TABLE 8. Summary of climate data for biogeoclimatic units within the guide area [a]

Climatic Characteristics		Biogeoclimatic Unit ESSFwc3	ESSFwk2	ESSFmv2	ESSFmv4
Annual Precipitation (mm)	Mean	1408.5	1537.8	780.4	N/A[b]
	Range	1177.1 - 1624.7	1190.4-1737.8	414.2 - 1259.3	N/A
Growing Season Precipitation (mm)	Mean	510.3	456.7	368.9	N/A
	Range	401.6 - 631.0	229.9 - 683.7	243.8 - 507.5	N/A
Annual Snowfall (cm)	Mean	782.1	N/A	N/A	N/A
	Range	N/A	N/A	N/A	N/A
Annual Temperature (°C)	Mean	-1.0	0.3	-0.3	N/A
	Range	-3.1- 1.1	-0.5 - 1.0	-.9-1.9	N/A
Growing Degree Days (>5C°)	Mean	671	N/A	N/A	N/A
	Range	N/A	N/A	N/A	N/A
Frost-Free Period (days)	Mean	75	N/A	N/A	N/A
	Range	N/A	N/A	N/A	N/A

[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 Victoria, B.C. Unpublished report.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] N/A: not available.

TABLE 9. Some important wildlife species that utilize ESSF variants described in the guide

Species	Occurrence in Variants			
	ESSFmv2	ESSFmv4	ESSFwk2	ESSFwc3
Mountain Goat	*	*	*	*
Rocky Mountain Bighorn Sheep [a]	*			
Stone Sheep	*	*		
Caribou [a]	*	*	*	*
Elk	*	*		
Moose	*	*	*	*
Mule Deer	*	*		
White-tailed Deer	*			
Grizzly Bear [a]	*	*	*	*
Furbearers	*	*	*	*

[a] denotes species "Blue Listed" by *Managing Wildlife to 2001: A Discussion Paper.* 1991. B.C. Wildl. Br., B.C. Min. Environ., Victoria, B.C. 152 pp. Because of major declines in their populations, they are considered sensitive and/or deserving of management attention.

4.2 Graham Moist Very Cold Engelmann Spruce - Subalpine Fir[7]

Location
The ESSFmv4 occurs predominantly east of the Rocky Mountain divide as far south as the Peace Arm of Williston Reservoir and as far north as Cypress Creek. It generally occurs between the elevations of 1000 - 1400 m, and above the SBSwk2 (MacKinnon *et al.* 1990) or BWBSwk2 (DeLong *et al.* 1990).

Elevation range
950 - 1550 m

Climate
There are no available climatic data for the ESSFmv4 variant but it likely has a similar climate to the ESSFmv2 (Section 4.1). Since it is situated north of the ESSFmv2 it is likely to be somewhat colder, especially during the winter.

Soils, geology and landforms
The bulk of this subzone is within the Muskwa Range of the Rocky Mountains and the adjacent foothills. Bedrock consists of Precambrian metamorphic and sedimentary rocks east of the Williston Reservoir, and Paleozoic limestone, sandstone, and shales farther east. Parent materials are predominantly morainal and colluvial with variable textures related to the underlying bedrock. Soil genetic types consist dominantly of Brunisols and Luvisols in the Rocky Mountain Foothills, with Podzols occurring mostly on non-calcareous parent materials in the Rocky Mountains. A small portion of this subzone lies west of the Williston Reservoir within the Butler Range of the Omineca Mountains. Colluvial and morainal materials of varying thickness cover the underlying Precambrian sedimentary bedrock. Soils include Humo-Ferric Podzols and Dystric Brunisols.

Distinguishing the ESSFmv4 from adjoining biogeoclimatic units
SBSwk2 has:
- more highbush-cranberry but less white-flowered rhododendron in the shrub layer; and
- trembling aspen and paper birch that occur occasionally in the canopy.

BWBSwk2 has:
- less subalpine fir in the canopy;
- prickly rose but no white-flowered rhododendron in the shrub layer; and
- more trailing raspberry but less five-leaved bramble in the herb layer, especially on mesic sites.

ESSFmv2 has:
- more sites dominated by devil's club and oak fern.

ESSFwk2 has:
- more oak fern and one- and three-leaved foamflower on mesic and wetter sites.

[7] Formerly ESSFn2.

Forests
Like most ESSF forests, climax forests in the ESSFmv4 are dominated by Engelmann spruce and subalpine fir. However, because fire occurs more frequently than in most of the ESSF in the region, a larger portion of the stands are dominated by lodgepole pine. Mixtures of lodgepole pine and black spruce also occur on poor sites at the lower elevational extent of this variant.

Wildlife
Steep high elevation shrub/grass habitats are used by Stone Sheep in the summer, while the more rugged sites near escape terrain are used by Mountain Goat. Avalanche tracks are important in the spring for Grizzly Bear and are also used by Mountain Goat, Caribou, Willow Ptarmigan and White-tailed Ptarmigan. Mature high elevation subalpine fir stands which contain arboreal lichen support Caribou during the winter. In summer, subalpine meadows are used by Moose, Caribou, a small number of Mule Deer, and Willow Ptarmigan. Older stands near the Peace Arm of Williston Reservoir are used by Elk in the summer. Mature coniferous forests support Wolverine, Marten, and Red Squirrel as well as Spruce Grouse, Great Gray Owl, Barred Owl, and Hawk Owl. Mixed age stands with small openings and edges support Grizzly Bear, Wolverine, Fisher and Great Homed Owl.

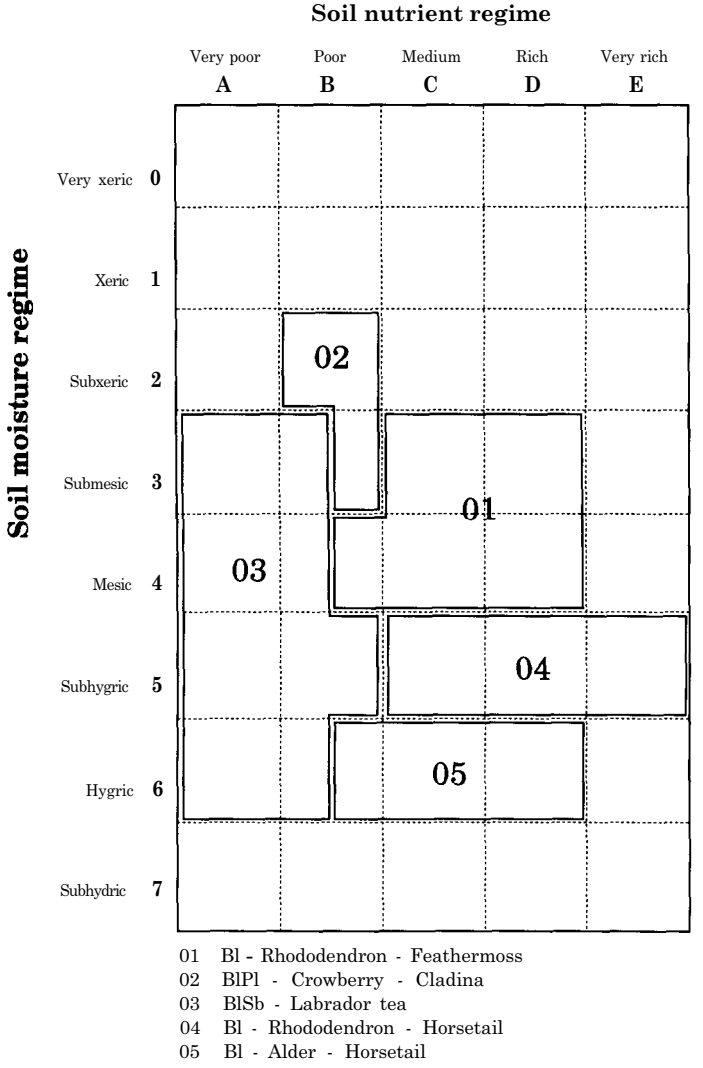


FIGURE 11. Edatopic grid displaying site series of the ESSFmv4 variant.

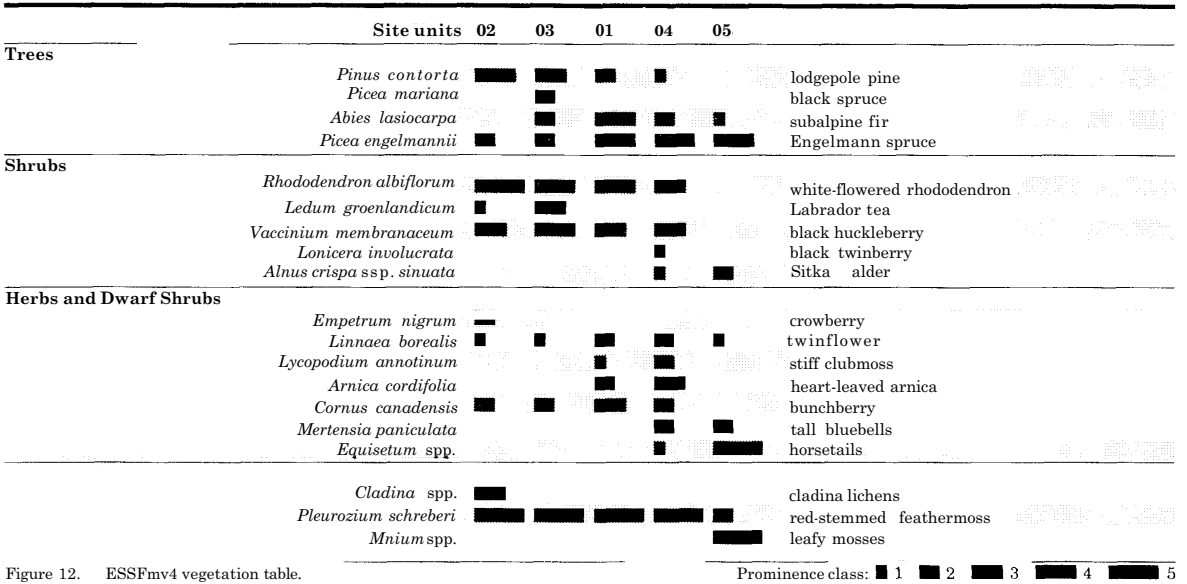


Figure 12. ESSFmv4 vegetation table.

1a Canopy dominated by lodgepole pine or a combination of black spruce and lodgepole pine.

2a Canopy dominated by a combination of black spruce and lodgepole pine; *Cladina* spp. (p. 334)[8] or *Cladonia* spp. (pp. 332-334) low cover (< 1% cover) or absent. Occurring on lower to upper slope positions.

ESSFmv4/03

2b Canopy dominated by lodgepole pine; *Cladina* or *Cladonia* spp. moderate to high cover (> 1%). Occurring on crest slope position.

ESSFmv4/02

1b Canopy dominated by Engelmann spruce or subalpine fir, black spruce and/or lodgepole pine minor or absent.

3a Generally occurring on lower to toe slopes or adjacent to open water or bogs; herb layer well developed, *Mertensia paniculata* (p. 218) or *Equisetum* spp. (p. 281-284) moderate cover (> 1% cover).

4a Occurring on level or depressional slope positions near open water or bogs; *Equisetum* spp. abundant (> 10% cover).

ESSFmv4/05

4b Generally occurring on mid to lower slope positions; *Equisetum* spp. moderate cover (> 1%) but not abundant (< 10% cover).

ESSFmv4/04

3b Generally occurring on mid to upper slopes; herb layer generally poorly developed, *Mertensia paniculata* and *Equisetum* spp. low cover (<1% cover) or absent.

ESSFmv4/01

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

ESSFmv4/01

Bl - Rhododendron - Feathermoss

Vaccinium membranaceum

Orthilia secunda

Hylocomium splendens

VEGETATION

Tree Layer: 60% cover
Engelmann spruce, subalpine fir, [lodgepole pine]

Shrub Layer: 65% cover

Vaccinium membranaceum	(black huckleberry)
Rhododendron albiflorum	(white-flowered rhododendron)
[Alnus crispa ssp. *sinuata*	(Sitka alder)]
subalpine fir	
[Engelmann spruce]	

Herb Layer: 25% cover

Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided wintergreen)
Linnaea borealis	(twinflower)
Arnica cordifolia	(heart-leaved arnica)
Lycopodium annotinum	(stiff clubmoss)
[Rubus pedatus	(five-leaved bramble)]

Moss Layer: 90% cover

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

SOIL AND SITE

Moisture Regime:	3-4(sm-m)
Nutrient Regime:	B-D (p-r)
Slope Gradient (%):	0-62
* Slope Position:	variable, often mid - upper
Parent Material:	variable, but generally morainal or colluvial
* Soil Texture:	(coarse -) medium
Coarse Fragments (%):	0-67

DISTRIBUTION: very common and widespread

B1- Rhododendron-Feathermoss (ESSFmv4/01)

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:
- see Section 5.1
- log on firm snowpack to protect advance regeneration.
- under a partial cutting system spruce regeneration requires mineral soil exposure and/or planting.
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- reduce spruce beetle hazard by avoiding high stumps and shaded slash > 15 cm diameter.

Site preparation:
- see Section 5.2

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.
- advance Bl regeneration should only be accepted if it meets size and acceptability criteria (Section 5.1).
- plant in summer with stock which has already set bud.

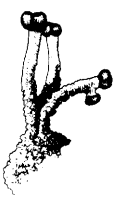
Concerns:
- site conditions may lead to frost damage of regeneration, especially in any naturally occurring or artificially created depression: ***leaving a partial canopy and/or preserving advance regeneration are advised.***
- heavy snowpack may cause stem deformity, especially on steep slopes; ***obstacle planting is advised.***
- if heavy equipment is used in summer, during or after partial cutting, every attempt should be made to avoid disturbing roots of standing trees.
- tomentosus root rot may cause low to moderate problems in mature spruce-dominated stands.
- spruce beetle may infest partial cut stands after harvesting; ***minimize blowdown and avoid mechanical damage to residuals.***

ESSFmv4/02

BlPl - Crowberry - Cladina

Rhododendron albiflorum

Empetrum nigrum



Cladonia spp.

VEGETATION

Tree Layer: 25% cover
Lodgepole pine, Engelmann spruce

Shrub Layer: 50% cover

Rhododendron albiflorum	(white-flowered rhododendron)
Vaccinium membranaceum	(black huckleberry)
Sorbus scopulina	(western mountain-ash)
Ledum groenlandicum	(Labrador tea)
subalpine fir	

Herb Layer: 10% cover

Linnaea borealis	(twinflower)
Empetrum nigrum	(crowberry)
Cornus canadensis	(bunchberry)
Calamagrostis canadensis	(bluejoint)

Moss Layer: 80% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Cladonia spp.	(cladonia lichens)
Hylocomium splendens	(step mass)
Peltigera spp.	(peltigera lichens)
Cladina spp.	(cladina lichens)

SOIL AND SITE

Moisture Regime:	2-3 (sx-sm)
Nutrient Regime:	B (p)
Slope Gradient (%):	0-19
* Slope Position:	crest - upper
Parent Material:	morainal or fluvial
* Soil Texture:	coarse
* Coarse Fragments (%):	generally >30

DISTRIBUTION: rare and generally small in extent

COMMENTS: based on limited data

BlPl - Crowberry - Cladina (ESSFmv4/02)

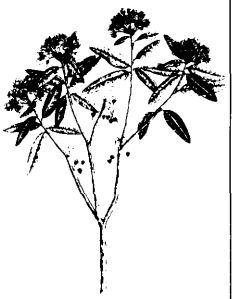
INTERPRETATIONS

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

Silvicultural system: - avoid logging

ESSFmv4/03

BlSb - Labrador tea



Ledum groenlandicum

VEGETATION

Tree Layer: 20% cover
Lodgepole pine, black spruce, [Engelmann spruce]

Shrub Layer: 50% cover

Vaccinium membranaceum	(black huckleberry)
Rhododendron albiflorum	(white-flowered rhododendron)
Ledum groenlandicum	(Labrador tea)
[Vaccinium myrtilloides	(velvet-leaved b1ueberry)]
subalpine fir	

Herb Layer: 10% cover

Orthilia secunda	(one-sided wintergreen)
Cornus canadensis	(bunchberry)
Linnaea borealis	(twinflower)
[Vaccinium vitis-idaea	(lingonberry)]

Moss Layer: 95% cover

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

Vaccinium vitis-idaea

SOIL AND SITE

Moisture Regime:	3-6 (sm-hg)
Nutrient Regime:	A-B (vp-p)
* Aspect:	generally northerly
* Slope Gradient (%):	0-45, generally < 20
Slope Position:	variable
Parent Material:	variable but often morainal
Soil Texture:	coarse - medium
Coarse Fragments (%):	7-59

Pleurozium schreberi

DISTRIBUTION: common

BlSb - Labrador tea (ESSFmv4/03)

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.***

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

Site preparation
- light scarification for seed bed preparation or summer logging with no site preparation.

Species choice
- Bl, P1, Se, (Sb)

Vegetation potential
- low

Reforestation
- attempt to regenerate naturally if potential exists.
- Sb is significantly less productive than the other tree species on this site.

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).***
- trafficability may be a problem on these sites during the summer, especially on sites where moisture regime is wetter than mesic

ESSFmv4/04

B1 - Rhododendron - Horsetail

Vaccinium membranaceum

Orthilia secunda

Equisetum scirpoides

VEGETATION

Tree Layer: 25% cover
Engelmann spruce, subalpine fir, [lodgepole pine]

Shrub Layer: 35% cover

Vaccinium membranaceum	(black huckleberry)
Rhododendron albiflorum	(white-flowered rhododendron)
Shepherdia canadensis	(soopolallie)
subalpine fir	
[Engelmann spruce]	

Herb Layer: 35% cover

Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided wintergreen)
Equisetum scirpoides	(dwarf scouring-rush)
Mertensia paniculata	(tall bluebells)
Linnaea borealis	(twinflower)
Lycopodium annotinum	(stiff clubmoss)
Mitella nuda	(common mitrewort)
Arnica cordifolia	(heart-leaved arnica)
[Rubus pubescens	(trailing raspberry)]
[Aster ciliolatus	(fringed aster)]

Moss Layer: 95% cover

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

SOIL AND SITE

Moisture Regime:	5 (shg)
Nutrient Regime:	C-E (m-vr)
* Slope Gradient (%):	0-16
* Slope Position:	mid - lower
Parent Material:	morainal
Soil Texture:	coarse - medium
Coarse Fragments (%):	15-50

DISTRIBUTION: common; associated with areas of imperfect soil moisture drainage

B1- Rhododendron - Horsetail (ESSFmv4/04)

INTERPRETATIONS

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

Silviculture system:
- clearcut (winter) or partial cut (see Section 5.1)
- log on firm snowpack to protect advance regeneration.
- under a partial cutting system spruce regeneration requires mineral soil exposure and/or planting.
- minimize or align large slash accumulations when logging to help meet site preparation objectives and reduce fire hazard.
- reduce spruce beetle hazard by avoiding high stumps and shaded slash > 15 cm diameter.

Site preparation:
- see Section 5.2

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

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

Reforestation:
- try to preserve advance regeneration if it is abundant and likely to release and form an acceptable stand.
- advance Bl regeneration should only be accepted if it meets size and acceptability criteria (Section 5.1).
- plant stock in groups, using available raised microsites, rather than evenly across the site.
- 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 choosing a frost-resistant species (e.g., Pl) is advised.***
- sites within this unit with restricted rooting and/or thick organic layers have a high windthrow hazard; ***block layouts must have wind-firm boundaries.***
- spruce beetle may infest partial cut stands after harvesting; ***minimize blowdown and avoid mechanical damage to residuals.***
- tomentosus root rot may cause minor problems in mature spruce-dominated stands.

ESSFmv4/05

Bl - Alder - Horsetail

Alnus crispa ssp. *sinuata*

Equisetem arvense

Aster ciliolatus

VEGETATION

Tree Layer: 15% cover
Engelmann spruce, subalpine fir

Shrub Layer: 15% cover

Alnus crispa ssp. *sinuata*	(Sitka alder)
Salix spp.	(willows)
Ledum groenlandicum	(Labrador tea)
Lonicera involucrata	(black twinberry)
Ribes triste	(red swamp currant)
subalpine fir	
Engelmann spruce	

Herb Layer: 85% cover

Equisetum arvense	(common horsetail)
Aster ciliolatus	(fringed aster)
Mertensia paniculata	(tall bluebells)
Rubus pubescens	(trailing raspberry)
Senecio triangularis	(arrow-leaved groundsel)

Moss Layer: 95% cover

Brachythecium spp.	(ragged mosses)
Mnium spp.	(leafy mosses)
Hylocomium splendens	(step moss)
Drepanocladus spp.	(drepanocladus mosses)
Tomenthypnum nitens	(golden fuzzy fen moss)

SOIL AND SITE

Moisture Regime:	6 (h)
Nutrient Regime:	B-D (p-r)
* Slope Gradient (%):	0-5
* Slope Position:	level or depression
* Parent Material:	fluvial
Soil Texture:	medium - fine
Coarse Fragments (%):	generally low

DISTRIBUTION: uncommon and small in size

COMMENTS: based on limited data

Bl - Alder - Horsetail (ESSFmv4/05)

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.***

Silviculture system:
- clearcut (winter) or partial cut (see Section 5.1)

Site preparation:
- see Section 5.2
- creating an excessive number of microsites (e.g., >300/ha) should be avoided, especially on sites with a water table < 30 cm from the surface.

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.
- advance Bl regeneration should only be accepted if it meets size and acceptability criteria (Section 5.1).

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 are advised.***
- sites within this unit with high water tables and thick organic horizons (> 10 cm) have increased windthrow hazard; ***block layouts must have wind-firm boundaries.***
- water table will likely rise above the ground surface in the spring, causing seedling mortality.
- these units represent important wildlife habitat; ***discuss prescription with fish and wildlife personnel.***
- this unit is critical to the control of runoff streamflow.
- tomentosus root rot may cause minor problems in mature spruce-dominated stands.

TABLE 16. Figure and page numbers for site preparation keys

Site Series	Site Group	Figure Number	Page Number
ESSFmv2/01 ESSFmv4/01,04	Bl - Rhododendron - Knight's plume	24	124
ESSFmv2/04 ESSFwk2/01,02,03,04	Bl - Rhododendron - Oak fern	23	122
ESSFmv2/05 ESSFwk2/05	Bl - Devil's club	23	122
ESSFmv4/05	Bl - Horsetail - Sphagnum	25	125
ESSFwk2/06	Bl - Horsetail - Oak fern	25	125
ESSFmv2/06	undescribed	25	125

APPENDIX 1. New names for biogeoclimatic and site units in the Northern Rockies portion of the Prince George Forest Region

Old Biogeoclimatic Units and Ecosystem Associations	New Biogeoclimatic Units and Site Series
ESSFn1	**ESSFmv2**
01 White-flowered Rhododendron - Black huckleberry	01 Bl - Rhododendron - Feathermoss
02 Pine - Black huckleberry	02 Bl - Lingonberry
03 Bunchberry - Stiff Clubmoss	01 Bl - Rhododendron - Feathermoss
04 White-flowered Rhododendron - Oak fern	04 Bl - Oak fern - Knight's plume
05 Pine - Black Spruce	03 BlSb - Labrador tea
06 Devil's club - Oak fern	05 Bl - Devil's club - Rhododendron
Not previously described	06 Bl - Alder - Horsetail
ESSFn2	**ESSFmv4**
01 White-flowered Rhododendron - Black huckleberry	01 Bl - Rhododendron - Feathermoss
02 Pine - Black huckleberry	02 BlPl - Crowberry - Cladina
03 White-flowered Rhododendron - Step moss	01 Bl - Rhododendron - Feathermoss
04 Currant - Gooseberry	04 Bl - Rhododendron - Horsetail
05 Pine - Black Spruce	03 BlSb - Labrador tea
06 Spruce - Horsetail	05 Bl - Alder - Horsetail
ESSFh3 (above 1300 m)	**ESSFwc3**
01 Rhododendron - Oak fern	01 Bl - Rhododendron - Oak fern
Not previously described	02 Bl- Rhododendron - Queen's cup
Not previously described	03 Bl - Globeflower - Horsetail
ESSFh3 (below 1300 m)	**ESSFwk2**
01 Rhododendron - Oak fern	01 Bl - Oakfern - Knight's plume
02 Rhododendron - Black huckleberry	02 Bl - Oakfern - Sarsaparilla
03 Devil's club - Oak fern	04 Bl - Devil's club - Rhododendron
04 Thimbleberry - Oak fern (in part)	03 Bl - Oakfern - Bluebells
04 Thimbleberry - Oak fern (in part)	05 Bl - Rhododendron - Lady fern
05 Rhododendron - Horsetail	06 Bl - Horsetail - Sphagnum
06 Bog Ecosystems	31 Non-forested Bog