A Field Guide for Identification and Interpretation of Ecosystems of the Northeast Portion of the Prince George Forest Region

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Word processing was by Jennifer Stuart and Louise Gronmyr. Illustrations have been used, with permission, from Goward (1987), Hale (1979), Schofield (1968), Szczawinski (1959, 1962), Taylor (1966, 1973a, 1973b, 1974a, 1974b) and Hitchcock et al. (1987). Scientific names follow Taylor and MacBryde (1977), and common names follow Meidinger (1987).
# TABLE OF CONTENTS

ACKNOWLEDGEMENTS .......................................................... iii  

1  INTRODUCTION .................................................................. 1 

2  USE OF THE GUIDE .......................................................... 6 
   2.1 Identifying Biogeoclimatic Units ....................................... 6 
   2.2 Identifying Site Units ................................................... 7 
      2.2.1 Soils and topographic features .................................. 7 
      2.2.2 Vegetation features .............................................. 7 
      2.2.3 Moisture and nutrient regimes ................................. 7 
      2.2.4 Identification of units ........................................ 8 
   2.3 Management Interpretations .......................................... 8 

3  BIOGEOCLIMATIC UNITS .................................................. 8 
   3.1 Distinguishing Floristic Features of the BWBS and Neighbouring Zones 9 
   3.2 Variants of the BWBS ................................................... 9 
      3.3 BWBSmw ............................................................... 9 
         3.3.1 Peace BWBSmw - BWBSmw1 (previously BWBSc1 and BWBSc2) .... 10 
         3.3.2 Fort Nelson BWBSmw - BWBSmw2 (previously BWBSa1) .......... 10 
      3.4 BWBSdk .......................................................... 12 
         3.4.1 Liard BWBSdk - BWBSdk2 (previously BWBSa2) .................. 12 
      3.5 BWBSwk .......................................................... 12 
         3.5.1 Murray BWBSwk - BWBSwk1 (previously BWBSd1) ................ 13 
         3.5.2 Graham BWBSwk - BWBSwk2 (previously BWBSd2) .............. 13 
         3.5.3 Kledo BWBSwk - BWBSwk3 (previously BWBSb) ............... 13 

4  THE BWBSmw1 VARIANT ................................................... 15 

5  THE BWBSmw2 VARIANT ................................................... 35 

6  THE BWBSwk1 VARIANT ................................................... 63 

7  THE BWBSwk2 VARIANT ................................................... 83 

8  LITERATURE CITED .......................................................... 98 

APPENDICES 

1  Meso slope position diagram ............................................... 100 
2  Hand texturing field guide .................................................. 101 
3  Key to the identification of potential moisture regime .......... 105 
4  Key to the identification of soil nutrient regime ................. 107
TABLES

1  New names for biogeoclimatic and site units in the northeast portion of the Prince George Forest Region .................................... 3
2  Full correlated vegetation unit names for site series described in this guide................................................................. 5
3  Summary climate data for biogeoclimatic units ........................ 11

FIGURES

1  Biogeoclimatic units of the northeast portion of the Prince George Forest Region............................................................. 2
2  Edatopic grid displaying site series in the BWBSmw1 variant........... 15
3  Edatopic grid displaying site series in the BWBSmw2 variant......... 35
4  Edatopic grid displaying site series in the BWBSwk1 variant........ 63
5  Edatopic grid displaying site series in the BWBSwk2 variant......... 83
INTRODUCTION

This guide describes the lowland and montane ecosystems (below 1200 m in the south and 1050 m in the north) in British Columbia’s northeastern corner (Figure 1). This area, northeast of the Rocky Mountains, encompasses the Alberta Plateau, Liard Plateau, and Liard Plain physiographic regions (Holland 1976). It is characterized by a northern continental climate, with very long, cold winters and short, warm summers. The landscape is a mosaic of poorly drained muskeg, mixed seral stands containing lodgepole pine and aspen, and some mature white and black spruce stands. Fires are common and the Northern Fire Ecology Project reports (Parminter 1983, 1984) describe the fires’ impact on the boreal landscape. The guide presents aids to the identification of described units, and management interpretations for each.

The units in this guide are described in the biogeoclimatic ecosystem classification (BEC) system. It is assumed that the user has a working knowledge of this system. Those unfamiliar with the system should consult Pojar (1983) for a non-technical account, or contact the Ecology personnel in the Forest Sciences Section, B.C. Ministry of Forests, Prince George. Most of the units described in this guide have also been described in other publications and reports: Meidinger and Lewis (1983) for the Fort Nelson Timber Supply Area; Jang et al. (1986) for the BWBSmw1 (previously BWBSc1); DeLong (1988) for the seral units of the BWBSmw1; Annas (1977) for the BWBSmw2 (previously BWBSa1); and Jang et al. (1987) for the BWBSwk1 (previously BWBSd1). As well, soil surveys have been done in the Peace River (Farstad et al. 1965) and Fort Nelson (Valentine 1971) areas, and the land base near

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FIGURE 1. Biogeoclimatic units of the northeast portion of the Prince George Forest Region.
TABLE 1. New names for biogeoclimatic and site units in the northeast portion of the Prince George Forest Region

<table>
<thead>
<tr>
<th>Old variants and ecosystem associations</th>
<th>New variants and site series</th>
</tr>
</thead>
<tbody>
<tr>
<td>BWBSc1</td>
<td>BWBSm1</td>
</tr>
<tr>
<td>01 Highbush-cranberry - Trailing Raspberry</td>
<td>01 SwAt - Step moss</td>
</tr>
<tr>
<td>02 Pine - Kinnikinnick</td>
<td>02 PI - Lingonberry - Velvet-leaved blueberry</td>
</tr>
<tr>
<td>03 Pine - Soopollallie</td>
<td>03 Sw - Wildrye - Peavine</td>
</tr>
<tr>
<td>04 Pine - Black Spruce</td>
<td>04 Sb - Lingonberry - Coltsfoot</td>
</tr>
<tr>
<td>05 Highbush-cranberry - Oak Fern</td>
<td>05 Sw - Currant - Oak fern</td>
</tr>
<tr>
<td>06 Highbush-cranberry - Tall Bluebells</td>
<td>06 Sw - Currant - Bluebells</td>
</tr>
<tr>
<td>07 Spruce - Horsetail</td>
<td>07 Sw - Currant - Horsetail</td>
</tr>
<tr>
<td>08 Black Spruce - Horsetail</td>
<td>08 Sb - Labrador tea - Sphagnum</td>
</tr>
</tbody>
</table>

| BWBSc2                                 | BWBSm1                      |
| 01 Highbush-cranberry - Trailing Raspberry | 01 SwAt - Step moss         |
| 02 Soopollallie - Fuzzy-spiked Wildrye  | 02 PI - Lingonberry - Velvet-leaved blueberry |
| 03 Prickly Rose - Fuzzy-spiked Wildrye  | 03 Sw - Wildrye - Peavine   |
| 04 Pine - Black Spruce                  | 04 Sb - Lingonberry - Coltsfoot |
| 05 Highbush-cranberry - Bluejoint       | 06 Sw - Currant - Bluebells |
| 06 Spruce - Horsetail                  | 07 Sw - Currant - Horsetail|
| 07 Black Spruce - Horsetail            | 08 Sb - Labrador tea - Sphagnum |

| BWBSa1                                 | BWBSm2                      |
| 01 Aspen - White Spruce                | 01 SwAt - Step moss         |
| 02 Pine - Lichen                       | 02-$ At - Sw - Step moss a  |
| 03 Pine - Black Spruce                 | 02 PI - Lingonberry - Velvet-leaved blueberry |
| 04 Pine - Clubmoss                     | 03 Sb - Lingonberry - Knight's plume |
| 05 Spruce - Horsetail                  | 04 Sb - Lingonberry - Coltsfoot |
| 05//M1 Balsam Poplar - Horsetail       | 05 Sw - Currant - Horsetail|
| 06 Black Spruce - Horsetail           | 05-$ Ac - Alder - Horsetail|
| 07 Tamarack - Horsetail                | 06 Sb - Feathermoss - Bluebells |
| 08 Black Spruce - Sphagnum             | 07 Lt - Horsetail           |
| 09 Black Spruce - Willow               | 08 Sb - Cloudberry - Sphagnum |
| 10 Tamarack - Buckbean                 | 09 Sb - Willow              |
|                                        | 10 Lt - Buckbean            |
TABLE 1. (Continued)

<table>
<thead>
<tr>
<th>Old variants and ecosystem associations</th>
<th>New variants and site series</th>
</tr>
</thead>
<tbody>
<tr>
<td>BWBSd1</td>
<td>BWBSwk1</td>
</tr>
<tr>
<td>01 Pine - Huckleberry</td>
<td>01 Sw - Huckleberry - Step moss</td>
</tr>
<tr>
<td>02 Pine - Lichen</td>
<td>02 Pl - Lingonberry - Velvet-leaved blueberry</td>
</tr>
<tr>
<td>03.1 Pine - Black Spruce - Velvet-leaved</td>
<td>03 Sb - Lingonberry - Coltsfoot</td>
</tr>
<tr>
<td>b.</td>
<td></td>
</tr>
<tr>
<td>03.2 Pine - Black Spruce - Clubmoss</td>
<td>03 Sb - Lingonberry - Coltsfoot</td>
</tr>
<tr>
<td>03.3 Pine - Black Spruce - Black Twinberry</td>
<td>03 Sb - Lingonberry - Coltsfoot</td>
</tr>
<tr>
<td>04 Pine - Soopolallie</td>
<td>04 Sw - Wildrye - Peavine</td>
</tr>
<tr>
<td>05 Spruce - Highbush-cranberry</td>
<td>05 Sw - Currant - Bluebells</td>
</tr>
<tr>
<td>06 Spruce - Horsetail</td>
<td>06 Sw - Currant - Horsetail</td>
</tr>
<tr>
<td>07.2 Black Spruce - Horsetail - Sphagnum</td>
<td>07 Sb - Horsetail - Sphagnum</td>
</tr>
<tr>
<td>07.1 Black Spruce - Horsetail - Feathermoss</td>
<td>08 Sb - Willow - Glow moss</td>
</tr>
<tr>
<td>BWBSd2</td>
<td>BWBSwk2</td>
</tr>
<tr>
<td>01 Black Huckleberry - Bunchberry</td>
<td>01 Sw - Huckleberry - Step moss</td>
</tr>
<tr>
<td>02 Pine - Lichen</td>
<td>02 Pl - Lingonberry - Feathermoss</td>
</tr>
<tr>
<td>03 Soopolallie - Fuzzy-spiked Wildrye</td>
<td>03 Sw - Wildrye - Peavine</td>
</tr>
<tr>
<td>04 Labrador Tea - Lingonberry</td>
<td>04 Sb - Lingonberry - Coltsfoot</td>
</tr>
<tr>
<td>05 Black Gooseberry - Common Mitrewort</td>
<td>05 Sw - Currant - Bluebells</td>
</tr>
<tr>
<td>06 Spruce - Horsetail</td>
<td>06 Sw - Currant - Horsetail</td>
</tr>
</tbody>
</table>

a The "$" symbol indicates that the unit described is seral.
TABLE 2. Full correlated vegetation unit names for site series described in this guide

<table>
<thead>
<tr>
<th>Site series</th>
<th>Vegetation unit names</th>
</tr>
</thead>
<tbody>
<tr>
<td>BWBSmw1</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>Sw - Populus - Hylocomium; Lathyrus</td>
</tr>
<tr>
<td>02</td>
<td>Pl - Vaccinium (vitis-idaea) - Vaccinium (myrtilloides)</td>
</tr>
<tr>
<td>03</td>
<td>Sw - Elymus - Lathyrus</td>
</tr>
<tr>
<td>04</td>
<td>Sb - Vaccinium (vitis-idaea) - Ptilium; Petasites</td>
</tr>
<tr>
<td>05</td>
<td>Sw - Ribes (triste) - Gymnocarpium</td>
</tr>
<tr>
<td>06</td>
<td>Sw - Ribes (triste) - Mertensia</td>
</tr>
<tr>
<td>07</td>
<td>Sw - Ribes (triste) - Equisetum (arvense and pratense)</td>
</tr>
<tr>
<td>08</td>
<td>Sb - Equisetum - Sphagnum</td>
</tr>
<tr>
<td>BWBSmw2</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>Sw - Populus - Hylocomium; Vaccinium (vitis-idaea)</td>
</tr>
<tr>
<td>02</td>
<td>Pl - Vaccinium (vitis-idaea) - Vaccinium (myrtilloides)</td>
</tr>
<tr>
<td>03</td>
<td>Sb - Vaccinium (vitis-idaea) - Ptilium; Pleurozium</td>
</tr>
<tr>
<td>04</td>
<td>Sb - Vaccinium (vitis-idaea) - Ptilium; Petasites</td>
</tr>
<tr>
<td>05</td>
<td>Sw - Ribes (triste) - Equisetum (arvense and pratense)</td>
</tr>
<tr>
<td>05-*$^a$</td>
<td>not correlated</td>
</tr>
<tr>
<td>06</td>
<td>Sb - Pleurozium; Mertensia</td>
</tr>
<tr>
<td>07</td>
<td>not correlated</td>
</tr>
<tr>
<td>08</td>
<td>Sb - Rubus (chamaemorus) - Sphagnum</td>
</tr>
<tr>
<td>09</td>
<td>not correlated</td>
</tr>
<tr>
<td>10</td>
<td>not correlated</td>
</tr>
<tr>
<td>BWBSwk1</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>Sw - Vaccinum (membranaceum) - Hylocomium; Spiraea</td>
</tr>
<tr>
<td>02</td>
<td>Pl - Vaccinium (vitis-idaea) - Vaccinium (myrtilloides)</td>
</tr>
<tr>
<td>03</td>
<td>Sb - Vaccinium (vitis-idaea) - Ptilium; Petasites</td>
</tr>
<tr>
<td>04</td>
<td>Sw - Elymus - Lathyrus</td>
</tr>
<tr>
<td>05</td>
<td>Sw - Ribes (triste) - Mertensia</td>
</tr>
<tr>
<td>06</td>
<td>Sw - Ribes (triste) - Equisetum (arvense and pratense)</td>
</tr>
<tr>
<td>07</td>
<td>Sb - Salix (myrtillifolia) - Aulacomnium</td>
</tr>
<tr>
<td>08</td>
<td>Sb - Equisetum - Sphagnum</td>
</tr>
<tr>
<td>BWBSwk2</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>Sw - Vaccinum (membranaceum) - Hylocomium; Ptilium</td>
</tr>
<tr>
<td>02</td>
<td>Pl - Vaccinium (vitis-idaea) - Pleurozium</td>
</tr>
<tr>
<td>03</td>
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<td>06</td>
<td>Sw - Ribes (triste) - Equisetum (arvense and pratense)</td>
</tr>
</tbody>
</table>

*a The "$" symbol indicates that the unit described is seral.
Tumbler Ridge has been ecologically described as part of an impact study for Northeast Coal development (Vold 1977; Harcombe 1978). Wildlife values in the area are described in Fenger et al. (1989).

The units described in this guide have been renamed as part of the provincial correlation of the ecological classification system. The old names, and the corresponding units described in this guide, are listed in Table 1. Additionally, the complete correlated vegetation unit names for most of the site units are given in Table 2. The new biogeoclimatic unit codes and names are designed to be connotative -- that is, they describe the climate of the unit, relative to other subzones in the zone. The connotative symbols in this guide describe the relative moisture (x = very dry, d = dry, m = moist, w = wet, v = very wet) and relative temperature (v = very cold, c = cold, k = "kool", m = mild, w = warm, h = hot) for each subzone/variant within its zone. For example, the Moist Warm (mw) Boreal White and Black Spruce biogeoclimatic unit is coded BWBSmw; the Wet Cool ("Kool") unit is coded BWBSkw.

The site units have also been correlated and renamed. The number of units has been reduced, and similar units in different variants have been given the same name. For example, previously named ecosystem associations "Highbush-cranberry - Tall Bluebells" (BWBSc1/06), "Highbush-cranberry - Bluejoint" (BWBSc2/05), "Spruce - Highbush-cranberry" (BWBSd1/05), and "Black Gooseberry - Common Mitrewort" (BWBSd2/05) are all now within the "Sw - Currant - Bluebells" site association. They share this name because they are site series which are recognized as having similar "quality" (actual available moisture and nutrients) and vegetation potential. They also respond in a similar fashion to management practices.

2 USE OF THE GUIDE

The guide is divided into nine sections: the Introduction is Section 1; Section 2 describes the use of the guide; Section 3 describes the biogeoclimatic units (variants) included in the guide, and differentiates them; Sections 4-7 describe the site units within each variant, and their management interpretations; and Section 8 is Literature Cited.

2.1 Identifying Biogeoclimatic Units

Biogeoclimatic units are most easily identified from maps. Figure 1 provides an overview of the distribution of these units within the area covered by this guide. Biogeoclimatic unit maps at a scale of 1:250 000 are available from Ministry of Forests (MOF) District Offices, or the Forest Science Section, MOF, Prince George.

If an area lies near a mapped biogeoclimatic unit boundary and it is not clear which biogeoclimatic unit it belongs to, the user should compare the site units found in the area to those described for both biogeoclimatic units, and select the unit that best fits.
2.2 Identifying Site Units

Site units can be identified by a combination of soil, site and vegetation factors, which together are used to derive soil moisture and nutrient regimes for the site. Having selected the appropriate biogeoclimatic unit (Section 2.1), the user should inspect the area under consideration to determine if there are obvious moisture or nutrient differences which have led to the development of several vegetation units on the site. If several site units appear to be present, the user should stratify the area before identifying these units. At each site unit, the user should then record site features (2.2.1) and vegetation features (2.2.2), and use these to determine moisture and nutrient regimes (2.2.3).

2.2.1 Soils and topographic features

The most important topographic characteristics to note are: slope position (Appendix 1), slope gradient, and aspect. The most important soil characteristics to note are: soil texture (procedures for determining soil texture are given in Appendix 2); coarse fragment %; humus form and depth (procedures for determining humus form are given in Appendix 3); soil drainage class; depth to water table; and rooting depth.

2.2.2 Vegetation features

The plant species on the site and their relative abundance should be noted. Vegetation as described in this guide is for mature ecosystems. Caution must be exercised in using vegetation to classify disturbed sites. Species occurring infrequently but sometimes with moderate cover are enclosed in square parentheses ( [ ] ). Plant guides such as "Some Common Plants of the Sub-Boreal Spruce Zone" (Pojar et al. 1982) or "Some Common Plants of the Skeena Region" (Coupé et al. 1982) are helpful and may be available from the Forest Science Section, MOF, Prince George.

2.2.3 Moisture and nutrient regimes

The information from soils, topography and vegetation is used to estimate the relative amounts of moisture and nutrients available for plant growth. The guide user must keep two important factors in mind:

i. Moisture and nutrient regimes are relative within a biogeoclimatic unit. For instance, a site that is average in moisture regime in the BWBSwk1 will be wetter than a site that is average in moisture regime in the BWBSmw1.
ii. All factors must be taken into account when soil moisture and nutrient regime are determined. One factor may compensate for another; for instance, a coarse-textured soil, which might be expected to be dry, might be wetter if it occurs at the base of a slope.

Moisture and nutrient regimes can be estimated using the keys in Appendices 4 and 5.

2.2.4 Identification of units

After gathering soils, topographic, and vegetation information, the user should now proceed to:

i. the edatopic grid (e.g., Figure 2) where the moisture and nutrient regime can be used to locate the site unit on the grid; and

ii. the key to site units, where dichotomous keys use the soils, topographic, and vegetation features to identify a site unit.

The edatopic grid and the key to site units will direct the user to a particular site unit, or units. Soils, topographic, and vegetation features on the site can then be compared with those summarized for the particular site unit(s) to ensure the proper site unit is identified. Soil and site features characteristic of a certain site unit, or particularly useful in distinguishing it from other site units, are marked with an asterisk (*).

2.3 Management Interpretations

Once the site unit has been identified, the management interpretations for that unit are available on the page adjacent to the site unit description. Interpretations are offered as guidelines to the preparation of management prescriptions; they detail the opportunities and constraints that a resource manager must consider when dealing with a particular ecosystem. Management interpretations will be revised as more information, different technologies and different management objectives dictate. The site preparation method generally considered to be the most appropriate for the site is marked with an asterisk (*). More information about mechanical site preparation is available in Coates and Haeussler (1987).

3 BIOGEOCLIMATIC UNITS

The dominant biogeoclimatic zone in the study area is the Boreal White and Black Spruce (BWBS) zone. The BWBS is bordered by the Sub-Boreal Spruce (SBS) zone to the west, the Engelmann Spruce - Subalpine Fir (ESSF) zone above 1200 m in the southern portions, and the Spruce - Willow - Birch (SWB) zone above 1050 m in the northern portions of the area.
3.1 Distinguishing Floristic Features of the BWBS and Neighbouring Zones

The boreal nature of the BWBS climate is reflected in the vegetation of the zone, which includes many of the common species of the boreal regions of Canada. True climax forests are largely unknown in the BWBS, as few (if any) areas have escaped fire for several hundred years. Hypothetical climax forests may be dominated by white spruce and/or black spruce, or perhaps subalpine fir (rare, probably because of repeated burnings and lack of seed).

Fire has had a major influence on the development of many plant communities. Seral (non-climax) stands of predominantly aspen or balsam poplar dominate the lower elevations, whereas seral lodgepole pine dominated stands are common at the higher elevations and on coarser-textured soils.

The SBS (to the west of the BWBS) is moister, warmer and less "continental" than the BWBS. Upland SBS forests often have a component of subalpine fir in them and seldom contain black spruce. The ESSF and SWB (above the BWBS) have subalpine climates which are colder and moister than the BWBS. Vegetationally, the ESSF and SWB generally lack black spruce, but have a large component of subalpine fir. White-flowered rhododendron, absent in the BWBS, is a common component of most ecosystems in the ESSF.

In the SWB, the understory is typically scrub birch and willow, neither of which are common understory components of most stands in the BWBS.

3.2 Variants of the BWBS

Within the BWBS there is considerable climatic variation which corresponds primarily to differences in latitude and elevation within the zone.

The latitudinal shifts in vegetation in the zone are subtle whereas the altitudinal shifts are quite significant. The BWBS zone in the area is divided into five distinct biogeoclimatic variants:

- BWBSmw1: Peace Moist Warm BWBS (previously BWBSc1 and BWBSc2)
- BWBSmw2: Fort Nelson Moist Warm BWBS (previously BWBSa1)
- BWBSDk2: Liard Dry Cool BWBS (previously BWBSa2)
- BWBSwk1: Murray Wet Cool BWBS (previously BWBSd1)
- BWBSwk2: Graham Wet Cool BWBS (previously BWBSd2)
- BWBSwk3: Klédo Wet Cool BWBS (previously BWBSb)

3.3 BWBSmw

The BWBSmw covers the rolling topography from the Red Willow River near where the Alberta border transects the Rocky Mountains up to the Yukon and Northwest Territories borders. Elevation ranges from 650 to 1050 m in the south and 350 to 1050 m in the north. The climate is warmer

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5 Any further reference to the BWBS will be to only the area included in this guide.
and intermediate in moisture when compared to the other BWBS subzones. The forests are generally dominated by white spruce or aspen.

### 3.3.1 Peace BWBSmw - BWBSmw1 (previously BWBSc1 and BWBSc2)

The BWBSmw1 variant covers the rolling plains which extend from near where the Rocky Mountains transect the Alberta border, north to near the Beatton River. Elevation ranges from 750 to 1050 m. This variant has a drier and cooler growing season than the BWBSmw2, but the winters are warmer and moister (see Table 3). The forests in this variant are dominated by aspen. Balsam poplar is common on the low lying, wetter sites. White spruce is present on moist to wetter sites where there has been limited fire history. Lodgepole pine is present as a seral species on drier and poorer sites. Black spruce forests, often with a minor component of tamarack, are common on organic soils.

The Peace River Lowland portion of this variant provides year-round habitat for mule deer, white-tailed deer, moose, black bear, and small herds of Rocky Mountain elk. Much of the original lowland habitat has been converted to agricultural crops and wildlife use the few remaining aspen stands and riverbreaks. Sharp-tailed grouse occur in the more open habitats and ruffed grouse occur in the aspen stands. Wood bison, grizzly bear and gray wolf have been extirpated from this area.

The upland portion, both south and north of the Peace River Lowland, provides habitat for moose, caribou, black bear, gray wolf and grizzly bear. The numerous wetlands support large populations of breeding waterfowl, such as mallard, northern pintail, Barrow's goldeneye and common snipe. A few trumpeter swan also nest in these wetlands.

### 3.3.2 Fort Nelson BWBSmw - BWBSmw2 (previously BWBSa1)

The BWBSmw2 variant covers the undulating terrain and lowlands from near the Beatton River in the south, to the Northwest Territories and Yukon borders in the north. This variant is wetter and warmer during the growing season but colder during the winter compared to the BWBSmw1. Elevation ranges from 300 to 1050 m. Aspen - white spruce forests dominate the better drained sites. On the poorly drained sites black spruce forests, often with a minor component of tamarack are common. Tamarack can form almost pure stands on very wet sites. Lodgepole pine is relatively common, especially on wetter sites in combination with black spruce or well-drained higher elevation sites. Balsam poplar, white spruce and often trembling aspen and paper birch are common on the floodplains of the major water courses.

The extensive Fort Nelson Lowland provides habitat for wintering populations of caribou, black bear, and furbearers, especially lynx, marten, beaver and muskrat. Moose are more commonly found along the riparian areas. The numerous wetlands support large populations of waterfowl, such as mallard, northern pintail, blue-winged teal and northern shoveler, and shorebirds,
TABLE 3. Summary climate data for biogeoclimatic units

<table>
<thead>
<tr>
<th>BGC unit</th>
<th>Seasonal precipitation</th>
<th>Annual precipitation</th>
<th>Annual mean temperature</th>
<th>Mean annual snowfall</th>
<th>Frost-free period</th>
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<td>(°C) Mean</td>
<td>Range</td>
<td>(cm) Mean</td>
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<td>295</td>
<td>275-345</td>
<td>460</td>
<td>450-485</td>
<td>-1.6</td>
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<tr>
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<td>460</td>
<td>440-480</td>
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<td>645</td>
<td>630-660</td>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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</tr>
</tbody>
</table>

such as yellowlegs, common snipe, semipalmated plover and Wilson's phalarope. The riparian habitats and southerly-facing aspen forests adjacent to the Rocky Mountain foothills in the Muskwa River drainage provide year-round habitat for Rocky Mountain elk, moose, mule deer, white-tailed deer, grizzly bear and gray wolf, while the deeply dissected canyons of the Sikanni River provide escape terrain for mountain goat, Stone’s sheep and mule deer.

3.4 BWBSdk

The BWBSdk in the Prince George Forest Region is found only in the Liard River drainage upriver of the Hells Gate rapids, between the elevations of 400 and 1100 m. It is located below the SWB and borders the BWBSmw2 near the Hells Gate rapids. The general climate is drier and colder with a shorter growing season than the BWBSmw.

3.4.1 Liard BWBSdk - BWBSdk2 (previously BWBSa2)

The BWBSdk2 Variant is the only variant of this subzone found in the study area. It is relatively dry during the growing season, but wetter during the winter. Mature forests on upland sites are dominated by white spruce, sometimes with variable amounts of subalpine fir and black spruce. Seral stands of lodgepole pine, trembling aspen, and mixes of white spruce, aspen and lodgepole pine are common, especially on upland sites. Wetland sites are dominated by black spruce with a minor component of tamarack. Because of the limited extent of this variant within the area described by this guide, no further discussion of this unit will be made in the text. The Liard Plain provides habitat for moose, wintering caribou, gray wolf, black bear and furbearers, especially lynx, wolverine, marten, beaver and muskrat. A small population of Rocky Mountain elk is found on the north side of the Liard River, between Hells Gate rapids and Liard Hot Springs. The wetlands support breeding populations of waterfowl, especially mallard, northern pintail, common goldeneye and ring-necked duck.

3.5 BWBSwk

The BWBSwk is found in the foothills and on lower to mid-slopes of the Rocky Mountains from the Alberta border, northward to the Yukon border. The BWBSwk is widespread at its southern extent, whereas in the north it is reduced to isolated pockets. It is located between the BWBSmw and either the ESSF or SWB at elevations of 900-1300 m depending on the latitude and topography. The general climate is wetter and cooler with a shorter growing season than the BWBSmw (see Table 3). The forests are generally dominated by white spruce or lodgepole pine.
3.5.1 Murray BWBSwk - BWBSwk1 (previously BWBSd1)

The BWBSwk1 variant is found in the foothills and mid to lower slopes of the Rocky Mountains from where the Rocky Mountains transect the Alberta border to just north of the Peace arm of Williston Lake in the Hackney Hills. Elevation generally ranges from 1050 to 1200 m but can occur as a narrow band from 900 to 1050 m in some of the portions that are in the Rocky Mountains. The climate during the growing season is slightly drier and colder with a shorter growing season than the BWBSwk2. The winters are warmer with a higher snowpack than the BWBSwk2 (Table 3).

Mature spruce forests are dominated by white spruce, with minor amounts of black spruce occurring on wetter and poorer sites. Pure black spruce stands can occur on very wet sites on organic soils. Lodgepole pine is the dominant seral species and forms widespread forests along with minor amounts of white spruce and/or black spruce. Trembling aspen is common as a seral species at lower elevations.

This variant provides summer habitat for moose, black bear and grizzly bear. Rocky Mountain elk and mule deer make somewhat limited use of this habitat.

3.5.2 Graham BWBSwk - BWBSwk2 (previously BWBSd2)

The BWBSwk2 Variant covers the foothills and mid to lower slopes of the Rocky Mountains from the Hackney Hills north to where the Sikanni Chief River drains out of the Rocky Mountains. It occurs at elevations between 1050 and 1200 m. The BWBSwk2 is slightly wetter and warmer over the growing season than the BWBSwk1. It also has a longer growing season, but colder winters with less snowpack. The forests are very similar to those of the BWBSwk1 variant. This variant provides summer habitat for moose, mule deer, black bear and grizzly bear. Rocky Mountain elk have recently been repatriated to the southerly facing slopes of the Peace River Canyon and will use this habitat in the summer.

3.5.3 Kledo BWBSwk - BWBSwk3 (previously BWBSb)

The BWBSwk3 variant occurs as isolated pockets in the Rocky Mountain foothills between 900 and 1200 m from the Sikanni Chief River north to the Northwest Territories border.

There is very little climatic data available from this variant, but it is assumed to have a similar climate to the other BWBSwk variants. Lodgepole pine - black spruce - white spruce forests dominate the landscape. The BWBSwk3 will not be discussed further in this text.

This variant provides summer habitat for black bear and, to a lesser extent, moose. It is used year-round by spruce grouse and blue grouse.
4 THE BWBSmw1 VARIANT

Soil Nutrient Regime

<table>
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<tr>
<th></th>
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<tr>
<td>7</td>
<td>subhydric</td>
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<td>07</td>
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</table>

Soil Moisture Regime

1. xeric
2. subxeric
3. submesic
4. mesic
5. subhygric
6. hygric
7. subhydric

Site Series

01 SwAt - Step moss
02 Pl - Lingonberry - Velvet-leaved blueberry
03 Sw - Wildrye - Peavine
04 Sb - Lingonberry - Coltsfoot
05 Sw - Currant - Oak fern
06 Sw - Currant - Bluebells
07 Sw - Currant - Horsetail
08 Sb - Labrador tea - Sphagnum

FIGURE 2. Edatopic grid displaying site series in the BWBSmw1 variant.
SIMPLIFIED KEY TO ECOSYSTEM UNITS OF BWBSmw1

1a Canopy dominated by black spruce or by a combination of black spruce and lodgepole pine; sites usually level

2a Canopy dominated by black spruce, lodgepole pine rare or absent, tamarack occasionally present; Equisetum spp. (p. 24)⁶ commonly present and often abundant; soils organic or fluvial

2b Canopy a combination of lodgepole pine and black spruce; Equisetum spp. usually very low cover (<1%) or absent; soils morainal or (glacio)fluvial

1b Canopy dominated by lodgepole pine or white spruce, black spruce minor or absent

3a Canopy dominated by white spruce or trembling aspen–white spruce, lodgepole pine rare or absent

4a Canopy often a mixture of lodgepole pine and white spruce or trembling aspen and white spruce; Gymnocarpium dryopteris (p. 26), Delphinium glaucum (tall larkspur) and/or Equisetum spp. (p. 24) usually absent

4b Canopy white spruce or a mixture of white spruce and balsam poplar; Gymnocarpium dryopteris, Delphinium glaucum or Equisetum spp. present

5a Sites usually level; Equisetum spp. (p. 24) abundant (usually >20%)

5b Site position variable, but usually not level; Equisetum spp. low cover (<1%) or absent

6a Aspect usually northerly; Sorbus scopulina (western mountain–ash) usually present, Gymnocarpium dryopteris moderate to high cover (usually >10%)

6b Aspect generally not northerly; Sorbus scopulina and Gymnocarpium dryopteris low cover (4% each) or absent

⁶ Page numbers refer to the publication "Some Common Plants of the Sub-Boreal Spruce Zone" (Pojar et al. 1982).
3b Canopy dominated by lodgepole pine or a combination of lodgepole pine and white spruce

7a Canopy usually pure lodgepole pine, white spruce absent; mid to upper slope; moss layer primarily Cladina spp. (p. 55)  

7b Canopy usually a combination of lodgepole pine and white spruce; slope position variable; moss layer primarily Hylocomium splendens (p. 60) and pleurozium schreberi (p. 61)

8a Generally mid to upper slope or if not then soils coarse; Elymus innovatus (fuzzy-spiked wildrye) usually present, if not then shrub and herb layer poorly developed; often on south- or west-facing aspects  

8b Slope position variable; Elymus innovatus low cover (<1%) or absent, shrub and herb layer well developed; aspect variable
**SwAt - STEP MOSS**

**VEGETATION**

Tree Layer: 40% cover
- White spruce, trembling aspen, lodgepole pine, balsam poplar

Shrub Layer: 25% cover
- *Rosa acicularis* (prickly rose)
- *Viburnum edule* (highbush cranberry)

Herb layer: 55% cover
- *Cornus canadensis* (bunchberry)
- *Linnaea borealis* (twining)
- *Rubus pubescens* (trailing raspberry)
- *Mertensia paniculata* (tall bluebells)
- *Petasites palmatas* (palmate coltsfoot)
- *Pyrola asarifolia* (pink wintergreen)
- *Orthilia secunda* (one-sided wintergreen)
- *Epilobium angustifolium* (fireweed)
- *Lathyrus ochroleucus* (creamy peavine)
- *Mitella nuda* (common mitrewort)
- *Arnica cordifolia* (heart-leaved arnica)
- *Elymus innovatus* (fuzzy-spiked wildrye)

Moss Layer: 55% cover
- *Hylocomium splendens* (step moss)
- *Pleurozium schreberi* (red-stemmed feathermoss)
- *Ptilium crista-castrensis* (knight's plume)

**SOIL AND SITE**

- Moisture Regime: (submesic) - mesic
- Nutrient Regime: poor - rich
- Slope Gradient (%): 0-65 (usually less than 20)
- Slope Position: upper - lower
- Parent Material: (glacio)fluvial, morainal occ. lacustrine
- Soil Texture: moderately fine to coarse
- Coarse Fragments (%): 0-65 (usually less than 20)
- Site Index (m @ 100yrs): PI 24 (18-29), SW 25 (18-32)

**DISTRIBUTION:** very common
SWAT - STEPMOSS (BWBSmw1/01)

INTERPRETATIONS

Logging:
- clearcut
- trafficability may be a problem in spring or after a long duration of rain in summer

Site preparation:
   Objective
   - reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature
   Mechanical
   - patch scarify; plow; winter ripper plow
   Prescribed fire
   - pile and burn

Species choice:
   Preferred
   - Sw, Pl
   Acceptable
   - At

Brush hazard:
- very high (trembling aspen, bluejoint, fireweed)
- brush competition will require post-planting inspections of harvested sites; these inspections may indicate the need to control vegetation competition

Reforestation:
- if stand has a large component of lodgepole pine and cone survey indicates adequate seed, natural stocking may be achievable
- to achieve natural stocking, humus depth must be reduced and seed dispersed

Concerns:
- windthrow
- root rot (if managing for Sw)
- compaction
- drought
- increasing soil temperature may be as important as reducing vegetation competition for improving seedling performance
- herbicide use to control brush competition may conflict with wildlife needs
PI - LINGONBERRY - VELVET-LEAVED BLUEBERRY

VEGETATION

Tree Layer: 30% cover
Lodgepole pine, white spruce

Shrub Layer: 30% cover
Spiraea betulifolia (birch-leaved spirea)
Vaccinium myrtilloides (velvet-leaved blueberry)
white spruce
lodgepole pine

Herb Layer: 55% cover
Arctostaphylos uva-ursi (kinnikinnick)
Geocaulon lividum (bastard toadflax)
Elymus innovatus (fuzzy-spiked wildrye)
Lathyrus ochroleucus (creamy peavine)
Maianthemum canadense (wild lily-of-the-valley)
Fragaria virginiana (wild strawberry)
Orvzopsis pungens (short-awned ricegrass)
Pyrola chlorantha (green wintergreen)
Orthilia (one-sided wintergreen)
[Vaccinium vitis-idaea (lingonberry)]

Moss Layer: 65% cover
Cladina spp. (step moss)
Hylocomium splendens (red-stemmed feathermoss)
Pleurozium schreberi (juniper haircap moss)
Polytrichum juniperinum

SOIL AND SITE

Moisture Regime: subxeric
Nutrient Regime: poor - (medium)
Slope Gradient (%): 0-40
* Slope Position: upper to crest or level
Parent Material: usually (glacio)fluvial
* Soil Texture: medium to coarse
Coarse Fragments (%): 0-30
Site Index (m @ 100 yr): PI 20

DISTRIBUTION: uncommon
PL - LINGONBERRY - VELVET-LEAVED BLUEBERRY (BWBSmw1/02)

INTERPRETATIONS

Logging:
- clearcut
- full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if you are managing for naturals

Site preparation:
Objective - enhance natural regeneration; improve moisture status; reduce debris; improve planter access; protect thin humus forms

Mechanical - light drag scarify*; disc trench; mix humus with mineral soil

Prescribed fire - do not burn

Species choice:
Preferred - PL
Acceptable

Brush hazard: - low

Reforestation: - conduct a PL cone survey to determine seed adequacy for establishing a natural PL stand. If cones are insufficient, plant PL stock.

Concerns:
- drought
- mistletoe
- the humus forms on these sites are thin and removal of any portion of the humus layer may seriously affect site productivity
- because of the low productivity of these sites, large silviculture expenditures may be difficult to justify, and management must ensure that productivity is not further reduced
**Vegetation**

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

**Shrub Layer:** 25% cover  
- *Rosa acicularis* (prickly rose)  
- *Viburnum edule* (highbush-cranberry)  
- *Shepherdia canadensis* (soopollie)  
- *Spiraea betulifolia* (birch-leaved spirea)  
- Trembling aspen

**Herb Layer:** 50% cover  
- *Linnaea borealis* (twinflower)  
- *Elymus innovatus* (fuzzy-spiked wildrye)  
- *Cornus canadensis* (bunchberry)  
- *Epilobium angustifolium* (fireweed)  
- *Rubus pubescens* (trailing raspberry)  
- *Lathyrus ochroleucus* (creamy peavine)  
- *Arnica cordifolia* (heart-leaved arnica)  
- *Orthilia secunda* (one-sided wintergreen)  
- *Petasites palmaris* (palmate coltsfoot)  
- *Pyrola asarifolia* (rosy wintergreen)  
- *Mertensia paniculata* (tall bluebells)  
- *Aster conspicuus* (showy aster)  
- *Maianthemum canadense* (false lily-of-the-valley)

**Moss Layer:** 75% cover  
- *Hylocomium splendens* (step moss)  
- *Pleurozium schreberi* (red-stemmed feathermoss)  
- *Ptilium crista-castrensis* (knight’s plume)

**Soil and Site**

- Moisture Regime: submesic - (mesic)  
- Nutrient Regime: poor - medium  
- Slope Gradient (%): 0-60  
- Slope Position: variable  
- Parent Material: variable, often (glacio)fluvial  
- Soil Texture: medium to coarse  
- Coarse Fragments (%): 0-80  
- Site Index (m @ 100yrs): PI 24 (22-30)  
- Sw 24 (20-32)

**Distribution:** uncommon
Logging:  - clearcut
        - full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals

Site preparation:
Objective  - enhance natural regeneration; improve moisture status; reduce debris; improve planter access; protect thin humus forms

Mechanical  - light drag scarify; disc trench; mix humus with mineral soil

Prescribed fire  - do not burn

Species choice:
Preferred  - Pl
Acceptable

Brush hazard:  - low

Reforestation:  - conduct a Pl cone survey to determine seed adequacy for establishing a natural Pl stand. If cones are insufficient, plant Pl stock.

Concerns:  - drought
        - the humus forms on these sites are often thin and removal of any portion of the humus layer may seriously affect site productivity
**VEGETATION**

**Tree Layer:** 35% cover
- Lodgepole pine, (black spruce)

**Shrub Layer:** 40% cover
- *Rosa acicularis* (prickly rose)
- *Ledum groenlandicum* (Labrador tea)
- *Viburnum edule* (highbush-cranberry)
- *black spruce*

**Herb Layer:** 35% cover
- *Cornus canadensis* (bunchberry)
- *Linnaea borealis* (twiningflower)
- *Vaccinium vitis-idaea* (lingonberry)
- *Epilobium angustifolium* (fireweed)
- *Petasites palmatus* (palmate coltsfoot)
- *Vaccinium caespitosum* (dwarf blueberry)

**Moss Layer:** 75% cover
- *Pleurozium schreberi* (red-stemmed feathermoss)
- *Hylocomium splendens* (step moss)
- *Peltigera aphthosa* (knight’s plume)
- *Ptilium crista-castrensis* (knight’s plume)

**SOIL AND SITE**

- **Moisture Regime:** submesic - subhygric
- **Nutrient Regime:** (very poor - ) medium
- **Slope Gradient (%):** 0-10
- **Aspect:** usually north-facing if sloping
  - usually level
- **Slope Position:**
- **Parent Material:** morainal, lacustrine or (glacio)fluvial
- **Soil Texture:** fine to coarse
- **Coarse Fragments (%):** 0-70
- **Site Index (m @ 100yrs):** PI 20 (13-27) Sw 20 (13-28)

**DISTRIBUTION:** common
SB - LINGONBERRY - COLTSFOOT (BWBS1/04)

INTERPRETATIONS

Logging:
- clearcut
- full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals
- trafficability will be a problem on these sites during the spring and after precipitation events in the summer

Site preparation:
- Objective: enhance natural regeneration; improve moisture status; reduce debris; improve planter access; increase soil temperatures; protect thin humus forms
- Mechanical: light drag scarify; mix humus with mineral soil
- Prescribed fire: do not burn

Species choice:
- Preferred: PI
- Acceptable: 

Brush hazard: low

Reforestation:
- conduct a PI cone survey to determine seed adequacy for establishing a natural PI stand. If cones are insufficient, plant PI stock.
- natural stocking could take up to 5 years

Concerns:
- drought
- compaction
- high water table in spring
- the humus forms on these sites are often thin and removal of any portion of the humus layer may seriously affect site productivity
- because of the low productivity of most of these sites large silviculture expenditures may be difficult to justify, and management must ensure that productivity is not further reduced
**VEGETATION**

Tree Layer: 30% cover
White spruce

Shrub Layer: 40% cover
- *Viburnum edule* (highbush cranberry)
- *Sorbus scopulina* (western mountain-ash)
- *Rosa acicularis* (prickly rose)
- *Lonicera involucrata* (black twinberry)
- *Ribes lacustre* (black gooseberry)
- *Alnus viridis* ssp. *sinuata* (Sitka alder)
- *Oplopanax horridus* (devil’s club)
- *Ribes triste* (red swamp currant)

Herb Layer: 60% cover
- *Cornus canadensis* (bunchberry)
- *Gymnocarpium dryopteris* (oak fern)
- *Mitella nuda* (common mitrewort)
- *Linnaea borealis* (twinflower)
- *Smilacina racemosa* (false Solomon's-seal)
- *Rubus pubescens* (trailing raspberry)
- *Petasites palmatus* (palmete coltsfoot)
- *Osmorhiza chilensis* (sweet-cicely)
- *Galium triflorum* (sweet-scented bedstraw)
- *Calamagrostis canadensis* (bluejoint)

Moss Layer: 55% cover
- *Hylocomium splendens* (step moss)
- *Pleurozium schreberi* (red-stemmed feathermoss)

**SOIL AND SITE**

Moisture Regime: (mesic) - subhygric
Nutrient Regime: (medium) - rich
Slope Gradient (%): 3-25
*S* Slope Position: mid - lower
Parent Material: variable
* Soil Texture: medium to fine
Coarse Fragments (%): 10-22
Site Index: Sx 29 (28-30)

**COMMENTS:** These sites can have a moderate to high cover of *Oplopanax horridus* (devil’s club).

**DISTRIBUTION:** uncommon
Logging:
- clearcut
- trafficability may be a problem if long durations of rainfall occur

Site preparation:
Objective
- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature

Mechanical
- patch scarify; mound; plow; winter ripper plow

Prescribed fire
- pile and burn; broadcast burn*

Species choice:
Preferred
- Sw
Acceptable
- Pl

Brush hazard:
- very high (black twinberry, fireweed)
- brush competition will require post-planting inspections of harvested sites to determine the need for vegetation control

Reforestation:
- use large planting stock

Concerns:
- windthrow
- root rot (if managing for Sw)
- compaction
- herbicide use to control brush competition may conflict with wildlife needs
**BWBSmw1/06**

**Sw - Currant - Bluebells**

**Vegetation**

**Tree Layer:** 35% cover
- White spruce

**Shrub Layer:** 50% cover
- *Viburnum edule* (highbush-cranberry)
- *Rosa acicularis* (prickly rose)
- *Ribes triste* (red swamp currant)
- *Lonicera involucrata* (black twinberry)
- *Ribes oxyacanthoides* (northern gooseberry)
- *Ribes lacustre* (black gooseberry)
- *Cornus sericea* (red-osier dogwood)
- Trembling aspen
- White spruce

**Herb Layer:** 60% cover
- *Cornus canadensis* (bunchberry)
- *Epilobium angustifolium* (fireweed)
- *Linnaea borealis* (twinfower)
- *Rubus pubescens* (trailing raspberry)
- *Mertensia paniculata* (tall bluebells)
- *Petasites palma* (palme coltsfoot)
- *Mitella nuda* (common mitrewort)
- *Lathyrus ochroleucus* (creamy peavine)
- *Pyrola asarifolia* (bluejoint)
- *Calamagrostis canadensis* (pink wintergreen)
- *Pyrola chlorantha* (green wintergreen)
- *Orthilia secunda* (one-sided wintergreen)
- *Viola spp.* (violets)
- *Galium triflorum* (sweet-scented bedstraw)

**Moss Layer:** 55% 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:** (mesic) - subhygric
- **Nutrient Regime:** (medium) - rich
- **Slope Gradient (%):** 0-35
- **Slope Position:** upper to lower or level
- **Parent Material:** variable
- **Soil Texture:** medium to fine
- **Coarse Fragments (%):** 0-40
- **Seepage Water:** often present
- **Site Index (m @ 100yrs):**
  - SW 28 (21-36)
  - PL 24 (18-28)

**Distribution:** common
SW - CURRANT - BLUEBELLS  (BWBSmw1/06)

INTERPRETATIONS

Logging:
- clearcut
- trafficability may be a problem after heavy rainfall

Site preparation:
Objective - reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature

Mechanical - patch scarify; mound; plow*; winter ripper plow

Prescribed fire - pile and burn

Species choice:
Preferred - Sw
Acceptable - Pl

Brush hazard:
- extreme (bluejoint, trembling aspen, fireweed)
- brush competition will require post-planting inspections of harvested sites to determine the need for vegetation control

Reforestation:
- use large planting stock

Concerns:
- windthrow
- root rot (if managing for Sw)
- compaction
- herbicide use to control brush competition may conflict with wildlife needs
Sw - CURRANT - HORSE TAIL

VEGETATION

Tree Layer: 40% cover
White spruce

Shrub Layer: 30% cover
Rosa acicularis (prickly rose)
Ribes triste (red swamp currant)
Ribes lacustre (black gooseberry)
Ribes triste (red-osier dogwood)

Viburnum edule (highbush-cranberry)
Lonicera involucrata (black twinberry)
Lonicera involucrata (red swamp currant)
Viburnum edule (black gooseberry)
Lonicera involucrata (red-osier dogwood)

Herb Layer: 65% cover
Equisetum spp. (horsetails)
Mertensia paniculata (tall bluebells)
Petasites palmatus (palmeate coltsfoot)
Linnaea borealis (twinflower)
Rubus pubescens (trailing raspberry)
Cornus canadensis (bunchberry)
Mitella nuda (common mitrewort)

Ribes triste (red-osier dogwood)
Rosa acicularis (prickly rose)

Moss Layer: 60% cover
Hylocomium splendens (step moss)
Pleurozium schreberi (red-stemmed feathermoss)
Ptilium crista-castrensis (knight's plume)

SOIL AND SITE

Moisture Regime: (subhygric) - hygric
Nutrient Regime: medium - rich
* Slope Gradient (%): 0-36; usually less than 5
* Slope Position: usually level (mid - lower)
* Parent Material: lacustrine, fluvial
  Soil Texture: moderately coarse to fine
  Coarse Fragments (%): 0-20 (usually 0)
  Site Index (m @ 100yrs): Sw 24 (21-33)

DISTRIBUTION: uncommon
SW-CURRANT-HORSETAIL  (SWBSmw1/07)

INTERPRETATIONS

Logging:
- clearcut
- trafficability will be a problem when ground not frozen

Site preparation:
Objective
- reduce debris; prepare raised planting spots; minimize future brush competition; improve planter access; increase soil temperature

Mechanical
- mound*

Prescribed fire
- broadcast burn

Species choice:
Preferred
- Sw

Acceptable
- Sw

Brush hazard:
- high (bluejoint, willows, balsam poplar)
- brush competition will require post-planting inspections of harvested sites to determine the need for vegetation control

Reforestation:
- plant after water table drops below ground level and plant on drier microsites
- use large planting stock

Concerns:
- root rot
- compaction
- this association is critical to the control of runoff and stream flow
- windthrow hazard is extreme
- water table will likely rise above the ground surface in the spring, causing seedling mortality
- herbicide use to control brush competition may conflict with wildlife needs
VEGETATION

Tree Layer: 25% cover
- Black spruce

Shrub Layer: 50% cover
- Ledum groenlandicum (Labrador tea)
- Salix spp. (willows)
- Rosa acicularis (prickly rose)
- Viburnum edule (highbush-cranberry)

Herb Layer: 60% cover
- Equisetum scirpoides (dwarf scouring-rush)
- Petasites palmatus (palmate coltsfoot)
- Vaccinium vitis-idaea (lingonberry)
- Mitella nuda (common mitrewort)
- Equisetum sylvaticum (wood horsetail)
- Mitella nuda (common mitrewort)
- Moneses uniflora (single delight)
- Equisetum arvense (common horsetail)
- Cornus canadensis (bunchberry)
- Rubus pubescens (trailing raspberry)

Moss Layer: 90% cover
- Hylocomium splendens (step moss)
- Pleurozium schreberi (red-stemmed feathermoss)
- Aulacomnium palustre (glow moss)
- Ptilium crista-castrensis (knight’s plume)
- Sphagnum spp. (sphagnum mosses)
- Peltigera aphthosa

SOIL AND SITE

- Moisture Regime: hygric - subhydric
- Nutrient Regime: very poor - poor
- Slope Gradient (%): 0-12 (usually 0)
- Slope Position: variable, often depression
- Parent Material: organic or fluvial
- Soil Texture: mesic, fibric if organic; medium if fluvial
- Coarse Fragments (%): 0-4; usually 0
- Site Index (m @ 100yrs): Sw 20 (17-23)
- Lt 17

DISTRIBUTION: common
SB - LABRADOR TEA - SPHAGNUM (BWBSmw1/08)

INTERPRETATIONS

Management objectives: - non-commercial at this time
FIGURE 3. Edatopic grid displaying site series in the BWBSmw2 variant.
SIMPLIFIED KEY TO ECOSYSTEM UNITS OF BWBSmw2

1a Site occurs on level to gently sloping river terraces
   2a Canopy dominated by white spruce
   2b Canopy dominated by balsam poplar

1b Site occurs on level to moderately sloping uplands, or on level to depressional wetlands
   3a Site occurs on level to moderately sloping uplands
      4a Canopy dominated by white spruce and/or trembling aspen; soils moderately fine textured
         5a White spruce dominant
         5b Trembling aspen dominant
      4b Canopy dominated by lodgepole pine, or by black spruce and lodgepole pine; soils variable
         6a Canopy dominated by lodgepole pine
            7a High cover (>15%) of lichens; soils coarse textured
            7b Low to moderate cover (<15%) of lichens; soils variable
               8a Black spruce very rare or absent in the canopy and in regeneration; Lycopodium annotinum (p. 28) moderate cover (>7%)
               8b Black spruce present in canopy and the dominant regeneration; Lycopodium annotinum very low cover (<1%) or absent

7 Page numbers refer to the publication "Some Common Plants of the Sub-Boreal Spruce Zone" (Pojar et al. 1982).
6b Canopy dominated by black spruce and lodgepole pine.

9a *Equisetum* spp. high cover (>10) (p. 24) BWBSmw2/06

9b *Equisetum* spp. low cover (<1%) or absent BWBSmw2/03

3b Site occurs on level to depressional wetlands

10a Canopy dominated by black spruce

11a Shrub layer dominated by *Ledum groenlandicum* (p. 9); moss layer dominated by *Sphagnum fuscum* (a sphagnum moss) BWBSmw2/08

11b Shrub layer dominated by *Salix* spp. (p. 12); moss layer dominated by *Aulacomnium palustre* (p. 58) BWBSmw2/09

10b Canopy dominated by tamarack

12a Shrub layer not dominated by *Betula glandulosa* (p. 8); moderate to high cover (>10%) of horsetails BWBSmw2/07

12b Shrub layer dominated by *Betula glandulosa*; horsetails very low cover (<1%) or absent BWBSmw2/10
VEGETATION

Tree Layer: 70% cover
- White spruce, trembling aspen, black spruce

Shrub Layer: 20% cover
- Viburnum edule (highbush-cranberry)
- Rosa acicularis (prickly rose)
- white spruce

Herb Layer: 20% cover
- Linnaea borealis (twinflower)
- Cornus canadensis (bunchberry)
- Rubus pubescens (trailing raspberry)
- Orthila secunda (one-sided wintergreen)
- Mertensia paniculata (tall bluebells)
- Mitella nuda (common mitrewort)
- Viola renifolia (kidney-leaved violet)
- Vaccinium vitis-idaea (lingonberry)

Moss Layer: 60% cover
- Hylocomium splendens (step moss)
- Ptilium crista-castrensis (knight's plume)
- Pleurozium schreberi (red-stemmed feathermoss)

SOIL AND SITE

- Moisture Regime: (submesic) - mesic
- Nutrient Regime: poor - rich
- * Slope Gradient (%): 0-22
- * Slope Position: level, upper to mid
- Parent Material: morainal, glaciofluvial, lacustrine
- * Soil Texture: moderately fine
- Coarse Fragments: few
- Site Index (m @ 100yrs): SW 22 (21-27)
- Pl 20

DISTRIBUTION: very common
Logging:  - clearcut

Site preparation:

Objective  - reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature

Mechanical  - patch scarify; plow; winter ripper plow; windrow and burn

Prescribed fire  - broadcast burn

Species choice:

Preferred  - Sw
Acceptable  - Pl, At

Brush hazard:

- high (bluejoint, willow, alder, fireweed, trembling aspen if managing for spruce)
- brush competition will require post-planting inspections of harvested sites to determine the need for vegetation control
- large vigorous stock should be planted as soon as possible after site preparation
- hack and squirt aspen 2 years prior to harvest
- if birch is present remove to reduce seeding in potential
- 3 m knockdown of all residuals to facilitate an aerial brushing and weeding program
- removal of duff layer down to mineral soil during site preparation will accelerate the invasion of bluejoint (Calamagrostis canadensis) unless the duff and soil layers are turned over (e.g., mounding or plowing)

Reforestation:

Concerns:  - frost heaving
- drought (from drying duff layer)
- compaction
- erosion
**VEGETATION**

**Tree Layer:** 60% cover  
Trembling aspen, (white spruce)

**Shrub Layer:** 75% cover  
Viburnum edule  
Rosa acicularis  
Alnus viridis spp. fruiticosa  
Salix bebbiana  
Ribes oxyacanthoides  
Cornus sericea  
Lonicera dioica  
Amelanchier alnifolia  
white spruce

**Herb Layer:** 40% cover  
Linnaea borealis  
Cornus canadensis  
Rubus pubescens  
Aralia nudicaulis  
Lathyrus ochroleucus  
Orthilia secunda  
Mertensia paniculata  
Mitella nuda  
Maianthemum canadense  
Galium boreale  
Pyrola asarifolia  
Viola renifolia  
Epilobium angustifolium

**Moss Layer:** 40% cover  
Hylocomium splendens  
Ptilium crista-castrensis  
Eurhynchium pulchellum

**SOIL AND SITE**

Moisture Regime: (submesic -) mesic  
Nutrient Regime: poor - rich  
* Slope Gradient (%): 0-22  
* Slope Position: level upper to mid  
Parent Material: morainal, glaciofluvial, lacustrine  
* Soil Texture: moderately fine  
Coarse Fragments: few

**DISTRIBUTION:** very common
Logging:  - clearcut aspen stands that have less than 900 stems/ha spruce
  - avoid logging stands that have between 900-1050 stems/ha spruce
  - protect spruce regeneration in stands that have more than 1050 stems/ha

Site preparation:
  Objective
  - as 01 if you are managing for planted spruce
  - stimulate aspen suckering if managing for aspen

  Prescribed fire
  - broadcast burn

Species choice:
  Preferred
  - Sw, At

  Acceptable
  - Pl

Brush hazard:
  - high (bluejoint, alder, fireweed and willow)
  - no site preparation is necessary if you are managing site for aspen, but broadcast burning will enhance stocking
  - identify dense patches of Sw and skid around them when logging
  - a sanitation spacing may be required at some point in the future if advanced Sw regeneration has been protected
  - protecting advance Sw regeneration will be difficult and may require modified harvesting techniques using smaller more manoeuvrable equipment, and designated rather than random skid trails
  - conifer release in naturally occurring stands of At with an Sw understory should be reassessed based on the potential value of the At

Reforestation:

Concerns:
  - maintenance of Sw understory
  - frost heaving
  - drought
  - compaction
  - heavy aspen slash load
**P1 - LINGONBERRY - VELVET-LEAVED BLUEBERRY**

**VEGETATION**

Tree Layer: 40% cover
- Lodgepole pine, trembling aspen, black spruce, (white spruce, jack pine)

Shrub Layer: 30% cover
- *Rosa acicularis* (prickly rose)
- *Ledum groenlandicum* (Labrador tea)
- *Shepherdia canadensis* (soopolallie)
- *Alnus viridis ssp. fruticosa* (green alder)
- *Viburnum edule* (highbush-cranberry)
- *Vaccinium myrtilloides* (velvet-leaved blueberry)
- Black spruce
- White spruce

Lodgepole pine

Herb Layer: 50% cover
- *Vaccinium vitis-idaea* (lingonberry)
- *Arctostaphylos uva-ursi* (kinnikinnick)
- *Linnaea borealis* (twinflower)
- *Cornus canadensis* (bunchberry)
- *Epilobium angustifolium* (fireweed)
- *Pyrola asarifolia* (lingonberry)
- *Pyrola chlorantha* (black spruce)
- *Vaccinium myrtilloides* (velvet-leaved blueberry)

Moss Layer: 50% cover
- *Cladina spp.*
- *Pleurozium schreberi* (red-stemmed feathermoss)
- *Hylocomium splendens* (step moss)
- *Cladonia spp.*
- *Peltigera spp.* (stem moss)

**SOIL AND SITE**

- Moisture Regime: xeric - subxeric
- Nutrient Regime: very poor - poor
- Slope Gradient (%): 0
- Slope Position: crest
- Parent Material: fluvial, eolian
- Soil Texture: moderately coarse - coarse

**DISTRIBUTION:** rare
Management objectives: - non-commercial at this time
**LB • LINGONBERRY • KNIGHT’S PLUME**

**VEGETATION**

**Tree Layer:** 40% cover
- Lodgepole pine, trembling aspen, (white spruce)

**Shrub Layer:** 50% cover
- **Ledum groenlandicum** (Labrador tea)
- Viburnum edule (highbush-cranberry)
- Rosa acicularis (prickly rose)
- Salix bebbiana (Bebb's willow)
- Salix scouleriana (Scouler's willow)
- Shepherdia canadensis (soopolallie)
- Trembling aspen
- White spruce
- Black spruce

**L. groenlandicum** Herb Layer: 60% cover
- Cornus canadensis (bunchberry)
- Vaccinium vitis-idaea (lingonberry)
- Epilobium angustifolium (fireweed)
- Lycopodium annotinum (stiff clubmoss)
- Elymus innovatus (fuzzy-spiked wildrye)
- Linnaea borealis (twinflower)
- Lathyrus ochroleucus (creamy peavine)
- Orthilia secunda (one-sided wintergreen)
- Maianthemum canadensis (false lily-of-the-valley)
- Equisetum sylvaticum (wood horsetail)
- Equisetum arvense (common horsetail)
- Lycopodium complanatum (ground cedar)
- Pyrola asarifolia (pink wintergreen)

**V. edule** Moss Layer: 70% cover
- Hylocomium splendens (step moss)
- Pleurozium schreberi (red-stemmed feathermoss)

**SOIL AND SITE**

- **Moisture Regime:** submesic
- **Nutrient Regime:** poor - medium
- **Slope Gradient (%):** 0-5
- **Slope Position:** crest to upper, level
- **Parent Material:** morainal, (eolian)
- **Soil Texture:** fine - moderately fine
- **Site Index (m @ 100 yr):** PI 17 (15-22)

**DISTRIBUTION:** uncommon

**V. vitis-idaea**
Logging:
- clearcut
- trafficability will be a problem on these sites after snowmelt or heavy rains
- full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if you are managing for naturals

Site preparation:
Objective - enhance natural regeneration; improve moisture status; reduce debris; improve planter access; increase soil temperatures; protect thin humus forms
Mechanical - light drag scarify; mix humus with mineral soil
Prescribed fire - do not burn

Species choice:
Preferred - PI
Acceptable

Brush hazard: - low

Reforestation: - conduct a PI cone survey to determine potential seed supply. If cones are insufficient, plant PI stock.

Concerns: - drought
- compaction
- high water table in spring
- the humus forms on these sites are often thin and removal of any portion of the humus layer may seriously affect site productivity
- because of the low productivity of these sites, large silviculture expenditures may be difficult to justify, and management must ensure that productivity is not further reduced
**Sb - LINGONBERRY - COLTSFOOT**

**VEGETATION**

Tree Layer: 65% cover  
Black spruce, lodgepole pine

Shrub Layer: 8% cover  
*Ledum groenlandicum* (Labrador tea)  
*black spruce*

Herb Layer: 15% cover  
*Cornus canadensis* (bunchberry)  
*Vaccinium vitis-idaea* (lingonberry)

Moss Layer: 75% cover  
*Pleurozium schreberi* (red-stemmed feathermoss)  
*Hylocomium splendens* (step moss)  
*Ptilium crista-castrensis* (knight’s plume)  
*Peltigera aphthosa*

**SOIL AND SITE**

Moisture Regime: submesic - subhygric  
Nutrient Regime: very poor - medium  
* Slope Gradient (%): 0-12  
* Slope Position: lower, toe  
Parent Material: morainal, glaciofluvial, lacustrine  
Soil Texture: variable  

DISTRIBUTION: very common
Management objectives: - non-commercial at this time
**Sw - CURRANT-HORSETAIL**

**VEGETATION**

**Tree Layer:** 45% cover
- White spruce, paper birch

**Shrub Layer:** 35% cover
- *Rosa acicularis* (prickly rose)
- *Viburnum edule* (highbush-cranberry)
- *Alnus incana ssp. tenuifolia* (mountain alder)
- *Ribes oxycanthoides* (northern gooseberry)
- *Cornus sericea* (red-osier dogwood)
- *Rubus pubescens* (red swamp currant)

**Herb Layer:** 70% cover
- *Cornus canadensis* (bunchberry)
- *Mitella nuda* (common mitrewort)
- *Goodyera repens* (dwarf rattlesnake orchid)
- *Equisetum pratense* (meadow horsetail)
- *Equisetum scirpoides* (dwarf scouring-rush)
- *Rubus pubescens* (trailing raspberry)
- *Pyrola asarifolia* (pink wintergreen)
- *Linnaea borealis* (twinflower)
- *Mertensia paniculata* (tall bluebells)
- *Viola renifolia* (kidney-leaved violet)
- *Galium triflorum* (sweet-scented bedstraw)
- *Calamagrostis canadensis* (bluejoint)

**Moss Layer:** 3-75% cover (depending on time since last flood)
- *Hylocomium splendens* (step moss)
- *Ptilium crista-castrensis* (knight’s plume)

**SOIL AND SITE**

- **Moisture Regime:** subhygric
- **Nutrient Regime:** medium - rich
- **Slope Gradient (%):** 1-2
- **Slope Position:** upper terrace (level)
- **Parent Material:** fluvial
- **Soil Texture:** moderately fine to moderately coarse
- **Site Index (m @ 100 yr):** Sw 22

**DISTRIBUTION:** common along major rivers
Logging: - clearcut
  - hardwood removal should be considered to facilitate chemical brushing and weeding

Site preparation:

Objective  Sw - reduce debris; prepare (elevated) planting spots; minimize future brush competition; improve planter access; mix humus and mineral soil; increase soil temperature
  Ac - prepare seedbed by exposing mineral soil

Mechanical  Sw - mound; plow; winter ripper plow
  Ac - scarify

Prescribed fire - broadcast burn

Species choice:

Preferred - Sw
Acceptable - Ac

Reforestation:

- terrace 1 - manage for Ac or hybrid poplar (trial basis)
- terraces 2 & 3 - plant Sw
- erosion of terraces 2 & 3 by the river may remove any planted Sw before it reaches merchantable size; extent of erosion should be predicted and planting boundaries adjusted accordingly
- natural Sw regeneration can be expected if there has been recent flooding
- raw plant Sw if duff depth is less than 10 cm, as roots will be in contact with moist, well-decomposed H material; otherwise prepare site
- plant on elevated microsites

Brush hazard:

- high (speckled alder, prickly rose, highbush cranberry, bluejoint, balsam poplar, paper birch); a conifer release program will probably be required

Concerns:

- flooding
- erosion
- windthrow on block edge
$Ac•ALDER•HORSETAIL$

VEGETATION

Tree Layer: 75% cover
Balsam poplar, white spruce

Shrub Layer: 50% cover
- Cornus sericea (red-osier dogwood)
- Viburnum edule (highbush-cranberry)
- Alnus incana ssp. tenuifolia (mountain alder)
- Rosa acicularis (prickly rose)
- white spruce

Herb Layer: 10% cover
- Pyrola asarifolia (pink wintergreen)
- Equisetum pratense (meadow horsetail)
- Equisetum hyemale (scouring-rush)
- Rubus pubescens (trailing raspberry)
- Vicia americana (American vetch)

Moss Layer: usually absent

SOIL AND SITE

- Moisture Regime: subhygic - hygric
- Nutrient Regime: rich
- Slope Gradient (%): 0
- Slope Position: middle terrace (level)
- Parent Material: fluvial
- Soil Texture: medium to moderately coarse

DISTRIBUTION: this association often occupies the middle and lower terraces of major river valleys
$ AC - ALDER - HORSETAIL  (BWBSmW/05-$)

INTERPRETATIONS

Logging:
- clearcut
- there is a large Sw understory associated with this association
- a conifer release program may aid in adding increment to the Sw, but it is more likely that the site will be clearcut and merchantable Sw harvested

Site preparation:
- Objective Sw - reduce debris; prepare (elevated) planting spots; minimize future brush competition; improve planter access; mix humus and mineral soil; increase soil temperature
- Ac - prepare seedbed by exposing mineral soil

- Mechanical Sw - mound; plow; winter ripper plow
- Ac - scarify

Prescribed fire - broadcast burn

Species choice:
- Preferred - Sw, Ac
- Acceptable - Sw, Ac

Brush hazard:
- high (speckled alder, prickly rose, highbush cranberry, bluejoint, balsam poplar)

Reforestation:
- terrace 1 - manage for Ac or hybrid poplar (trial basis)
- terraces 2 & 3 - plant Sw, mixed wood management or manage for Ac
- erosion of terraces 2 & 3 by the river may remove any planted Sw before it reaches merchantable size; extent of erosion should be predicted and planting boundaries adjusted accordingly
- natural Sw regeneration can be expected if there has been recent flooding and there is an adjacent seed source
- raw plant Sw if duff depth is less than 10 cm or roots will be in contact with moist, well-decomposed H material; otherwise prepare site
- plant on elevated microsites

Concerns:
- flooding