A Temporary Supplement to Land Management Handbook 71

A Field Guide to Ecosystem Classification and Identification for Southeast British Columbia: Two Biogeoclimatic Subzones/Variants in the Golden–Invermere TSAs[1]

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INTRODUCTION AND BACKGROUND

This supplement is part of a series of new field guides being developed for southeast British Columbia. The information will be re-published as part of *A Field Guide to Ecosystem Classification and Identification for Southeast British Columbia: the North Columbia Mountains*.

This supplement is being released in 2018 in conjunction with *Land Management Handbook 71: A Field Guide for to Ecosystem Classification and Identification for Southeast British Columbia: the East Kootenay* (MacKillop et al. 2018), which covers the area immediately to the south.

This field guide includes site classification and ecosystem information for two biogeoclimatic units:

- ICHmk5 (previously mapped as ICHmk4 and managed as ICHmk1)
- ESSFmm3 (previously mapped and managed as ESSFwm)

Both of these biogeoclimatic units were previously mapped and described as part of a biogeoclimatic unit that has been updated and published in LMH 71. Releasing that guide without providing management direction for the biogeoclimatic units described here would cause confusion and could lead to incorrect management decisions. This supplement is accompanied by new biogeoclimatic mapping (BECv11) and several management applications, including new stocking standards for the Chief Forester's reference guide and District-level shared stocking standards.

Users can consult LMH 71 or LMH 70 (MacKillop and Ehman 2016) for information on the BEC system, how to use the tools in this temporary supplement, and for descriptions of non-forested ecosystems.

This field guide can be downloaded from: https://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/

For additional information on new field guide materials and BEC mapping, please contact:

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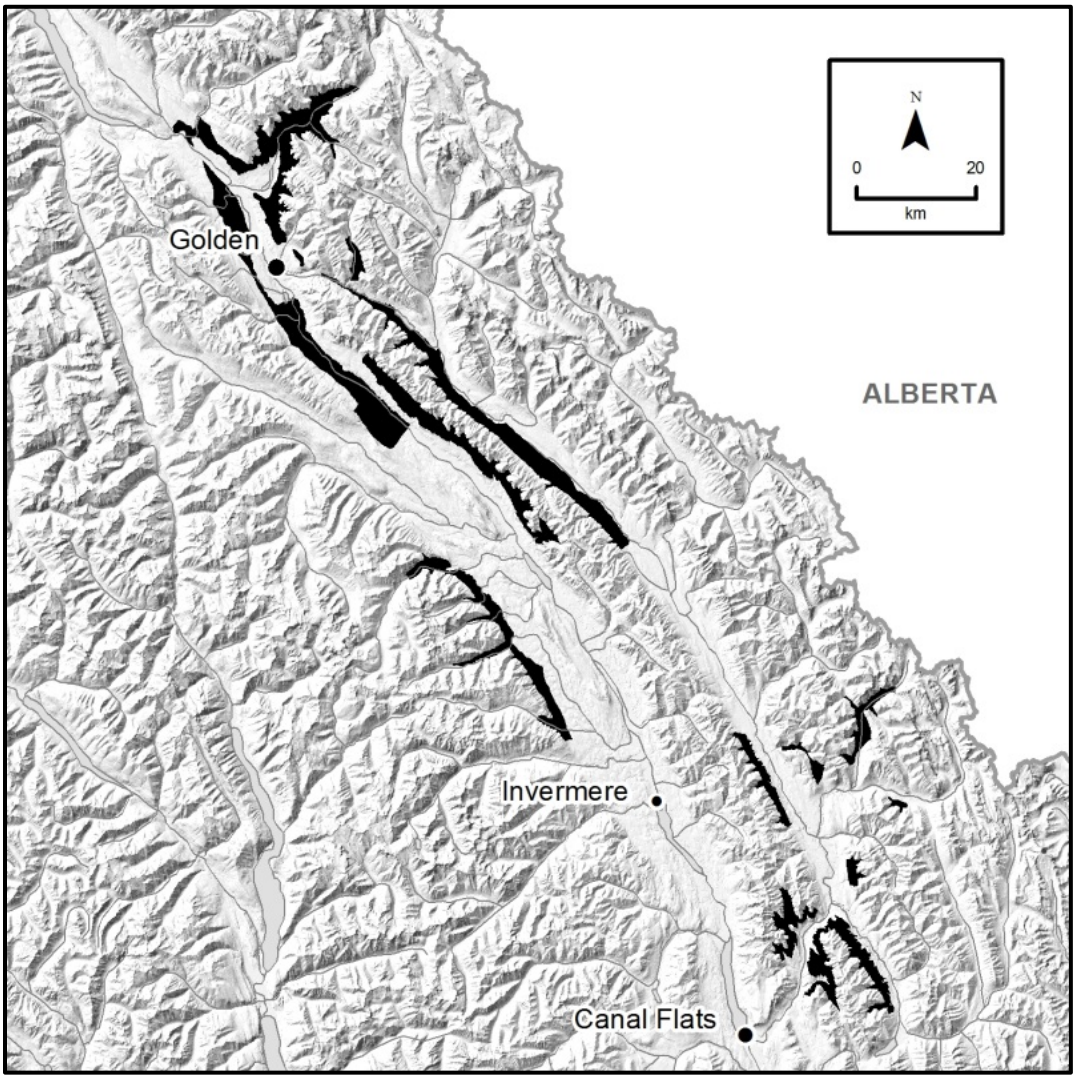
ICHmk5
Kootenay Moist Cool
Interior Cedar – Hemlock

Geographic Distribution

The ICHmk5 covers dispersed areas at low to mid elevations in the Kootenay, Beaverfoot, Kicking Horse, and Columbia River valleys. It occurs adjacent to and above the MSdk and IDFdk5 and below the ESSFdk2 and ESSFmm3. At the northern extent, it also occurs below the ICHmw1.

Distribution of the ICHmk5



Elevation Range

Elevation ranges for the ICHmk5 are highly variable and are more closely linked to moist climate areas where Cw is consistently present than to strong elevation/aspect patterns. In general, the ICHmk5 borders the IDFdk5 at approximately 1250–1350 m on warm aspects and 1100–1250 m on cool/neutral aspects. Where the ICHmk5 occurs above the MSdk, elevations vary widely. At the southern extent of its range in the Kootenay Valley, including Cochrane and Albert Creeks and the Palliser and White Rivers, upper elevations of the ICHmk5 border the ESSFdk2 at 1550–1600 on cool/neutral aspects and 1700–1750 m on warm aspects. In the Purcell Mountains, from Bugaboo Creek to Forster Creek, upper elevations between the ICHmk5 and ESSFdk2 are approximately 100 m lower. At the northern extent, where the ICHmk5 occurs below the ESSFmm3, upper limits are approximately 100 m lower except on cool/neutral aspects and 150 m lower on warm aspects.

Climate[2]

The ICHmk5 occurs in the Moist climate subregion but is surrounded by ecosystems in the Dry climate subregion. Growing seasons are warm, while winters are cold. Precipitation regimes are relatively dry for ICH climates. Snowpacks are moderately deep and persist from November or December through March or April. Large fluctuations in weather are common. Arctic air masses from the north result in cold snaps throughout the winter. Growing-season moisture deficits typically occur on subxeric and drier sites, and on submesic to mesic sites in dry years.

Forest and Vegetation Characteristics

The ICHmk5 covers a mixed range of environmental conditions that result in variable vegetation patterns across its range. As a transitional unit between the moister ICHmw1 and the drier MSdk, it has characteristics of both the ICH and MS zones. **Sxw is a dominant species** across most of the range, with **Cw and Fd**. Cw is most common on moister (subhygric to hygric) sites, but is usually present, at least in the understorey, on mesic sites. **Hw is very uncommon**, and only occurs as scattered trees or regeneration. **Pl** is a relatively common seral species across drier to mesic sites, while **Bl** is frequently present in the understorey and often forms a minor component of subcanopy layers in mesic and wetter sites. **Lw** is abundant at the southern extent of the ICHmk5, especially in the Kootenay River valley and its tributaries, but is absent in natural stands throughout the rest of the ICHmk5. **Ep, At, and Act** commonly occur and provide important broadleaf-dominated habitats. **Pf** is uncommon, but occurs in the ICHmk5.[3]

Mesic sites are characterised by Sxw, Cw, and Fd, often with a minor component of Pl, Bl, and/or Ep. Common understorey species include bunchberry, twinflower, prince's pine, rattlesnake-plantain, and abundant feathermosses. Sites that are d**rier than mesic** have pinegrass, showy aster, and kinnikinnick, along with more shrubby understories of Douglas maple, soopolallie, saskatoon, Oregon-grape, birch-leaved spirea, juniper, and snowberry, and are generally Fd-dominated. Rocky Mountain juniper occurs on the driest, rocky sites. **Wetter sites** have abundant Cw and/or Sxw, with black twinberry, highbush-cranberry, black gooseberry, red-osier dogwood, and/or devil's club with oak fern, mitreworts, clasping twistedstalk, dwarf red raspberry, and/or horsetails.

[2] See Section 4.5 for more information on climate variables.
[3] Species codes are described in Appendix 3.7 of LMH 71; Pf refers to *Pinus flexilis* (limber pine).

The ICHmk5 includes an extensive portion of the **Columbia Wetlands**, a Ramsar Wetland of International Importance.[4] Valley-bottom habitats and ecosystems in this area include extensive marshes, swamps, fens, shallow-water wetlands, and flood ecosystems. Avalanche paths, rock outcrops, and talus also provide critical habitat and landscape diversity within an otherwise forest-dominated landscape.

Disturbance

Stand-replacing fires were the dominant historical disturbance agent in the ICHmk5, although mixed-severity fire was likely most common on warm-aspect sites where fire-scarred Fd, and occasionally Lw or Cw, are common. The current landscape is dominated by early- to mid-seral mixed coniferous stands, although prior to European settlement, old and mature forest were likely to have been more common.

Bark beetles are important disturbance agents, particularly **mountain pine beetle** in seral stands, but also **Douglas-fir beetle** in stands with high Fd cover. **Spruce beetle** can cause high mortality in mature stands, especially following fire or blowdown, or where slash retention is high after harvest. Spruce terminal weevil is an impediment to regenerating Sxw. Defoliation from 2-year-cycle spruce budworm can cause both growth loss and mortality of Sxw and Bl.

Pathogens are also important influences on growth and survival of mature and regenerating stands. **Armillaria root rot** creates gaps in mature stands and can be a major impediment to tree regeneration. Several rusts and fungi also affect regenerating trees, particularly Pl. **Commandra blister** rust commonly kills Pl, while **stalactiform blister rust** reduces growth and form and sometimes kills Pl**. Western gall rust** and **atropellis cankers** rarely kill Pl but cause growth loss and deformity. **Dothistroma** is a growing concern at the moister end of the ICHmk5, particularly in areas transitional to the ICHmw1. In other conifers, **rhabdocline needle cast** can cause growth losses in Fd on warmer sites, while **larch needle blight** has similar effects on Lw at the southern extent of the ICHmk5 where Lw is abundant. **Black stain root disease** poses a moderate threat to its most common hosts: Douglas-fir and lodgepole pine. **Birch decline**, caused by a combination of factors, has had large effects on Ep.

Soils, Geology, and Landforms

The bedrock geology in the ICHmk5 is a complex mix of sedimentary and metasedimentary rocks. The most common types are fine-grained mudstone, siltstone, and shale found mainly north of Spillimacheen and Kootenay Crossing. Limestone and fine-grained metamorphic and sedimentary rocks (slate, phyllite, siltstone, and argillite), with some dolomite and marble, are also very common in the southern part of the unit south of the Cross River, west of the Columbia River between Parsons and Moberly, and in the Blaeberry River Valley. Quartzite, sandstone, and other coarse-grained sedimentary rocks occur between Horsethief and Bugaboo Creeks, east of Parsons, and in the upper Blaeberry valley.

[4] The Ramsar Convention on Wetlands of International Importance was signed in 1971 in Ramsar, Iran, and is an international treaty for the conservation and sustainable use of wetlands.

Most soils are associated with colluvium and till deposits derived from fine-grained bedrock and have gravelly silt loam or silt loam as the most common textures. Morainal soils often have moderate coarse fragment content and/or clay-enriched (Bt) subsurface horizons. In areas with parent materials derived from coarser grained bedrock types, soils have loam to loamy sand textures (sandy loam is most common), moderate to high coarse fragment content, and generally poorer nutrient status compared to finer textured soils. Fluvial deposits occur in the Columbia, Kootenay and Albert river valley bottoms and associated soils have silt loam to fine sandy loam textures and few coarse fragments overlying gravelly subsoil layers. Most soils in the unit are calcareous and carbonate-enriched (Cca) subsoil layers are common.

Wildlife Habitat

The ICHmk5 provides **ungulate winter range** for populations of **Rocky mountain elk, bighorn sheep, mule deer** and occasional **moose**. Wetlands in the Parson to Nicholson reach of the Columbia represent important breeding and staging areas for a **range of waterfowl, shorebirds, and other waterbirds,** including at-risk **western, horned, and eared grebes**; **great blue heron**, **sandhill crane**, **short-eared owl**, **surf scoter**, **long-tailed duck**, **tundra swan**, and **California gull**. These wetlands also represent breeding and overwintering habitats for **amphibians** (**western toad**) and **aquatic mammals** (beaver, otter and mink). Other furbearers/carnivores are abundant in this unit, with at-risk **American badger** found in more open habitats and **wolverine** and **grizzly bear** found seasonally.

The ICHmk5 also supports a diversity of cavity-nesting waterfowl and forest birds (e.g., woodpeckers, chickadees, nuthatches, creepers), and retention of large-diameter **wildlife trees**, **coarse woody debris**, and **deciduous trees** in a range of species and decay classes, with cavities, heart rot, broken tops, and limbs for perching, is required for their habitat needs. Stands with large veteran trees are also important for at-risk **northern goshawk** and other forest hawks in uplands, and bald eagle and osprey in riparian areas.

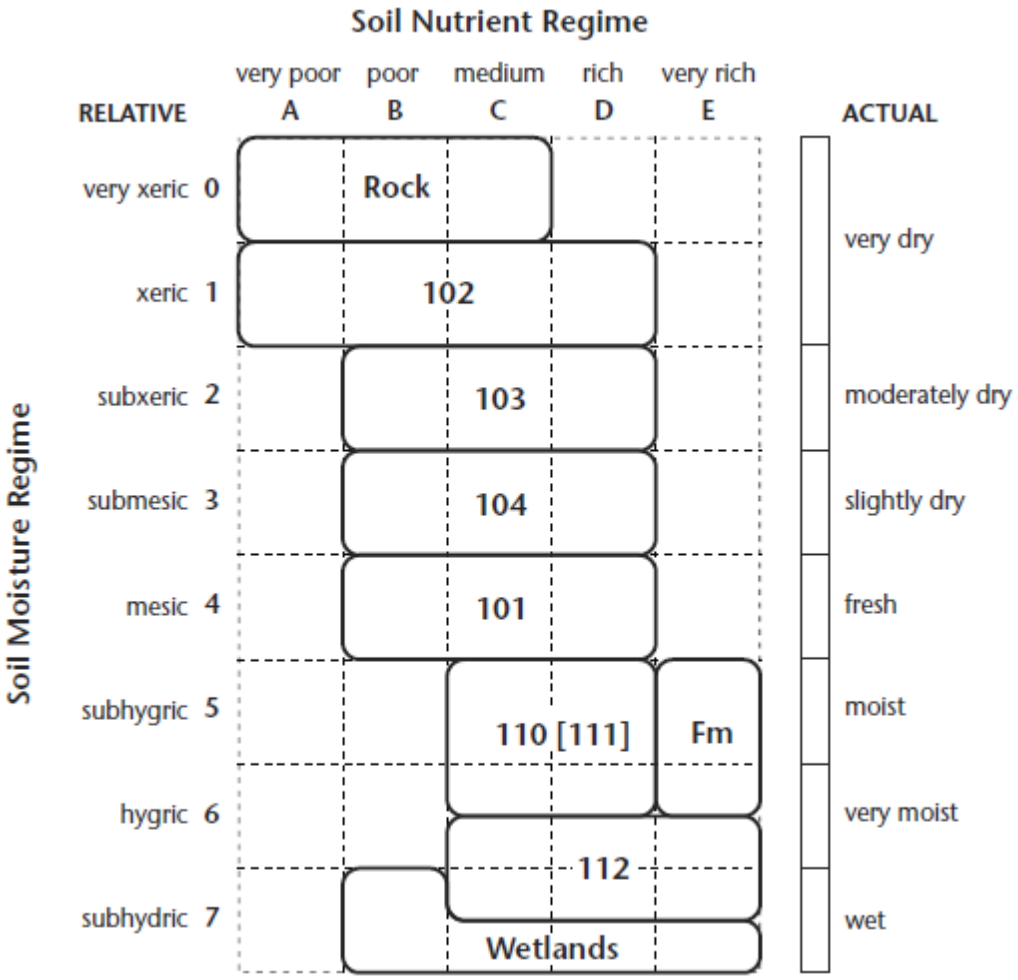
Important habitat is also available in the ICHmk5 for various **migratory birds** and **aerial insectivores**, including **little brown myotis**, **olive-sided flycatcher**, **common nighthawk**, **black swift**, **bank swallow**, and **barn swallow,** which forage in both riparian and upland areas. More common forest bird species in the ICHmk5 include Swainson's thrush, yellow-rumped warbler, warbling vireo, dark-eyed junco, chipping sparrow, American robin, and Hammond's flycatcher.

Several **listed vascular plants** occur (including **limber pine**) and controlled livestock grazing (especially near wetland and riparian areas) combined with invasive plant management and access restrictions are key management strategies that can help protect this diversity.

Distinguishing the ICHmk5 from Adjacent Biogeoclimatic Units

In the **ESSFdk2**, most sites have:	- more Pl - no Cw - white-flowered rhododendron and/or more false azalea - grouseberry/low bilberry
zonal sites have:	- more Bl and no Cw or Fd - grouseberry/low bilberry
dry sites have:	- less Fd, more Bl and Se - less pinegrass and birch-leaved spirea; no Rocky Mountain juniper
wet sites have:	- no oak fern, lady fern, and/or spiny wood fern (except in isolated areas)
In the **ESSFmm3**, most sites have:	- little or no Cw - more Bl - white-flowered rhododendron and/or more false azalea
zonal sites have:	- no Fd - more false azalea - more five-leaved bramble
dry sites have:	- Bl and/or Se - no Rocky Mountain Juniper - less pinegrass and birch-leaved spirea
wet sites have:	- Sitka valerian, arrow-leaved groundsel, false hellebore, and/or globeflower - little or no devil's club and less ferns
In the **MSdk**, most sites have:	- more Pl - Cw restricted to riparian and adjacent areas - more pinegrass and grouseberry/low bilberry
zonal sites have:	- grouseberry/low bilberry
wet sites have:	- little or no foamflower, oak fern, or devil's club
In the **ICHmw1**, most sites have:	- Hw
zonal sites have:	- Hw
dry sites have:	- less Rocky Mountain juniper
In the **IDFdk5**, most sites have:	- no Cw or Sxw - more pinegrass
zonal sites have:	- more Fd - no Cw, Sxw, or Bl - pinegrass
dry sites have:	- more Rocky Mountain juniper - more bunchgrasses, including fescues and bluebunch wheatgrass
wet sites have:	- no oak fern and/or devil's club

Edatopic Grid



Site Series

101	CwSxw – Falsebox
102	Fd – Juniper – Douglas maple
103	Fd – Juniper – Pinegrass – Showy aster
104	Fd – Pinegrass – Showy aster
110	CwSxw – Devil's club – Oak fern
111	SxwBl – Dogwood – Sarsaparilla
112	SxwBl(Cw) – Horsetail

Site Series Flowchart

VERY DRY to DRY FORESTS

* warm aspects
* shallow soils

Y → * SMR 1
* Fd stands
* exposed bedrock or talus is prominent
* common juniper and/or Rocky Mountain juniper
* minor amounts of dry-site species: kinnikinnick, rock ferns, stonecrops, saxifrages

Y → **102**

Y → * SMR 2
* Fd (Pl) stands
* steep, warm aspects; coarse and/or shallow soils
* kinnikinnick, pinegrass, showy aster
* lacks twinflower, meadowrue, one-sided wintergreen, rattlesnake-plantain, and prince's pine

Y → **103**

SLIGHTLY DRY to MESIC FORESTS

* mid slopes (usually) with deep soils

Y → * SMR 3
* Fd (Sxw, Pl) stands
* pinegrass, showy aster
* twinflower, meadowrue, one-sided wintergreen, rattlesnake-plantain, and/or prince's pine

Y → **104**

Y → * SMR 4
* Sxw, Fd, Cw stands
* bunchberry, twinflower, feathermosses

Y → **101**

MOIST to WET FORESTS

* lower and toe slopes or level

* seepage, mottles, or water table present

Y → * SMR 5 (6)
* Cw (Sxw, Bl) stands
* lower and toe slopes; usually riparian
* devil's club, oak fern, mitreworts, bunchberry, and leafy mosses

Y → **110**

Y → * SMR 5 (6)
* Sxw-leading stands
* lower and toe slopes; riparian
* cold air accumulation
* red-osier dogwood, dwarf red raspberry

Y → **111**

Y → * SMR 6–7
* Sxw (Bl, Cw) stands
* level or gentle sites; water table at or near the surface
* riparian; cold air
* abundant horsetails

Y → **112**

Vegetation Table

Layer	Scientific name	102	103	104	101	110	111	112	Common name
Trees	*Pseudotsuga menziesii*	■■■■■	■■■■	■■■■	■■■■	■■■	■■■		Douglas-fir
	Pinus contorta		■■■	■■■	■■		■■		lodgepole pine
	Picea engelmannii x *glauca*			■■■	■■■■	■■■■	■■■■■	■■■■	interior spruce
	Abies lasiocarpa				■■■	■■■	■■	■■■	subalpine fir
	Thuja plicata				■■■	■■■■■		*	western redcedar
	Populus tremuloides					*	■■■		trembling aspen
Regen	*Pseudotsuga menziesii*	■■■	■■■	■■■					Douglas-fir
	Picea engelmannii x *glauca*			■■	■■■	■■■	■■■	■■■	interior spruce
	Thuja plicata			*	■■■	■■■■	■■	■■■	western redcedar
	Abies lasiocarpa			*	■■■	■■■	■■■	■■■	subalpine fir
Shrubs	*Acer glabrum*	■■■■	■■■	■■■	■■	■	■		Douglas maple
	Juniperus communis	■■■■	■■■						common juniper
	Juniperus scopulorum	■■■							Rocky Mountain juniper
	Spiraea lucida	■■	■■■	■■	■■		■		birch-leaved spirea
	Symphoricarpos spp.	■■	■■■	■■			■		snowberry
	Shepherdia canadensis	■	■■■	■■■	*		■		soopolallie
	Amelanchier alnifolia	■	■■	■■	■		■		saskatoon
	Berberis spp.	■	■■	■■	■		■		Oregon-grape
	Menziesia ferruginea				■■	■■	■■	■■■	false azalea
	Rubus parviflorus				■■	■■	■■	■■■	thimbleberry
	Vaccinium membranaceum				■	■	■■	*	black huckleberry
	Lonicera involucrata				■		■■	■■	black twinberry
	Viburnum edule				*	■	■■	■	highbush-cranberry
	Oplopanax horridus					■■■		■■■	devil's club
	Ribes lacustre					■■	■	■■	black gooseberry
	Cornus stolonifera						■■■	■■■	red-osier dogwood

Layer	Scientific name	102	103	104	101	110	111	112	Common name
Herbs	*Arctostaphylos uva-ursi*	■■■	■■■						kinnikinnick
	Saxifraga bronchialis	■■							spotted saxifrage
	"rock ferns"[a]	■							rock ferns
	"dry sedges" [a]	■							dry sedges
	Fragaria spp.	■	■	■			■		strawberry
	Calamagrostis rubescens		■■■	■■■■					pinegrass
	Eurybia conspicua		■■■	■■■			■■		showy aster
	Linnaea borealis			■■	■■	■■	■■	■	twinflower
	Chimaphila umbellata			■	■				prince's pine
	Goodyera oblongifolia			■	■	■			rattlesnake-plantain
	Orthilia secunda			■	■	■	■	■	one-sided wintergreen
	Aralia nudicaulis			*	■■	■■■	■■■	*	wild sarsaparilla
	Cornus canadensis				■■■	■■■	■■■	■■■	bunchberry
	"mitreworts" [a]					■■■	■■	■■	mitreworts
	Gymnocarpium dryopteris					■■■	*	*	oak fern
	Tiarella trifoliata var. unifoliata					■■	*	*	one-leaved foamflower
	Equisetum spp.					■	■	■■■■	horsetails
	Rubus pubescens						■■	■■	dwarf red raspberry
	Streptopus amplexifolius						■	■	clasping twistedstalk
Moss layer	*Syntrichia ruralis*	■■							sidewalk screw-moss
	Peltigera spp.	■	■■	■■	■	■			pelt lichens
	Cladonia spp.	■	■■						clad lichens
	Pleurozium schreberi		■■	■■■	■■■■	■■	■■■	■■■■	red-stemmed feathermoss
	Hylocomium splendens		*	*	■■■	■■■■	■■■	*	step moss
	Ptilium crista-castrensis				■■■	■■■■	■■■■	■■■■	knight's plume
	"leafy mosses" [a]					■■■	*	■■	leafy mosses

[a] Lists of grouped species are provided in Appendix 1.1

Mean cover: ■ < 1% ■■ 1–3% ■■■ 3–10% ■■■■ 10–25% ■■■■■ > 25% * 25–50% of plots and >1% cover

Constancy: ■ > 70% of plots ■ 50–70% of plots

Environment Table[a]

Site series	102	103	104	101	110	111	112
No. of plots	2	9	14	18	4	4	10
SMR	1	2	3	4	5 (6)	5 (6)	6–7
SNR	B–C (A–D)	B–C (D)	C–D (B)	C–D (B)	C–D	C–D	D–E (C)
Slope position	MD–UP	MD, UP, CR	MD (UP)	MD	LW, TO (MD)	LW, TO (MD, LV)	TO, LV, DP
Typical slope/aspect	Steep–moderately steep/warm	Steep/warm	Moderate/ warm	Moderate/ neutral (cool)	Gentle (moderate)	Gentle	Gentle–level
Common compensating conditions		Coarse-textured crests and upper slopes	Upper/ cool or neutral shedding; shallow, coarse/ neutral, cool	Lower, coarse; gentle, warm	Sub-irrigated mid-slopes and benches		
Surficial materials	Cx/R, Mx/R (Cvb)	Cv, Cb (Mv)	Mb, Cb	Mb (Cb, FG)	Mb, F (FG)	FG, F, Mb	F (Ov/F, Mb)
Soil texture	SL, SiL (FSL, LS)	SiL, SL (LS, FSL)	SiL, SL	SiL, FSL (L, SCL)	SiL (SL, L, LS)	SiL (SiCL, SL)	SiL (SL, FSL)
Coarse fragment content	High–fragmental	High–fragmental	Moderate–high	Moderate; occasionally high, especially at depth	Moderate; often higher at depth	Moderate; often higher at depth	Variable, often with coarser flood deposition
Important features	Bedrock is prominent and abundant; soils are often fragmental	Insolation			Seepage or mottles; riparian areas	Seepage or mottles; riparian areas; cold air pooling	Water table near surface; can have an organic surface layer or flooding; cold air

[a] Codes and categories are in Chapter 3. Keys for use in the field are in the appendices.

101 CwSxw - Falsebox

General Description

SMR 4. The 101 site series typically occurs on **mid slopes** of **neutral** and **cool aspects** with deep, moderate-textured soils. On warm aspects, it often occurs on lower slope positions and on gentle to moderate mid slopes. Soils typically have silt loam or fine sandy loam textures and moderate coarse fragment content, often increasing at depth.

Cw is generally present in the overstorey and/or understorey, generally in mixed-species stands with **Fd**, **Sxw**, and minor cover of Bl and/or Pl. Cw, Sxw, and Bl are usually present in the regeneration layers of mature stands. **False azalea**, **thimbleberry**, and/or **black huckleberry** are usually present with **bunchberry** and low cover of wild sarsaparilla, prince's pine, twinflower, one-sided wintergreen, and/or rattlesnake-plantain. Red-stemmed feathermoss, step moss, and knight's plume are usually present and often abundant.

Differentiating from other site series

Slightly drier sites (104) differ in shrub cover and composition with juniper, Douglas maple, soopolallie, birch-leaved spirea, and snowberry being more common and false azalea, thimbleberry, and black huckleberry rarely present. Pinegrass is also absent on 101 sites. Slightly moister sites (110) have more Cw, lack Pl, and have minor to moderate cover of devil's club, mitreworts, oak fern, and/or foamflower. Colder and slightly moister sites (111) are Sxw-dominated with low cover of Cw and have red-osier dogwood and dwarf red-raspberry.

Variability

Cw is frequently restricted to the understorey where it can be abundant, although Cw may be absent from both the overstorey and understorey of some stands even though it is present in the area. Minor cover of Lw can occur at the southern extent of the ICHmk5 in the Kootenay River valley

Management Issues

This site series is amenable to the growth of a wide variety of species, and species diversity should be maintained. Forest productivity is high and brush competition may limit tree growth and establishment.

102 Fd – Juniper – Douglas maple

General Description

SMR 1. The 102 occurs on forested sites where **exposed bedrock**, **talus**, and/or **very rocky, very shallow soils** are prominent. Sites are generally restricted to steep, warm-aspect slopes.

Fd is the dominant tree species with **Douglas maple**, **common juniper**, and/or **Rocky Mountain juniper** usually abundant in the understorey. The herb layer is highly diverse and variable, depending on soil depth and bedrock lithology. Common species are associated with dry sites and include **kinnikinnick**, **saxifrages**, **dry sedges**, **stonecrops** (*Sedum* spp.), **rock ferns**, and/or **round-leaved alumroot** (*Heuchera cylindrica*). Clad and pelt lichens are commonly present.

Differentiating from other site series

The 102 is the driest forested site series and is easily differentiated by the forested canopy (> 10% tree cover at maturity) and the abundance of exposed rock (bedrock or talus). Drier sites are non-forested rock outcrops and talus sites (see Section 6.5). Slightly moister sites (103) lack exposed rock, Rocky Mountain juniper, saxifrages, and rock ferns, and have pinegrass and showy aster.

Variability

Pf (*Pinus flexilis*) occurs infrequently on these sites. Herb and shrub cover varies depending on frequency of soil pockets.

Management Issues

This site series is not recommended for timber harvesting due to limitations in available soil and soil moisture for tree regeneration and growth. Drought stress can increase the susceptibility of trees to insects and disease.

103 Fd – Juniper – Pinegrass – Showy aster

General Description

SMR 2. The 103 site series occurs on **mid to upper slopes** on moderately steep to **steep** (> 55%), **warm-aspect** sites where soils are **shallow, rocky, and/or coarse**. It is also common on warm, dry crests. Soils are rapidly to well-drained, usually with silt loam or sandy loam textures and high coarse fragment content.

Fd is common in the overstorey, sometimes with minor amounts of **Pl**. Douglas maple, **common juniper**, **snowberry**, **soopolallie**, and **birch-leaved spirea** occur in the brushy understorey. **Pinegrass** and **showy aster** dominate the diverse herb layer, often with minor **kinnikinnick** and arnica (*Arnica* spp.). Pelt and clad lichens are common in the usually sparse moss layer.

Differentiating from other site series

Slightly drier (102) sites have more rock and bedrock, less Pl, pinegrass, and showy aster, and Rocky Mountain juniper is often present. Slightly moister sites (104) have higher herb cover with more abundant pinegrass and showy aster and some scattered twinflower, prince's pine, one-sided wintergreen, false Solomon's-seal, and/or rattlesnake-plantain present, as well as minor cover of Sxw in the understorey and/or overstorey.

Variability

Pinegrass cover varies from sparse to abundant (up to ~ 20% cover). Minor cover of Lw can occur at the southern extent of the ICHmk5 in the Kootenay River valley. Pl can be abundant, particularly on earlier seral sites.

Management Issues

Drought may limit tree productivity and cause mortality, especially during dry growing seasons. Ungulate browsing and vegetation competition can also limit tree establishment and growth. Soil erosion may be a concern following harvesting on steep slopes. Sites with large trees, lower snow depths, and high forage availability often provide important ungulate winter range.

104 Fd – Pinegrass – Showy aster

General Description

SMR 3. The 104 site series occurs on mid-slopes of **warm aspects** with **deep, moderate-textured soils**. On cool and neutral aspect sites, it also occurs on moisture-shedding sites where soils are coarse and/or shallow.

Fd, **Pl**, and **Sxw** occur in the overstorey with Douglas maple, **saskatoon**, **Oregon-grape**, **soopolallie**, **birch-leaved spirea**, and/or **snowberry** common in the shrub layer. **Pinegrass** is often abundant (> 15% cover) with **showy aster** and minor cover of **twinflower**, **western meadowrue** (*Thalictrum occidentale*), **prince's pine**, **one-sided wintergreen**, **false Solomon's-seal**, and/or **rattlesnake-plantain**. The moss layer varies, although **red-stemmed feathermoss** is generally present and often abundant (> 30% cover). Step moss and pelt lichens are also commonly present.

Differentiating from other site series

Slightly drier (103) sites have common juniper and kinnikinnick, and have little or no Cw, Sxw, twinflower, western meadowrue, prince's pine, one-sided wintergreen, false Solomon's-seal, and/or rattlesnake-plantain. Slightly moister sites (101) have more Cw, Bl, Sxw, false azalea, bunchberry, and feathermosses, and no pinegrass.

Variability

Cw may be present in the understorey or with very low cover in the suppressed and/or intermediate canopy layers. Lw occurs at the southern extent of the ICHmk5 in the Kootenay River valley. Pinegrass cover is variable, ranging from sparse to abundant (up to ~ 30% cover). Falsebox (*Paxistima myrsinites*) is frequently present. Pl, Ep, and At can be abundant in younger stands.

Management Issues

This site series is amenable to the growth of a wide variety of species, and species diversity should be maintained. Forest productivity is high, but moisture deficits may limit tree growth during dry years. Shrub competition may inhibit conifer regeneration. Soil erosion can be a concern on steep slopes. Warm-aspect sites with large Fd trees, lower snow depths, and high forage availability may provide important ungulate winter range.

110 CwSxw – Devil's club – Oak fern

General Description

SMR 5 (6). The 110 site series occurs on gently to moderately sloping, **lower and toe slopes** where seepage or subirrigation are present seasonally or in the upper 50–100 cm of the soil. Sites can also occur in mid-slope seepage areas. Soils typically have silt loam textures with moderate coarse fragment content, although soils with sandy loam textures and high coarse fragment content often occur where seepage is constant throughout the growing season. Sites are often associated with **riparian areas**.

Cw is usually the dominant tree species, occurring with **Sxw**, and sometimes minor amounts of **Fd** and/or **Bl**. Ep, At, and Act are often present and can be abundant in disturbed, young, or maturing stands. **Devil's club**, **thimbleberry**, **black gooseberry**, and **highbush-cranberry** are common shrubs. **Wild sarsaparilla**, **bunchberry**, **oak fern,** and **mitreworts** are usually present in the understorey, often with **one-leaved foamflower**. Feathermosses, especially knight's plume, step moss, red-stemmed feathermoss are common and abundant; leafy mosses frequently occur.

Differentiating from other site series

The 110 occurs on similar sites as the 111, although the 111 is restricted to areas where cold air accumulates, and is dominated by Sxw and Bl with little or no Cw. Slightly drier sites (101) lack devil's club, oak fern, mitreworts, and one-leaved foamflower. Moister sites (112) have abundant horsetail.

Variability

Oak fern may be absent on these sites. Indicator species in the absence of oak fern include abundant Cw with devil's club, one-leaved foamflower, mitreworts, and/or leafy mosses. Other ferns, including lady fern (*Athyrium felix-femina*) may also occur.

Management Issues

Tree productivity is high on these sites. Frost and vegetation competition may impede regeneration following harvest. When soils are moist, compaction and rutting are potential harvesting hazards, and harvesting should occur when soils are dry or frozen. Sites often provide important forage, hiding cover, and travel corridors for wildlife.

111 SxwBl – Dogwood – Sarsaparilla

General Description

SMR 5 (6). The 111 site series occurs on **gentle**, **lower and toe slopes** where **cold air accumulates**. **Seepage** is present seasonally or at depth and sites are generally associated with **riparian areas**. Soils vary, but usually have silt loam textures with moderate coarse fragment content. Increasingly coarse soils, with sandy loam or loamy sand and high coarse fragment content, often occur deeper in the soil profile.

Sxw is the dominant tree species, often with Bl and sometimes minor amounts of Fd. At is usually present in young and maturing stands. **False azalea**, **thimbleberry**, **highbush-cranberry**, and **red-osier dogwood** are commonly present with **bunchberry**, **wild sarsparilla**, **dwarf red raspberry**, clasping twistedstalk, and/or five-leaved bramble (*Rubus pedatus*). Feathermosses, including red-stemmed feathermoss, step moss, and knight's plume characterise the moss layer.

Differentiating from other site series

The 111 occurs on similar sites as the 110 but differs by the presence of **cold air**, the **dominance of Sxw**, and the lack or scarcity of Cw. Slightly drier sites (101) have more Fd and Cw, little or no dwarf red raspberry, and lack red-osier dogwood. Slightly moister sites (112) are also dominated by Sxw, but have abundant horsetails.

Variability

111 sites reflect areas where cold air accumulates and may have minor cover of species associated with higher elevations and colder climates, such as Sitka valerian (*Valeriana sitchensis*) or false hellebore (*Veratrum viride*).

Management Issues

Frost and vegetation competition may limit regeneration following harvesting. When soils are moist, compaction and rutting are potential harvesting hazards, and harvesting should occur when soils are dry or frozen. Windthrow hazard should be a consideration in areas adjacent to harvesting due to shallow rooting.

112 SxwBl(Cw) – Horsetail

General Description

SMR 6–7. 112 forests occur on **level sites**, in **depressions**, and on **toe slopes** in riparian areas adjacent to wetlands, streams, and small lakes. The **water table is at or near the surface** throughout most of the growing season and **cold-air** accumulation is common. A thin, peaty, **organic veneer** may be present where flooding is rare. Soils are typically Gleysols or Orthic-Humic Regosols where flooding is common.

Open Sxw stands occur with minor to moderate cover of Bl or Cw in the overstorey and understorey. Ep and Act may be present in young and maturing stands. False azalea, black twinberry, thimbleberry, and/or red-osier dogwood are commonly present. **Horsetails** (mostly common [*Equisetum arvense*] and sometimes meadow [*E. pratense*]) are abundant. Other herbaceous species vary, but often include dwarf red raspberry, mitreworts, and/or bunchberry. The moss layer is variable, often with ragged-mosses (*Brachythecium* spp.), knight's plume, leafy mosses, and red-stemmed feathermoss.

Differentiating from other site series

Slightly drier sites (110 and 111) lack abundant horsetails. Slightly wetter sites are non-forested wetlands (< 10% tree cover) (see Section 6.2).

Variability

Devil's club and oak fern may be present, usually with low cover. Microsite variability can be high on these sites, with trees and species associated with slightly drier conditions growing on mounds, and species associated with wet conditions such as peat-mosses (*Sphagnum* spp.) and sedges (*Carex* spp.). With cold-air common on these sites, minor cover of species associated with higher elevations or colder climates may occur, such as arrow-leaved groundsel (*Senecio triangularis*).

Management Issues

This site series is not recommended for timber harvesting due to sensitive soils and proximity to streams and other water features. Compaction and rutting are potential harvesting hazards, and the water table may rise once trees are removed. Sites have high productivity, and vegetation competition may be a concern in regenerating stands. Cold air and frost may limit regeneration. Windthrow hazard should be a consideration in areas adjacent to harvesting due to shallow rooting. These sites provide forage for wildlife and are often part of travel corridors in steep terrain.

Other Ecosystems

The following ecosystems occur in the ICHmk5; many are described in LMH 71 (MacKillop et al. 2018).

Wetlands

The most common wetland ecosystems in the ICHmk5 are fens (Wf), although marshes (Wm) and swamps (Ws) also occur. Wetland ecosystems are described in Section 6.2.

Flood ecosystems

Middle bench cottonwood stands provide important habitat. Low bench flood ecosystems, dominated by either alder or willows, also occur. See Section 6.3 for details on the Flood Group.

Avalanche features

Avalanche tracks occur in the ICHmk5, with most start zones initiating high above in the ESSF. Herb meadow (Vh), shrub-thicket (Vs), and treed (Vt) avalanche ecosystems are common. The Avalanche Group is described in Section 6.5.

Rock outcrops and talus slopes

With abundant exposed rock and diverse bedrock geology throughout the Rocky and Purcell Mountains, several rock outcrop (Ro) and talus (Rt) ecosystems commonly occur in the ICHmk5. Ecosystems within the Rock Group are described in Section 6.6.

ESSFmm3
Spillimacheen Moist Mild
Engelmann Spruce – Subalpine Fir

Geographic Distribution

The ESSFmm3 occurs at upper elevations in the Purcell and Rocky Mountains. In the Purcell Mountains, it occurs from the upper drainages of Stockade and Forster Creeks north to Quartz Creek, including the Spillimacheen and Beaver River drainages and many of their tributaries. In the Rocky Mountains, the ESSFmm3 occurs in drainages from the Vermillion River north to the Blaeberry River and Waitabit Creek, including areas in the Beaverfoot and Kicking Horse drainages and their tributaries. It includes areas in Kootenay, Yoho, and Glacier National Parks, Bugaboo Provincial Park, and Kicking Horse Mountain Resort. The ESSFmm3 occurs below the ESSFmmw and above the MSdk, ICHmk5, and ICHmw1. The ESSFdk2 occurs at similar elevations at the southern extent of the ESSFmm3, while the ESSFwc4 and ESSFvc occur to the west, and the ESSFvk[5] occurs to the north.

Distribution of the ESSFmm3

[5] Currently mapped as ESSFwc2, but expected to be correlated as ESSFvk in future publications.

Elevation Range

Upper and lower elevation bounds of the ESSFmm3 varying widely across its range with cold-air drainage and latitude as key drivers of this variability. Throughout much of its extent, the ESSFmm3 extends to valley bottom. Where it occurs above the ICH, lower limits are generally between 1450 and 1550 on cool/neutral aspects and between 1550 and 1600 on warm aspects. Where it occurs above the MSdk, elevations are typically lower on cool aspects, dropping to 1400–1450 m. Upper elevations range from 1950–2050 m on cool/neutral aspects and from 2000–2100 m on warm aspects at the southern extent, while at more northern latitudes, upper elevations drop to 1900–1950 m on cool/neutral aspects and from 1950–2025 m on warm aspects.

Climate[6]

The ESSFmm3 occurs in the Moist climate subregion. Fall and winter are cold and moist with a deep annual snowpack. Summers are cool and moist, and spring is cool and wet. Snow typically persists from October or early November through May. Growing season moisture deficits are uncommon except in the driest sites. The ESSFmm3 climate is moister than the ESSFdk2, cooler than the ESSFwm2, and slightly drier than the ESSFwc4, ESSFvc, and ESSFvk.

Forest and Vegetation Characteristics

The ESSFmm3 occurs in the transition between the drier ESSFdk to the south and the wetter ESSFvc and vk to the north. **Sxw and Bl are dominant** across the landscape. **Fd** is usually present and abundant on warm-aspect, dry sites, often with **Pl**, especially on younger, post-fire stands. **Pa** is often present on the driest sites, especially at upper elevations and on colder sites. **La** is also occasionally present, particularly at the southern extent of the ESSFmm3 in areas such as the Vermillion, Ottertail, and Bugaboo valleys. **Cw**, and occasionally **Hw**, frequently occur with low cover at lower elevations, especially in the understorey. [7]

Black huckleberry, false azalea, white-flowered rhododendron, feathermosses, and leafy liverworts are common on most sites, while oval-leaved blueberry is frequently present on mesic and moister sites, especially in the lower two thirds of the ESSFmm3. **Mesic sites** are characterised by Sxw, Bl, false azalea, and five-leaved bramble. **Submesic sites** have grouseberry/low bilberry and the **driest sites** typically have high shrub cover and sparse understorey herb layers. Oak fern, Sitka valerian, arrow-leaved groundsel, leafy mosses, and/or horsetails are common on the **wettest sites**.

Avalanche tracks and rock outcrops are the most common non-forested ecosystems in the ESSFmm3. Wetlands are uncommon and are restricted to areas in small basins and depressions and along mountain streams and lakes. The ESSFmm3 differs from the drier ESSFdk2 where there are considerably fewer ferns and more grouseberry/low bilberry. At higher elevations, the ESSFmmw has shorter growing seasons, lower productivity, and a number of high-elevation species such as anemones, mountain-heathers, and wood-rushes.

[6] See Section 4.5 for more information on climate variables.

[7] Species codes are described in Appendix 3.7 of LMH 71; Pa refers to *Pinus albicaulis* (whitebark pine), an at-risk species, and La refers to *Larix lyallii* (subalpine larch).

Disturbance

Infrequent stand-replacing fires characterize the disturbance history in the ESSFmm3. In subalpine forests of the Columbia and Rocky Mountains, fire patterns are largely weather-dependent, with most very large fires burning during years with prolonged drought (see Agee 1997). In wetter years, ignition probability and fire spread are lower, resulting in fewer, smaller fires. Wildfire, with both small and larger fires, is a key driver of stand and landscape change in the ESSFmm3.

Bark beetles are also key drivers of forest disturbance in the ESSFmm3. Pl is generally restricted to drier sites in the ESSFmm3, and **mountain pine beetle** has had significant effects on Pl stands in localized areas. **Spruce bark beetles** are known to inflict high mortality in some areas, particularly following fire or blowdown, or where slash retention is high after harvest. Endemic levels of **western balsam bark beetle** kill Bl trees and create small canopy openings that, along with windthrow, pathogens, and other small-scale disturbances, facilitate development of multi-aged stands and are important for creating stand structural complexity in older stands. White pine blister rust and, more recently, mountain pine beetle have had devastating effects on Pa. Western gall rust can also limit the growth and form of regenerating Pl. The combination of deep snowpacks and steep terrain results in widespread avalanche tracks and a high risk of snowpress in regenerating stands on steep slopes. Timber harvesting has been extensive in many areas of the ESSFmm3.

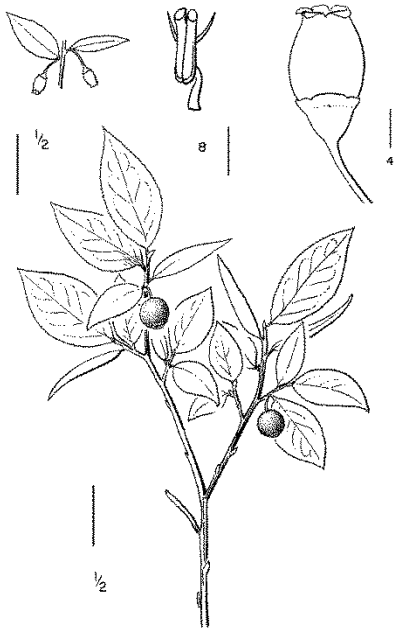
Soils, Geology, and Landforms

The bedrock geology in the ESSFmm3 includes a complex mix of sedimentary and metasedimentary rocks. Medium to coarse-grained, non-calcareous bedrock types (quartzite, sandstone, and conglomerate) are dominant in the Purcell Mountains and occur in the Rocky Mountains at the south end of the Kinbasket Reservoir and in scattered pockets between the upper Kicking Horse River and upper Waitabit Creek. Fine-grained metamorphic and sedimentary rocks (slate, phyllite, siltstone, and argillite), limestone, marble, and dolomite are very common in the Rockies in the Vermillion, Ottertail, and Ice river drainages and in areas north of the Kicking Horse River. Limestone, marble, and other calcareous rocks also occur in the Purcell Mountains north of the upper Spillimacheen Valley. Fine-grained mudstone, siltstone, and shale are common in the upper Kootenay, Beaverfoot, and lower Kicking Horse River valleys, in areas north of the Kicking Horse River, and in the Purcell Mountains north of Vowell Creek.

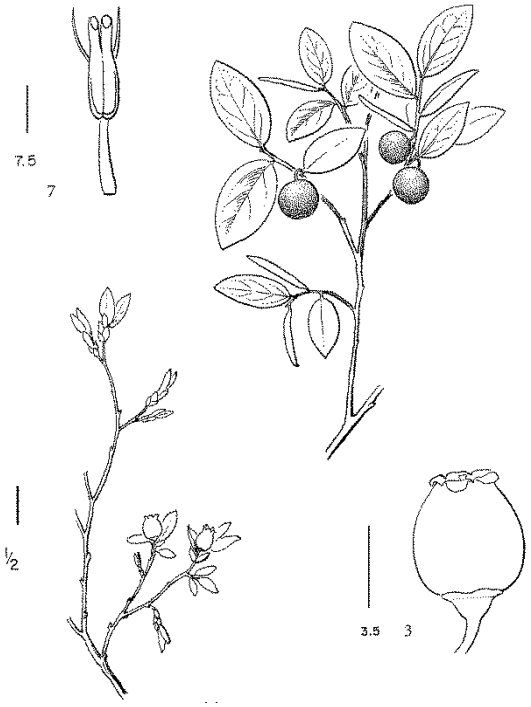
The most common landforms are colluvial blankets and veneers. Areas of exposed bedrock (where soils are < 10 cm deep) are also very common throughout the unit, often at upper elevations above colluvial and morainal deposits. Morainal blankets are locally common along the west side of the Columbia River Valley north of Parsons, in the Spillimacheen Valley south of McMurdo Creek, and in the Vermillion River and Helmet Creek valleys. Soils derived from fine–medium grained, mainly calcareous bedrock types commonly have gravelly silt loam or silt loam textures. Morainal soils often have moderate coarse fragment content and/or clay-enriched (Bt) subsurface horizons; colluvial soils do not. Where parent materials are derived from coarser grained, mainly non-calcareous rocks, soils have textures ranging from loam to loamy sand (sandy loam is most common) and moderate to high coarse fragment content. Calcareous soils are dominant in the Rockies and often have a carbonate-enriched (Cca) subsoil layer. Most soils in the Purcell Mountains portion of the unit are non-calcareous.

Wildlife Habitat

In progress



Black huckleberry
Vaccinium membranaceum



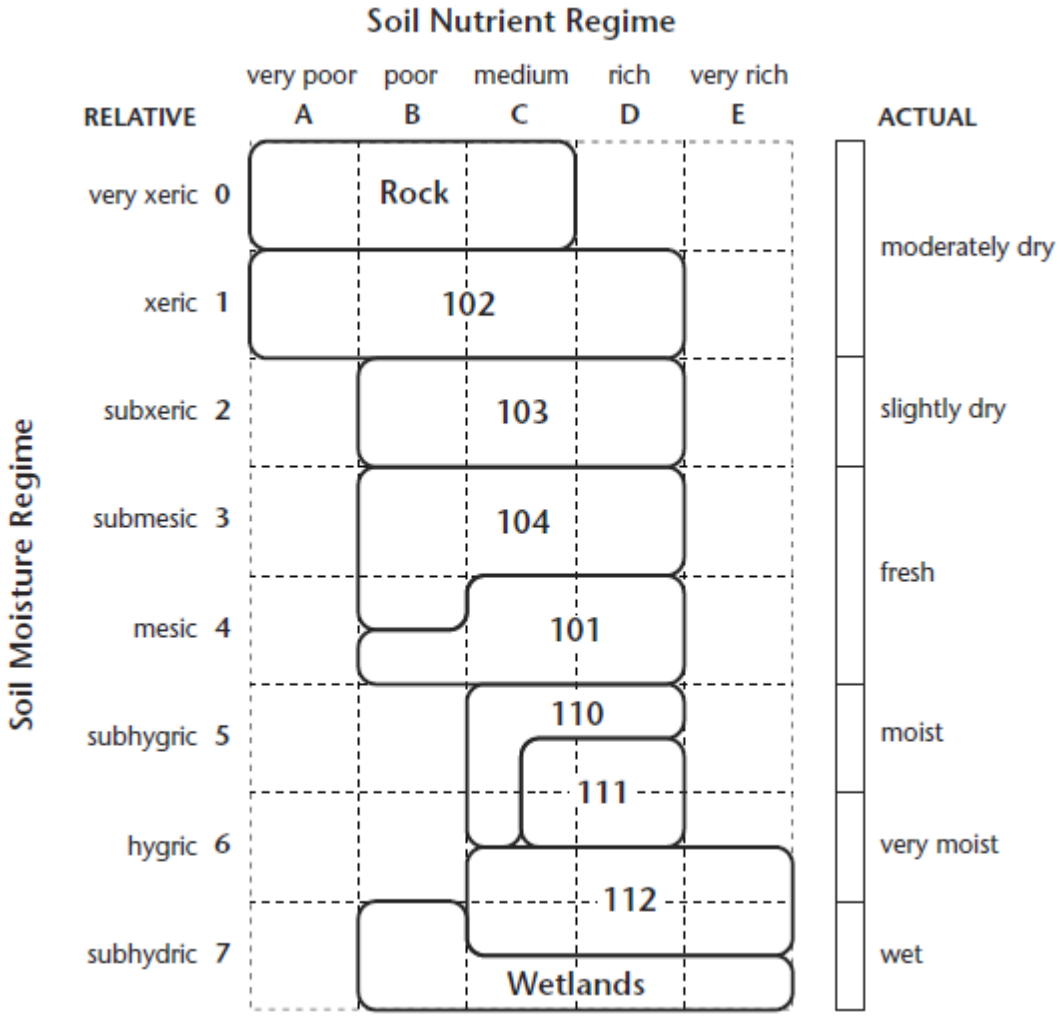
Oval-leaved blueberry
Vaccinium ovalifolium

Distinguishing the ESSFmm3 from Adjacent Biogeoclimatic Units

In the **ESSFdk2**, most sites have:	- more Pl - less white-flowered rhododendron, oval-leaved blueberry, and five-leaved bramble - grouseberry/low bilberry
zonal sites have:	- grouseberry/low bilberry - no five-leaved bramble and foamflower
wet sites have:	- less valerian - no oak fern, lady fern, and/or spiny wood fern (except in isolated areas)
In the **ESSFvk**,[8] most sites have:	- Hm, at least scattered on the landscape
zonal sites have:	- oak fern and/or valerian
dry sites have:	- little or no Fd
In the **ESSFmmw**, most sites have:	- generally lower productivity - little or no Pl - mountain-heathers, wood-rushes, or anemones
zonal sites have:	- no bunchberry; more wood-rushes - less false azalea
dry sites have:	- frequent occurrence of Pa or La - no Fd
wet sites have:	- no oak fern or lady fern
In the **MSdk**, most sites have:	- no white-flowered rhododendron; less false azalea - more abundant Fd and less Bl
zonal sites have:	- Fd - less false azalea; no five-leaved bramble or foamflower
dry sites have:	- Rocky Mountain juniper - more pinegrass and bluebunch wheatgrass
wet sites have:	- little or no oak fern, foamflower, or arrow-leaved groundsel
In the **ICHmk5**, most sites have:	- Cw - less Bl
zonal sites have:	- Fd and Cw - less false azalea and Bl
dry sites have:	- Rocky Mountain Juniper - more pinegrass and birch-leaved spirea
wet sites have:	- more ferns and/or devil's club - little or no Sitka valerian, arrow-leaved groundsel, false hellebore, or globeflower
In the **ICHmw1**, most sites have:	- Cw and/or Hw - less Bl
zonal sites have:	- Fd, Cw, and Hw - little or no false azalea
dry sites have:	- more pinegrass and birch-leaved spirea
wet sites have:	- more ferns and/or devil's club - no Sitka valerian, arrow-leaved groundsel, false hellebore, or globeflower

[8] The ESSFvk was previously part of the ESSFwc2 and will be described in a future publication.

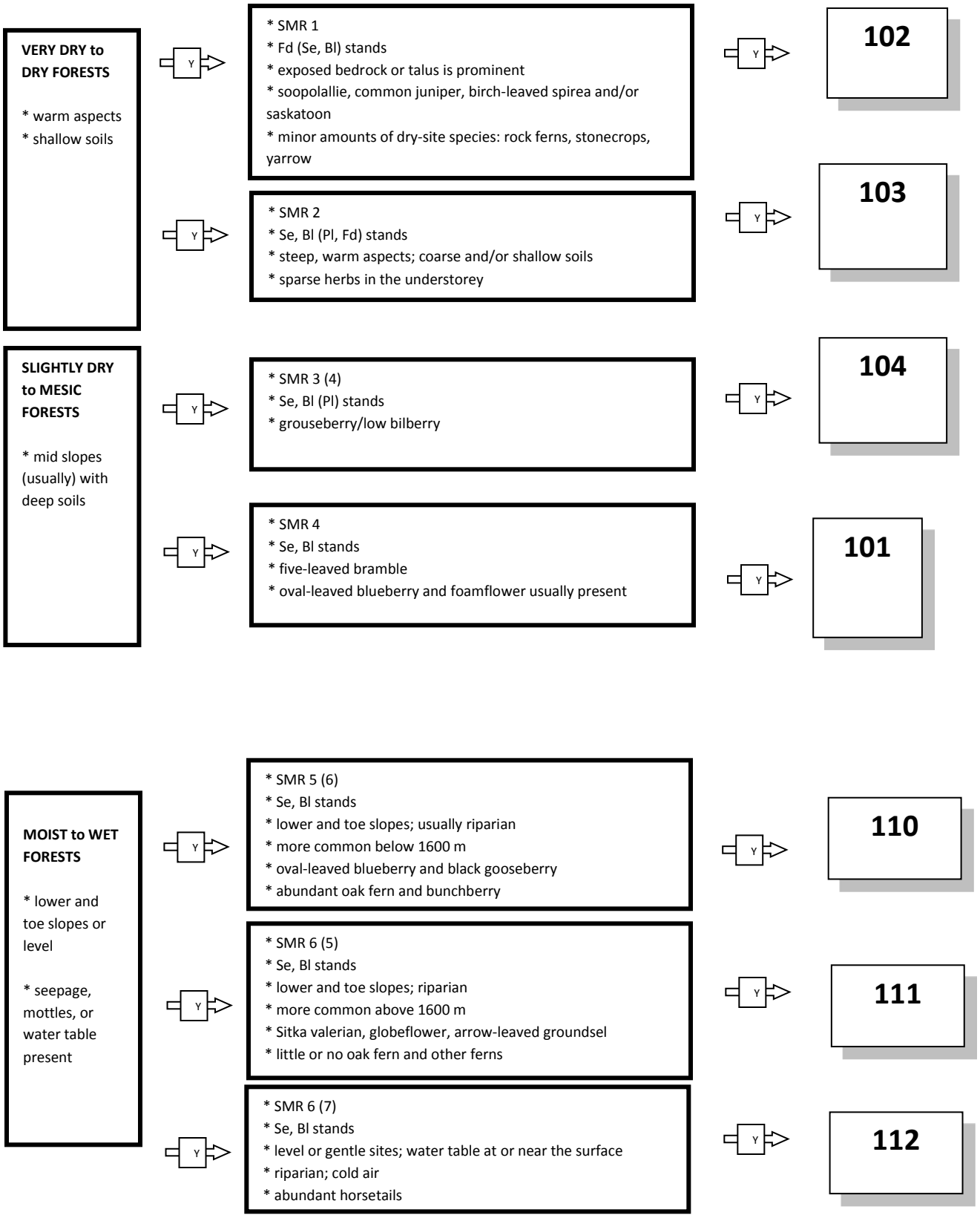
Edatopic Grid



Site Series

101	Bl – Azalea – Bramble
102	BlFd – Juniper – Clad lichens
103	Bl – Huckleberry – Clad lichen
104	Bl – Azalea– Feathermoss
110	BlSe – Azalea – Oak fern
111	BlSe – Valerian – Leafy liverwort
112	Se – Horsetail – Valerian

Site Series Flowchart



Vegetation Table

Layer	Scientific name	102	103	104	101	110	111	112	Common name
Trees	*Pseudotsuga menziesii*	■■■■	*						Douglas-fir
	Picea engelmannii	■■■	■■■■	■■■■	■■■■	■■■■	■■■■	■■■■	Engelmann spruce
	Abies lasiocarpa	■■	■■■■	■■■■	■■■■	■■■■	■■■■	■■■■	subalpine fir
	Pinus contorta		*	■■					lodgepole pine
Regen	*Abies lasiocarpa*	■■■	■■■■	■■■■	■■■	■■■	■■■	■■■	subalpine fir
	Picea engelmannii	■■	■■	■■	■■	■■	■■	■■	Engelmann spruce
	Pseudotsuga menziesii	■■							Douglas-fir
Shrubs	*Juniperus communis*	■■■							common juniper
	Shepherdia Canadensis	■■■							soopolallie
	Spiraea lucida	■■							birch-leaved spirea
	Amelanchier alnifolia	■■							saskatoon
	Vaccinium membranaceum	■	■■■	■■■	■■■	■■■	■■	■■	black huckleberry
	Menziesia ferruginea		■■■■	■■■■■	■■■■	■■■■■	■■■	■■	false azalea
	Rhododendron albiflorum		■■	■■	*	*	■■	■	white-flowered rhododendron
	Vaccinium ovalifolium				■■■	■■■	■■	■■	oval-leaved blueberry
	Ribes lacustre				■	■■	*	■■■	black gooseberry
	Salix spp.							■■■	willows
Herbs	*Fragaria* spp.	■							strawberry
	"rock ferns"[a]	■							rock ferns
	Achillea spp.	■							yarrow
	Sedum spp.	■							stonecrops
	Orthilia secunda	■■	■	■	■				one-sided wintergreen
	Vaccinium scoparium/myrtillus			■■■					grouseberry/low bilberry

Layer	Scientific name	102	103	104	101	110	111	112	Common name
Herbs	*Arnica* spp.			■■	■	■	■■■	■■	arnicas
	Cornus canadensis			■■	■■	■■■	*	*	bunchberry
	Rubus pedatus				■■■	■■■	■■	*	five-leaved bramble
	Tiarella trifoliata var. *unifoliata*				■■	■■■	■■	*	one-leaved foamflower
	Streptopus amplexifolius				■	■	■■	*	clasping twistedstalk
	Gymnocarpium dryopteris					■■■■			oak fern
	Valeriana sitchensis					■■■	■■■■	■■■	Sitka valerian
	Veratrum viride					■	*	*	green false hellebore
	"mitreworts"[a]						■■	■■	mitreworts
	Senecio triangularis						■	■■	arrow-leaved groundsel
	Petasites frigidus						■	■■	sweet coltsfoot
	Trollius albiflorus						■	■	globeflower
	Parnassia fimbriata						■	■	fringed grass-of-Parnassus
	Equisetum spp.						■	■■■■	horsetails
Moss layer	*Dicranum* spp.	■■■	■■■	■■■	■■■	*	*		heron's-bill mosses
	Peltigera spp.	■■■	■■	■■	■	*	■		pelt lichens
	Brachythecium spp.	■■■	*		*	*	■■	■■■■	ragged-mosses
	Pleurozium schreberi	■■	■■■■	■■■■■	■■■■	■■■■	*	*	red-stemmed feathermoss
	"leafy liverworts"[a]	■■	■■	■■■	■■■■	■■■■	■■■■		leafy liverworts
	Cladonia spp.	■■	■■						clad lichens
	Hylocomium splendens	■■		■■■■		*			step moss
	Polytrichum spp.	■■							haircap mosses
	Ptilium crista-castrensis		*	*	■■■	*			knight's plume
	"leafy mosses"[a]					*	■■■	■■■	leafy mosses

[a] Lists of grouped species are provided in Appendix 1.1

Mean cover: ■ < 1% ■■ 1–3% ■■■ 3–10% ■■■■ 10–25% ■■■■■ > 25% * 25–50% of plots and >1% cover

Constancy: ■ > 70% of plots ■ 50–70% of plots

Environment Table[a]

Site series	102	103	104	101	110	111	112
No. of plots	4	7	20	34	16	11	7
SMR	1	2	3 (4)	4	5 (6)	6 (5)	6 (7)
SNR	B–C (A)	B–C (D)	B–C (D)	C (B–D)	C–D	C–D	D–E (C)
Slope position	MD (UP)	MD–UP (CR)	MD (LW, UP)	MD	LW, TO (MD)	LW, TO (MD)	TO, LV (DP)
Typical slope/aspect	Steep–moderately steep/warm	Steep/warm	Upper/cool or neutral shedding; shallow, coarse/ neutral or cool	Moderate/ neutral (cool)	Gentle–moderate	Level–gentle (moderate)	Gentle–level
Common compensating conditions		Coarse-textured crests and upper slopes	Moderate/ warm	Lower, coarse; gentle, warm	Mid-slopes with seepage or subirrigation	Mid-slope receiving sites; moderately coarse toe slopes	
Surficial materials	Cx/R, Mx/R (Cvb)	Cv, Cb (Mv)	Mb, Cb	Mb (Cb)	M, F (C)	F (M, C)	F (Ov, M)
Soil texture	SL (SiL, LS)	SiL, SL (LS, FSL)	SL, SiL	SiL (L, FSL)	SiL (SL)	SiL (SL, LS)	SiL (SL, FSL)
Coarse fragment content	High–fragmental	High–fragmental	High–moderate	Moderate; occasionally high	Moderate (variable)	Moderate; often higher at depth	Variable, often with coarser flood deposition
Important features	Bedrock is prominent and abundant; soils are often fragmental	Insolation			Seepage at depth; often riparian; more common below 1600 m	Seepage; often riparian; more common above 1600 m	Water table near surface; can have Ov or flooding; cold air is common

[a] Codes and categories are in Chapter 3. Keys for use in the field are in the appendices.

101 BlSe – Azalea – Bramble

General Description

SMR 4 (3). The 101 site series typically occurs on **mid slopes** of **neutral** to **cool aspects** with deep, moderate-textured soils. This site series also occurs on warm aspects, either in lower slope positions or on gentle to moderate mid-slopes. Soils usually have silt loam textures and moderate coarse fragment content, often increasing at depth.

Bl and **Se** are abundant. False azalea cover is typically high, along with moderate cover of black huckleberry. Oval-leaved blueberry is often present. The herb layer is characterised by **five-leaved bramble**, often with minor cover of one-leaved foamflower. Arnica, bunchberry, and clasping twistedstalk are commonly present. The well-developed moss layer typically consists of red-stemmed feathermoss with heron's bill mosses, knight's plume, and/or leafy liverworts.

Differentiating from other site series

Slightly drier sites (104) have grouseberry/low bilberry and lack five-leaved bramble and/or foamflower. Slightly moister sites (110) have oak fern and/or Sitka valerian and more bunchberry and one-leaved foamflower.

Variability

White-flowered rhododendron and oval-leaved blueberry are usually present in the understorey, but may be sparse or absent. Pl can be a minor component of younger stands that are dominated by Se and Bl.

Management Issues

Snow creep and avalanching can damage regenerating trees on steeper slopes. High cover of shrubs can compete with regenerating conifers.

102 PlFd – Juniper – Douglas maple

General Description

SMR 1. The 102 occurs on forested sites with abundant exposed **bedrock** or, occasionally, coarse **talus**, and **root restricting** layers at or near the surface. Soils are shallow and/or rocky and growing conditions can be droughty on these warm-aspect sites.

Fd is often dominant at lower elevations while **Pa** may be present at upper elevations. Se and Bl are typically codominant or form a minor component of the stand. Dry-site species such as **rock ferns**, **stonecrops**, and/or yarrow are usually present along with **common juniper**, **soopolallie**, and **birch-leaved spirea**. False azalea and white-flowered rhododendron are typically sparse or absent. Moss cover is variable and typically includes heron's-bill mosses, haircap mosses, ragged-mosses, and/or pelt and clad lichens.

Differentiating from other site series

The 102 is the driest forested site series and is easily differentiated by the sparse forested canopy (> 10% tree cover at maturity) and the abundance of exposed rock (bedrock or talus). Drier sites are non-forested rock outcrops and talus sites (see Section 6.5). Slightly moister sites (103) have little or no exposed rock, and usually have more Se, false azalea, and white-flowered rhododendron, and less Fd.

Variability

Pa is often present, particularly at upper elevations, although mortality from white pine blister rust and mountain pine beetle has been high in most stands. Understorey species composition varies depending on soil depth and parent materials. Where soils are calcareous, species typically associated with slightly moister sites may occur.

Management Issues

This site series is not recommended for timber harvesting due to limitations in available soil and soil moisture for tree regeneration and growth. These sites may provide habitats for rare and at-risk species (e.g., Pa).

103 Bl – Huckleberry – Clad lichen

General Description

SMR 2 (3). 103 sites occur on **mid to upper slopes** on moderately steep to **steep, warm aspects**, typically with **coarse and/or shallow**, rocky soils, and on warm and/or dry crests. Soils are rapidly to well-drained, usually with silt loam textures and **high coarse fragment content**.

Se and Bl dominate the overstorey on these sites. Understorey vegetation is dominated by **shrubs and mosses**. False azalea, white-flowered rhododendron, and black huckleberry are abundant. The well-developed moss layer usually has high cover of feathermosses, heron's bill mosses, and/or leafy liverworts, and minor cover of pelt and clad lichens. Herb cover is very sparse (often less than < 2%, total) and comprised of few species. Minor cover of one-sided wintergreen is common.

Differentiating from other site series

Slightly drier sites (102) have prominent exposed bedrock or talus and typically have more Fd and/or Pa and less false azalea, white-flowered rhododendron, and black huckleberry. Slightly moister sites (104) have higher herb cover, including grouseberry/low bilberry and minor cover of arnica and/or bunchberry.

Variability

Pl can be abundant, particularly on earlier seral sites, and minor cover of Fd may occur. Pa may be present and can be abundant in some areas, although mortality from white pine blister rust and mountain pine beetle has been high in most stands. Sites can occur on neutral aspects, especially where they are exposed to broad valleys that receive slightly more sun exposure or where soils are very coarse.

Management Issues

Drought may inhibit conifer regeneration, particularly during drier than average growing seasons. On steep slopes, avalanching and snowpress can damage regenerating trees in winter, while soil erosion can be a concern during the growing season.

104 Bl – Azalea– Feathermoss

General Description

SMR 3 (4). The 104 site series typically occurs on **coarse, shallow, or shedding sites** on **cool- and neutral-aspect sites** and on **mid slopes of warm aspects** with deep soils. Soils have sandy loam or silt loam textures, usually with high or moderate coarse fragment content.

Se and Bl dominate the overstorey with abundant black huckleberry and **false azalea**. **Grouseberry/low bilberry** are usually abundant in the understorey and bunchberry and arnica are often present with low cover. **Feathermosses** (red-stemmed feathermoss, knight's plume, and step moss) dominate the moss layer. Leafy liverworts can be abundant, especially at higher elevations.

Differentiating from other site series

Slightly drier (103) sites are generally shrub-dominated with sparse herb cover. Slightly moister sites (101) are characterised by five-leaved bramble, often with minor cover of foamflower and/or oval-leaved blueberry.

Variability

Grouseberry/low bilberry is usually present although cover can vary from sparse (< 1%) to abundant (> 15%); higher covers are more typical where the 104 occurs at upper elevations. Where grouseberry/low bilberry are sparse, minor cover of bunchberry is common. White-flowered rhododendron is usually present.

Management Issues

On steep slopes, avalanching and snowpress can damage regenerating trees in winter, while soil erosion can be a concern during the growing season. High cover of shrubs can compete with conifer regeneration.

110 BlSe – Azalea – Oak fern

General Description

SMR 5 (6). The 110 site series occurs on gently to moderately sloping, **lower and toe slopes** where seepage is present in the upper 50–100 cm of the soil. Sites also occur in mid-slope seepage areas. Soil textures are generally silt loam with moderate coarse fragment content, although soils with sandy loam textures and high coarse fragment content occur where seepage is constant throughout the growing season.

Se and Bl dominate the overstorey. False azalea, oval-leaved blueberry, and black huckleberry characterize the shrub layer. Herb cover is high, and **oak fern**, **foamflower**, **bunchberry**, and five-leaved bramble are abundant. Spiny wood fern (*Dryopteris expansa*), lady fern (*Athyrium filix-femina*), and/or Sitka valerian may be present. Moss cover is generally moderate to high. Leafy liverworts and feathermosses (red-stemmed feathermoss, knight's plume, and step moss) generally form a large component of the moss cover.

Differentiating from other site series

Slightly drier sites (101) lack oak fern and Sitka valerian. On slightly moister (and colder) sites (111), Sitka valerian is abundant and oak fern is sparse or absent; globeflower, arrow-leaved groundsel, and arnica (mostly mountain arnica [*Arnica latifolia*]) are usually present.

Variability

This site series is most common at elevations below ~ 1600 m, although it can occur throughout the elevation range of the ESSFmm3. Infrequent flooding may occur on sites adjacent to streams.

Management Issues

Brush competition is often a concern in regenerating stands. When soils are moist, compaction and rutting are potential harvesting hazards, and harvesting should occur when soils are dry or frozen. Sites are usually associated with riparian areas and often provide important forage, hiding cover, and travel corridors for wildlife.

111 BlSe – Valerian – Leafy liverwort

General Description

SMR 6 (5). 111 sites occur on gently sloped **lower and toe slopes** in moist, **receiving sites** where **seepage** and mottles or gleying are present within 50–75 cm of the soil surface. Soil textures are most commonly silt loam with moderate coarse fragment content, although increasingly coarse soils, with sandy loam or loamy sand and high coarse fragment content, often occur deeper in the soil profile.

Se and Bl dominate the relatively open tree layers. Shrub cover is often low to moderate (< 30%) and is comprised of white-flowered rhododendron, false azalea, black huckleberry, oval-leaved blueberry, and black gooseberry. **Sitka valerian**, arnica, **globeflower**, **arrow-leaved groundsel**, mitreworts, and Canby's lovage (*Ligusticum canbyii*) are characteristic in the herb layer. Leafy mosses and leafy liverworts typically dominate the moss layer.

Differentiating from other site series

The 110 site series occurs on similar sites at lower elevations or on slightly warmer sites and has oak fern and/or spiny wood fern, more feathermosses, less arnicas, and more bunchberry and false azalea. Slightly moister sites (112) have abundant horsetails.

Variability

The 111 site series is more common at elevations above ~ 1600 m and on colder sites at lower elevations.

Management Issues

Brush competition is often a concern in regenerating stands. When soils are moist, compaction and rutting are potential harvesting hazards, and harvesting should occur when soils are dry or frozen. Sites are often associated with riparian areas and provide important forage, hiding cover, and travel corridors for wildlife.

112 Se – Horsetail – Valerian

General Description

SMR 6 (7). 112 forests are uncommon in the ESSFmm3. They occur on gentle toe slopes, level sites, and depressions. The water table is at or near the surface throughout the growing season and cold air accumulation is common. Sites are typically associated with **riparian areas** and usually experience **occasional flooding**. A thin, peaty, **organic veneer** may be present where flooding is rare. Soils are typically Gleysols or Orthic-Humic Regosols on sites with a history of frequent flooding.

Open Se stands occur with minor to moderate cover of Bl in the overstorey and understorey. **Horsetails** (mostly common; *Equisetum arvense* and meadow; *E. pratense*) characterize the understorey, often with black gooseberry, Sitka valerian, arrow-leaved groundsel, mitreworts, and willows. Ragged mosses and leafy mosses (mostly *Rhizomnium* spp.) usually occur with moderate to high cover.

Differentiating from other site series

Slightly drier sites (110 and 111) lack abundant horsetails. Slightly wetter sites are non-forested wetlands (< 10% tree cover) (see Section 6.2).

Variability

Microsite variability can be high on these sites, with trees and species associated with slightly drier conditions growing on mounds, and species associated with wet conditions such as rein orchids (*Platanthera* spp.) and willowherbs (*Epilobium* spp.). High herb species diversity is common, with many species occurring, each with low cover.

Management Issues

This site series is not recommended for timber harvesting due to sensitive soils and proximity to streams and other water features. Compaction and rutting are potential hazards, and the water table may rise once trees are removed. Cold air, frost, and brush competition may limit tree regeneration following harvest. Sites often provide important forage, hiding cover, and travel corridors for wildlife.

Other Ecosystems

The following ecosystems occur in the ESSFmm3; many are described in LMH 71 (MacKillop et al. 2018).

Wetlands

The most common wetland ecosystems in the ESSFmm3 are fens (Wf), although marshes (Wm) and swamps (Ws) also occur. Alpine wetlands (Wa) occur on very cold sites. Wetland ecosystems are described in Section 6.2.

Flood ecosystems

Low bench flood ecosystems, dominated by either alder or willows, are uncommon. See Section 6.3 for details on the Flood Group.

Avalanche features

Avalanche tracks are very common in the ESSFmm3, and include highly diverse plant communities. Most of the herb meadow (Vh) and shrub thicket (Vs) avalanche units that have been described occur in the ESSFdk2, and a number of currently undescribed treed avalanche (Vt) units are also known to occur. Avalanche ecosystems are described in Section 6.5.

Rock outcrops and talus slopes

With abundant exposed rock and diverse bedrock geology throughout the Rocky and Purcell Mountains, several rock outcrop (Ro) and talus (Rt) ecosystems commonly occur in the ESSFmm3. Ecosystems within the Rock Group are described in Section 6.6.