIGURE 8.2 *SBSwk2 vegetation table.*

1a Canopy composed almost exclusively of lodgepole pine or mixed lodgepole pine and black spruce; white spruce low cover (<5%) or absent; upper slope or level

2a Black spruce present in canopy; soils generally not coarse textured; *Cladina* spp. (p. 334)[2] low cover (<5%) or absent

SBSwk2/04

2b Black spruce not present in canopy; soils coarse textured; *Cladina* spp. usually moderate to high cover (>5%)

SBSwk2/02

1b Canopy composed partly or entirely of hybrid white spruce, occasionally in combination with lodgepole pine; slope position variable

3a Canopy usually lodgepole pine and hybrid white spruce; mid to upper slope; *Gymnocarpium dryopteris* (p. 293) low cover (<1%) or absent

SBSwk2/03

3b Lodgepole pine usually absent from canopy; mid to lower slope or toe, or level, occasionally upper slope on north aspects; *Gymnocarpium dryopteris* moderate to high cover (>5%)

4a Lower slope; *Oplopanax horridus* (p. 36) moderate to high cover (>5%)

SBSwk2/05

4b Midslope to toe or level; *Oplopanax horridus* low cover (<5%) or absent

[2] Page numbers refer to the publication *Plants of Northern British Columbia* (MacKinnon et al. 1992).

5a Usually toe or level; seepage water often present; *Equisetum* spp. (pp. 281–282) moderate to high cover (>5%)

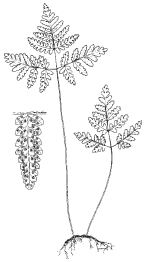
SBSwk2/06

5b Usually midslope, upper slope if north aspect, lower slope if south aspect; seepage water usually absent; *Equisetum* spp. low cover (<5%) or absent

SBSwk2/01

Ribes lacustre

Viburnum edule



Gymnocarpium dryopteris

VEGETATION

Tree Layer: 25% cover
Hybrid white spruce, subalpine fir

Shrub Layer: 30% cover

Ribes lacustre	(black gooseberry)
Viburnum edule	(highbush-cranberry)
Vaccinium membranaceum	(black huckleberry)
Oplopanax horridus	(devil's club)
Alnus viridis ssp. *sinuata***	(Sitka alder)
[*Rubus parviflorus*	(thimbleberry)]
[*Acer glabrum*	(Douglas maple)]
Ribes lacustre	
subalpine fir	

Herb Layer: 60% cover

Gymnocarpium dryopteris	(oak fern)
Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided wintergreen)
Streptopus amplexifolius	(clasping twistedstalk)
Lycopodium annotinum	(stiff clubmoss)
Rubus pedatus	(five-leaved bramble)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
*Maianthemum racemosum***	(false Solomon's-seal)
Linnaea borealis	(twinflower)
Tiarella trifoliata	(three-leaved foamflower)

Moss Layer: 80% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)

SOIL AND SITE

Moisture Regime:	(3)–4 ((submesic)–mesic)
Nutrient Regime:	(B)–(D) ((poor–) medium (–rich))
Slope Gradient (%):	0–80 (rarely 0)
* Slope Position:	mid; upper if northerly aspect
* Parent Material:	morainal, (glacio) fluvial
Soil Texture:	coarse to moderately fine
Coarse Fragments (%):	0–60

DISTRIBUTION: common

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with medium- to fine-textured lacustrine soils often have poor soil structure, leading to poor root growth; ***plant stock that will achieve better lateral root development (e.g., Cu-treated), prescribe natural regeneration, or protect advance regeneration.***

Site preparation:
- see Section 12.

Species choice:
- Pl, Sx, [Bl]
  At, Ep, {Act}

Vegetation potential:
- moderate to high (trembling aspen, fireweed, thimbleberry)

Reforestation:
- plant sturdy stock as soon after harvesting as possible.
- try to preserve advance regeneration if it is abundant and likely to release and form an acceptable stand.
- help maintain stand diversity on sites to be planted with Pl by mapping aspen patches prior to harvest and planting these areas to spruce.
- Act may not be consistently productive on these sites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***

Vaccinium membranaceum

Alnus viridis ssp. *sinuata*

Cladina spp.

VEGETATION

Tree Layer: 40% cover
Lodgepole pine

Shrub Layer: 60% cover

Vaccinium membranaceum	(black huckleberry)
Alnus viridis ssp. *sinuata*[**]	(Sitka alder)

subalpine fir, hybrid white spruce

Herb Layer: 15% cover

Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided wintergreen)
Pyrola chlorantha	(green wintergreen)

Moss Layer: 95% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Cladina spp.	(cladina lichens)
Peltigera aphthosa	(freckle pelt lichen)
Dicranum spp.	(crane's-bill mosses)
Barbilophozia spp.	(leafy liverworts)

SOIL AND SITE

Moisture Regime:	1–2 (subxeric–xeric)
Nutrient Regime:	A–B (poor–very poor)
* Slope Gradient (%):	0–6 (usually 0)
* Slope Position:	level or upper
* Parent Material:	glaciofluvial, (fluvial)
* Soil Texture:	coarse
Coarse Fragments (%):	40–60

DISTRIBUTION: uncommon

[**] The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- site and soil conditions of this unit result in marginal forest productivity; ***serious consideration should be given to excluding logging from this unit.***
- sites within this unit with high coarse fragment content (>70%) will have significantly reduced soil moisture retention and will be extremely difficult to plant; ***attempt to regenerate naturally by retaining Pl cones.***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- no site preparation
- see Section 12.

Species choice:
- Pl, (**Bl**, **Sx**)

Vegetation potential: low

Reforestation:
- attempt to regenerate naturally if potential exists.
- if natural regeneration is not feasible, plant Pl without site preparation.
- Sx and Bl are generally significantly less productive than Pl on this unit and should be accepted only on moist microsites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site and soil conditions of this unit result in drought hazard for a significant portion of the growing season; ***natural regeneration is generally better adapted to surviving these conditions, especially during establishment.***
- sites within this unit are vulnerable to nutrient deficiency if forest floors are reduced; ***site preparation methods that reduce forest floor thickness, such as slashburning or brushblading, must be avoided.***

Sxw – Huckleberry – Highbush-cranberry

Vaccinium membranaceum

Viburnum edule

Spiraea betulifolia

VEGETATION

Tree Layer: 30% cover
Lodgepole pine, hybrid white spruce

Shrub Layer: 50% cover

Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)
Spiraea betulifolia	(birch-leaved spirea)
Alnus viridis ssp. *sinuata***	(Sitka alder)
Ribes lacustre	(black gooseberry)
Sorbus scopulina	(western mountain-ash)

subalpine fir, lodgepole pine

Herb Layer: 60% cover

Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided wintergreen)
Lycopodium annotinum	(stiff clubmoss)
Rubus pedatus	(five-leaved bramble)
Linnaea borealis	(twinflower)
*Maianthemum racemosum***	(false Solomon's-seal)
Pyrola chlorantha	(green wintergreen)
Arnica cordifolia	(heart-leaved arnica)

Moss Layer: 95% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)

SOIL AND SITE

Moisture Regime:	3 (submesic)
Nutrient Regime:	B–C (poor–medium)
Slope Gradient (%):	0–75
* Slope Position:	mid to upper; or level
Parent Material:	glaciofluvial, morainal, colluvial
* Soil Texture:	moderately coarse to coarse
Coarse Fragments (%):	0–60

DISTRIBUTION: common

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:	– sites within this unit with colluvial soils may be difficult to plant; ***attempt to regenerate naturally or make use of advance regeneration.*** – sites within this unit with high coarse fragment content (>70%) will have significantly reduced soil moisture retention and will be extremely difficult to plant; ***attempt to regenerate naturally by retaining Pl cones.***
Site preparation:	– see Section 12.
Species choice:	– Sx, Pl, [Bl] {At, Ep}
Vegetation potential:	– low to moderate (fireweed)
Reforestation:	– attempt to regenerate naturally if potential exists. – if natural regeneration is not feasible, plant Pl or Sx without site preparation. – try to preserve advance regeneration if it is abundant and likely to release and form an acceptable stand. – young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose. – At and Ep will generally be less productive on these sites.
Concerns:	– full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***

black spruce

Equisetum scirpoides

Lycopodium annotinum

VEGETATION

Tree Layer: 25% cover
Hybrid white spruce, lodgepole pine, black spruce

Shrub Layer: 50% cover

Rosa acicularis	(prickly rose)
Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)
Alnus viridis ssp. *sinuata***	(Sitka alder)
Ribes lacustre	(black gooseberry)
Sorbus scopulina	(western mountain-ash)
[*Ledum groenlandicum*	(Labrador tea)]

subalpine fir, hybrid white spruce, black spruce

Herb Layer: 45% cover

Cornus canadensis	(bunchberry)
Linnaea borealis	(twinflower)
Equisetum scirpoides	(dwarf scouring-rush)
Orthilia secunda	(one-sided wintergreen)
Epilobium angustifolium	(fireweed)
Lycopodium annotinum	(stiff clubmoss)
Mitella nuda	(common mitrewort)
Gymnocarpium dryopteris	(oak fern)
Rubus pubescens	(trailing raspberry)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Rubus pedatus	(five-leaved bramble)

Moss Layer: 60% cover

Ptilium crista-castrensis	(knight's plume)
Pleurozium schreberi	(red-stemmed feathermoss)
Peltigera aphthosa	(freckle pelt lichen)

SOIL AND SITE

Moisture Regime:	3–5 (submesic–subhygric)
Nutrient Regime:	A–B (very poor–poor)
* Aspect:	northerly or flat
* Slope Gradient (%):	usually less than 25
Slope Position:	mid to upper or level
* Parent Material:	glaciofluvial, morainal, (fluvial)
Soil Texture:	moderately fine to coarse
Coarse Fragments (%):	0–85

DISTRIBUTION: common in some areas

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- soil drainage and rooting may be impeded by dense basal till layers or poorly structured clay-rich horizons within 30 cm of the soil surface; this results in a shallow rooting zone that is saturated and poorly aerated in the spring following snowmelt, but subject to drought in summer.
- ***the poor productivity resulting from these limitations should dictate a limited investment in intensive silviculture; protect advance regeneration and regenerate naturally whenever possible or if planting then plant stock that will achieve better lateral root development (e.g., Cu-treated).***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- see Section 12.

Species choice:
- Pl, (***Sx***, ***Sb***)
  {At}

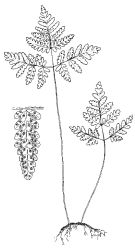
Vegetation potential:
- low

Reforestation:
- attempt to regenerate naturally if potential exists.
- if natural regeneration is not feasible, plant Pl; ***use stock that will achieve better lateral root development (e.g., Cu-treated).***
- At, Sx, and Sb will generally be less productive than Pl on these sites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- these sites may be subject to severe growing-season frosts, especially in naturally occurring or artificially created depressional microsites; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***

Oplopanax horridus

Rubus parviflorus



Gymnocarpium dryopteris

VEGETATION

Tree Layer: 15% cover
Hybrid white spruce, subalpine fir

Shrub Layer: 75% cover

Oplopanax horridus	(devil's club)
Rubus parviflorus	(thimbleberry)
Ribes lacustre	(black gooseberry)
subalpine fir	

Herb Layer: 80% cover

Gymnocarpium dryopteris	(oak fern)
Rubus pedatus	(five-leaved bramble)
Tiarella trifoliata	(three-leaved foamflower)
Clintonia uniflora	(queen's cup)
Streptopus amplexifolius	(clasping twistedstalk)
Cornus canadensis	(bunchberry)
*Osmorhiza berteroi***	(mountain sweet-cicely)
Lycopodium annotinum	(stiff clubmoss)
*Maianthemum racemosum***	(false Solomon's-seal)
Rubus pubescens	(trailing raspberry)

Moss Layer: 70% cover

Ptilium crista-castrensis	(knight's plume)
Pleurozium schreberi	(red-stemmed feathermoss)
Mnium spp.	(leafy mosses)

SOIL AND SITE

Moisture Regime:	(4)–5 ((mesic)–subhygric)
Nutrient Regime:	C–D (medium–rich)
Slope Gradient (%):	5–35
* Slope Position:	lower
Parent Material:	variable
Soil Texture:	variable
Coarse Fragments (%):	9–80
* Seepage Water:	may be present

DISTRIBUTION: common

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with colluvial soils may be difficult to plant; ***attempt to regenerate naturally or make use of advance regeneration.***

Site preparation:
- see Section 12.

Species choice:
- ***Sx***, ***Bl***, [Pl]
  At, Ep, {Act}

Vegetation potential:
- high (black twinberry, thimbleberry, fireweed)

Reforestation:
- plant sturdy stock as soon after harvesing as possible.
- try to preserve advance regeneration if it is abundant and likely to release and form an acceptable stand.
- planting Sx or Bl in obvious frost pockets should be avoided unless risk can be reduced by providing cover.
- Act may not be consistently productive on these sites.

Concerns:
- sites within this unit with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict traffic to winter operations or dry soil conditions.***
- sites within this unit with thick organic horizons (>10 cm) have increased windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***

Ribes lacustre

Cornus stolonifera

Equisetum arvense

VEGETATION

Tree Layer: 15% cover
Hybrid white spruce, subalpine fir

Shrub Layer: 25% cover

Ribes lacustre	(black gooseberry)
Lonicera involucrata	(black twinberry)
Viburnum edule	(highbush-cranberry)
Cornus stolonifera	(red-osier dogwood)
Rosa acicularis	(prickly rose)
subalpine fir	

Herb Layer: 80% cover

Equisetum arvense	(common horsetail)
Equisetum pratense	(meadow horsetail)
Cornus canadensis	(bunchberry)
Rubus pubescens	(trailing raspberry)
Linnaea borealis	(twinflower)
Mitella nuda	(common mitrewort)
Gymnocarpium dryopteris	(oak fern)
Mertensia paniculata	(tall bluebells)
Galium triflorum	(sweet-scented bedstraw)
Streptopus amplexifolius	(clasping twistedstalk)
*Maianthemum racemosum***	(false Solomon's-seal)
*Heracleum maximum***	(cow-parsnip)
Rubus pedatus	(five-leaved bramble)

Moss Layer: 50% cover

Hylocomium splendens	(step moss)
Mnium spp.	(leafy mosses)
Ptilium crista-castrensis	(knight's plume)
Pleurozium schreberi	(red-stemmed feathermoss)

SOIL AND SITE

Moisture Regime:	6 (hygric)
Nutrient Regime:	C–D (medium –rich)
Slope Gradient (%):	0–6
Slope Position:	(lower)–toe or level
Parent Material:	(glacio) fluvial
Soil Texture:	medium to moderately coarse
Coarse Fragments (%):	0–56
Seepage Water:	may be present

DISTRIBUTION: common but small

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- very difficult sites to manage; ***serious consideration should be given to managing these sites as wildlife corridors.***
- sites with saturated soils are poorly aerated, which slows root development; ***plant seedlings on naturally or artificially raised microsites.***

Site preparation:
- creating an excessive number of mounds (i.e., >300/ha) should be avoided, especially on sites within this unit with a water table <30 cm from the surface.
- see Section 12.

Species choice:
- ***Sx***, ***Bl*** , [***Pl***]
  Act, At

Vegetation potential:
- high (black twinberry, fireweed)

Reforestation:
- advance regeneration should be preserved.
- supplement advance regeneration by planting sturdy stock in groups, using available raised microsites.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.

Concerns:
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***
- sites with thick organic horizons (>10 cm) have extreme windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***
- water table will likely rise above the ground surface in the spring, causing seedling mortality on non-elevated sites.
- these units represent important wildlife habitat; ***discuss prescription with fish and wildlife personnel.***
- this unit is critical to the control of runoff streamflow.

9 TAKLA WET COOL SUB-BOREAL SPRUCE (SBSwk3)[1]

Location
The SBSwk3 occurs in the main and side drainages of the valley occupied by Takla Lake and the Driftwood River. It occurs as far south as Trembleur Lake and as a far north as the Sustut River.

Elevation range
750 – 1100 m

Climate
According to long-term climate records, the SBSwk3 has lower mean annual precipition and mean seasonal precipitation than the SBSmk2 (Table 4.1). However, according to PRISM data, it is intermediate between the SBSmk2 and SBSwk2 (Table 4.1). It is similar in temperature regime to the other sub-boreal units but warmer than the ESSFmv3, which replaces it at higher elevations.

Distinguishing the SBSwk3 from adjoining biogeoclimatic units

BWBSdk1, SBSmk1, and SBSmc2 have:
- more prickly rose in the shrub layer on mesic sites; and
- less oak fern in the herb layer on mesic sites.

SBSwk3a has:
- Douglas-fir occurring over a wider range of moisture regimes; and
- more Hooker's fairybells in the herb layer on mesic sites.

ESSFmc and ESSFmv3 have:
- more white-flowered rhododendron and/or false azalea but less black twinberry and/or thimbleberry in the shrub layer on mesic sites; and
- less oak fern in the herb layer on mesic sites.

Forests
Due to the lower frequency of stand replacement events in this variant, forested areas are often climax forests dominated by hybrid white spruce and subalpine fir. Lodgepole pine is common

[1] Formerly SBSn

on sites drier than mesic. Black spruce occurs in wetlands, and with lodgepole pine on gently sloping upland sites with a cool aspect. Homogeneous stands of trembling aspen occur primarily along the shores of Takla Lake. Black cottonwood occurs along streams and rivers and is often associated with hybrid white spruce.

Wildlife

This variant provides very good moose winter range habitat. The wetlands are important to waterfowl for breeding and migration staging. Grizzly and black bear use this variant. Bears and bald eagles concentrate along waterways during the sockeye spawning period. Aquatic furbearer habitat is plentiful.

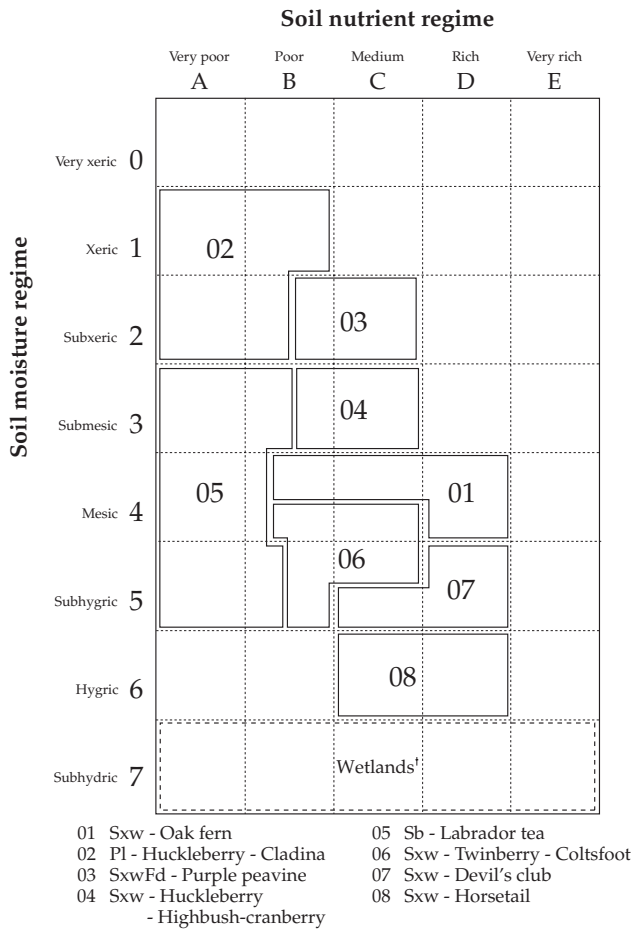


FIGURE 9.1 *Edatopic grid displaying site units of the SBSwk3 variant.*

Site Series	02	03	04	01	05	06	07	08	
Trees									
Pinus contorta	5	1	3	3	2		1	1	lodgepole pine
Pseudotsuga menziesii		3							Douglas-fir
Picea mariana					3				black spruce
Picea glauca × *engelmannii*		2	3	3		3	3	3	hybrid white spruce
Shrubs									
Shepherdia canadensis	2	1				1			soopolallie
Vaccinium membranaceum	2		3	2	2	2	2		black huckleberry
Amelanchier alnifolia		1							saskatoon
Spiraea betulifolia		1	1			1			birch-leaved spirea
Rubus parviflorus			2	2		2	2		thimbleberry
Lonicera involucrata			1	2	2	2	2	2	black twinberry
Salix spp.					3			1	willows
Oplopanax horridus		1					3		devil's club
Viburnum edule			2	2	2	2	2	3	highbush-cranberry
Herbs and Dwarf Shrubs									
Gaultheria hispidula	1								creeping-snowberry
Lathyrus nevadensis		3							purple peavine
Linnaea borealis	2		1	1	1	2		2	twinberry
Cornus canadensis	1	1	2	2	1	2	2	2	bunchberry
Maianthemum racemosum		2		1		1			false Solomon's-seal
Rubus pubescens		2	1	1	2	2		2	trailing raspberry
Streptopus amplexifolius						1	1		clasping twistedstalk
Gymnocarpium dryopteris				2			2		oak fern
Equisetum arvense				1	3			3	common horsetail
Mosses and Lichens									
Cladina spp.	3								cladina lichens
Pleurozium schreberi	3	2	3	3	2	3	3	2	red-stemmed feathermoss
Ptilium crista-castrensis	1	2	3	3		3	3	3	knight's plume
Mnium spp.				1			1		leafy mosses

Prominence class: 1 2 3 4 5

FIGURE 9.2 *SBSwk3 vegetation table.*

1a Canopy dominated by Douglas-fir or lodgepole pine; *Amelanchier alnifolia* (p. 46)[2] or *Cladina* spp. (p. 334) present; slope position upper or level; soil texture coarse

2a Canopy dominated by Douglas-fir

SBSwk3/03

2b Canopy dominated by lodgepole pine

SBSwk3/02

1b Canopy generally dominated by mixtures of lodgepole pine and white or black spruce; *Amelanchier alnifolia* and *Cladina* spp. low cover (<1%) or absent; slope position variable; soil texture variable

3a Canopy dominated by a combination of lodgepole pine and black spruce; slope gradient less than 10%, often flat; *Aulacomnium palustre* (p. 311) present

SBSwk3/05

3b Canopy dominated by hybrid white spruce, sometimes in combination with lodgepole pine; slope gradient variable; *Aulacomnium palustre* usually absent

4a Level or depression; parent material fluvial or lacustrine; *Equisetum* spp. (p. 281–284) abundant (usually >30% cover)

SBSwk3/08

4b Slope position variable; parent material variable; *Equisetum* spp. low cover (<5%) or absent

5a Slope position mid to lower (occasionally upper on north aspects); *Oplopanax horridus* (p. 36) abundant (usually >15% cover)

SBSwk3/07

[2] Page numbers refer to the publication *Plants of Northern British Columbia* (MacKinnon et al. 1992).

5b Slope position variable; *Oplopanax horridus* low cover (<5%) or absent

6a *Gymnocarpium dryopteris* (p. 293) moderate to high cover (usually >5%)

SBSwk3/01

6b *Gymnocarpium dryopteris* low cover (usually <2%) or absent

7a Usually mid to upper slope; lodgepole pine usually present in the canopy; *Rubus pubescens* (p. 91) usually very low cover (<1%) or absent

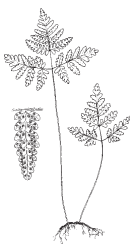
SBSwk3/04

7b Usually mid to lower slope; lodgepole pine usually absent from the canopy; *Rubus pubescens* usually low to moderate cover (>1%)

SBSwk3/06

Lonicera involucrata

Ribes lacustre



Gymnocarpium dryopteris

VEGETATION

Tree Layer: 45% cover
Hybrid white spruce, lodgepole pine, subalpine fir

Shrub Layer: 45% cover

Lonicera involucrata	(black twinberry)
Ribes lacustre	(black gooseberry)
Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)
Rubus parviflorus	(thimbleberry)
Sorbus scopulina	(western mountain-ash)

subalpine fir, hybrid white spruce

Herb Layer: 80% cover

Gymnocarpium dryopteris	(oak fern)
Rubus pedatus	(five-leaved bramble)
Cornus canadensis	(bunchberry)
Lycopodium annotinum	(stiff clubmoss)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Linnaea borealis	(twinflower)
Orthilia secunda	(one-sided wintergreen)
*Maianthemum racemosum***	(false Solomon's-seal)

Moss Layer: 75% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
Barbilophozia lycopodioides	(common leafy liverwort)

SOIL AND SITE

Moisture Regime:	4 (mesic)
Nutrient Regime:	B–D (poor–rich)
Slope Gradient (%):	13 (0–35; usually less than 20)
* Slope Position:	mid (lower to upper)
Parent Material:	glaciofluvial, fluvial, or morainal
* Soil Texture:	usually medium to moderately coarse
Coarse Fragments (%):	40 (13–61)

DISTRIBUTION: common

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with medium- to fine-textured lacustrine soils often have poor soil structure, leading to poor root growth; ***plant stock that will achieve better lateral root development (e.g., Cu-treated), prescribe natural regeneration, or protect advance regeneration.***

Site preparation:
- see Section 12.

Species choice:
- Pl, Sx, [***Bl***]
  At, Ep, {Act}

Vegetation potential:
- moderate to high (trembling aspen, fireweed, thimbleberry)

Reforestation:
- plant sturdy stock as soon after harvesting as possible.
- try to preserve advance regeneration if it is abundant and likely to release and form an acceptable stand.
- help maintain stand diversity on sites to be planted with Pl by mapping aspen patches prior to harvest and planting these areas to spruce.
- Act is not consistently productive on these sites.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***

Vaccinium membranaceum

Shepherdia canadensis

Linnaea borealis

VEGETATION

Tree Layer: 20% cover
Lodgepole pine

Shrub Layer: 20% cover

Vaccinium membranaceum	(black gooseberry)
Shepherdia canadensis	(soopolallie)
Rosa acicularis	(prickly rose)
[*Amelanchier alnifolia*	(saskatoon)]

subalpine fir, hybrid white spruce

Herb Layer: 15% cover

Linnaea borealis	(twinflower)
Cornus canadensis	(bunchberry)
Geocaulan lividum	(bastard toad-flax)
Epilobium angustifolium	(fireweed)
Vaccinium caespitosum	(dwarf blueberry)
[*Chimaphila umbellata*	(prince's pine)]
[*Arctostaphylos uva-ursi*	(kinnikinnick)]

Moss Layer: 75% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Cladina mitis	(green reindeer lichen)
Cladina rangiferina	(grey reindeer lichen)
Dicranum fuscescens	(curly heron's-bill moss)
Peltigera aphthosa	(freckle pelt lichen)
Polytrichum juniperinum	(juniper haircap moss)
Ptilium crista-castrensis	(knight's plume)
Cladonia spp.	(cladonia lichens)
Dicranum polysetum	(wavy-leaved moss)

SOIL AND SITE

Moisture Regime:	1–2 (xeric–subxeric)
Nutrient Regime:	A–B (very poor to poor)
* Slope Gradient (%):	0–70 (gentle, if fluvial)
* Slope Position:	level or upper
* Parent Material:	glaciofluvial, fluvial, or morainal over rock
* Soil Texture:	coarse
Coarse Fragments (%):	25–80

DISTRIBUTION: uncommon except in rocky terrain or on upper terrace of large rivers

INTERPRETATIONS

Site limitations:
- site and soil conditions of this unit result in marginal forest productivity; ***serious consideration should be given to excluding logging from this unit.***
- sites within this unit with high coarse fragment content (>70%) will have significantly reduced soil moisture retention and will be extremely difficult to plant; ***attempt to regenerate naturally by retaining Pl cones.***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- no site preparation

Species choice:
- Pl, (***Bl***, ***Sx***)

Vegetation potential:
- low

Reforestation:
- attempt to regenerate naturally if potential exists.
- if natural regeneration is not feasible, plant Pl without site preparation.
- Sx and Bl are generally significantly less productive than Pl on this unit and should be accepted only on moist microsites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site and soil conditions of this unit result in drought hazard for a significant portion of the growing season; ***natural regeneration is generally better adapted to surviving these conditions, especially during establishment.***
- sites within this unit are vulnerable to nutrient deficiency if forest floors are reduced; ***site preparation methods that reduce forest floor thickness, such as slashburning or brushblading, must be avoided.***

Douglas-fir

Amelanchier alnifolia

Lathyrus nevadensis

VEGETATION

Tree Layer: 80% cover
Douglas-fir, (hybrid white spruce)

Shrub Layer: 20% cover

Amelanchier alnifolia	(saskatoon)
Spiraea betulifolia	(birch-leaved spirea)
Cornus stolonifera	(red-osier dogwood)
Ribes lacustre	(black gooseberry)
Acer glabrum	(Douglas maple)
subalpine fir	

Herb Layer: 35% cover

Lathyrus nevadensis	(purple peavine)
Aralia nudicaulis	(wild sarsaparilla)
Clintonia uniflora	(queen's cup)
Thalictrum occidentale	(western meadowrue)
Orthilia secunda	(one-sided wintergreen)
Aster conspicuus	(showy aster)
*Maianthemum racemosum***	(false Solomon's-seal)
Goodyera oblongifolia	(rattlesnake-plantain)
*Prosartes hookeri***	(Hooker's fairybells)

Moss Layer: 30% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Ptilium crista-castrensis	(knight's plume)

SOIL AND SITE

Moisture Regime:	2 (subxeric)
Nutrient Regime:	B–C (poor–medium)
Slope Gradient (%):	21 (2–40)
* Slope Position:	upper or level
* Parent Material:	morainal or colluvial
Soil Texture:	coarse
Coarse Fragments (%):	55 (50–59)

DISTRIBUTION: rare and usually small in size

COMMENTS: represents the northern extent of Douglas-fir.

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- light scarification for seedbed preparation or summer logging with no site preparation.

Species choice:
- ***Fd***, ***Pl***, [***Sx***]
  {At, Ep}

Vegetation potential:
- low

Reforestation:
- attempt to regenerate naturally if potential exists.
- if natural regeneration is not feasible, plant Fd stock grown from the most northern seedlot available.
- Sx is less productive than Fd or Pl on these sites.
- At and Ep are not consistently productive on these sites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site and soil conditions of this unit result in drought hazard for a significant portion of the growing season; ***natural regeneration is generally better adapted to surviving these conditions, especially during establishment.***

Sxw – Huckleberry – Highbush-cranberry

Vaccinium membranaceum

Viburnum edule

Maianthemum racemosum

VEGETATION

Tree Layer: 40% cover
Lodgepole pine, hybrid white spruce, subalpine fir

Shrub Layer: 35% cover

Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)
Ribes lacustre	(black gooseberry)
Spiraea betulifolia	(birch-leaved spirea)

subalpine fir

Herb Layer: 25% cover

*Maianthemum racemosum***	(false Solomon's-seal)
Linnaea borealis	(twinflower)
Orthilia secunda	(one-sided wintergreen)
Cornus canadensis	(bunchberry)
Clintonia uniflora	(queen's cup)
Arnica cordifolia	(heart-leaved arnica)
Epilobium angustifolium	(fireweed)

Moss Layer: 90% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)

SOIL AND SITE

Moisture Regime:	3–(4) (submesic–(mesic))
Nutrient Regime:	B–C (poor–medium)
Slope Gradient (%):	11 (4–20)
Slope Position:	variable
Parent Material:	morainal, glaciofluvial, (colluvial)
* Soil Texture:	coarse (medium)
* Coarse Fragments (%):	43 (8–85); usually more than 30

DISTRIBUTION: uncommon

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:	– sites within this unit with high coarse fragment content (>70%) will have significantly reduced soil moisture retention and will be extremely difficult to plant; ***attempt to regenerate naturally by retaining Pl cones.***
Site preparation:	– light scarification for seedbed preparation or summer logging with no site preparation. – see Section 12.
Species choice:	– Pl, Sx, [***Bl***] At, Ep
Vegetation potential:	– low
Reforestation:	– attempt to regenerate naturally if potential exists. – if natural regeneration is not feasible, plant Pl or Sx. – young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
Concerns:	– full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).*** – sites within this unit with shallow and/or coarse-textured soils are vulnerable to nutrient deficiency if forest floors are reduced; ***site preparation methods that reduce forest floor thickness, such as slashburning or brushblading, must be avoided.***

black spruce

Salix spp.

Equisetum arvense

VEGETATION

Tree Layer: 15% cover
Black spruce, lodgepole pine

Shrub Layer: 45% cover

Salix spp.	(willows)
Lonicera involucrata	(black twinberry)
Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)

Herb Layer: 95% cover

Equisetum arvense	(common horsetail)
Rubus pubescens	(trailing raspberry)
Fragaria virginiana	(wild strawberry)
Elymus glaucus	(blue wildrye)
Galium boreale	(northern bedstraw)

Moss Layer: 15% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Aulacomnium palustre	(glow moss)

SOIL AND SITE

Moisture Regime:	3–5 (submesic–subhygric)
Nutrient Regime:	A–B (very poor–poor)
* Aspect:	northerly or flat
* Slope Gradient (%):	usually less than 10
Slope Position:	mid to lower or level
* Parent Material:	glaciofluvial
* Soil Texture:	medium to coarse
* Coarse Fragments (%):	0–40

DISTRIBUTION: rare

INTERPRETATIONS

Site limitations:
- soil drainage and rooting may be impeded by dense basal till layers or poorly-structured clay-rich horizons within 30 cm of the soil surface; this results in a shallow rooting zone that is saturated and poorly aerated in the spring following snowmelt, but subject to drought in summer.
- ***the poor productivity resulting from these limitations should dictate a limited investment in intensive silviculture; regenerate naturally whenever possible or if planting then plant stock that will achieve better lateral root development (e.g., Cu-treated).***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- see Section 12.

Species choice:
- Pl, (***Sx***, ***Sb***)
  {At}

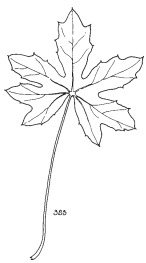
Vegetation potential:
- low

Reforestation:
- attempt to regenerate naturally if potential exists.
- if natural regeneration is not feasible, plant Pl.
- At, Sx and Sb are generally less productive than Pl on these sites.
- on sites with saturated soils, plant seedlings on naturally or artificially raised microsites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- sites within this unit with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict all traffic to winter operations or dry soil conditions.***
- these sites may be subject to severe growing-season frosts, especially in any naturally occurring or artificially created depressional microsites; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***

Lonicera involucrata

Viburnum edule



Petasites frigidus var. *palmatus*

VEGETATION

Tree Layer: 35% cover
Hybrid white spruce, subalpine fir, (trembling aspen)

Shrub Layer: 25% cover

Lonicera involucrata	(black twinberry)
Ribes lacustre	(black gooseberry)
Viburnum edule	(highbush-cranberry)
Rubus parviflorus	(thimbleberry)
Rosa acicularis	(prickly rose)
[*Cornus stolonifera*	(red-osier dogwood)]

subalpine fir, hybrid white spruce

Herb Layer: 30% cover

Cornus canadensis	(bunchberry)
Rubus pubescens	(trailing raspberry)
Linnaea borealis	(twinflower)
Thalictrum occidentale	(western meadowrue)
*Maianthemum racemosum***	(false Solomon's-seal)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Mitella nuda	(common mitrewort)
*Osmorhiza berteroi***	(mountain sweet-cicely)
Pyrola asarifolia	(rosy wintergreen)

Moss Layer: 85% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
Rhytidiadelphus triquetrus	(electrified cat's-tail moss)

SOIL AND SITE

Moisture Regime:	(4)–5 ((mesic)–subhygric)
Nutrient Regime:	B–C (poor–medium)
* Aspect:	generally not northerly
Slope Gradient (%):	15 (2–30)
* Slope Position:	mid (upper to lower)
Parent Material:	glaciofluvial, (morainal)
* Soil Texture:	moderately coarse to medium
Coarse Fragments (%):	36 (24–66)

DISTRIBUTION: uncommon

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with medium- to fine-textured lacustrine soils often have poor soil structure, leading to poor root growth; ***plant stock that will achieve better lateral root development (e.g., Cu-treated), or protect advance regeneration.***

Site preparation:
- see Section 12.

Species choice:
- Pl, Sx, [***Bl***]
  At, Ep, {Act}

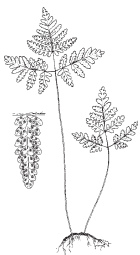
Vegetation potential:
- very high (fireweed, black twinberry)

Reforestation:
- plant sturdy stock as soon after harvesting as possible.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
- help maintain stand diversity in areas to be planted with Pl by mapping aspen patches prior to harvest and planting these areas to spruce.
- Act is not consistently productive on these sites.

Concerns:
- sites within this unit with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict traffic to winter operations or dry soil conditions.***
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***

Oplopanax horridus

Rubus parviflorus



Gymnocarpium dryopteris

VEGETATION

Tree Layer: 35% cover
Hybrid white spruce, subalpine fir, (lodgepole pine)

Shrub Layer: 60% cover

Oplopanax horridus	(devil's club)
Ribes lacustre	(black gooseberry)
Rubus parviflorus	(thimbleberry)
Viburnum edule	(highbush-cranberry)
Vaccinium membranaceum	(black huckleberry)
Lonicera involucrata	(black twinberry)
subalpine fir	

Herb Layer: 30% cover

Gymnocarpium dryopteris	(oak fern)
Streptopus amplexifolius	(clasping twistedstalk)
Actaea rubra	(baneberry)
Rubus pubescens	(trailing raspberry)
Cornus canadensis	(bunchberry)
Galium triflorum	(sweet-scented bedstraw)
Tiarella trifoliata	(three-leaved foamflower)
Dryopteris expansa	(spiny wood fern)
Lycopodium annotinum	(stiff clubmoss)

Moss Layer: 65% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
[*Mnium* spp.	(leafy mosses)]

SOIL AND SITE

Moisture Regime:	(4)–65((mesic)–subhygric)
Nutrient Regime:	C–D (medium–rich)
Slope Gradient (%):	26 (5–49)
* Slope Position:	usually mid to lower; may be upper on north aspects
Parent Material:	morainal, glaciofluvial
Soil Texture:	variable
Coarse Fragments (%):	34 (18–66)

DISTRIBUTION: fairly common

INTERPRETATIONS

Site limitations:
- sites within this unit with saturated soils are poorly aerated, which slows root development; ***plant seedlings on naturally or artificially raised microsites.***

Site preparation:
- see Section 12.

Species choice:
- Sx, [Pl, ***Bl***]
  At, Ep, {Act}

Vegetation potential:
- very high (thimbleberry, fireweed)

Reforestation:
- if vigorous advance regeneration is present it should be preserved when feasible.
- plant sturdy stock as soon after harvesting as possible.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
- due to the very high level of competition on theses sites it will be difficult to successfully regenerate them to Pl without high site treatment costs.
- Act is not consistently productive on these sites.

Concerns:
- sites within this unit with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict traffic to winter operations or dry soil conditions.***
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***
- sites within this unit with thick organic horizons (>10 cm) have increased windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***

Viburnum edule

Lonicera involucrata

Equisetum arvense

VEGETATION

Tree Layer: 25% cover
Hybrid white spruce, lodgepole pine

Shrub Layer: 35% cover

Viburnum edule	(highbush-cranberry)
Lonicera involucrata	(black twinberry)
Rosa acicularis	(prickly rose)
Ribes lacustre	(black gooseberry)
Salix spp.	(willows)
Rubus parviflorus	(thimbleberry)
Vaccinium membranaceum	(black huckleberry)

Herb Layer: 60% cover

Equisetum spp. *(arvense, sylvaticum)*	(horsetails)
Cornus canadensis	(bunchberry)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Mitella nuda	(common mitrewort)
Galium triflorum	(sweet-scented bedstraw)
Rubus pubescens	(trailing raspberry)
Linnaea borealis	(twinflower)
Rubus pedatus	(five-leaved bramble)

Moss Layer: 50% cover

Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)
[*Mnium* spp.	(leafy mosses)]

SOIL AND SITE

Moisture Regime:	6 (hygric)
Nutrient Regime:	C–D (medium–rich)
* Slope Gradient (%):	2 (0–5)
* Slope Position:	level or depression
* Parent Material:	fluvial or lacustrine
Soil Texture:	coarse to fine
Coarse Fragments (%):	variable

DISTRIBUTION: common but generally small in size

INTERPRETATIONS

Site limitations:
- very difficult sites to manage; ***serious consideration should be given to managing these sites as wildlife corridors.***
- sites within this unit with saturated soils are poorly aerated, which slows root development; ***plant seedlings on naturally or artificially raised microsites.***

Site preparation:
- creating an excessive number of mounds (i.e., >300/ha) should be avoided, especially on sites within this unit with a water table <30 cm from the surface.
- see Section 12.

Species choice:
- ***Sx***, [***Bl***, ***Pl***]
  Act, At

Vegetation potential:
- high to very high (black twinberry, prickly rose, fireweed)

Reforestation:
- advance regeneration should be preserved.
- supplement advance regeneration by planting sturdy stock in groups on available raised microsites.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
- retain Ac veterans where possible for wildlife.

Concerns:
- these units may represent important wildlife habitat; ***discuss prescription with fish and wildlife personnel.***
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***
- sites within this unit with thick organic horizons (>10 cm) have increased windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***
- water table will likely rise above the ground surface in the spring, causing seedling mortality on non-elevated sites.
- this association is critical to the control of runoff and streamflow.

10 TAKLA WET COOL SUB-BOREAL SPRUCE – DOUGLAS-FIR PHASE (SBSwk3a)[1]

Location
The SBSwk3a is bounded by Stuart Lake to the south and west, the Tachie River to the east, and Trembleur Lake to the north.

Elevation range
750 – 1100 m

Climate
No long-term climate data are available for the SBSwk3a.

Distinguishing the SBSwk3 from adjoining biogeoclimatic units

SBSdk, SBSmk1, and SBSmc2 have:
- less devil's club in the shrub layer on mesic sites; and
- less oak fern in the herb layer on mesic sites.

SBSwk3 has:
- Douglas-fir occurring only on dry sites; and
- little or no Hooker's fairybells but more five-leaved bramble in the herb layer on mesic sites.

ESSFmv1 has:
- more white-flowered rhododendron but less highbush-cranberry and devil's club in the shrub layer on mesic sites; and
- less oak fern in the herb layer on mesic sites.

Forests
Due to the relatively low frequency of stand replacement events in this variant, forested areas are often climax forests dominated by hybrid white spruce, Douglas-fir, and subalpine fir. Lodgepole pine is common on sites drier than mesic. Black spruce occurs on upland sites with lodgepole pine on gentle slopes with a cool aspect and in wetlands. Black cottonwood occurs along streams and rivers and is often associated with hybrid white spruce.

[1] Formerly part of SBSn

Wildlife

This variant supports moose and mule deer year-round. Black bear and grizzly bear habitat is common. Aquatic furbearer and waterfowl habitat occurs in the numerous lakes and wetlands.

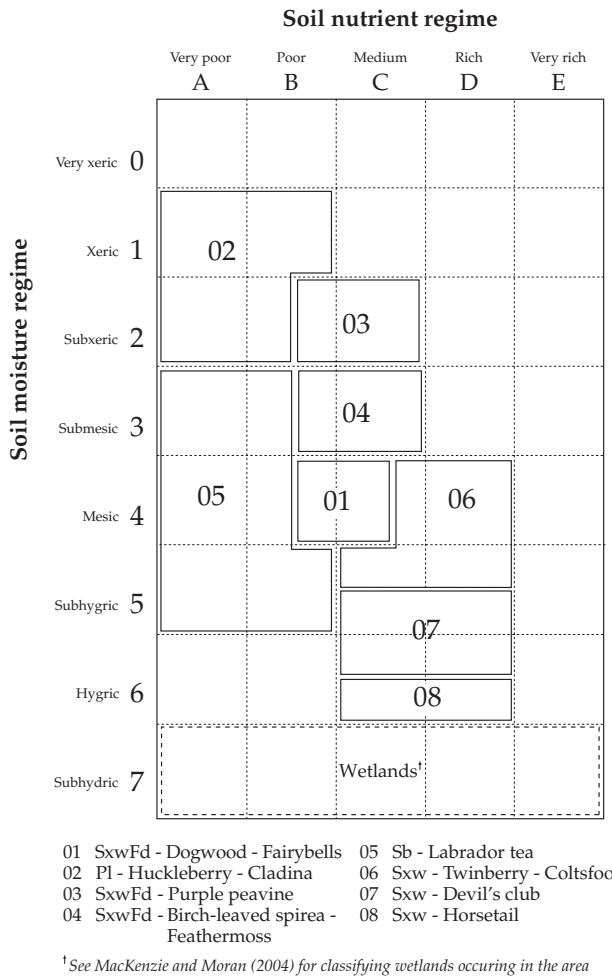


FIGURE 10.1 *Edatopic grid displaying site units of the SBSwk3a phase.*

Site Series	02	03	04	01	05	06	07	08	
Trees									
Pinus contorta	5	4	4	2	4			2	lodgepole pine
Pseudotsuga menziesii		5	4	4	5		4		Douglas-fir
Picea mariana						4			black spruce
Picea glauca × engelmannii			3	3		4	3	4	hybrid white spruce
Shrubs									
Shepherdia canadensis	4	3				2			soopolallie
Vaccinium membranaceum	4	2	2		3	2			black huckleberry
Amelanchier alnifolia		3							saskatoon
Spiraea betulifolia		4	3	3		2			birch-leaved spirea
Rubus parviflorus			2	4		3			thimbleberry
Lonicera involucrata				2	3	3	2	2	black twinberry
Cornus stolonifera			3	3		3	4		red-osier dogwood
Oplopanax horridus				3	3		4		devil's club
Viburnum edule				2	3	2	2	3	highbush-cranberry
Herbs and Dwarf Shrubs									
Gaultheria hispidula	1								creeping-snowberry
Lathyrus nevadensis		4	3	3			2		purple peavine
Cornus canadensis	2			2	2	3		3	bunchberry
Maianthemum racemosum						2			false Solomon's-seal
Rubus pubescens					4	3		2	trailing raspberry
Streptopus amplexifolius						2			clasping twistedstalk
Gymnocarpium dryopteris				3			3		oak fern
Equisetum arvense					4	4		4	common horsetail
Mosses and Lichens									
Cladina spp.	4	3							cladina lichens
Pleurozium schreberi	4	4	4	4	4	4	4	2	red-stemmed feathermoss
Ptilium crista-castrensis	2	4	4	4	4	4	4	4	knight's plume
Mnium spp.									leafy mosses

Prominence class: 1 2 3 4 5

FIGURE 10.2 *SBSwk3a vegetation table.*

1a Canopy dominated by Douglas-fir or lodgepole pine; *Amelanchier alnifolia* (p. 46)[2] or *Cladina* spp. (p. 332–334) present; slope position upper or level; soil texture coarse

2a Canopy dominated by Douglas-fir

SBSwk3a/03

2b Canopy dominated by lodgepole pine

SBSwk3a/02

1b Canopy generally dominated by mixtures of two or more Douglas-fir, lodgepole pine, and white or black spruce; *Amelanchier alnifolia* and *Cladina* spp. low cover (<1%) or absent; slope position variable; soil texture variable

3a Canopy dominated by a combination of lodgepole pine and black spruce; slope gradient less than 10%, often flat); *Aulacomnium palustre* (p. 311) present

SBSwk3a/05

3b Canopy dominated by Douglas-fir or hybrid white spruce, often in combination with lodgepole pine; slope gradient variable; *Aulacomnium palustre* usually absent

4a Level or depression; parent material fluvial or lacustrine; *Equisetum* spp. (p. 281–284) abundant (usually >30% cover)

SBSwk3a/08

4b Slope position variable; parent material variable; *Equisetum* spp. low cover (<5%) or absent

[2] Page numbers refer to the publication *Plants of Northern British Columbia* (MacKinnon et al. 1992).

5a Slope position mid to lower (occasionally upper on north aspects); *Oplopanax horridus* (p. 36) abundant (usually >15% cover)

SBSwk3a/07

5b Slope position variable; *Oplopanax horridus* low cover (<5%) or absent

6a *Gymnocarpium dryopteris* (p. 293) or *Clintonia uniflora* moderate to high cover (usually >5%)

SBSwk3a/01

6b *Gymnocarpium dryopteris* low cover (usually <5%) or absent

7a Usually mid to upper slope; Douglas-fir usually present in the canopy; *Rubus pubescens* (p. 91) usually very low cover (<1%) or absent

SBSwk3a/04

7b Usually mid to lower slope; Douglas-fir usually absent from the canopy; *Rubus pubescens* usually low to moderate cover (>1%)

SBSwk3a/06

Oplopanax horridus

Prosartes hookeri

Gymnocarpium dryopteris

VEGETATION

Tree Layer: 30% cover
Hybrid white spruce, Douglas-fir, subalpine fir, lodgepole pine

Shrub Layer: 40% cover

Cornus stolonifera	(red-osier dogwood)
Spiraea betulifolia	(birch-leaved spirea)
Oplopanax horridus	(devil's club)
Viburnum edule	(highbush-cranberry)
Rubus parviflorus	(thimbleberry)
Ribes lacustre	(black gooseberry)
Lonicera involucrata	(black twinberry)

subalpine fir, hybrid white spruce

Herb Layer: 40% cover

*Prosartes hookeri***	(Hooker's fairybells)
Orthilia secunda	(one-sided wintergreen)
Clintonia uniflora	(queen's cup)
Lathyrus nevadensis	(purple peavine)
*Maianthemum racemosum***	(false Solomon's-seal)
Actaea rubra	(baneberry)
*Osmorhiza berteroi***	(mountain sweet-cicely)
Aralia nudicaulis	(wild sarsaparilla)
Thalictrum occidentale	(western meadowrue)
Rubus pubescens	(trailing raspberry)
Gymnocarpium dryopteris	(oak fern)

Moss Layer: 25% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Brachythecium spp.	(ragged mosses)
Peltigera aphthosa	(freckle pelt lichen)

SOIL AND SITE

Moisture Regime:	4 (mesic)
Nutrient Regime:	B–C (poor–medium)
Slope Gradient (%):	23 (13–40)
* Slope Position:	mid to lower
Parent Material:	generally glaciolacustrine or morainal
* Soil Texture:	usually moderately fine to medium
Coarse Fragments (%):	28 (0–65)

DISTRIBUTION: common

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with medium- to fine-textured lacustrine soils often have poor soil structure, leading to poor root growth; ***plant stock that will achieve better lateral root development (e.g., Cu-treated) or protect advance regeneration.***

Site preparation:
- see Section 12.

Species choice:
- Pl, ***Sx***, ***Fd***, [***Bl***]
  At, Ep, {Act}

Vegetation potential:
- moderate to high (black twinberry, thimbleberry, fireweed)

Reforestation:
- plant sturdy stock as soon after harvesting as possible.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
- help maintain stand diversity on sites to be planted with Pl by mapping aspen patches prior to harvest and planting these areas with spruce.
- maintain Fd component, especially veterans that are valuable for wildlife and seed production.
- Act is not consistently productive on these sites.

Concerns:
- sites within this unit with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict traffic to winter operations or dry soil conditions.***
- site conditions resulting in cold air ponding will lead to frost damage of Fd and Sx regeneration; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***

Vaccinium membranaceum

Shepherdia canadensis

Linnaea borealis

VEGETATION

Tree Layer: 20% cover
Hybrid white spruce, lodgepole pine, subalpine fir

Shrub Layer: 20% cover

Vaccinium membranaceum	(black gooseberry)
Shepherdia canadensis	(soopolallie)
Rosa acicularis	(prickly rose)
[Amelanchier alnifolia	(saskatoon)]

subalpine fir, hybrid white spruce

Herb Layer: 15% cover

Linnaea borealis	(twinflower)
Cornus canadensis	(bunchberry)
Geocaulon lividum	(bastard toad-flax)
Epilobium angustifolium	(fireweed)
Vaccinium caespitosum	(dwarf blueberry)

Moss Layer: 75% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Cladina mitis	(green reindeer lichen)
Cladina rangiferina	(grey reindeer lichen)
Dicranum fuscescens	(curly heron's-bill moss)
Peltigera aphthosa	(freckle pelt lichen)
Polytrichum juniperinum	(juniper haircap moss)
Ptilium crista-castrensis	(knight's plume)
Cladonia spp.	(cladonia lichens)
Dicranum polysetum	(wavy-leaved moss)

SOIL AND SITE

Moisture Regime:	1–2 (xeric–subxeric)
Nutrient Regime:	A–B (very poor–poor)
* Slope Gradient (%):	0–70 (gentle, if fluvial)
* Slope Position:	level or upper
* Parent Material:	(glacio) fluvial or morainal over rock
* Soil Texture:	coarse
Coarse Fragments (%):	25–80

DISTRIBUTION: uncommon except in rocky terrain or on upper terrace of large rivers

INTERPRETATIONS

Site limitations:
- site and soil conditions of this unit result in marginal forest productivity; ***serious consideration should be given to excluding logging from this unit.***
- sites within this unit with high coarse fragment content (>70%) will have significantly reduced soil moisture retention and will be extremely difficult to plant; ***attempt to regenerate naturally by retaining Pl cones.***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- see Section 12.
- no site preparation.

Species choice:
- Pl, (***Bl***, ***Sx***)

Vegetation potential:
- low

Reforestation:
- attempt to regenerate naturally if potential exists.
- if natural regeneration is not feasible, plant Pl without site preparation.
- Sx and Bl are generally significantly less productive than Pl on this unit and should be accepted only on moist microsites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site and soil conditions of this unit result in drought hazard for a significant portion of the growing season; ***natural regeneration is generally better adapted to surviving these conditions, especially during establishment.***
- sites within this unit are vulnerable to nutrient deficiency if forest floors are reduced; ***site preparation methods that reduce forest floor thickness, such as slashburning or brushblading, must be avoided.***

Douglas-fir

Amelanchier alnifolia

Lathyrus nevadensis

VEGETATION

Tree Layer: 30% cover
Douglas-fir, lodgepole pine

Shrub Layer: 20% cover

Spiraea betulifolia	(birch-leaved spirea)
Amelanchier alnifolia	(saskatoon)
Shepherdia canadensis	(soopolallie)
Acer glabrum	(Douglas maple)
Rosa acicularis	(prickly rose)
Vaccinium membranaceum	(black huckleberry)

Douglas-fir, hybrid white spruce, subalpine fir

Herb Layer: 20% cover

Lathyrus nevadensis	(purple peavine)
Aster conspicuus	(showy aster)
*Maianthemum racemosum***	(false Solomon's-seal)
Goodyera oblongifolia	(rattlesnake-plantain)
Arnica cordifolia	(heart-leaved arnica)
Elymus glaucus	(blue wildrye)
Oryzopsis asperifolia	(rough-leaved ricegrass)
*Streptopus lanceolatus***	(rosy twistedstalk)
Aralia nudicaulis	(wild sarasaparilla)

Moss Layer: 50% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Peltigera aphthosa	(freckle pelt lichen)
Dicranum fuscescens	(curly heron's-bill moss)
Cladina rangiferina	(grey reindeer lichen)
Hylocomium splendens	(step moss)
Cladonia spp.	(cladonia lichens)

SOIL AND SITE

Moisture Regime:	2 (subxeric)
Nutrient Regime:	B–C (poor–medium)
Slope Gradient (%):	18 (0–50)
* Slope Position:	crest or level
* Parent Material:	morainal or (glacio) fluvial
Soil Texture:	moderately coarse to moderately fine
Coarse Fragments (%):	42 (15–60)

DISTRIBUTION: uncommon and usually small in size

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with high coarse fragment content (>70%) will have significantly reduced soil moisture retention and will be extremely difficult to plant; ***attempt to regenerate naturally by retaining Pl cones and/or leaving Fd seed trees on site.***

Silvicultural system:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.

Site preparation:
- light scarification for seedbed preparation or summer logging with no site preparation.

Species choice:
- Fd, Pl, [***Sx***]
  {At, Ep}

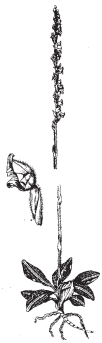
Vegetation potential:
- low

Reforestation:
- maintain Fd component, especially veterans that are valuable for wildlife and seed production.
- attempt to preserve Fd advance regeneration when partial cutting.
- natural Pl and Fd regeneration should be promoted by light scarification or spot screefing.
- plant Sx on moist microsites only
- At and Ep are not consistently productive on these sites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce the number and distribution of cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site and soil conditions of this unit result in drought hazard for a significant portion of the growing season; ***natural regeneration is generally better adapted to surviving these conditions, especially during establishment.***
- sites within this unit are vulnerable to nutrient deficiency if forest floors are reduced; ***site preparation methods that reduce forest floor thickness, such as slashburning or brushblading, must be avoided.***

SxwFd – Birch-leaved spirea – Feathermoss

Spiraea betulifolia



Goodyera oblongifolia

Aralia nudicaulis

VEGETATION

Tree Layer: 35% cover
Douglas-fir, hybrid white spruce, subalpine fir, lodgepole pine

Shrub Layer: 15% cover

Spiraea betulifolia	(birch-leaved spirea)
Viburnum edule	(highbush-cranberry)
Ribes lacustre	(black gooseberry)
Vaccinium membranaceum	(black huckleberry)
Acer glabrum	(Douglas maple)
Rosa acicularis	(prickly rose)
Amelanchier alnifolia	(saskatoon)
Lonicera involucrata	(black twinberry)

subalpine fir, hybrid white spruce, Douglas-fir, paper birch

Herb Layer: 10% cover

Goodyera oblongifolia	(rattlesnake-plantain)
Orthilia secunda	(one-sided wintergreen)
*Streptopus lanceolatus***	(rosy twistedstalk)
Aralia nudicalus	(wild sarsaparilla)
Cornus canadensis	(bunchberry)
*Maianthemum racemosum***	(false Solomon's-seal)
Lathyrus nevadensis	(purple peavine)
Arnica cordifolia	(heart-leaved arnica)
Aster conspicuus	(showy aster)
*Osmorhiza berteroi***	(mountain sweet-cicely)
[*Clintonia unifloria*	(queen's cup)]

Moss Layer: 65% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
Dicranum spp.	(heron's-bill mosses)

SOIL AND SITE

Moisture Regime:	3 (submesic)
Nutrient Regime:	B–C (poor–medium)
Slope Gradient (%):	34 (15–65)
Slope Position:	variable
Parent Material:	morainal or colluvial
* Soil Texture:	coarse (medium)
* Coarse Fragments (%):	55 (30–85)

DISTRIBUTION: uncommon

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with high coarse fragment content (>70%) will have significantly reduced soil moisture retention and will be extremely difficult to plant; ***attempt to regenerate naturally by retaining Pl cones and/or leaving Fd seed trees on site.***

Site preparation:
- see Section 12.

Species choice:
- Fd, Pl, Sx, [***Bl***]
  At, Ep

Vegetation potential:
- moderate (black twinberry, fireweed)

Reforestation:
- attempt to regenerate naturally if potential exists.
- if natural regeneration is not feasible, plant Pl, or Fd and Sx on moister microsites.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
- help maintain stand diversity on sites to be planted with Pl by mapping aspen patches prior to harvest and planting these areas with spruce.
- maintain Fd component, especially veterans that are valuable for wildlife and seed production.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce the number and distribution of cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site and soil conditions of this unit result in drought hazard for a significant portion of the growing season; ***natural regeneration is generally better adapted to surviving these conditions, especially during establishment.***
- sites within this unit are vulnerable to nutrient deficiency if forest floors are reduced; ***site preparation methods that reduce forest floor thickness, such as slashburning or brushblading, must be avoided.***

black spruce

VEGETATION

Tree Layer: 15% cover
Black spruce, lodgepole pine

Shrub Layer: 45% cover

Salix spp.	(willows)
Lonicera involucrata	(black twinberry)
Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)

Herb Layer: 95% cover

Equisetum arvense	(common horsetail)
Rubus pubescens	(trailing raspberry)
Fragaria virginiana	(wild strawberry)
Elymus glaucus	(blue wildrye)
Galium boreale	(northern bedstraw)

Moss Layer: 15% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Aulacomnium palustre	(glow moss)

Salix spp.

Equisetum arvense

SOIL AND SITE

Moisture Regime:	3–5 (submesic–subhygric)
Nutrient Regime:	A–B (very poor–poor)
* Aspect:	northernly or flat
* Slope Gradient (%):	usually less than 10
Slope Position:	mid to lower or level
* Parent Material:	glaciofluvial
* Soil Texture:	medium to coarse
* Coarse Fragments (%):	0–40

DISTRIBUTION: rare

INTERPRETATIONS

Site limitations:
- soil drainage and rooting may be impeded by dense basal till layers or poorly structured clay-rich horizons within 30 cm of the soil surface; this results in a shallow rooting zone that is saturated and poorly aerated in the spring following snowmelt, but subject to drought in summer;
- ***the poor productivity resulting from these limitations should dictate a limited investment in intensive silviculture; regenerate naturally whenever possible or if planting then plant stock that will achieve better lateral root development (e.g., Cu-treated).***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- see Section 12.

Species choice:
- Pl, (***Sx***, ***Sb***)
  {At}

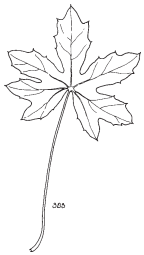
Vegetation potential:
- low

Reforestation:
- attempt to regenerate naturally if potential exists.
- if natural regeneration is not feasible, plant Pl.
- Sx and Sb are generally less productive than Pl on these sites.
- on sites with saturated soils, plant seedlings on naturally or artificially raised microsites.
- At not consistently productive on these sites.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- sites within this unit with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict all traffic to winter operations or dry soil conditions.***
- these sites may be subject to severe growing-season frosts, especially in any naturally occurring or artificially created depressional microsites; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***

Lonicera involucrata

Viburnum edule



Petasites frigidus var. *palmatus*

VEGETATION

Tree Layer: 35% cover
Hybrid white spruce, subalpine fir, (trembling aspen)

Shrub Layer: 25% cover

Lonicera involucrata	(black twinberry)
Ribes lacustre	(black gooseberry)
Viburnum edule	(highbush-cranberry)
Rubus parviflorus	(thimbleberry)
Rosa acicularis	(prickly rose)
[*Cornus stolonifera*	(red-osier dogwood)]

subalpine fir, hybrid white spruce

Herb Layer: 30% cover

Cornus canadensis	(bunchberry)
Rubus pubescens	(trailing raspberry)
Linnaea borealis	(twinflower)
Thalictrum occidentale	(western meadowrue)
*Maianthemum racemosum***	(false Solomon's-seal)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Mitella nuda	(common mitrewort)
*Osmorhiza berteroi***	(mountain sweet-cicely)
Pyrola asarifolia	(rosy wintergreen)

Moss Layer: 85% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
Rhytidiadelphus triquetrus	(electrified cat's-tail moss)

SOIL AND SITE

Moisture Regime:	4–5 (mesic–subhygric)
Nutrient Regime:	C–D (medium–rich)
* Aspect:	generally not northerly
Slope Gradient (%):	15 (2–30)
* Slope Position:	mid (upper to lower)
Parent Material:	glaciofluvial (and morainal)
* Soil Texture:	moderately coarse to medium
Coarse Fragments (%):	36 (24–66)

DISTRIBUTION: uncommon

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site Limitations:
- sites within this unit with medium- to fine-textured lacustrine soils often have poor soil structure, leading to poor root growth; ***plant stock that will achieve better lateral root development (e.g., Cu-treated), prescribe natural regeneration, or protect advance regeneration.***

Site preparation:
- avoid mechanical site preparation when clay-textured soils occur right to the surface.
- see Section 12.

Species choice:
- Pl, Sx, [***Bl***]
  At, Ep, {Act}

Vegetation potential:
- moderate (trembling aspen, black twinberry, thimbleberry, fireweed)
- a young trembling aspen canopy can help reduce frost damage of planted stock.

Reforestation:
- preserve vigorous Sx regeneration.
- help maintain stand diversity on sites to be planted with Pl by mapping aspen patches prior to harvest and planting these areas with spruce.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
- Act is not consistently productive on these sites.

Concerns:
- a combination of poorly structured soils and frost on level sites within this unit make them difficult to regenerate; ***preserve good-quality advance regeneration during harvesting.***
- sites within this unit with fine-textured soils are very vulnerable to compaction under wet conditions; ***restrict traffic to winter operations.***
- site conditions may lead to frost damage of Sx regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***
- sites within this unit with silty soils are susceptible to frost-heaving; ***bareroot stock will likely resist frost-heaving better than plug stock.***
- sites within this unit with thick organic horizons (>10 cm) have increased windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***

Oplopanax horridus

Viburnum edule

Prosartes hookeri

VEGETATION

Tree Layer: 20% cover
Douglas-fir, hybrid white spruce, subalpine fir, (paper birch)

Shrub Layer: 80% cover

Oplopanax horridus	(devil's club)
Ribes lacustre	(black gooseberry)
Viburnum edule	(highbush-cranberry)
Lonicera involucrata	(black twinberry)
Cornus stolonifera	(red-osier dogwood)
Rubus parviflorus	(thimbleberry)
Acer glabrum	(Douglas maple)
Alnus incana ssp. *tenuifolia***	(mountain alder)

subalpine fir, hybrid white spruce

Herb Layer: 25% cover

*Prosartes hookeri***	(Hooker's fairybells)
Clintonia uniflora	(queen's cup)
Actaea rubra	(baneberry)
Aralia nudicaulis	(wild sarsaparilla)
Thalictrum occidentale	(western meadowrue)
Cornus canadensis	(bunchberry)
Galium triflorum	(sweet-scented bedstraw)
*Osmorhiza berteroi***	(mountain sweet-cicely)
Rubus pubescens	(trailing raspberry)
*Maianthemum racemosum***	(false Solomon's-seal)
[*Viola canadensis*	(Canada violet)]
[*Gymnocarpium dryopteris*	(oak fern)]

Moss Layer: 5% cover

Brachythecium spp.	(ragged mosses)
[*Mnium* spp.	(leafy mosses)]
[*Pleurozium schreberi*	(red-stemmed feathermoss)]
[*Ptilium crista-castrensis*	(knight's plume)]

SOIL AND SITE

Moisture Regime:	5–6 (subhygric–hygric)
Nutrient Regime:	C–D (medium–rich)
Slope Gradient (%):	13 (5–24)
* Slope Position:	lower to level
Parent Material:	lacustrine and morainal
* Soil Texture:	coarse to moderately fine
Coarse Fragments (%):	25 (0–80) mostly under 30

DISTRIBUTION: uncommon

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with saturated soils are poorly aerated, which slows root development; ***plant seedlings on naturally or artificially raised microsites.***

Site preparation:
- see Section 12.

Species choice:
- ***Sx***, ***Fd***, [***Bl***, ***Pl***]
  At, Ep, {Act}

Vegetation potential:
- very high (thimbleberry, fireweed, black twinberry)

Reforestation:
- if vigorous advance regeneration is present it should be preserved when feasible.
- plant sturdy stock as soon after harvesting as possible.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
- due to the very high level of competition on these sites it will be difficult to successfully regenerate them to Pl without high site treatment costs.
- Act is not consistently productive on these sites.

Concerns:
- sites within this unit with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict traffic to winter operations or dry soil conditions.***
- site conditions may lead to frost damage of Fd and Sx regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***
- sites within this unit with thick organic horizons (>10 cm) have increased windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***

Viburnum edule

Lonicera involucrata

Equisetum arvense

VEGETATION

Tree Layer: 25% cover
Hybrid white spruce, lodgepole pine

Shrub Layer: 35% cover

Viburnum edule	(highbush-cranberry)
Lonicera involucrata	(black twinberry)
Rosa acicularis	(prickly rose)
Ribes lacustre	(black gooseberry)
Salix spp.	(willows)
Rubus parviflorus	(thimbleberry)
Vaccinium membranaceum	(black huckleberry)

Herb Layer: 60% cover

Equisetum spp. *(arvense, sylvaticum)*	(horsetails)
Cornus canadensis	(bunchberry)
Petasites frigidus var. *palmatus*	(palmate coltsfoot)
Mitella nuda	(common mitrewort)
Galium triflorum	(sweet-scented bedstraw)
Rubus pubescens	(trailing raspberry)
Linnaea borealis	(twinflower)
Rubus pedatus	(five-leaved bramble)

Moss Layer: 50% cover

Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)
[*Mnium* spp.	(leafy mosses)]

SOIL AND SITE

Moisture Regime:	6 (hygric)
Nutrient Regime:	C–D (medium–rich)
* Slope Gradient (%):	2 (0–5)
* Slope Position:	level or depression
* Parent Material:	fluvial or lacustrine
Soil Texture:	coarse to fine
Coarse Fragments (%):	variable

DISTRIBUTION: common but generally small in size

INTERPRETATIONS

Site limitations:
- very difficult sites to manage; ***serious consideration should be given to managing these sites as wildlife corridors***.
- sites within this unit with saturated soils are poorly aerated, which slows root development; ***plant seedlings on naturally or artificially raised microsites.***

Site preparation:
- creating an excessive number of mounds (i.e., >300/ha) should be avoided, especially on sites within this unit with a water table <30 cm from the surface.
- see Section 12.

Species choice:
- ***Sx***, [***Bl***, ***Pl***]
  Act, At

Vegetation potential:
- high to very high (black twinberry, prickly rose, fireweed)

Reforestation:
- advance regeneration should be preserved.
- supplement advance regeneration by planting sturdy stock in groups on available raised microsites.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
- retain Ac veterans where possible for wildlife.

Concerns:
- these units may represent important wildlife habitat; ***discuss prescription with fish and wildlife personnel.***
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***
- sites within this unit with thick organic horizons (>10 cm) have increased windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***
- water table will likely rise above the ground surface in the spring, causing seedling mortality on non-elevated sites.
- this association is critical to the control of runoff and streamflow.

11 MOIST COOL SPRUCE – WILLOW – BIRCH (SWBmk)[1]

Location
The SWBmk occurs in higher-elevation valleys and mountain slopes as far south as the Mesilinka River in the Omineca Mountains and the Halfway River in the Rocky Mountains. Its northern extent is the Yukon border, while its eastern extent lies just east of where the Halfway River exits the Rocky Mountains. The western extent is uncertain at this time.

Elevation range
800 – 1100 m

Climate
This biogeoclimatic unit has a boreal subalpine climate. The precipitation regime of this biogeoclimatic unit is similar to that of the SBSwk3 but the mean annual temperature is lowest of all the biogeoclimatic units in the guide area.

Distinguishing the SWBmk from adjoining biogeoclimatic units

BWBSdk1 has:
- less scrub birch and willow but more prickly rose and highbush-cranberry in the shrub layer on mesic sites; and
- little or no lingonberry or crowberry but more palmate coltsfoot and/or tall bluebells in the herb layer on mesic sites.

ESSFmv3 and ESSFmc have:
- less scrub birch and willow but more black huckleberry and/or white-flowered rhododendron in the shrub layer on mesic sites; and
- less lingonberry but more five-leaved bramble and heart-leaved arnica in the herb layer on mesic sites.

Forests
Due to extensive cold air drainage and cold temperatures, stands are often sparsely treed. Older forests have short, large-diameter white spruce with variable amounts of subalpine fir. Extensive

[1] Formerly SWBe

prescribed burning in many valleys has resulted in extensive seral trembling aspen forests, particularly on warm slopes. Black spruce is common on upland sites, often with lodgepole pine on slopes with cooler aspects and in wetlands. Black cottonwood occurs along streams and rivers and is often associated with white spruce.

Wildlife

This variant provides important habitat for wolverine, Stone sheep, Dahl sheep, mountain goat, elk, and grizzly bear, especially in the spring and summer. Moose and caribou are abundant, except in winter when they tend to move out of the zone to where snow is less deep.

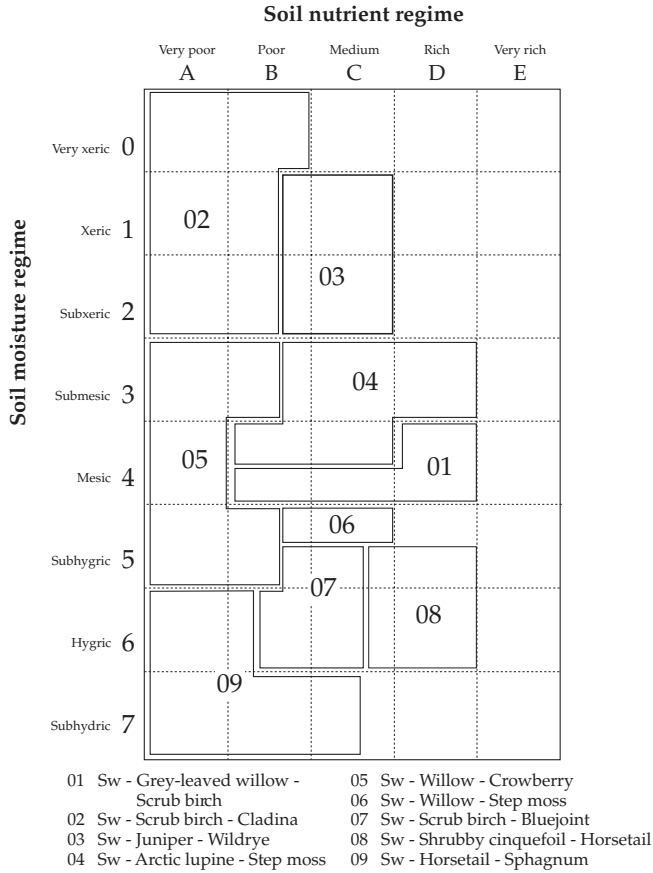


FIGURE 11.1 *Edatopic grid displaying site units of the SWBmk subzone.*

FIGURE 11.2 *SWBmk vegetation table.*

1a Aspect northerly; generally on steep slopes (>20%)

2a Mid to upper slope; soil texture coarse to medium; *Empetrum nigrum* (p. 79)[2] common; *Calamagrostis canadensis* (p. 239) absent

SWBmk/05

2b Generally lower slope; soil texture fine to medium; *Empetrum nigrum* generally absent; *Calamagrostis canadensis* present

SWBmk/07

1b Aspect and slope gradient variable but generally not on steep northerly aspects

3a Generally mid to crest slope or, if not, then aspect southerly; *Leymus innovatus* (p. 232) common

4a *Cladina* spp. (p. 334) common

SWBmk/02

4b *Cladina* spp. <1% cover or absent

5a Forest floor generally <5 cm; *Arctostaphylos uva-ursi* (p. 82) common

SWBmk/03

5b Forest floor generally >5 cm; *Arctostaphylos uva-ursi* <1% cover or absent

SWBmk/04

3b Generally mid to lower slope *Leymus innovatus* <2% cover or absent

[2] Page numbers refer to the publication *Plants of Northern British Columbia* (MacKinnon et al. 1992).

6a Slope gradient generally <5%; often located on fluvial benches; *Equisetum arvense* (p. 282) generally present and often moderate to high cover (>5%)

SWBmk/08

6b Slope gradient variable; generally not located on fluvial benches; *Equisetum arvense* <1% cover or absent

7a Lodgepole pine often present in canopy; mesic moisture regime

SWBmk/01

7b Lodgepole pine absent from canopy; subhygric moisture regime

SBSmk/06

Betula nana

Vaccinium vitis-idaea

Hylocomium splendens

VEGETATION

Tree Layer: 10% cover
White spruce, lodgepole pine, subalpine fir

Shrub Layer: 20% cover

*Betula nana***	(scrub birch)
Ledum groenlandicum	(Labrador tea)
Salix spp.	(willows)
subalpine fir, [white spruce]	

Herb Layer: 25% cover

Vaccinium vitis-idaea	(lingonberry)
Cornus canadensis	(bunchberry)
Epilobium angustifolium	(fireweed)
Empetrum nigrum	(crowberry)
Linnaea borealis	(twinflower)
Festuca altaica	(Altai fescue)]
[*Lupinus arcticus*	(arctic lupine)]
[*Orthilia secunda*	(one-sided wintergreen)]

Moss Layer: 85% cover

Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)
Peltigera aphthosa	(freckle pelt lichen)
Ptilium crista-castrensis	(knight's plume)
[*Cladina* spp.	(reindeer lichens)]

SOIL AND SITE

Moisture Regime:	4 (mesic)
Nutrient Regime:	B–D (poor–rich)
Slope Gradient (%):	0–70
* Slope Position:	upper to lower or level; often mid
Parent Material:	(glacio) fluvial, colluvial, morainal
Soil Texture:	variable
Coarse Fragments (%):	0–90 (usually <40)

DISTRIBUTION: common and well distributed

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with high coarse fragment content (>70%) will have significantly reduced soil moisture retention and will be extremely difficult to plant; ***attempt to regenerate naturally by retaining Pl cones.***
- sites within this unit with medium- to fine-textured lacustrine soils often have poor soil structure, leading to poor root growth; ***plant stock that will achieve better lateral root development (e.g., Cu-treated), prescribe natural regeneration, or protect advance regeneration.***
- sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, slowing root development; ***reduce organic horizon thickness during site preparation.***

Site preparation:
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.

Species choice:
- Pl, Sx, [***Bl***]

Vegetation potential:
- moderate (trembling aspen, fireweed, grasses)

Reforestation:
- attempt to regenerate naturally if potential exists.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.

Concerns:
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- low productivity of this zone will considerably lengthen rotation times for reasonable timber yield.
- attempts to meet regeneration standards may be difficult due to shortness of growing season.

Festuca altaica

Anemone parviflora

Cladina spp.

VEGETATION

Tree Layer: 10% cover
White spruce, lodgepole pine

Shrub Layer: 35% cover

Salix spp.	(willows)
Juniperus communis	(common juniper)
*Betula nana***	(scrub birch)
subalpine fir	

Herb Layer: 40% cover

Linnaea borealis	(twinflower)
Anemone parviflora	(northern anemone)
[*Festuca altaica*	(Altai fescue)]
[*Lupinus arcticus*	(arctic lupine)]

Moss Layer: 50% cover

Hylocomium splendens	(step moss)
Cladina spp.	(reindeer lichens)
Pleurozium schreberi	(red-stemmed feathermoss)
Peltigera aphthosa	(freckle pelt lichen)

SOIL AND SITE

Moisture Regime:	0–1(2) (very xeric–xeric (subxeric))
Nutrient Regime:	A–B (very poor–poor)
* Slope Gradient (%):	20–60
* Slope Position:	mid–upper or crest
* Parent Material:	fluvial or colluvial/rock
* Soil Texture:	coarse
Coarse Fragments (%):	10–85

DISTRIBUTION: restricted to rock outcrops and coarse fluvial benches

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:

- the combination of poor productivity and high wildlife value means that these sites should be protected from harvesting.

Concerns:

- conserving the humus layer is critical for moisture and nutrient retention.
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site and soil conditions of this unit result in drought hazard for a significant portion of the growing season; ***natural regeneration is generally better adapted to surviving these conditions, especially during establishment.***

Sheperdia canadensis

Juniperus communis

Arctostaphylus uva-ursi

VEGETATION

Tree Layer: 5% cover
White spruce, lodgepole pine

Shrub Layer: 30% cover

Juniperus communis	(common juniper)
Sheperdia canadensis	(soopolallie)
Pentaphylloides floribunda	(shrubby cinquefoil)
Rosa acicularis	(prickly rose)
[*Salix* spp.	(willows)]
[*Betula nana***	scrub birch]

lodgepole pine

Herb Layer: 30% cover

Arctostaphylus uva-ursi	(kinnikinnick)
Leymus innovatus	(fuzzy-spiked wildrye)
Carex concinnoides	(northwestern sedge)
Vaccinium vitis-idaea	(lingonberry)
Festuca altaica	(Altai fescue)
Hedysarum boreale	(northern hedysarum)
Zigadenus elegans	(mountain death camas)
Solidago multiradiata	(northern goldenrod)

Moss Layer: 20% cover

Hylocomium splendens	(step moss)
Cladonia spp.	(cladonia lichens)

SOIL AND SITE

Moisture Regime:	1–(2) (xeric–(subxeric))
Nutrient Regime:	B–C (poor–medium)
* Slope Gradient (%):	2–85 (usually >40)
* Slope Position:	mid–upper
Parent Material:	(glacio) fluvial, colluvial
* Soil Texture:	coarse–medium
Coarse Fragments (%):	40–80

DISTRIBUTION: common on warm aspects on colluvial soils

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:

- the combination of poor productivity and high wildlife value means that these sites should be protected from harvesting.

Concerns:

- conserving the humus layer is critical for moisture and nutrient retention.
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site and soil conditions of this unit result in drought hazard for a significant portion of the growing season; ***natural regeneration is generally better adapted to surviving these conditions, especially during establishment.***

Salix spp.

Leymus innovatus

Hylocomium splendens

VEGETATION

Tree Layer: 15% cover
White spruce, lodgepole pine

Shrub Layer: 30% cover

Salix spp.	(willows)
*Betula nana***	(scrub birch)
[*Ledum groenlandicum*	(Labrador tea)]
[*Shepherdia canadensis*	(soopolallie)]

white spruce, lodgepole pine

Herb Layer: 30% cover

Leymus innovatus	(fuzzy-spiked wildrye)
Epilobium angustifolium	(fireweed)
Lupinus arcticus	(arctic lupine)
Vaccinium vitis-idaea	(lingonberry)
Festuca altaica	(Altai fescue)
[*Linnaea borealis*	(twinflower)]

Moss Layer: 60% cover

Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)

SOIL AND SITE

Moisture Regime:	3–4 (submesic–mesic)
Nutrient Regime:	B–C(D) (poor–medium (rich))
Slope Gradient (%):	3–45
* Aspect:	often southerly
* Slope Position:	generally upper
Parent Material:	(glacio) fluvial, colluvial (morainal)
* Soil Texture:	moderately fine to coarse
Coarse Fragments (%):	0–85 (often >25)

DISTRIBUTION: common on warm aspects

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

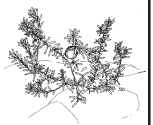
Site limitations:

- the combination of poor productivity and high wildlife value means that these sites should be protected from harvesting.

Concerns:

- conserving the humus layer is critical for moisture and nutrient retention.
- full tree harvesting will lead to nutrient depletion and seriously reduce cones; ***woody debris and cones should be distributed across these sites (i.e., lop and scatter).***
- site and soil conditions of this unit result in drought hazard for a significant portion of the growing season; ***natural regeneration is generally better adapted to surviving these conditions, especially during establishment.***

Salix spp.



Empetrum nigrum

Hylocomium splendens

VEGETATION

Tree Layer: 10% cover
White spruce, black spruce

Shrub Layer: 35% cover

Salix spp.	(willows)
Ledum groenlandicum	(Labrador tea)
*Betula nana***	(scrub birch)
[white spruce]	

Herb Layer: 30% cover

Empetrum nigrum	(crowberry)
Festuca altaica	(Altai fescue)
Vaccinium vitis-idaea	(lingonberry)
Arctostaphylos alpina var. *rubra*	(red bearberry)

Moss Layer: 65% cover
(step moss)

SOIL AND SITE

Moisture Regime:	3–5 (submesic–subhygric)
Nutrient Regime:	A–B (very poor–poor)
* Slope Gradient (%):	20–70
* Aspect:	often northerly
* Slope Position:	mid–upper
Parent Material:	colluvial or morainal
* Soil Texture:	moderately coarse to medium
Coarse Fragments (%):	30–85

DISTRIBUTION: these sites can be dominated by black spruce and lodgepole pine

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:

- the combination of poor productivity and inaccessibility due to steep slopes make these sites non-commercial at this time.

Concerns:

- sites with thick organic horizons (>10 cm) have extreme windthrow hazard***; block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***
- water table will likely rise above the ground surface in the spring, causing seedling mortality on non-elevated sites.

Ledum groenlandicum

Festuca altaica

Hylocomium splendens

VEGETATION

Tree Layer: 10% cover
White spruce

Shrub Layer: 35% cover

Salix spp.	(willows)
Ledum groenlandicum	(Labrador tea)
*Betula nana***	(scrub birch)
Rosa acicularis	(prickly rose)
[white spruce]	

Herb Layer: 25% cover

Vaccinium vitis-idaea	(lingonberry)
Festuca altaica	(Altai fescue)
Cornus canadensis	(bunchberry)
Leymus innovatus	(fuzzy-spiked wildrye)
Epilobium angustifolium	(fireweed)
Pedicularis labradorica	(Labrador lousewort)

Moss Layer: 85% cover

Hylocomium splendens	(step moss)
Aulacomnium palustre	(glow moss)

SOIL AND SITE

Moisture Regime:	5 (subhygric)
Nutrient Regime:	B–C (poor–medium)
* Slope Gradient (%):	10–20
* Aspect	generally warm or neutral
Slope Position:	lower–upper
Parent Material:	(glacio) fluvial, colluvial morainal
Soil Texture:	variable
Coarse Fragments (%):	0–90 (usually <40)

DISTRIBUTION: very common

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with high coarse fragment content (>70%) will have significantly reduced soil moisture retention and will be extremely difficult to plant; ***attempt to regenerate naturally by retaining advance regeneration.***
- sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, slowing root development; ***reduce organic horizon thickness during site preparation.***

Site preparation:
- creating an excessive number of mounds (i.e., >300/ha) should be avoided.

Species choice:
- Sx, Pl, [***Bl***], (***Sb***)

Vegetation potential:
- moderate (willow, fireweed, grasses)

Reforestation:
- if vigorous advanced Sx or Bl regeneration is present it should be preserved when feasible.
- plant sturdy stock as soon after harvesting as possible.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.
- Sb is generally less productive than Sx or Pl on these sites.

Concerns:
- sites within this unit with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict traffic to winter operations or dry soil conditions.***
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***

Betula nana

Calamagrostis canadensis

Hylocomium splendens

VEGETATION

Tree Layer: 10% cover
White spruce

Shrub Layer: 55% cover

*Betula nana***	(scrub birch)
Salix spp.	(willows)
Ledum groenlandicum	(Labrador tea)
white spruce	

Herb Layer: 20% cover

Vaccinium vitis-idaea	(lingonberry)
Calamagrostis canadensis	(bluejoint)
Mertensia paniculata	(tall bluebells)
[*Festuca altaica*	(Altai fescue)]

Moss Layer: 65% cover

Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)

SOIL AND SITE

Moisture Regime:	5–6 (subhygric–hygric)
Nutrient Regime:	B–C (poor–medium)
* Slope Gradient (%):	1–43, generally >20
* Aspect:	generally cool
* Slope Position:	generally lower
Parent Material:	variable
* Soil Texture:	fine to medium
Coarse Fragments (%):	0–30

DISTRIBUTION: common

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- sites within this unit with medium- to fine-textured lacustrine soils often have poor soil structure, leading to poor root growth; ***plant stock that will achieve better lateral root development (e.g., Cu-treated), prescribe natural regeneration, or protect advance regeneration.***
- sites within this unit with thick organic horizons (>10 cm) have reduced spring soil temperatures, slowing root development; ***reduce organic horizon thickness during site preparation.***

Site preparation:
- creating an excessive number of mounds (i.e., >300/ha) should be avoided.

Species choice:
- Sx, Pl, [***Bl***]

Vegetation potential:
- moderate (willow, fireweed, grasses)

Reforestation:
- if vigorous advanced Sx or Bl regeneration is present it should be preserved when feasible.
- plant sturdy stock as soon after harvesting as possible.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.

Concerns:
- sites within this unit with fine-textured soils are vulnerable to compaction under wet conditions; ***restrict traffic to winter operations or dry soil conditions.***
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***

Salix spp.

Equisetum arvense

Hylocomium splendens

VEGETATION

Tree Layer: 15% cover
White spruce

Shrub Layer: 55% cover

Salix spp.	(willows)
*Betula nana***	(scrub birch)
Pentaphylloides floribunda	(shrubby cinquefoil)

White spruce, subalpine fir

Herb Layer: 20% cover

Mertensia paniculata	(tall bluebells)
Equisetum arvense	(common horsetail)
Epilobium angustifolium	(fireweed)
Equisetum scirpoides	(dwarf scouring-rush)
Orthilia secunda	(one-sided wintergreen)
[*Petasites frigidus* var. *palmatus*	(palmate coltsfoot)]

Moss Layer: 65% cover

Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)

SOIL AND SITE

Moisture Regime:	6–5 (hygric–subhygric)
Nutrient Regime:	C–D (medium–rich)
* Slope Gradient (%):	0–30, generally <5
* Slope Position:	lower to toe or level
Parent Material:	generally fluvial
* Soil Texture:	fine to medium
Coarse Fragments (%):	0–30

DISTRIBUTION: common on fluvial benches

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- very difficult sites to manage; ***serious consideration should be given to managing these sites as wildlife corridors.***
- sites with saturated soils are poorly aerated, which slows root development; ***plant seedlings on naturally or artificially raised microsites.***

Site preparation:
- creating an excessive number of mounds (i.e., >300/ha) should be avoided, especially on sites within this unit with a water table <30 cm from the surface.

Species choice:
- ***Sx***, [***Pl***, ***Sb***]

Vegetation potential:
- high (black twinberry, fireweed, bluejoint)

Reforestation:
- advance regeneration should be preserved.
- supplement advance regeneration by planting sturdy stock in groups, using available raised microsites.
- young Bl regeneration (<3 m tall) may be susceptible to heavy browsing by moose.

Concerns:
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression; ***leaving a partial canopy and/or choosing a frost-resistant species (e.g., Pl) is advised.***
- sites with thick organic horizons (>10 cm) have extreme windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***
- water table will likely rise above the ground surface in the spring, causing seedling mortality on non-elevated sites.
- these units represent important wildlife habitat; ***discuss prescription with fish and wildlife personnel.***
- this unit is critical to the control of runoff streamflow.

Ledum groenlandicum

Carex spp.

Sphagnum spp.

VEGETATION

Tree Layer: 15% cover
Black spruce

Shrub Layer: 45% cover

Ledum groenlandicum	(Labrador tea)
Salix spp.	(willows)
*Betula nana***	(scrub birch)
black spruce	

Herb Layer: 35% cover

Vaccinium vitis-idaea	(lingonberry)
Carex spp.	(sedges)
Calamagrostis canadensis	(bluejoint)
[*Equisetum arvense*	(common horsetail)]
[*Empetrum nigrum*	(crowberry)]

Moss Layer: 90% cover

Aulacomnium palustre	(glow moss)
Cladina spp.	(reindeer lichens)
Sphagnum spp.	(sphagnum mosses)
Peltigera spp.	(pelt lichens)
Hylocomnium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)

SOIL AND SITE

Moisture Regime:	6–5 (hygric–subhydric)
Nutrient Regime:	B–C (poor–medium)
* Slope Gradient (%):	0–30, generally <5
* Aspect:	cool if sloping
* Slope Position:	lower to toe, level or depression
Parent Material:	organic or lacustrine
* Soil Texture:	fine to medium
Coarse Fragments (%):	generally 0

DISTRIBUTION: common in depressions and cool gentle toe slopes

** The name of this species has been updated (see Appendix 1).

INTERPRETATIONS

Site limitations:
- very difficult sites to manage; ***avoid harvesting.***

Concerns:
- sites with thick organic horizons (>10 cm) have extreme windthrow hazard; ***block layouts must have windfirm boundaries, or a wide buffer of standing timber must be left around such sites.***
- these units represent important wildlife habitat; ***discuss prescription with fish and wildlife personnel.***

12 SITE PREPARATION RECOMMENDATIONS

The following keys are provided to assist in selecting appropriate site preparation treatment options based on a knowledge of the site series and site and soil characteristics. The publications *Mechanical Site Preparation Equipment in North Central British Columbia* (Coates and Haeussler 1987) and *Site Preparation Strategies to Manage Soil Disturbance* (Curran et al. 1990) were used extensively in preparing these keys. It is recommended that these references also be directly consulted as part of the decision-making process. Another useful reference is *Regenerating British Columbia's Forests* (Lavender et al. 1990, chapters 11 and 12). Proceed through the keys as follows:

Step 1 Identify the site series and collect the following site and soil information: soil texture and coarse fragment content, slope, forest floor depth, and depth to water table or any other restricting layers in the soil.

Step 2 Using Table 12.1, identify the appropriate soil grouping based on coarse fragment content and soil texture information.

Step 3 Using Table 12.2, identify the interpretive site group based on the site series.

Step 4 Proceed to the appropriate interpretive site group key and advance step by step through the key until a site preparation code box is reached.

Step 5 Refer to site preparation code descriptions (Section 12.1) and decide which option best suits site limitations and management objectives.

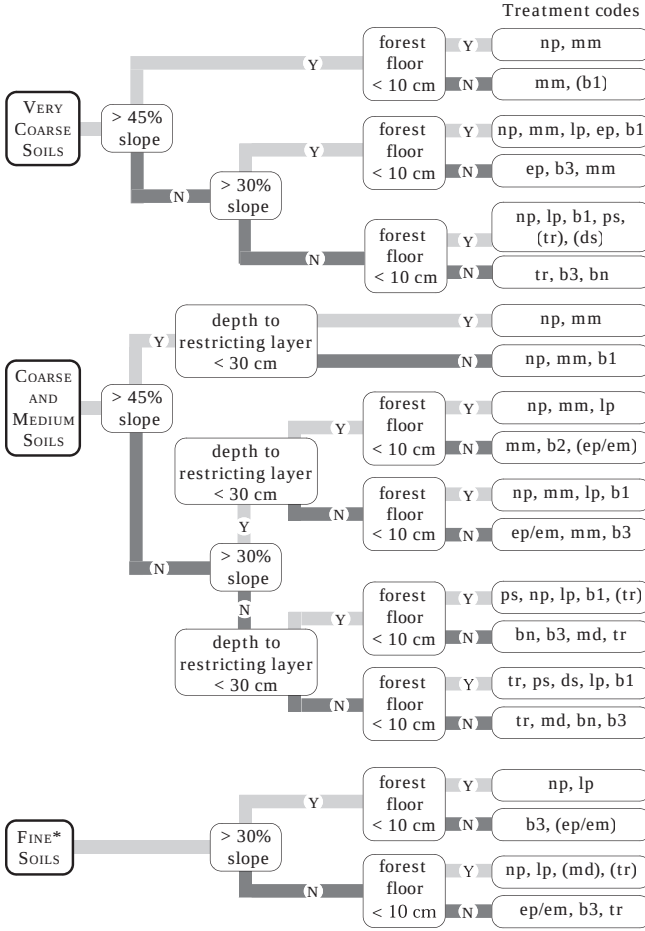
TABLE 12.1 *Soil grouping for all combinations of coarse fragment content and soil texture (from Lewis and Carr 1993)*

Soil texture	Coarse fragment content		
	< 30%	30–70%	>70%
S, LS, SL	Coarse	Very coarse	Very coarse
vfSL, Si	Medium	Coarse	Very coarse
SiL, Loam	Medium	Medium	Coarse
SC, SiC, SCL, SiCL, CL, C	Fine	Medium	Medium

S = sand, sandy C = clay, clayey vfSL = very fine sandy loam
Si = silt, silty L = loam, loamy

TABLE 12.2 *Site groups for site preparation keys*

Site series	Site group	Figure #
BWBSdk1/01, –05, –06	Moist	12.1
BWBSdk1/04, –07	Wet	12.2
BWBSdk1/08, –09	Very Wet	12.3
ESSFmv3/01, –04, –05	High elevation	12.1
ESSFmv3/06	Wet	12.2
ESSFmv3/07	Very Wet	12.3
SBSmk2/01,–03,–04	Moist	12.1
SBSmk2/05	Wet	12.2
SBSmk2/06	Very Wet	12.3
SBSwk2/02, –03, –04	Moist	12.1
SBSwk2/01, –05	Wet	12.2
SBSwk2/06	Very Wet	12.3
SBSwk3/04, –05	Moist	12.1
SBSwk3/01, –07	Wet	12.2
SBSwk3/08	Very Wet	12.3
SBSwk3a/04, –05	Moist	12.1
SBSwk3a/01, –07	Wet	12.2
SBSwk3a/08	Very Wet	12.3



* LGP vehicles must be used as prime mover for mechanical site preparation on these soils and soils must be dry or frozen.

FIGURE 12.1 *Site preparation key for moist sites.*

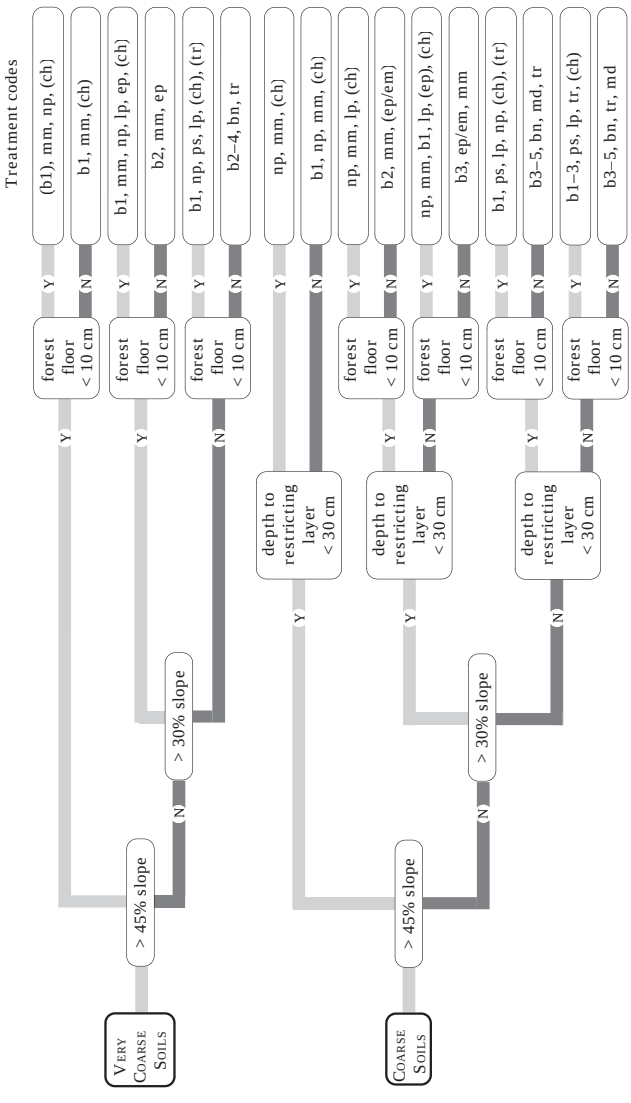
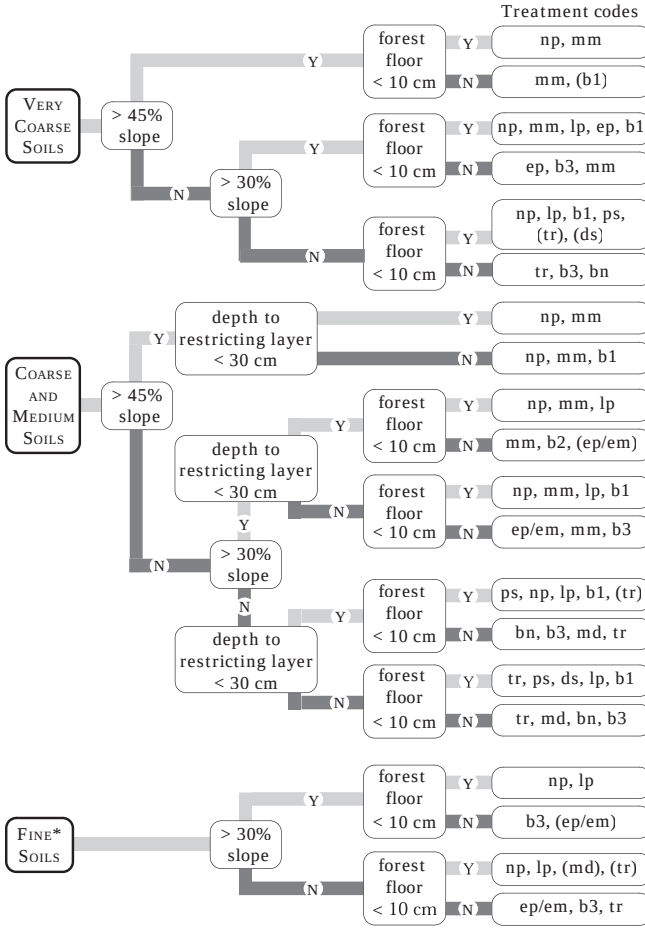


FIGURE 12.2 *Site preparation key for wet sites.*

FIGURE 12.2 *continued*

FIGURE 12.3 *Site preparation key for very wet sites.*



* LGP vehicles must be used as prime mover for mechanical site preparation on these soils and soils must be dry or frozen.

FIGURE 12.4 *Site preparation key for high-elevation sites.*

12.1 Site Preparation Codes

np: No Site Preparation - requires that slash reduction and alignment of slash become important components of the harvesting prescription (see Section 12.2). If brush hazard is high to extreme (see individual site unit interpretations), large sturdy stock should be planted in planter-prepared screefs. Areas receiving no site preparation should be monitored carefully to assess the need for brushing and weeding.

bn: Brush Blading Normal - includes all equipment capable of blading on sites with up to a 30% slope. The intent of this treatment is to pile slash and remove a portion of the organic layer without exposing mineral soil. Complex microtopography makes this treatment difficult to perform. A skilled operator, small equipment, and close supervision are required for this treatment to be effective without damaging the site.

b#: Broadcast Burning - includes a range of severity classes reflecting desired levels of slash and forest floor consumption (Table 12.3). Operational experience is crucial to meeting treatment objectives. When prescribing a broadcast burn it is important to consider the sensitivity of the cutblock area as a whole to burning, including any drier units with thinner forest floor layers or shallow soils. If burning is considered to be too severe for some units, an attempt should be made either to exclude them from harvesting, or fireguarding them prior to burning. Broadcast burning will generally stimulate species that regenerate from buried seed (e.g., raspberry, currants, and gooseberries) or rhizomes (e.g., thimbleberry). Brushing and weeding will be required if these types of species are present.

TABLE 12.3 *Approximate levels of fuel consumption by prescribed fire severity class*[a]

Severity class	Duff (depth consumed)	Fuel consumption: Slash (% consumed) <7 cm diam.	Slash (% consumed) >7 cm diam.
1	moss/ litter layer	40	15
2	1–2 cm	50	20
3	2–5 cm	60–70	30
4	5–8 cm	80	40
5	8–15 cm	90	50

[a] Based on *Slashburning severity guidelines for the moist cold Sub-Boreal Spruce Subzone (SBSmc) in the Prince Rupert Forest Region* (Trowbridge et al. 1989). Insert for the Sub-Boreal Spruce Zone Field Guide. Land Manage. Handb. No. 10, Smithers, B.C.

ch: Chemical or Biological - includes biological controls (e.g., sheep grazing) and any type of chemical or biological herbicide control. With this option, slash reduction and alignment of slash become important components of the harvesting prescription (see Section 12.2). Important wildlife browse species associated with the site should be identified prior to treatment (see Section 13). Choose the treatment that best meets wildlife and site preparation objectives.

ds: Drag Scarification - can be used to prepare sites for planting but is more generally used to enhance natural regeneration of lodgepole pine. It is important to include a cone survey in the prescription when implementing drag scarification for natural regeneration. A lop-and-scatter clause may also need to be included if the harvesting is to be done by feller-bunchers. On sites with moderate or higher brush hazard (see individual site unit interpretations), the site should be carefully monitored in case brushing and weeding are required.

em: Excavator Mounding - requires that slash reduction and alignment of slash become components of the harvesting prescription (see Section 12.2), or excavators must windrow at time of mounding. As slash loading increases on slopes, the

productivity of the excavator decreases. Vegetation growth generally increases with the amount of organic matter incorporated in the mound capping. Careful monitoring will determine if brushing and weeding are required on sites with thick organic layers, although this may not be required where mounds are sufficiently large.

ep: Excavator Patch Scarification - requires that slash reduction and alignment of slash become components of the harvesting prescription (see Section 12.2), or excavators must windrow at time of patch scarification. Little or no mineral soil should be removed during treatment. As slash loading increases on slopes, the productivity of the excavator decreases.

lp: Light Piling - includes any equipment capable of placing slash in piles without the use of a blade (e.g., rake with retractable teeth). The equipment should be capable of piling while causing very minimal disturbance of the upper soil layers, including the forest floor. There will be minimal effect on competing vegetation and no increase in soil warming using this treatment.

md: Mounding - includes equipment capable of producing well-distributed raised planting spots composed of organic and/or mineral soil. On sites where heavy slash accumulations are expected, alignment of slash will become an important component of the harvesting prescription (see Section 12.2). Vegetation growth generally increases with amount of organic matter incorporated in the mound capping. Careful monitoring will determine if brushing and weeding are required on sites with thick organic layers. Soils that are fine-textured and have blocky structure should not be mounded, unless using some form of mixed mounds. This is especially true on drier sites or in drier biogeoclimatic units.

mm: Motor Manual - includes brush saws and hand-held spot scarifiers. This option requires that slash reduction and alignment of slash become important components of the harvesting prescription (see Section 12.2). On sites where potentially competing species are present and will be

stimulated by the action of the treatment chosen (e.g., thimbleberry if spot scarifying), large sturdy stock should be planted.

ps: **Patch Scarification** - includes equipment capable of producing well-distributed patches of exposed mineral soil for planting. The intent of this treatment is to remove the forest floor from the prepared patch. On sites where heavy slash accumulations are expected, alignment of slash will become an important component of the harvesting prescription (see Section 12.2). Patch scarification will generally stimulate species that regenerate from on-site seeding (e.g., fireweed and grasses) or rhizomes (e.g., thimbleberry). Brushing and weeding will be required if these types of species are present.

tr: **Trenching** - includes equipment capable of producing shallow continuous trenches (e.g., disc trencher). Trenches should be made by contouring the slope where slopes are continuously or intermittently >15%. Trenching will generally stimulate species that regenerate from on-site seeding (e.g., fireweed and grasses). Brushing and weeding will be required if these species are present. Trees should usually be planted well above the hinge in the units covered by this guide. Trench depth should never exceed 2/3 of the effective rooting depth on the site (see Table 2).

12.2 Reducing Slash during Harvesting

Slash reduction to reduce fire and pest risks and to improve planter access is often one of the main reasons that site preparation is conducted. On ecologically sensitive sites, however, many site preparation techniques used to reduce slash may also damage the site. Slash can often be reduced during harvesting if the need is identified in the PHSP. Good references on this subject include *Treatment of Logging Residues: Alternatives to Prescribed Burning* (Hedin 1991) and *Alternatives to Prescribed Burning* (Burton 1991). Some of the techniques that can be used are slash alignment using feller-bunchers or grapples, increasing utilization, and on-site processing of residue (e.g., chipping).

13 WILDLIFE INTERPRETATIONS

Important wildlife considerations specific to individual biogeoclimatic and site units are discussed briefly within guide sections devoted to these units. This section includes a listing of important wildlife species found within the guide area (Table 13.1) and a general discussion of their habitat requirements (Section 13.1). The relationship of wildlife and their habitat requirements to particular site units is summarized in Section 13.2.

The importance to wildlife of particular species of vegetation should be considered when choosing site preparation and brushing and weeding options. Information on how some plant species are affected by treatments is provided in *A Preliminary Guide to the Response of Major Species of Competing Vegetation to Silvicultural Treatments* (Coates and Haeussler 1986). In some cases (e.g., *Bryoria* spp.), the species can only be retained by leaving older trees on the site.

13.1 Habitat Requirements for Wildlife Species of Management Concern

Grizzly bear – early seral stages provide berries, especially huckleberries, blueberries, soapberries, and raspberries. Grizzly bears must have a variety of berry-bearing shrubs so that fruit is available throughout the summer. Protein-rich succulent herbs (horsetail, sledges, cow parsnip) in riparian and seepage areas are particularly important in spring. Where significant concentrations of spawning fish (e.g., salmon, bull trout, Kokanee) occur, they provide an important protein supplement. Grizzly bears feed on ants in stumps and CWD (coarse woody debris), and on the plateau den under the roots of large, old trees.

Beaver – uses aspen/willow shrubs <10 cm dbh (diameter at breast height), near water; also riparian herbs in spring; preferred stream gradient is <6%.

Red squirrel – population fluctuates with cone crop, primarily spruce; uses groups of large conifers for nesting, CWD for food cache.

Coyote – uses mostly early seral stages through young forest; often associated with edges/ecotones.

Gray wolf – depends on prey (beaver-sized or larger); no particular habitat requirements.

Red fox – uses mostly early seral stages through young forest; often associated with edges/ecotones.

Cougar – depends on ungulate (chiefly deer) prey; no particular habitat requirements.

Lynx – dependent on snowshoe hare (found chiefly in shrubby stands or overstocked pine plantations 15–25 years old); dens in blowdown in old growth.

Wolverine – dependent on ungulate carrion; no particular habitat requirements althxough generally prefers upland coniferous forest; does not tolerate disturbance.

River otter – aquatic and riparian; often associated with beaver activity; uses logjams, coarse woody debris, dense riparian shrubs and herbs.

Marten – uses mature forest and old growth, most common in productive forest with large down logs; highly dependent on coarse woody debris. Wildlife trees and brush piles are also used as den sites and access routes to subnivean hunting grounds.

TABLE 13.1 *Some important wildlife species that utilize biogeoclimatic units within the guide area*

Species	Occurrence of species by unit					
	BWBSdk1	ESSFmv3	SBSmk2	SBSwk2	SBSwk3[b]	SWBmk
Mountain goat	ps	Y	ps	ps	ps	Y
Stone sheep	ps	ps	-	-	-	Y
Caribou (northern pop.)	Y	Y	y	y	y	Y
Elk	y	sa	y	y	y	Y
Moose	Y	pSA	Y	Y	Y	Y
Grizzly bear[a]	Y	Y	y	Y	Y	Y
Gray wolf	Y	Y	Y	Y	Y	Y
Wolverine[a]	Y	Y	Y	Y	Y	Y
Fisher[a]	Y	y	Y	Y	Y	y
Marten	Y	Y	Y	Y	Y	Y

[a] Species considered to be threatened or endangered ("red-listed") or of special concern ("blue-listed") (B.C. Conservation Data Centre 2003.)

[b] Includes SBSwk3a

Key to coding

Abundance:

Uppercase letter = common to very common and abundant

Lowercase letter = rare, scarce, or uncommon and scattered

Timing:

Y, y = yearlong; P, p = spring (approximately March–May); S, s = summer (approximately June–August); A, a = autumn (approximately September–November); Example: pSA = scarce in spring, common–abundant in summer and autumn

Fisher – uses pole-sapling and young mixed forest in summer, mature forest and old growth in winter, possibly for snow interception; requires >50% crown closure; natal dens in large tree cavities; also uses coarse woody debris, slash piles, edges/ecotones.

Striped skunk – opportunistic omnivore; prefers open forest and forest edge.

Ermine – dependent on small mammals, chiefly voles; most common in early seral stages.

Long-tailed weasel – dependent on small mammals, chiefly voles but also takes hares; most common in fairly early seral stages.

Least weasel – hunts mostly small voles and mice; prefers open areas, especially aspen parkland.

Mink – wetlands, riparian; dependent on emergent vegetation and riparian thickets; also uses brush piles, coarse woody debris, logjams.

Black bear – uses wetland and seepage areas for grasses and sedges in early spring; early seral stages for berries in summer, especially raspberries, huckleberries, strawberries, saskatoon; dens under tree roots, fallen logs, slash piles, rock crevices.

Moose – uses wetland edges and areas of dense cover in summer; requires adequate densities of browse plants, chiefly willow and red-osier dogwood, in areas of reduced snow accumulation in winter. May move to mature or old-growth forest for protection from cold stress and in late winter for snow interception. Young aspen bark is important in spring.

Woodland Caribou (northern caribou ecotype) – dependent on a variety of habitat types to meet lifecycle needs. Terrestrial lichens within mature stands are an important source of winter forage throughout most of the guide area. Arborel lichen types, though less important for northern caribou than terrestrial lichen types, provide forage in high-elevation ranges for various periods throughout the year.

Mule deer – old-growth coniferous forest, especially Douglas-fir forest on southerly aspects, with arboreal lichen, are important habitats in winter.

13.2 Relationship of Site Units to Wildlife Habitat Requirements

Tables 13.3–13.9 summarize the habitat requirements of wildlife species of particular concern within the guide area by site unit. For this purpose, site series have been grouped according to the general

characteristics of the habitat they provide. Use Table 13.2 to identify the wildlife table corresponding to the site series of interest.

Within the tables, normal type indicates general concern; bold text indicates species or habitat attributes of particular importance; bracketed species or habitat components are of lower incidence or concern.

Coding for bird species groups listed in the tables is in Table 13.10. Coding and explanatory notes for key wildlife habitat attributes cited in tables, including successional stage and special habitat components, are provided in Sections 13.3 and 13.4, respectively.

TABLE 13.2 *Table and page numbers linking site series to site groups for wildlife tables*

Site Series		Map[a] code	Table number	Page number
BWBSdk1				
01	Sw - Knight's plume - Step moss	SM	13.5	13•10
02	Pl - Lingonberry - Feathermoss	LL	13.3	13•8
03	Sw - Wildrye - Feathermoss	SW	13.5	13•10
04	Sb - Lingonberry - Knight's plume	BL	13.3	13•8
05	SwPl - Soopolallie - Twinflower	SS	13.5	13•10
06	Sw - Scouring-rush - Step moss	SR	13.5	13•10
07	Sb - Lingonberry - Coltsfoot	BC	13.5	13•10
08	Sw - Currant - Horsetail	SC	13.5	13•10
09	Sb - Horsetail - Sphagnum	BH	13.9	13•16
10	Sb - Labrador tea - Sphagnum	BS	13.9	13•16
ESSFmv3				
01	Bl - Rhododendron - Feathermoss	FR	13.8	13•14
02	BlPl - Crowberry - Cladina	LC	13.3	13•8
03	BlSb - Labrador tea	BT	13.5	13•10
04	Bl - Oak fern - Knight's plume	FO	13.8	13•14
05	Bl - Devil's club - Rhododendron	FD	13.8	13•14
06	Sxw - Huckleberry - Highbush - cranberry	SC	13.5	13•10
07	Bl - Horsetail - Feathermoss	FH	13.8	13•14
SBSmk2				
01	Sxw - Black huckleberry - Highbush-cranberry	SB	13.5	13•10
02	Pl - Feathermoss - Cladina	LC	13.3	13•8
03	Sxw - Huckleberry - Soopolallie	SS	13.5	13•10
04	Sb - Huckleberry - Spirea	BH	13.3	13•8
05	Sxw - Oak fern	SO	13.6	13•11
06	Sxw - Horsetail	SH	13.7	13•13
SBSwk2				
01	Sxw - Oak fern	SO	13.6	13•11
02	Pl - Huckleberry - Cladina	LH	13.3	13•8
03	Sxw - Huckleberry - Highbush-cranberry	SC	13.5	13•10
04	SbPl - Feathermoss	BF	13.3	13•8
05	Sxw - Devil's club	SD	13.6	13•11
06	Sxw - Horsetail	SH	13.7	13•13

SBSwk3

01	Sxw - Oak fern	SO	13.6	13•11
02	Pl - Huckleberry - Cladina	LH	13.3	13•8
03	SxwFd - Purple peavine	SP	13.4	13•9
04	Sxw - Huckleberry - Highbush-cranberry	SC	13.5	13•10
05	Sb - Labrador tea	BT	13.5	13•10
06	Sxw - Twinberry - Coltsfoot	ST	13.6	13•11
07	Sxw - Devil's club	SD	13.6	13•11
08	Sxw - Horsetail	SH	13.7	13•13

SBSwk3a

01	SxwFd - Dogwood - Fairybells	**	13.6	13•11
02	Pl - Huckleberry - Cladina	LH	13.3	13•8
03	SxwFd - Purple peavine	SP	13.4	13•9
04	SxwFd - Birch-leaved spirea – Feathermoss	**	13.5	13•10
05	Sb - Labrador tea	BT	13.5	13•10
06	Sxw - Twinberry - Coltsfoot	ST	13.6	13•11
07	Sxw - Devil's club	SD	13.6	13•11
08	Sxw - Horsetail	SH	13.7	13•13

SWBmk

01	Sw – Grey-leaved willow – Scrub birch	SB	13.5	13•10
02	Sw – Scrub birch – Cladina	PL	13.3	13•8
03	Sw – Juniper – Wildrye	SK	13.3	13•8
04	Sw – Arctic lupine – Step moss	SW	13.3	13•8
05	Sw – Willow – Crowberry	SL	13.5	13•10
06	Sw – Willow – Step moss	SS	13.5	13•10
07	Sw – Scrub birch – Bluejoint	SC	13.6	13•11
08	Sw – Shrubby cinquefoil – Horsetail	SH	13.7	13•13

[a] refers to provincially correlated ecosystem mapping codes

TABLE 13.3 *Habitat requirements of wildlife species in dry lodgepole pine and black spruce site units*

Wildlife species[a]	Successional stage[ab]	Important forage species	Special habitat components[ab]
(grizzly bear)	SH MF OG (PS YF)	*Rosa acicularis, Shepherdia canadensis, Vaccinium* spp., *Arctostaphylos uva ursi*	**CWD, SU, SA**
(black bear)	(all)	*Rosa acicularis, Shepherdia canadensis, Vaccinium* spp., *Arctostaphylos uva ursi*	**SU, SA, ED**
caribou	MF (OG YF)	*Cladina* spp., *Cladonia* spp., *Alectoria* spp., *Bryoria* spp.	
(moose)	MF OG (SH)	*Abies lasiocarpa, Amelanchier alnifolia, Rosa acicularis, Vaccinium* spp., *Epilobium angustifolium*	**SL, ED, DT**
(mule deer)	SH MF OG	*Amelanchier alnifolia, Populus tremuloides, Alectoria* spp., *Bryoria* spp.	**SL, ED**
(gray wolf)	(all)		
coyote	all		**SP, ED**
(red fox)	SH PS		**ED, SP**
lynx	SH PS, YF of Pl		**CWD, SP**
ermine	SH (all)		**SP, CWD**
red squirrel	(PS) YF MF OG		**WT, CWD**
chipmunks	all		**CWD, SP**
voles/mice	all		**CWD, SP**
snowshoe hare	**PS** YF (SH MF)		**SP, CWD**
(porcupine)	PS YF		**SP**
Bird species			
(Group B)	MF, OG		**WT, DT**
(Group C)	MF, OG		**WT, DT**
(Group E)	all		**DT, CWD**
Group F	all		**DT**

[a] Normal type indicates general concern; bold text indicates species or habitat attributes of particular importance; bracketed species or habitat components are of lower incidence or concern.

[b] Coding and explanatory notes for successional status and special habitat components are in Sections 13.3 and 13.4.

TABLE 13.4 *Habitat requirements of wildlife species in moist Douglas-fir site units*

Wildlife species[a]	Successional stage[ab]	Important forage species	Special habitat components[ab]
grizzly bear	SH MF OG (PS YF)	*Amelanchier alnifolia, Rosa acicularis, Rubus parviflorus, Vaccinium membranaceum*	**CWD, SA**
black bear	all	*Amelanchier alnifolia, Rosa acicularis, Rubus parviflorus, Vaccinium membranaceum*	**SA, ED**
moose	**SH** PS MF OG (YF)	*Abies lasiocarpa, Amelanchier alnifolia, Populus tremuloides, Rosa acicularis, Epilobium angustifolium*	**SL, ED, DT**
mule deer	**SH OG** PS MF (YF)	*Acer glabrum, Abies lasiocarpa, Pseudostuga menziesii, Rosa acicularis*	**SA, ED**
cougar	all		
gray wolf	(all)		
coyote	all		**SP, ED**
red fox	all		**ED, SP**
(lynx)	all		**CWD, SP**
ermine	SH (all)		**SP, CWD**
red squirrel	**MF OG**PS YF		**WT, CWD**
chipmunks	all (PS YF)		**CWD, SP**
voles/mice	all (PS YF)		**CWD, SP**
(snowshoe hare)	PS YF (SH MF)		**SP, CWD**
porcupine	PS YF MF		**SP**
Bird species			
Group A	MF OG		**WT, DT**
Group B	MF OG		**WT, DT**
Group C	MF OG		**WT, DT**
(Group D)			**CWD**
Group E	all	*Viburnum edule*	**DT, CWD**
Group F	MF OG		**DT**

[a] Normal type indicates general concern; bold text indicates species or habitat attributes of particular importance; bracketed species or habitat components are of lower incidence or concern.

[b] Coding and explanatory notes for successional status and special habitat components are in Sections 13.3 and 13.4.

TABLE 13.5 *Habitat requirements of wildlife species in moist hybrid white spruce and black spruce site units*

Wildlife species[a]	Successional stage[ab]	Important forage species	Special habitat components[ab]
grizzly bear	all	*Lonicera involucrata, Rubus parviflorus, Shepherdia canadensis, Vaccinium membranaceum, Viburnum edule, Epilobium angustifolium*	**CWD**
black bear	all	*Lonicera involucrata, Rubus parviflorus, Shepherdia canadensis, Vaccinium membranaceum, Viburnum edule, Epilobium angustifolium*	**ED**
moose	**SH** PS MF OG (YF)	*Abies lasiocarpa, Acer glabrum, Populus* spp., *Rubus parviflorus, Salix* spp., *Vaccinium membranaceum, Viburnum edule, Epilobium angustifolium*	**SL, ED, DT**
(mule deer)	(all)	*Cornus stolonifera, Rosa acicularis, Pseudostuga menziesii, Alectoria* spp., Bryoria spp.	**SL, ED**
gray wolf	(all)		
coyote	SH PS		**SP, ED**
red fox	SH PS		**ED, SP**
lynx	SH PS (YF MF OG)		**CWD, SP**
(wolverine)	(all)		
(fisher)	PS YF MF OG		**CWD, DT**
marten	MF OG (SH)		**CWD, WT, SP, ED**
ermine	SH PS OG		**SP, CWD**
(beaver)	SH PS YF	*Populus* spp., *Salix* spp.	**LGS, WE, DT**
red squirrel	PS YF MF OG		**WT, CWD**
voles/mice	SH OG		**CWD, WT,**
red-backed vole	(PS YF MF)		**SP**
snowshoe hare	**PS** YF(SH MF OG)		**SP, CWD**

TABLE 13.5 *continued*

Wildlife species[a]	Successional stage[ab]	Important forage species	Special habitat components[ab]
porcupine	(PS YF MF)		**SP**
Bird species			
Group A	MF OG (YF)		**WT, DT**
Group B	OG YF MF		**WT, DT**
Group C	OG MF		**WT, DT**
(Group D)	MF OG		**CWD**
Group E	all	*Vaccinium membranaceum*	**DT, CWD**
Group F	MF OG		**DT**

[a] Normal type indicates general concern; bold text indicates species or habitat attributes of particular importance; bracketed species or habitat components are of lower incidence or concern.

[b] Coding and explanatory notes for successional status and special habitat components are in Sections 13.3 and 13.4.

TABLE 13.6 *Habitat requirements of wildlife species in wet hybrid white spruce site units*

Wildlife species[a]	Successional stage[ab]	Important forage species	Special habitat components[ab]
grizzly bear	**SH** MF OG (PS YF)	*Cornus stolonifera, Rubus parviflorus, Lonicera involucrata, Ribe lacustre, Vaccinium* spp., *Viburnum edule, Epilobium angustifolium, Steptopus amplexifolius*	**CWD**
black bear	**SH** MF OG (PS YF)	*Cornus stolonifera, Rubus parviflorus, Lonicera involucrata, Ribe lacustre, Vaccinium* spp., *Viburnum edule, Epilobium angustifolium, Steptopus amplexifolius*	**ED**
moose	**SH** PS MF OG (YF)	*Abies lasiocarpa, Cornus stolonifera, Populus* spp., *Ribes* spp., *Salix* spp., *Vaccinium* spp., *Viburnum edule, Epilobium angustifolium*	**SL, ED, DT**

TABLE 13.6 *continued*

Wildlife species[a]	Successional stage[ab]	Important forage species	Special habitat components[ab]
(mule deer)	(all)	*Abies lasiocarpa, Rosa acicularis, Alectoria* spp., *Bryoria* spp.	**SL, ED**
gray wolf	(all)		
coyote	SH		**SP, ED**
red fox	SH PS		**ED, SP**
lynx	SH PS OG (YF)		**CWD, SP**
(wolverine)	(all)		
fisher	YF MF OG (PS)		**WT, DT, CWD**
marten	MF OG (SH)		**CWD, WT, SP, ED**
ermine	SH (all)		**SP, CWD**
beaver	SH PS YF	*Populus* spp., *Salix* spp.	**LGS, WE, DT**
red squirrel	MF OG (PS YF)		**WT, CWD**
voles/mice	SH OG		**CWD, WT**
red-backed vole	(PS YF MF)		**SP**
snowshoe hare	**PS** SH (YF OG)		**SP, CWD**
porcupine	PS YF MF		**SP**
Bird species			
Group A	MF OG (YF)		**WT, DT**
Group B	OG YF MF		**WT, DT**
Group C	**OG** MF		**WT, DT**
(Group D)	MF OG		**CWD**
Group E	SH PS YFMF (OG)		**DT, CWD**
Group F	MF OG	*Vaccinium* spp.	**DT**

[a] Normal type indicates general concern; bold text indicates species or habitat attributes of particular importance; bracketed species or habitat components are of lower incidence or concern.

[b] Coding and explanatory notes for successional status and special habitat components are in Sections 13.3 and 13.4.

TABLE 13.7 *Habitat requirements of wildlife species in very wet hybrid white spruce site units*

Wildlife species[a]	Successional stage[ab]	Important forage species	Special habitat components[ab]
grizzly bear	all	*Cornus stolonifera, Lonicera involucrata, Ribes* spp., *Vaccinium* spp., *Viburnum edule, Equisetum* spp., *Heracleum maximum, Steptopus amplexifolius*	**CWD**
black bear	all	*Cornus stolonifera, Lonicera involucrata, Ribes* spp., *Vaccinium* spp., *Viburnum edule, Equisetum* spp., *Heracleum maximum, Steptopus amplexifolius*	**ED**
moose	**SH** OG (PS YF MF)	*Abies lasiocarpa, Cornus stolonifera, Lonicera involucrata, Populus balsamifera, Ribes* spp., *Salix* spp., *Viburnum edule, Epilobium angustifolium, Equisetum* spp., *Urtica dioica*	**ED, SL**
(mule deer)	(all)	*Cornus stolonifera, Salix* spp., *Ribes* spp., Rosa *acicularis*	**ED, SL**
(cougar)	(all)		
gray wolf	(all)		
coyote	SH PS YF		**SP, ED**
(red fox)	SH (PS YF)		**ED, SP**
lynx	SH PS (OG YF)		**CWD, SP**
(fisher)	PS YF MF OG		**WT, CWD, SPED, DT**
marten	MF OG (SH)		**WT, CWD, SP, ED**
ermine	SH (all)		**SP, CWD**
beaver	SH PS YF	*Salix* spp., Populus spp.	**LGS, WE, DT**
red squirrel voles/mice	MF OG (PS YF) SH OG (PS YF MF)		**WT, CWD** **CWD, WT, SP**
(snowshoe hare)	**PS** YF (SH MF OG)		**SP, CWD**

TABLE 13.7 *continued*

Wildlife species[a]	Successional stage[ab]	Important forage species	Special habitat components[ab]
Bird species			
Group A	MF OG		**WT**
Group B	MF **OG**		**WT, DT**
Group C	MF **OG**		**WT, DT**
Group E	SH PS YFMF (OG)	*Ribes* spp., *Viburnum edule*	**DT**
Group F	MF OG		**DT**

[a] Normal type indicates general concern; bold text indicates species or habitat attributes of particular importance; bracketed species or habitat components are of lower incidence or concern.

[b] Coding and explanatory notes for successional status and special habitat components are in Sections 13.3 and 13.4.

TABLE 13.8 *Habitat requirements of wildlife species in moist–very wet subalpine fir site units*

Wildlife species[a]	Successional stage[ab]	Important forage species	Special habitat components[ab]
grizzly bear	SH MF OG (PS YF)	*Ribes* spp., *Vaccinium* spp., *Heracleum maximum*, *Valeriana sitchensis*	**CWD, SA**
(black bear)	all	*Ribes* spp., *Vaccinium* spp., *Heracleum maximum*, *Valeriana sitchensis*	**ED, SA**
caribou	MF OG	*Alectoria* spp., *Bryoria* spp.	
moose	SH MF OG (PS YF)	*Vaccinium* spp., *Carex* spp., Forbs	**SL, ED**
gray wolf	(all)		
(coyote)	SH		**SP, ED**
(lynx)	(all)		**CWD, SP**
marten	MF OG (SH)		**WT, SP, CWD, ED**
ermine	SH (all)		**SP, CWD**
red squirrel	MF OG (PS YF)		**WT, CWD**
voles/mice	SH OG		**CWD, SP, WT**
red-backed vole	(PS YF MF)		

TABLE 13.8 *continued*

Wildlife species[a]	Successional stage[ab]	Important forage species	Special habitat components[ab]
(snowshoe hare)	PS YF (SH MF OG)		**SP, CWD**
Bird species			
(Group A)	MF OG		**WT**
(Group C)	MF OG		**WT, DT**
Group E	SH PS YF	*Ribes* spp., *Viburnum edule*	**DT**
Group F	MF OG		**DT**

[a] Normal type indicates general concern; bold text indicates species or habitat attributes of particular importance; bracketed species or habitat components are of lower incidence or concern.

[b] Coding and explanatory notes for successional status and special habitat components are in Sections 13.3 and 13.4.

TABLE 13.9 *Habitat requirements of wildlife species in very wet black spruce site units*

Wildlife species[a]	Successional stage[ab]	Important forage species	Special habitat components[ab]
grizzly bear	SH MF OG (PS YF)	*Carex* spp., *Equisetum* spp., grasses	**CWD, SU**
black bear	(all)	*Carex* spp., *Equisetum* spp., grasses	**SU, ED**
moose	all SH **OG**	*Betula nana, Lonicera involucrata, Salix* spp.	**SL, ED, DT**
(mule deer)	(all) SH OG		**SL, ED**
gray wolf	(all)		
coyote	SH		**SP, ED**
lynx	SH PS YF		**CWD, SP**
(wolverine)	(all)		
(fisher)	PS YF MF OG		**SP, WT, CWD, ED, DT**
(marten)	MF OG		**WT, CWD, SP**
mink	(all)		**CWD, SP**
ermine	SH (all)		**SP, CWD**
(beaver)	SH PS YF	*Betula nana, Salix* spp.	**DT**
(red squirrel)	MF OG PS YF		**WT, CWD**
voles/mice	(all) SH OG	*Lonicera involucrata, Viburnum edule*	**CWD, SP**
chipmunks	all		**CWD, SP**
(snowshoe hare)	PS YF (SH MF OG)		**SP, CWD**
porcupine	(PS YF MF)		**SP**
Bird species			
(Group D)	SH YF **MF OG**		**ED**
(Group E)	all		**DT, CWD, SP**
(Group F)	MF OG		**DT, WT**

[a] Normal type indicates general concern; bold text indicates species or habitat attributes of particular importance; bracketed species or habitat components are of lower incidence or concern.

[b] Coding and explanatory notes for successional status and special habitat components are in Sections 13.3 and 13.4.

TABLE 13.10 *Coding for bird species groups used in the wildlife tables*

Species group	Description	Representative species
A	primary cavity-nesters, mainly in conifers	black-backed woodpecker, three-toed woodpecker
B	primary cavity-nesters, mainly in deciduous trees or wildlife trees	red-breasted sapsucker, northern flicker, downy woodpecker, hairy woodpecker, pileated woodpecker
C	secondary cavity-nesters	Barrow's goldeneye, common goldeneye, bufflehead, hooded merganser, common merganser, northern hawk owl, boreal owl, northern saw-whet owl, Vaux swift, many passerines; also bats
D	ground-nesters near water	Canada goose, green-winged teal, mallard, northern pintail, blue-winged teal, cinnamon teal, American wigeon, ring-necked duck, lesser scaup, white-winged scoter
E	deciduous tree and thicket dwellers	warblers, vireos, flycatchers, thrushes; other migrating passerines
F	mature coniferous forest dwellers	northern goshawk, red-breasted nuthatch, brown creeper, Townsend's warbler, red crossbill

13.3 Successional Stage

Many wildlife species are associated with a particular successional stage, usually the shrub-herb or the mature forest–old-growth stages. Timber management practices emphasize the pole-sapling and young forest stages, which are generally the least valuable for wildlife and have the lowest species diversity.

Successional stage is defined on the basis of attributes that change over time, including stand age, vegetation physiognomy, stand structure, mortality/replacement relationships, and stand diversity. Figure 13.1 offers a schematic representation of various successional stages. The ecological importance, extent, and distribution of a certain combination of site unit and successional stage within a management area (e.g., watershed) helps to determine if harvesting should be deferred in the unit.

The various stages are recognized and classified as follows:

SH: **Shrub-herb** – this stage develops after a disturbance in which most or all of the forest canopy is removed (e.g., clearcut logging or a severe fire). It typically lasts up to 15 years, but may persist much longer if maintained by environmental conditions. It is dominated by shrubby vegetation; seedlings and advance regeneration may be abundant. Tree cover <10%, shrub cover >20% or >33% of total cover. Establishment is the primary process; biomass increases rapidly and floristic diversity is often high.

PS: **Pole-sapling** – this stage typically begins 5–15 years after a disturbance, when the young trees overtop the shrubby or herbaceous vegetation. It is dominated by trees >10 m tall and is typically densely stocked. Younger stands are vigorous (usually >10–15 years old) but older stagnated stands up to 100 years of age are also included. Self-thinning and vertical structure are 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 <40 years for normal forest succession; up to 100+ years for dense (5000–15000+ stems per ha) stands. Stands are more or less even-aged, having been planted or established naturally within a relatively short time. Establishment remains the dominant process with stand biomass continuing to increase. Understorey biomass declines as the canopy closes.

YF: **Young Forest** – this stage begins when self-thinning becomes evident and the forest canopy has begun to differentiate into distinct layers (dominant, main canopy,

and overtopped). A second cycle of trees begin to show a significant presence in the ground layer by the end of this stage. Self-thinning, low stand diversity, and increasing biomass through rapid height growth are characteristic of this stage. Understorey development is often limited by the dense forest canopy. In open forests where self-thinning may not be evident and a second cycle of trees is lacking, this stage will be characterized more by the vigorous growth of the trees. Begins as early as age 30 and extends to 50–80 years; time since disturbance is generally 40–80 years, depending on tree species and ecological conditions.

MF: **Mature Forest** – this stage extends until the trees established after the last disturbance mature, height growth slows, and some of the oldest trees begin to die. A second cycle of trees may show a significant presence in the lower tree layers. In some cases the first cycle of trees may begin to die from old age before significant development of a replacement layer begins; in other cases the next cycle of trees may be well developed before significant mortality of the initial cohort occurs. Generally, the even age distribution typical of early stages changes as new trees become established and older trees begin to die. Gap phase replacement may begin to be important at this stage. The understorey generally becomes well developed as the canopy opens. Time since disturbance is generally 80–140 years.

OG: **Old Growth** – old-growth stands are generally structurally complex and comprised mainly of shade-tolerant and regenerating tree species. However, older seral and long-lived trees established after a disturbance such as fire may still dominate the upper canopy. Stands show structural heterogeneity as gaps develop in the canopy after trees fall. The understorey biomass increases as light becomes available. The presence of dead wildlife trees and rotting logs in all stages of decomposition enhances the value of forests for wildlife at this successional stage. This stage often begins about 140 years after a succession-initiating disturbance.

FIGURE 13.1 *Example of forest structure associated with successional stages.*

13.4 Special Habitat Components

The following are key features and attributes of the habitat required by various species of wildlife. Though timber management practices emphasize the pole-sapling and young forest successional stages, which lack many of these attributes, management at the stand level can maintain some of the most important features of shrub-herb and old-growth forests, thereby increasing the stand's value to wildlife throughout the rotation.

WT: Wildlife Trees – otherwise known as snags, these are important for cavity-dwellers such as woodpeckers, common and Barrow's goldeneye, marten, and fisher. They also provide perching sites for owls and raptors and foraging substrates for insectivorous birds. Small wildlife trees are used only by small species; pileated woodpeckers, which excavate the larger cavities used by ducks and fisher, require wildlife trees of at least 26 cm dbh and preferably 40 cm.

CWD: Coarse Woody Debris – this includes sound and rotting logs and stumps and provides cover for small mammals and their predators. It is widely used by invertebrates and hence as a foraging substrate by insectivorous birds. CWD provides nesting and denning sites for birds and larger mammals and can be important in courtship rituals. It provides a sheltered environment for reptiles and amphibians that cannot tolerate extremes of temperature or drought. CWD also provides subnivean access routes that are particularly important for marten. Wildlife trees and CWD have a limited lifespan, depending on their size and degree of decomposition, and isolated wildlife trees are of limited value to wildlife. A preferred option would be to leave groups of wildlife trees with some large green trees (future wildlife trees), possibly where harvesting would be difficult or uneconomical. Wildlife trees and CWD are vulnerable to destruction by prescribed fire. However, large-diameter wood is generally only charred, especially if fire is used in spring or after heavy rain when fine fuels have dried out but larger fuels have not. Although charred logs are made more durable by fire hardening, they also become less valuable to wildlife in the short term as loose bark is removed and they

are made too hard to be utilized by wood-boring insects or by cavity-excavating birds.

DT: **Deciduous Trees** – this component is important to songbirds such as warblers, vireos, and flycatchers as foraging and nesting areas. Many primary cavity-nesters prefer aspen and cottonwood to conifers, probably because cavity excavation is easier. Living and dead cottonwood trees are particularly important because of their large size.

SP: **Slash/Brush Piles** – this structural feature provides snow interception and cover for small birds and mammals. Because this is such an important structural attribute for voles, predators such as marten, fox, coyote, and weasels will also benefit. Leaving small slash piles unburned could increase populations of voles and porcupines.

ED: **Edges** – these occur between vegetation types (such as mature timber–clearcut or forested wetland–mesic forest) and are important for species that utilize either area. Species using both areas often prefer the juxtaposition of habitat types. Edges also provide habitat for species that prefer the transition zone (ecotone) between them. Creating edge can be accomplished by dispersing smaller clearcuts or by having larger blocks with irregular edges and dispersed wildlife tree patches within the block. The latter is preferred as it reduces fragmentation and active road density.

SA: **Southerly Aspects –** this feature, because of increased solar radiation, is associated with reduced snow accumulation. This favours species such as mule deer that do not tolerate deep snow. These areas are among the first sites to provide spring forage.

SU: **Spring Use –** occurs on those sites that provide important early-season foraging opportunities. As such, it is closely related to southerly aspect and early disappearance of snow cover. These areas are important for hibernating species and for those that do not tolerate deep snow.

SL: **Shelter** – provides thermal and hiding cover for all wildlife species. It is particularly important for big game species during hunting and calving seasons. In winter, tree canopies intercept snowfall and minimize the energy expended in movement.

LGS: **Low-Gradient Streams** – as one component of riparian habitats, these areas are extremely important for fish and wildlife. These areas provide a water source for many organisms and create a more moderate microclimate than is found in more upland forests. Streams may also function as corridors that facilitate genetic interchange, daily and seasonal movements, and range extension. Beaver prefer streams with gradients <6%.

WE: **Wetlands** – these areas are found adjacent to the normal high water line around lakes, ponds, rivers, and streams. These habitats provide abundant vegetation for forage and cover, horizontal and vertical diversity, large invertebrate populations, water sources for drinking, and a more stable microclimate than the surrounding upland forests. Because of their high productivity, many wildlife species reach their highest densities in riparian habitats, especially in those adjacent to old-growth forests.

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APPENDIX 1 Species name changes

The following plant species names were updated in this guide to make them consistent with the *Illustrated Flora of British Columbia*[1], which is the current standard reference for plant names in British Columbia.

Name used previously		Current name		Common name
Alnus crispa ssp. *sinuata*	=	*Alnus viridis* ssp. *sinuata*	=	Sitka alder
Alnus tenuifolia	=	*Alnus incana* ssp. *tenuifolia*	=	mountain alder
Betula glandulosa	=	*Betula nana*	=	scrub birch
Disporum hookeri	=	*Prosartes hookeri*	=	Hooker's fairybells
Heracleum lanatum	=	*Heracleum maximum*	=	cow parsnip
Lycopodium complanatum	=	*Diphasiastrum complanatum*	=	ground-cedar
Osmorhiza chilensis	=	*Osmorhiza berteroi*	=	mountain sweet-cicely
Smilacina racemosa	=	*Maianthemum racemosum*	=	false Solomon's-seal
Streptopus roseus	=	*Streptopus lanceolatus*	=	rosy twistedstalk

[1] *Illustrated Flora of British Columbia*, Vol. 1–**8.** (Douglas et al. 1998–2002). B.C. Min. Sustainable Resource Manage. (Min. Env., Lands and Parks) and B.C. Min. For., Victoria, B.C.