4.2.3 ESSF Engelmann Spruce – Subalpine Fir Zone

Location and Distribution: (Figure 4.6; Table 4.2) The ESSF is the high-elevation or subalpine forested zone found in the interior portion of the southern PRFR. It occurs on the east slopes of the Coast Mountain Range, throughout the Hazelton Mountains and most of the Skeena Mountains, and wherever there are high-elevation peaks, plateaus, and ridges within the Nechako Plateau. The ESSF makes up 17.5% of the land area within the south half of the PRFR, and is found in all forest districts except the North Coast.

The ESSF lies below the AT zone, and above the SBS, ICH, SBPS, and easternmost CWH. Its lower elevation limits are 900 - 1400 m and its upper elevation limits are 1350 - 1800 m (rarely 2100 m). The considerable range in both the upper and lower limits is caused by climatic variability and topography, particularly as they influence snowpacks. Where snowpacks are deep and long lasting, the ESSF tends to be found at lower elevations.

Climate: (Table 4.3) There are no long-term climate stations in the ESSF, but we know that it has a shorter, cooler, and moister growing season than the adjacent low-elevation zones, and a longer, colder, and snowier winter. It is mainly the length and warmth of the snow-free season that determines whether or not trees are able to survive and reproduce — thus determining the elevation of treeline. Within the ESSF, precipitation generally increases with increasing elevation and from east to west. Total precipitation ranges from approximately 450 to 1100 mm. Average snowpacks range from about 70 cm to well over 2 m and last from 6 to 9 months. Soils are commonly frozen throughout the winter in drier parts of the zone, but in the west, bordering on the MH, heavy early snowfalls often prevent soil freezing.

Vegetation: (Figure 4.7) The ESSF includes continuous forest at its lower and middle elevations and subalpine parkland at its upper elevations. In the subalpine parkland, clumps of trees occur together with areas of heath, meadow, and grassland. This is a stressful, relatively low productivity environment for most tree species. Stands are relatively open, and mature trees often show frost cracks or other signs of environmental stress. Subalpine fir is the dominant tree throughout the zone. It has a characteristic spire-shaped crown and tapered bole that is not as evident at lower elevations. Hybrid white spruce and lodgepole pine are common in drier, eastern portions of the zone that have been influenced by fire (mainly above the SBS zone); mountain hemlock and amabilis fir are common in wetter, western portions where less soil freezing occurs (mainly above the ICH zone). Other locally common tree species include whitebark pine and western hemlock.

The most common forest understory species in the ESSF are black huckleberry, five-leaved bramble, leafy liverwort, and curly heron's-bill moss. Avalanche tracks are a typical feature of the steep mountainous terrain. Slide vegetation normally includes Sitka alder, arrow-leaved

FIGURE 4.6. Distribution of forested ESSF subzones and variants in the PRFR, south half.

groundsel, Indian hellebore, and cow-parsnip. Subalpine heath communities are dominated by dwarf woody plants such as white mountain-heather or pink mountain-heather. Subalpine meadow communities are characterized by arctic lupine, Sitka valerian, arrow-leaved groundsel, subalpine daisy, mountain sagewort, mountain arnica, Indian hellebore, and Altai fescue.

Soils: (Table 4.2) The most common zonal soils in the ESSF are Humo-Ferric Podzols, but Ferro-Humic Podzols are dominant in the wettest parts of the zone, while Podzolic Gray Luvisols are common in the driest, eastern portions. Humus forms on zonal ecosystems are Hemimors (< 10 cm thick) in drier subzones and thicker (5 - 15 cm thick) Hemihumimors in wetter subzones. Higher precipitation and cooler temperatures cause ESSF soils to be more strongly leached and have slower organic matter decomposition than those at lower elevations. Because of the mountainous terrain, ESSF soils are often shallow and show evidence of colluvial action. Melanic or Sombric Brunisols with thick organic-enriched surface horizons can be found in avalanche tracks or subalpine meadows.

Differentiating Features: The ESSF can be distinguished from the neighbouring MH by dominance of subalpine fir over both mountain hemlock and amabilis fir, and dominance of black huckleberry over Alaskan blueberry and oval-leaved blueberry. In the ESSF, subalpine fir takes on a characteristic spire-shaped form and clumped distribution, which are not as evident in the ICH and SBS. Lack of western hemlock, relative to subalpine fir and mountain hemlock, distinguish the ESSF from the ICH. Relative scarcity of hybrid white spruce, knight's plume, and step moss helps to distinguish the ESSF from the SBS. Subalpine indicator species such as whitebark pine (in the south only), mountain hemlock (western portions only), Sitka mountain-ash, Sitka valerian, Indian hellebore, arrow-leaved groundsel, white mountain-heather, pink mountain-heather, and abundant heron's-bill mosses and leafy liverworts also help to separate the ESSF from adjacent low-elevation zones.

Subzones and Variants: (Figures 4.6 and 4.7; Table 4.5) In the PRFR, there are four forested subzones described based on regional climate. One of these is represented in the PRFR by a single variant:

ESSFmk - Moist Cool (Forested) subzone

ESSFmc - Moist Cold (Forested) subzone

ESSFmv - Moist Very Cold (Forested) subzone
ESSFmv3 - Omineca variant[5]

ESSFwv - Wet Very Cold (Forested) subzone

The ESSFmc lies directly above the SBSmc subzone in the southeastern part of the PRFR. It has the most continental climate of the four subzones, with cold winter temperatures, relatively low annual precipitation (450 - 650 mm), and the lightest snowpack (70 - 150 cm).

[5] The ESSFmv1 and 2 variants occur outside the PRFR.

TABLE 4.5. Environmental characteristics of ESSF and MH subzones and variants in the PRFR, south half

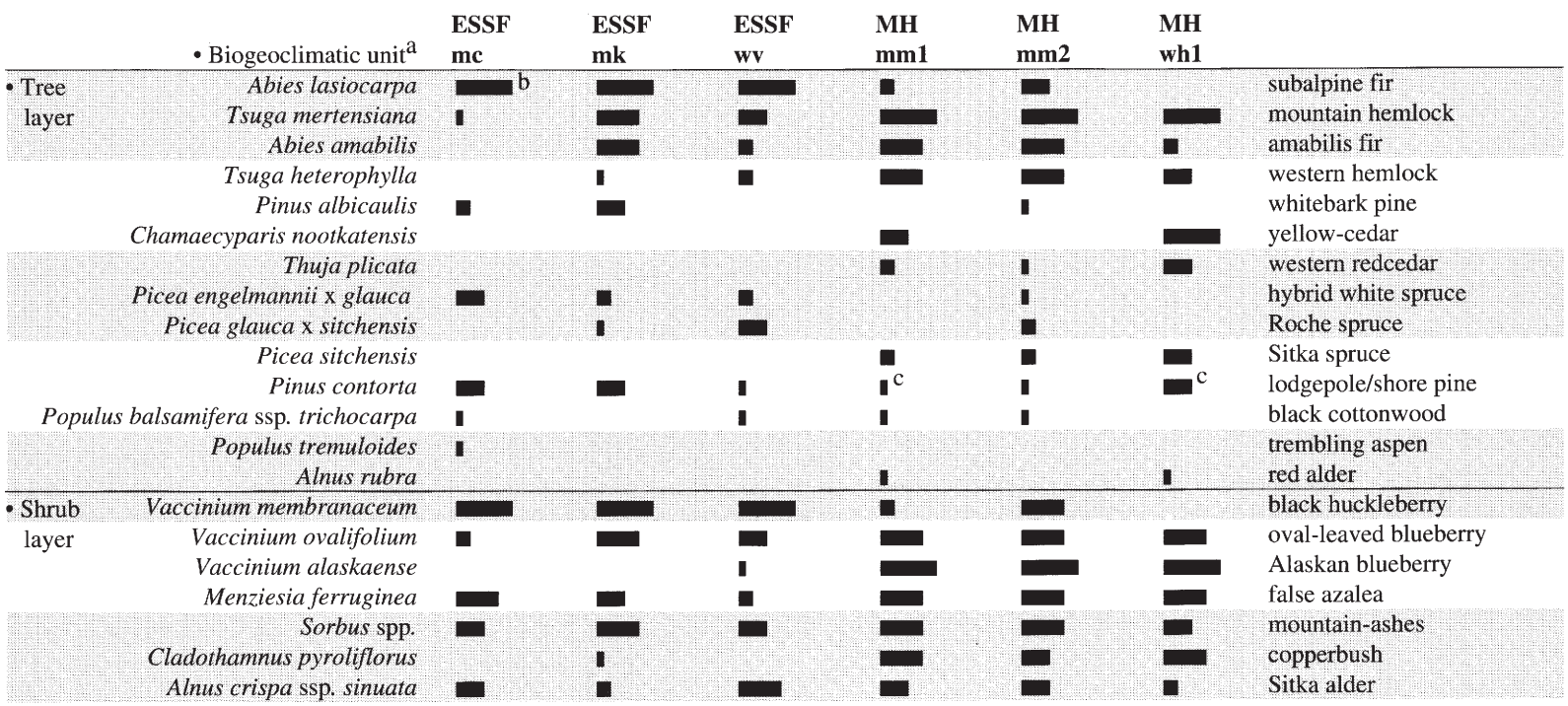
Subzone or Variant[a]	ESSFmc	ESSFmk	ESSFwv
Extent[b]			
Area	683 602 ha	149 332 ha	1 107 991 ha
% of PRFR, south half	6.2%	1.3%	10.0%
Elevation range	1200 - 1800 m, south 950 - 1500 m, north	1000 - 1800 m	900 - 1550 m
Distribution			
Physiographic regions	Nechako Plateau; southeast Skeena Mtns; eastern Hazelton Mtns.	Eastern Kitimat Ranges, Coast Mtns.; also southernmost Hazelton Mtns.	Southeast Boundary Ranges, Coast Mtns.; northwest Skeena Mtns.; central Hazelton Mtns.
Major drainages, inlets, and islands	Above SBSmc and SBPS; Tahtsadle Cr.; Babine, Nilkitkwa, Bulkley, Morice, and Endako drainages; eastern Whitesail and Eutsuk lakes	Above southeastern CWHws2; upper Telkwa R., Burnie R.; Morice, Nanika, Kidprice, Tahtsa, and western Whitesail, Eutsuk, and Tesla lks.	Above ICH; Kitseguecla, Suskwa, Kitwanga, Kispiox, upper Skeena, and Nass rivers
Climate	Continental; cold winters; cool, fairly dry summers, and light snowpack (70 - 150 cm); total precip. 450 - 600 mm; deeply frozen soils	Subcontinental; warmest ESSF subzone; snowy winters but dry summers; total precipitation 1000+ mm; snowpack 2+ m; soil may not freeze deeply	Subcontinental; cool, moist summers and snowy winters; snowpack 1.2 - 2 m; total precip. 650 - 1100+ mm; soils may not freeze deeply
Soils			
Zonal soils	Humo-Ferric Podzols and Podzolic Gray Luvisols	Humo-Ferric Podzols	Ferro-Humic Podzols
Humus forms	Hemimors; 2 - 7 cm thick	Hemimors; 2 - 5 cm thick	Hemihumimors; 5 - 15 cm thick
Vegetation[c]			
Major tree species	Bl, Sxw, Pl	Bl, Hm, Ba, Pa, Pl	Bl, Hm, Sxw, Hw
Zonal site association	Bl -Huckleberry - Leafy liverwort	BlHm - Twistedstalk	BlHm - Azalea

a For a description of the ESSFmv3 refer to MacKinnon *et al*. (1990).

b Information includes contiguous parkland subzones.

c Tree species codes are found in Appendix 3.

MHmm1	MHmm2	MHwh1
729 759 ha 6.6% 800 - 1200 m	567 963 ha 5.1% 1000 - 1600 m	127 465 ha 1.1% 600 - 1100 m
Western slopes of Kitimat Ranges and southwest Boundary Ranges, Coast Mtns.	Eastern slopes of Kitimat Ranges, Coast Mtns.; western slopes of Hazelton Mtns.	Hecate Lowland
Above CWHvm2 and southern CWHwm; Portland Canal; lower Skeena R.; Douglas Channel and lower Kitlope R.; Princess Royal Is.	Above CWHws2; Alice Arm, Kiteen R., Skeena R. and tribs. from Exstew to Seven Sisters; upper Kemano and Kitlope rivers	Above CWHvh; scattered on all major coastal islands and a fringe of mainland from mouth of Portland Canal to Vancouver Forest Region
Maritime; cool and very wet year-round with deep, wet snow (snowpack up to 3 m); soils never freeze	Submaritime; colder and drier than MHmml with heavy, wet snowpack (2 - 3 m); soils do not freeze	Hypermaritime; mild, foggy, wet with wet, intermittent heavy snowpack (< 0.5 m)
Ferro-Humic and Humo -Ferric Podzols (Folic phases) and Folisols Humimors; 10 - 69 cm thick	Humo-Ferric and Ferro-Humic Podzols Hemihumimors; 7 - 25 cm thick	Wet Folisols and Gleyed Ferro-Humic Podzols Thick, compacted Humimors and Hemihumimors
Hm, Ba, Hw, Yc HmBa - Blueberry	Hm, Ba, Hw, Bl HmBa - Blueberry	Hm, Yc, Hw, Cw, Ss, Pl HmSs - Blueberry



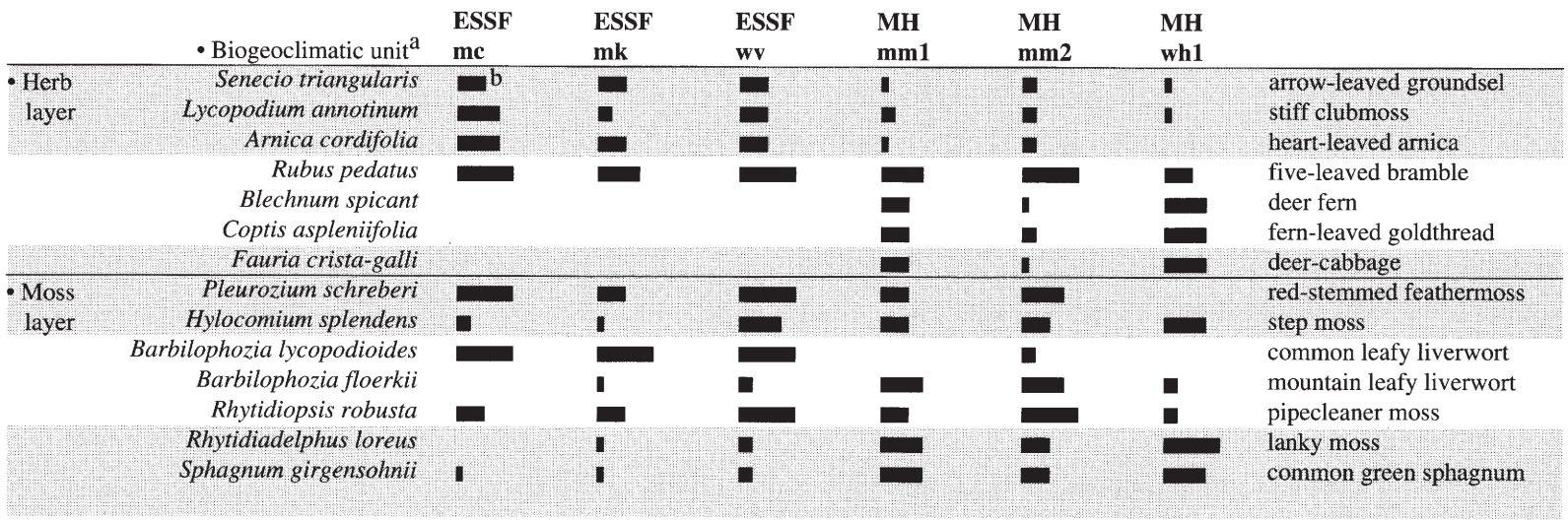
	• Biogeoclimatic unit[a]	ESSF mc	ESSF mk	ESSF wv	MH mm1	MH mm2	MH wh1	
• Tree layer	*Abies lasiocarpa*	[b]						subalpine fir
	Tsuga mertensiana							mountain hemlock
	Abies amabilis							amabilis fir
	Tsuga heterophylla							western hemlock
	Pinus albicaulis							whitebark pine
	Chamaecyparis nootkatensis							yellow-cedar
	Thuja plicata							western redcedar
	Picea engelmannii x *glauca*							hybrid white spruce
	Picea glauca x *sitchensis*							Roche spruce
	Picea sitchensis							Sitka spruce
	Pinus contorta				[c]		[c]	lodgepole/shore pine
	Populus balsamifera ssp. *trichocarpa*							black cottonwood
	Populus tremuloides							trembling aspen
	Alnus rubra							red alder
• Shrub layer	*Vaccinium membranaceum*							black huckleberry
	Vaccinium ovalifolium							oval-leaved blueberry
	Vaccinium alaskaense							Alaskan blueberry
	Menziesia ferruginea							false azalea
	Sorbus spp.							mountain-ashes
	Cladothamnus pyroliflorus							copperbush
	Alnus crispa ssp. *sinuata*							Sitka alder

[a] For a description of the ESSFmv3 refer to MacKinnon *et al.* (1990).

[b] Bars indicate the relative abundance of plants across all site series within a biogeoclimatic unit. These bars are defined in Section 3.2.2, page 3•6.

[c] Mainly shore pine (*Pinus contorta* var. *contorta*).

FIGURE 4.7. Vegetation table for ESSF and MH subzones and variants in the PRFR, south half.



[a] For a description of the ESSFmv3 refer to MacKinnon *et al.* (1990).

[b] Bars indicate the relative abundance of plants across all site series within a biogeoclimatic unit. These bars are defined in Section 3.2.2, page 3•6.

FIGURE 4.7 (Continued).

Subalpine fir, hybrid white spruce, and lodgepole pine are dominant species; amabilis fir is absent, mountain hemlock is rare, and whitebark pine is occasionally present on the driest sites.

The **ESSFmk** occurs as a narrow (30 km wide at most) band along the leeward, eastern flanks of the Coast Mountains, south of the Telkwa Pass. It also occupies much of the subalpine elevations of the Tahtsa Ranges and Bulkley Ranges in the Burnie River area. The ESSFmk is the warmest of the three ESSF subzones. It also differs from the others in that it lies in a rainshadow of the Coast Mountains that receives low summer rainfall (total precipitation about 1000 mm), but experiences relatively snowy winters with minimal ground freezing. This combination allows for the growth of mountain hemlock and amabilis fir. Whitebark pine is also a common and distinctive feature of the ESSFmk, particularly on dry, rocky sites. The relatively dry summer climate seems to be responsible for a low diversity of herb and moss species. Increased presence of mountain leafy liverwort and lichens are characteristic of the ESSFmk.

The **ESSFmv** extends into the PRFR from the Prince George Forest Region to the east. The **ESSFmv3**, or Omineca variant, occupies a few high-elevation areas east of Babine Lake. It is of very limited extent in the PRFR and is not described in this guide. Readers should refer to MacKinnon *et al*. (1990) or use the descriptions provided here for the ESSFmc. The occurrence of white rhododendron in the ESSFmv3 is the main floristic distinction between these two biogeoclimatic units.

The ESSFwv is the most northerly ESSF subzone. It lies above the ICH zone and portions of the CWHws2 in the Hazelton Mountains, Skeena Mountains, Nass Basin, and along the eastern flanks of the Coast Mountains north of the Nass River. The ESSFwv has a snowy winter and a moister growing season than the other two subzones. Mean annual precipitation is 650 - 1100 mm, and growing season moisture deficits are unlikely. Climax forests are dominated by subalpine fir, with lesser components of mountain hemlock, hybrid white spruce, and western hemlock. Lodgepole pine is rare and whitebark pine is absent. This subzone has a greater diversity of shrubs and herbs than the other subalpine subzones, including many typically coastal species.

Above each of the forested subzones, there is a corresponding parkland subzone/variant (the ESSFmcp, ESSFmkp, ESSFmvp3, and ESSFwvp) occupying the transition from treeline to true alpine tundra (AT zone). These parkland subzones and variants share many of the classification features of their forested counterparts, but the harsher climate and lingering snowpack do not allow the growth of continuous forests. Instead, there is a mosaic of tree islands interspersed with heath vegetation (i.e., dwarf shrubs, usually of the heather, family) and subalpine herb meadows. Subalpine fir is the dominant tree throughout. Mountain hemlock is common in tree clumps of the ESSFmkp and ESSFwvp, but is rare in the ESSFmcp and absent from the ESSFmvp3. Compared to the two westerly subzones, the ESSFmcp and ESSFmvp3 also tend to have more subalpine forbs, grasses, and sedges, and less heath vegetation.

4.2.4 ICH Interior Cedar – Hemlock Zone

Location and Distribution: (Figure 4.8; Table 4.2) The ICH is the zone of low- to mid-elevation forest found within the coast-interior transition. It lies just east of the Coast Mountain Range in the mid-portions of the Skeena and Nass river drainages, including major tributary valleys such as the Bell-Irving, Kinskuch, Kispiox, Kitwanga, and the lower Bulkley. It encompasses most of the Nass Basin and adjacent parts of the Hazelton and Skeena mountains. The ICH makes up 9.2% of the land area within the south half of the PRFR, in the Kalum and Kispiox forest districts, with a small portion in the Bulkley Forest District.

The ICH is bounded to the west by the CWH zone and to the east by the SBS zone. It includes valley floors and low to middle mountain slopes ranging in elevation from 100 to 1100 m. In the Hazelton area, the ICH lies roughly between 150 and 1000 m, below the ESSF zone. In the Nass Valley near Aiyansh, the ICH occupies only the valley floor, giving way to the CWH zone at 350 - 600 m elevation, depending on topography. In the Meziadin - Bell-Irving area, the ICH ranges in elevation from 240 m at Meziadin Lake up to approximately 900 -1000 m where the ESSF zone begins.

Climate: (Table 4.3) The climate of the ICH is intermediate between the cool, wet, more equable conditions of the North Coast and the drier, more extreme conditions of the Interior Plateau. Where wide valleys such as the Skeena and Nass cut through the Coast Mountains, warm, humid coastal weather systems are able to penetrate considerable distances inland, losing their warmth and moisture gradually, and creating the wide band of transitional climate that characterizes the ICH. In brief, the climate is warm and moist in summer, cool and wet in fall, and cold in winter. Average annual precipitation ranges from 500 to 1200 mm. Snowfall varies from moderately light to very heavy depending on location, and snowpacks last from 4 to 7 months. The ground is generally frozen throughout the winter and breakup occurs between early March and late May.

Vegetation: (Figure 4.4) The transitional nature of the ICH climate is reflected in the vegetation of the zone, which combines elements of both coastal and interior flora. Climax forests are dominated by western hemlock, which occurs together with subalpine fir, Roche spruce, and western redcedar. Amabilis fir is found at higher elevations in some southern and western portions of the zone, but is mostly absent.

Zonal ecosystems over most of the ICH have a thick feathermoss carpet (step moss, red-stemmed feathermoss, knight's plume, and electrified cat's-tail moss) and poorly developed shrub and herb layers (scattered oval-leaved blueberry, Alaskan blueberry, or black huckleberry, bunchberry, five-leaved bramble, one-sided wintergreen, and prince's pine). In areas of higher precipitation (especially snow) and less frequent fire, the zonal ecosystem has a well-developed *Vaccinium* spp. - false azalea shrub layer. Devil's club, black gooseberry, highbush-cranberry, oak fern, lady fern, and leafy mosses are characteristic of wetter sites.

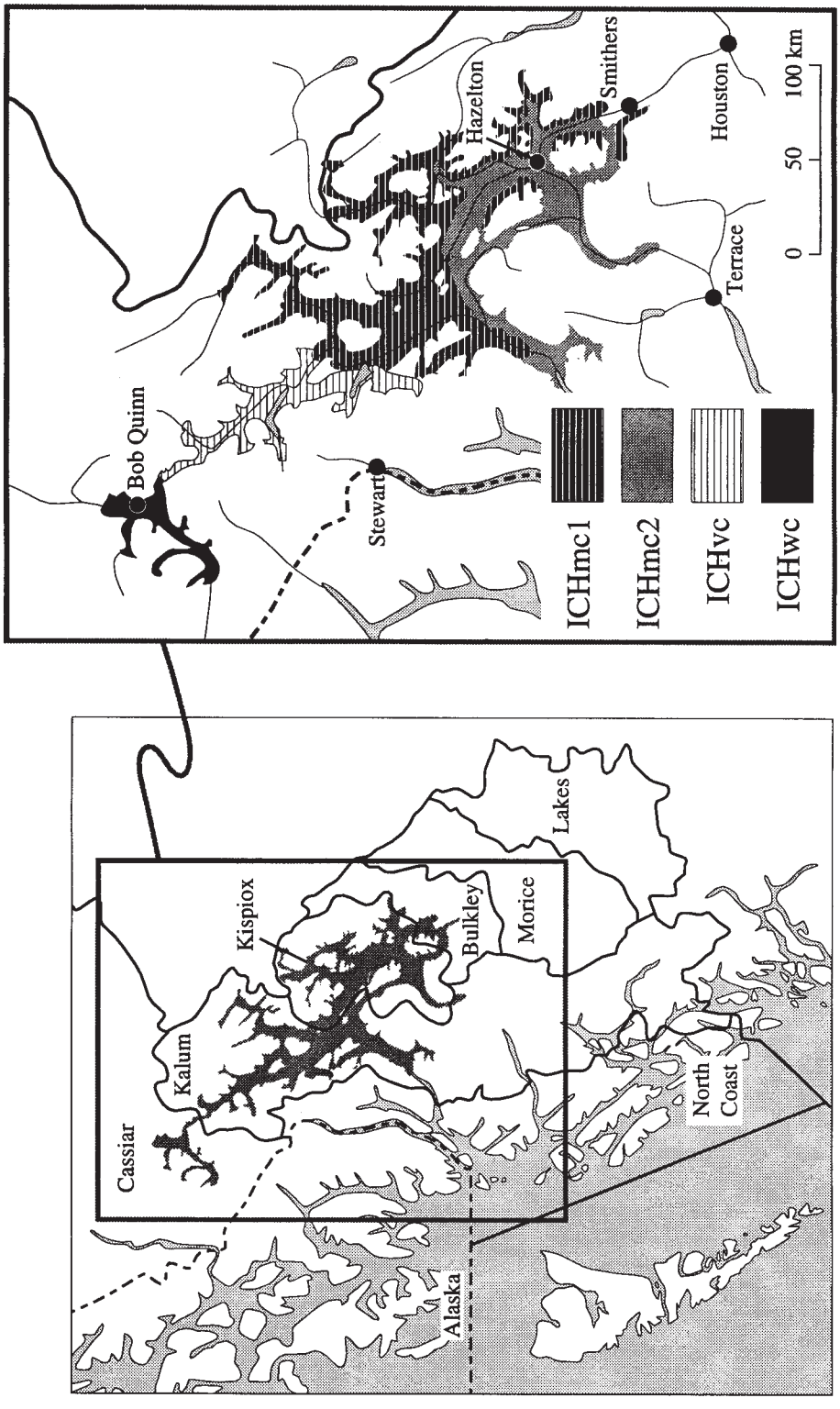


Figure 4.8 Distribution of ICH subzones and variants in the PRFR, south half.

Fire has had a major influence on vegetation development in the ICH. Seral (nonclimax) stands of lodgepole pine, trembling aspen, paper birch, spruce, subalpine fir, and black cottonwood often dominate at lower elevations. Even older stands, approaching climax, usually contain remnant individuals of shade-intolerant species that established after a fire. Except in sheltered middle-elevation valleys, on some north-facing slopes, and in the Meziadin - Bell-Irving area, it is difficult to find a stand in the ICH that has not been disturbed by fire within the past few centuries. Red alder is absent from the ICH.

Soils: (Table 4.2) The soils of the ICH are developed mainly from morainal parent materials, but fluvial and colluvial materials are also common. There is less leaching and organic matter accumulation than in the CWH zone, but these processes are still very important, especially in northern and higher-elevation areas where precipitation is heavy. The zonal soils are Orthic Humo-Ferric Podzols with 5 - 15 cm thick Hemimor humus forms. Brunisolic or Podzolic Gray Luvisols are found on finer-textured morainal materials in the driest parts of the zone. Dystric Brunisols are found on some coarse-textured colluvial or fluvial materials. Gleysols and Regosols occur on wet and/or productive alluvial ecosystems. Organic soils are uncommon.

Differentiating Features: The ICH can be distinguished from the adjacent CWH by the abundance of subalpine fir, black huckleberry, electrified cat's-tail moss, and knight's plume, and the lack or scarcity of amabilis fir, red alder, red huckleberry, and lanky moss. It can be distinguished from the SBS by the presence of western hemlock and/or western redcedar, and by the occurrence of shrub species such as oval-leaved blueberry, salmonberry, and beaked hazelnut. The ESSF and MH zones lying above the ICH have more subalpine fir and/or mountain hemlock than western hemlock and always lack western redcedar.

Subzones and Variants: (Figures 4.8 and 4.9; Table 4.6) Two subzones, two variants, and one phase of the ICH have been identified in the south half of the Prince Rupert Forest Region[6]:

ICHmc - Moist Cold subzone
ICHmc1 - Nass variant
ICHmc1a - Amabilis Fir phase
ICHmc2 - Hazelton variant

ICHvc - Very Wet Cold subzone

The **ICHmc** represents all of the ICH lying south and east of Meziadin Lake and Mount Bell-Irving. It is drier, less snowy, and probably warmer — at least in summer — than the ICHvc. Seral forests are extensive at low elevations because of a history of recurring fire. The **ICHmc1** covers the undulating terrain of the Nass Basin north and east of Cranberry Junction (300 - 950 m elevation), and some middle elevations in the southeastern

[6] A fourth subzone, the ICHwc, occurs in the northern half of the region (Cassiar Forest District) and is described on page 4•86.

TABLE 4.6. Environmental characteristics of ICH subzones, variants, and phases in the PRFR, south and north halves

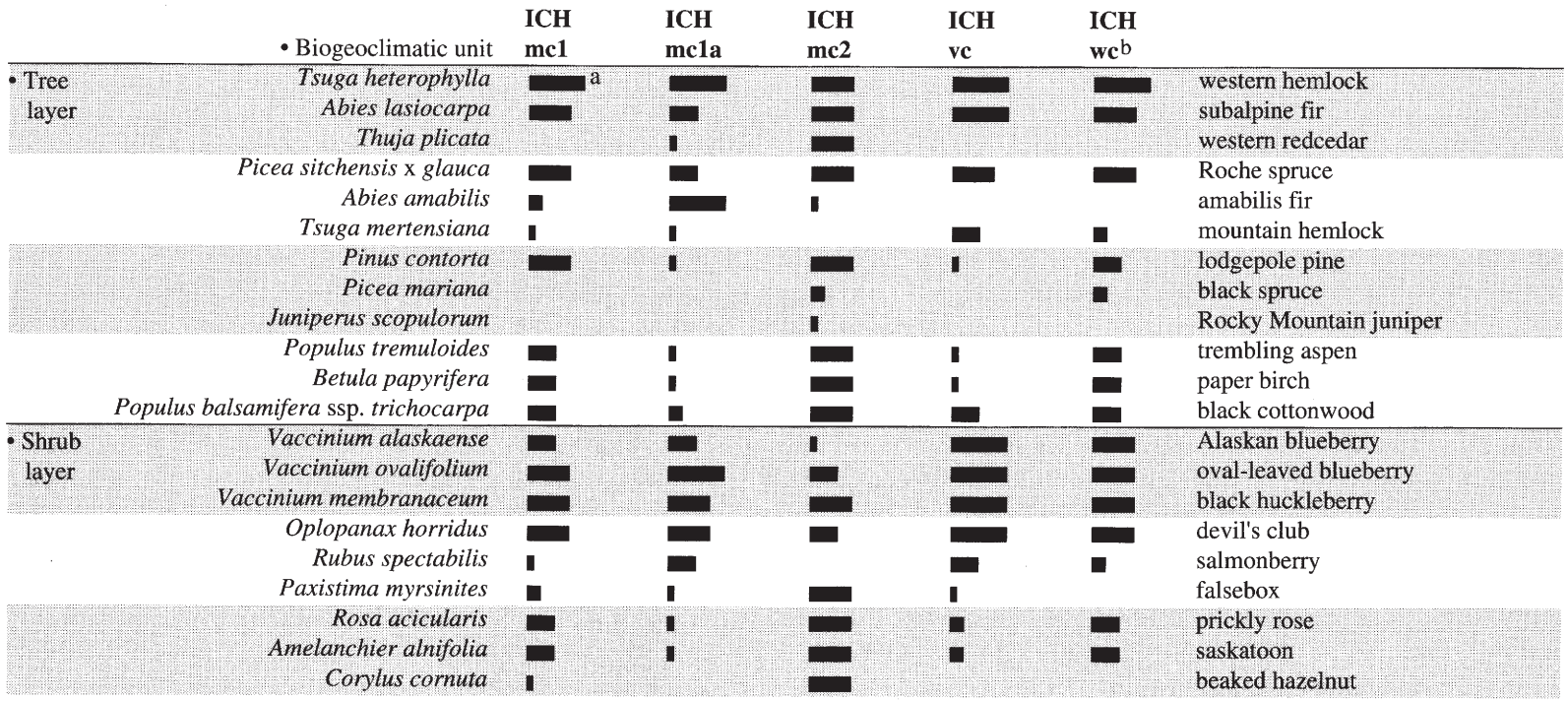
Subzone, variant, or phase	ICHmc1	ICHmc1a	ICHmc2
Extent			
Area	528 026 ha[a]	see mc1	352 297 ha
% of PRFR, south half	4.8%	--	3.2%
Elevation range	350 - 950 (1100) m	750 - 1100 m	100 - 750 m
Distribution			
Physiographic regions	Central Nass Basin and adjacent Skeena and Hazelton mtns.	Some northeast slopes in Hazelton Mtns. and parts of Nass Basin	Southern Nass Basin and adjacent Skeena and Hazelton mtns.
Major drainages	Most of Nass R. and tribs. above Cranberry Junction; upper Skeena and Kispiox rivers	Upper Tchitin and Kinskuch; McCully and Date crs.; Station, Mudflat, Porphyry, Boulder and Corya crs.	Nass R. from Cranberry R. to Tseax R.; central Skeena incl. Kitwanga, lower Kispiox, Suskwa, and Bulkley rivers
Climate	Cool, moist; longest and most severe winters; moderately heavy moist snow (up to 1 m snowpack); minor summer drought	Mild and unusually humid local climate; summers cooler, wetter, and cloudier than mc1; soils apparently do not freeze under snow	Summers warm, fairly moist with longest growing season in ICH; snowpacks light to moderate (up to 1 m); major valleys have cold air ponding and significant summer drought
Soils			
Zonal soils	Orthic Humo-Ferric Podzols	Orthic Ferro-Humic and Humo-Ferric Podzols	Brunisolic & Podzolic Gray Luvisols; Orthic Humo-Ferric Podzols
Humus forms	Orthihemimors; 5 - 15 cm thick	Orthi and Lignohemimors; often > 20 cm thick	Orthihemimors; 4 - 12 (15) cm thick
Vegetation[c]			
Major tree species	Hw, Bl, Sx; Cw absent	Hw, Ba, Bl; Cw mostly absent	Hw, Cw, Bl, Sx, Pl, At, Ep, Act
Seral stands	Extensive mainly in southern sections; dominantly Pl, Bl, Sx, often with Ep	Uncommon except after logging; mostly Hw, Ba, Bl	Widespread; dominant in major valleys; extensive deciduous stands at low elevation
Zonal site association	Hw - Step moss	HwBa - Bramble	Hw - Step moss

[a] This includes the area for the ICHmc1a phase.

[b] This subzone occurs only is the PRFR, north half. See Section 4.3.5 for description.

[c] Tree species codes are found in Appendix 3.

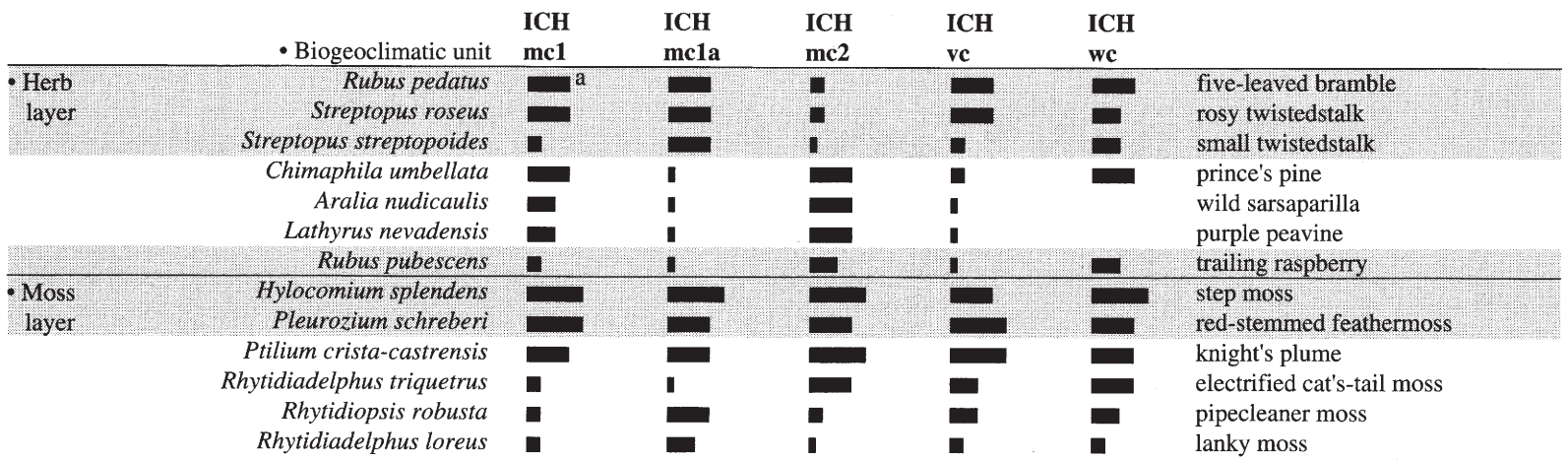
ICHvc	ICHwc[b]
140 361 ha 1.3% 240 - 1000 m	100 367 ha 0.9% 150 - 900 m
Northern Nass Basin and adjacent Coast and Skeena mtns.	Coast Mtns, Boundary Ranges; Stikine Plateau
White R.; Meziadin Lk.; Hanna and Tintina crs.; Bowser M.; Bell-Irving R. to Ningunsaw Pass	Iskut R., Durham Cr. to Snippaker Cr.; Stikine R., Dokdaon Cr. to Scud R.
Very heavy snowpack (3 - 6 m); winters wetter, less severe than mc1; summers cool & moist with little or no drought; short growing season due to lingering snow	Cool, moist; winters wet with moderately heavy moist snow; summers cool, moist; little or no summer drought
Orthic Humo-Ferric Podzols	Orthic Humo-Ferric Podzols
Mors; often compacted by snow	Hemimors, Mormoders
Bl, Hw, Sx; Cw absent	Hw, Bl, Sx, Act; Cw absent
Uncommon; mostly Bl; Pl rare; Act on floodplains; At on a few south-facing slopes	Uncommon except on floodplains and central Iskut valley; Pl, Act, Ep, At
Hw - Devil's club	HwBl - Oak fern



[a] Bars indicate the relative abundance of plants across all site series within a biogeoclimatic unit. These bars are defined in Section 3.2.2, page 3•6.

[b] This subzone occurs in the north half of the PRFR only.

FIGURE 4.9. Vegetation table for ICH subzones and variants in the PRFR, south and north halves.



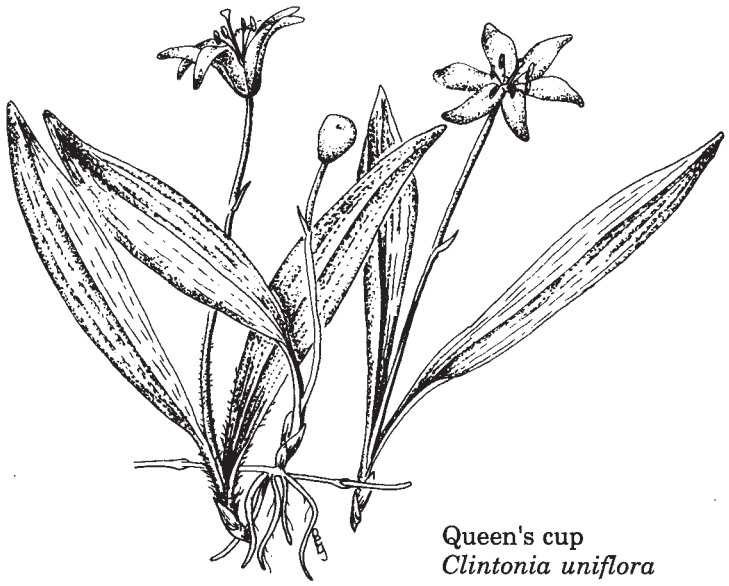
• Biogeoclimatic unit		ICH mc1	ICH mc1a	ICH mc2	ICH vc	ICH wc	
• Herb layer	*Rubus pedatus*	[a]					five-leaved bramble
	Streptopus roseus						rosy twistedstalk
	Streptopus streptopoides						small twistedstalk
	Chimaphila umbellata						prince's pine
	Aralia nudicaulis						wild sarsaparilla
	Lathyrus nevadensis						purple peavine
	Rubus pubescens						trailing raspberry
• Moss layer	*Hylocomium splendens*						step moss
	Pleurozium schreberi						red-stemmed feathermoss
	Ptilium crista-castrensis						knight's plume
	Rhytidiadelphus triquetrus						electrified cat's-tail moss
	Rhytidiopsis robusta						pipecleaner moss
	Rhytidiadelphus loreus						lanky moss

[a] Bars indicate the relative abundance of plants across all site series within a biogeoclimatic unit. These bars are defined in Section 3.2.2, page 3•6.

FIGURE 4.9. (Continued)

part of the subzone (750 - 1100 m elevation). This variant is cooler and moister, with a shorter growing season than the ICHmc2. Western hemlock and subalpine fir forests with moss ground cover characterize the variant; western redcedar is absent. Subalpine fir and Roche spruce dominate on low-lying, wetter sites. Lodgepole pine is the dominant seral species, with trembling aspen and paper birch common, especially on south-facing slopes. The Amabilis Fir phase (**ICHmc1a**) is the name given to enclaves of a seemingly coastal, western hemlock - amabilis fir forest found in the upper Kinskuch Valley and on sheltered northeast-facing slopes and side drainages in the Rocher de Boule and Kispiox ranges of the Hazelton Mountains (750 - 1100 m elevation). These drainages have escaped fire and have a milder, humid climate that permits exceptional growth of coastal tree species and CWH-like understory vegetation development. The **ICHmc2** occupies the Nass Valley from the Tseax lava beds to the Cranberry River at elevations up to 600 m, and the Skeena Valley (Legate Creek to Kisgegas) and its tributaries between 150 and 750 m elevation. The ICHmc2 has a warmer, mostly drier climate than the ICHmc1, and is characterized by western redcedar and extensive seral forests of trembling aspen, paper birch, Roche spruce, lodgepole pine, and subalpine fir.

The **ICHvc** extends from the White River north along the Bell-Irving River to Ningunsaw Pass. It ranges in elevation from 240 m at Meziadin Lake to approximately 900 - 1000 m. The ICHvc is distinguished by deep, heavy snowpacks (up to 6 m thick) and cool, moist summers. Most of the landscape, including zonal sites, is dominated by devil's club ecosystems with large subalpine fir and Roche spruce. Drier upland sites, dominated by western hemlock (and mountain hemlock) with a dense growth of blueberries, are less common. Avalanches are the major disturbance factor; there are few fires and, as a consequence, few lodgepole pine.



Queen's cup
Clintonia uniflora

4.2.5 MH Mountain Hemlock Zone

Location and Distribution: (Figure 4.10; Table 4.2) The MH is the high-elevation or subalpine zone in the coastal portion of the PRFR. It is located almost entirely on the western slopes of the Coast Mountains, although it does slip over to the east side in a few locations, most notably around the Zymoetz (Copper) River, Seven Sisters Peaks, and the Kiteen River. The MH is restricted to scattered patches on the outer coastal islands because they have so little relief. It makes up 13.0% of the south half of the PRFR, occurring mainly in the North Coast and Kalum forest districts, with small areas along the western margins of the Morice, Bulkley, and Kispiox forest districts and Tweedsmuir Provincial Park.

The MH lies between the CWH and AT zones, at elevations ranging from 400 to 1600 m. The transition from CWH to MH occurs at approximately 550 - 600 m on the outer coast and at 900 -1000 m inland; but in valleys with pronounced cold air drainage, especially near glaciers, the MH can appear as low as 400 m. The upper timberline boundary is determined primarily by the duration of the snowpack. It tends to be lower on windward slopes, which receive a heavy snowpack, and higher on drier, leeward slopes. It ranges from 800 m (outer coastal lowlands) to approximately 1600 m (leeward slopes in the south).

Climate: (Table 4.3) The coastal subalpine climate of the MH is characterized by short, cool summers, rainy autumns, and long, cool, wet winters with heavy snow cover for 5 - 9 months. Almost no detailed climatic data exist for this zone, but it is thought that a characteristic feature is that the soils rarely freeze beneath the heavy wet snowpack. Lack of soil freezing probably has a major influence on the plants that grow in the zone. During occasional winter outbreaks of arctic air, the MH is probably protected from extreme low temperatures (-30°C and below) by temperature inversions, and by the fact that most plants are covered in snow. The snow-free season is short and the soils rarely dry out. Low-lying clouds often envelop the MH forest, providing substantial moisture in addition to what is received from direct precipitation and snowmelt.

Vegetation: (Figure 4.7) Mountain hemlock and amabilis fir are the characteristic dominant tree species of the MH zone in the PRFR. Yellow-cedar is abundant in the more coastal portions of the zone; subalpine fir is found inland, and becomes increasingly common near the transition to the ESSF zone. Western hemlock occurs throughout, but is less abundant than mountain hemlock. Sitka spruce and western redcedar are occasionally present, especially on the outer coast. Deciduous trees are rare. The trees often show signs of climatic stress such as snowcreep and snow or wind damage, especially near timberline. Lower elevations of the MH are continuously forested, while upper, parkland elevations have clumps of trees interspersed with subalpine heath, meadows, and wetlands.

Understory vegetation in the forested MH lacks diversity. On zonal ecosystems, Alaskan blueberry, oval-leaved blueberry, false azalea, black huckleberry, and mountain-ashes usually form a well-developed shrub layer together with

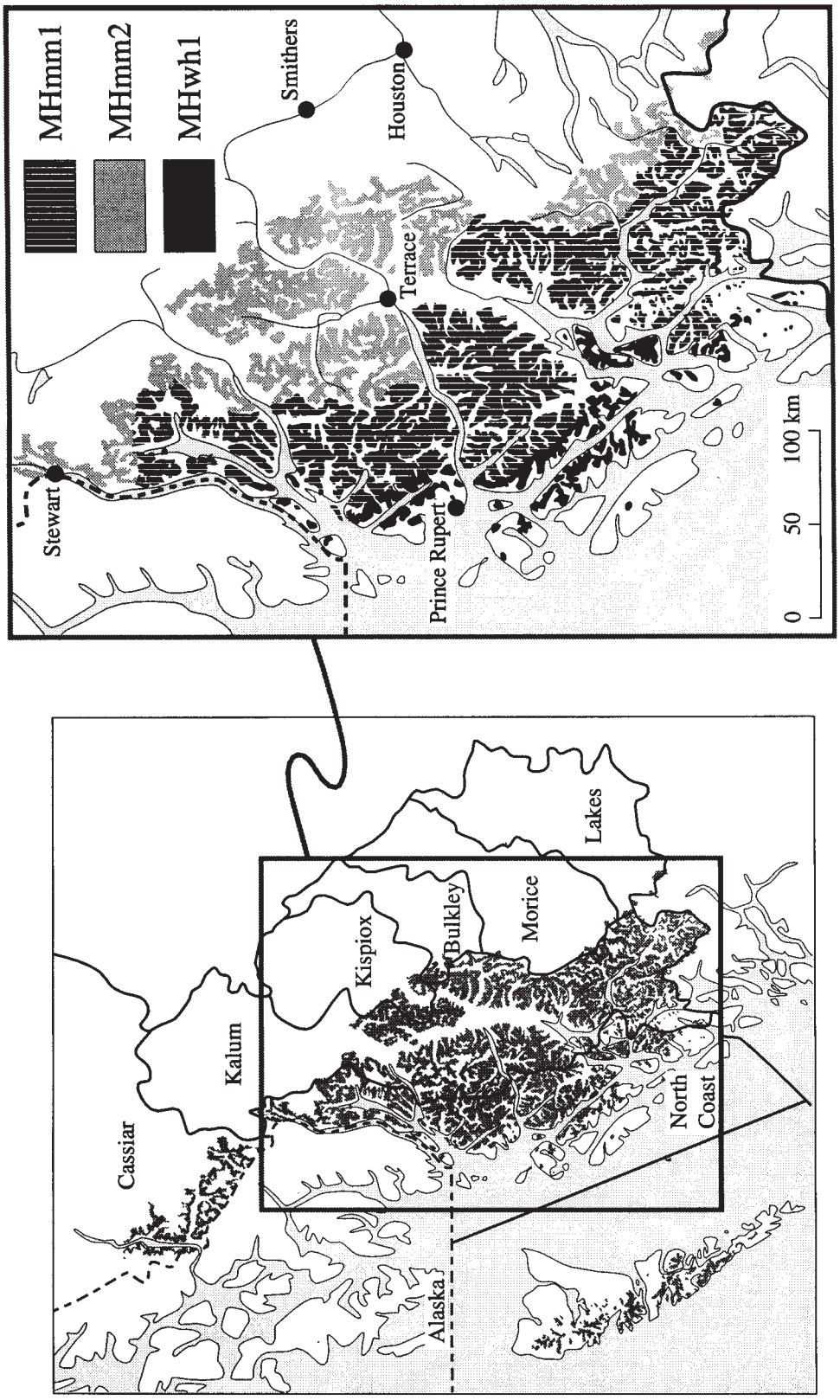


FIGURE 4.10. Distribution of the MH variants in the PRFR, south half.

regeneration of amabilis fir and mountain hemlock. There are a few small herbs (five-leaved bramble, rosy twistedstalk, clasping twistedstalk, deer fern, bunchberry, heart-leaved twayblade, Indian hellebore, and foamflowers) and a moss layer that characteristically includes pipecleaner moss, curly heron's-bill moss, and mountain leafy liverwort. A striking feature of the MH is the abundance of yellow-green lichen hanging from the trees.

Soils: (Table 4.2) Soils of the MH zone are predominantly Ferro-Humic and Humo-Ferric Podzols and Folisols with Mor humus forms. Dominant factors affecting soil development are the heavy snowpack and continuously cool, wet conditions. Soils are acidic and highly leached, and fungal decomposition predominates. Many soils show signs of mottling or gleying because they remain moist or saturated throughout the year. Organic matter builds up because decomposition rates are slow. The organic layers are often visibly compacted by the weight of the snowload. Plant roots are mainly confined to organic layers, which suggests that these layers play a vital role in ecosystem nutrient cycling. Wetlands with acidic, Organic soils are very common in the western part of the zone where the terrain is less steep and the climate is particularly humid.

Differentiating Features: The MH can be distinguished from the CWH and ICH by the dominance of mountain hemlock over western hemlock, either in the canopy or in regeneration layers. Absence of deciduous trees and seral conifers such as lodgepole pine is also characteristic. Low species diversity and moss layers dominated by pipecleaner moss, heron's-bill mosses, and mountain leafy liverwort, rather than by step moss or lanky moss, are diagnostic features of the understory. The boundary between the MH and ESSF is usually drawn along the height of the Coast Mountains divide, but separation of these two zones can be difficult in areas where the transition from coast to interior is gradual. In general, the MH has more mountain hemlock, amabilis fir, and western hemlock, and less subalpine fir, than does the ESSF. Alaskan blueberry and pipecleaner moss are characteristic MH species that are scarce or absent in the ESSF.

Subzones and Variants: (Figures 4.7 and 4.10; Table 4.5) The MH in the south half of the PRFR has been divided into two forested subzones on the basis of regional climate. Each subzone is further subdivided into windward and leeward variants:

MHmm - Moist Maritime (Forested) subzone
MHmm1 - Windward variant
MHmm2 - Leeward variant

MHwh - Wet Hypermaritime (Forested) subzone
MHwh1 - Windward variant[7]

The **MHmm** includes all of the subalpine forest lying within the mountainous portion of the zone, east of the Hecate Lowland. Mountain hemlock, amabilis fir, and western hemlock are the characteristic dominant

[7] The leeward variant (MHwh2) occurs outside the PRFR on the Queen Charlotte Islands.

trees. The windward variant, **MHmm1**, is found on the western side of the Coast Mountains, more-or-less contiguous with the CWHvm and CWHwm subzones. This variant has yellow-cedar (mainly on seepage sites), together with other maritime species such as deer fern and deer-cabbage, and it generally lacks subalpine fir, except in areas of severe cold air ponding. The leeward variant, **MHmm2**, is found on the central and eastern slopes of the Coast Mountains and the adjacent Hazelton Mountains, almost directly above the CWHws subzone. This inland variant borders on the ESSF and is colder and drier than the windward variant. It does not have yellow-cedar, and inland species such as subalpine fir and black huckleberry are widespread.

The hypermaritime windward variant, **MHwh1**, is found on the scattered patches of higher ground on the outer coastal islands and adjacent low-lying mainland that make up the Hecate Lowland. The **MHwh1** lies directly above the CWHvh2 variant, beginning at 550 - 600 m elevation. This variant is characterized by the co-dominance of yellow-cedar and mountain hemlock, the scarcity of amabilis fir, and the complete lack of subalpine fir. Western redcedar and Sitka spruce are present but grow poorly. The separation between forest and parkland is often indistinct because of the subdued terrain and the many non-forested wetlands in the landscape.

Above each forested subzone is a corresponding parkland subzone (MHmmp or MHwhp) occupying the transition from treeline to true alpine tundra (AT zone). The parkland subzones are distinguished by discontinuous forest cover interspersed with subalpine heath, lush herb meadows, and subalpine bogs and fens. Bogs and fens become increasingly common as one moves westward. Parkland subzones feature a variety of alpine/subalpine plants, such as mountain-heather and partridgefoot, that are absent from the forested subzones. Differences among the parkland variants (MHmmp1, MHmmp2, and MHwhp1) are comparable to the differences among the forested variants.

4.2.6 SBPS Sub-Boreal Pine – Spruce Zone

Location and Distribution: (Figure 4.11; Table 4.2) Only a small area of SBPS occurs in the PRFR, making up 0.5% of the south half. It is located within the Lakes Forest District and just barely extends into the adjacent portion of Tweedsmuir Provincial Park. The SBPS in the PRFR occurs entirely within a portion of the Nechako Plateau bounded in the north by Tetachuck Lake, in the east by the Entiako River, and in the south by the Dean River. It represents the northwestern extent of the region known as "the Chilcotin".

The SBPS ranges from 850 to 1300 - 1400 m in the PRFR. To the north and west it grades into the SBS zone; at its upper elevations it gives way to the ESSF zone.

Climate: (Table 4.3) The SBPS has a severe, cold continental climate that is reflected in low forest productivity. Its cool, dry climate is caused by the strong rainshadow effect of the solid mass of Coast Mountains to the west, and the relatively high elevation. The low precipitation, dry air, and clear skies result in cold night-time temperatures and frequent summer frosts that inhibit tree growth. There are no long-term climatic stations located within the SBPS in the PRFR, but it is known to be somewhat moister and milder than the Alexis Creek - Anahim Lake country to the south.

Vegetation: (Figure 4.12) Extensive even-aged stands of lodgepole pine dominate the rolling plateau landscape of the SBPS, interrupted only by the depressional wetlands or "wet meadows" so typical of the Chilcotin. Within the PRFR, white spruce (or, if hybrid, predominantly white spruce) commonly occurs in the understory of these pine stands. Mixtures of mature pine and spruce are found in moist depressions, frequently ringing wetlands. Trembling aspen is the major deciduous tree, but it is much less abundant than in the SBS zone. Black spruce may be found both in bogs and on upland sites. Subalpine fir occurs rarely and Douglas-fir is absent.

Zonal ecosystems of the SBPS characteristically have sparse shrub and herb layers and a moderately developed moss layer (red-stemmed feathermoss) with abundant lichens (mostly *Cladonia* and *Cladina* spp.). Typical species in the shrub layer include common juniper, soopolallie, prickly rose, and birch-leaved spirea. The herb layer includes twinflower, dwarf blueberry, kinnikinnick, bunchberry, bastard toad-flax, fireweed, yarrow, wild strawberry, ricegrasses, bluejoint, and pinegrass.

Soils: (Table 4.2) Zonal soils are Brunisolic Gray Luvisols with relatively thin Hemimor humus forms. The soils are most often formed in compacted glacial till parent materials. Orthic and Gleyed Gray Luvisols, Dystric Brunisols, and Organic soils are also common in the SBPS landscape.

Differentiating Features: The SBPS can be distinguished from adjacent subzones of the SBS and the ESSF by the dominance of poor stands of lodgepole pine, the relative lack of hybrid spruce, and the virtual absence of subalpine fir. Features of zonal ecosystems that distinguish the SBPS are: the ability of lodgepole pine to regenerate under its own canopy; the sparse

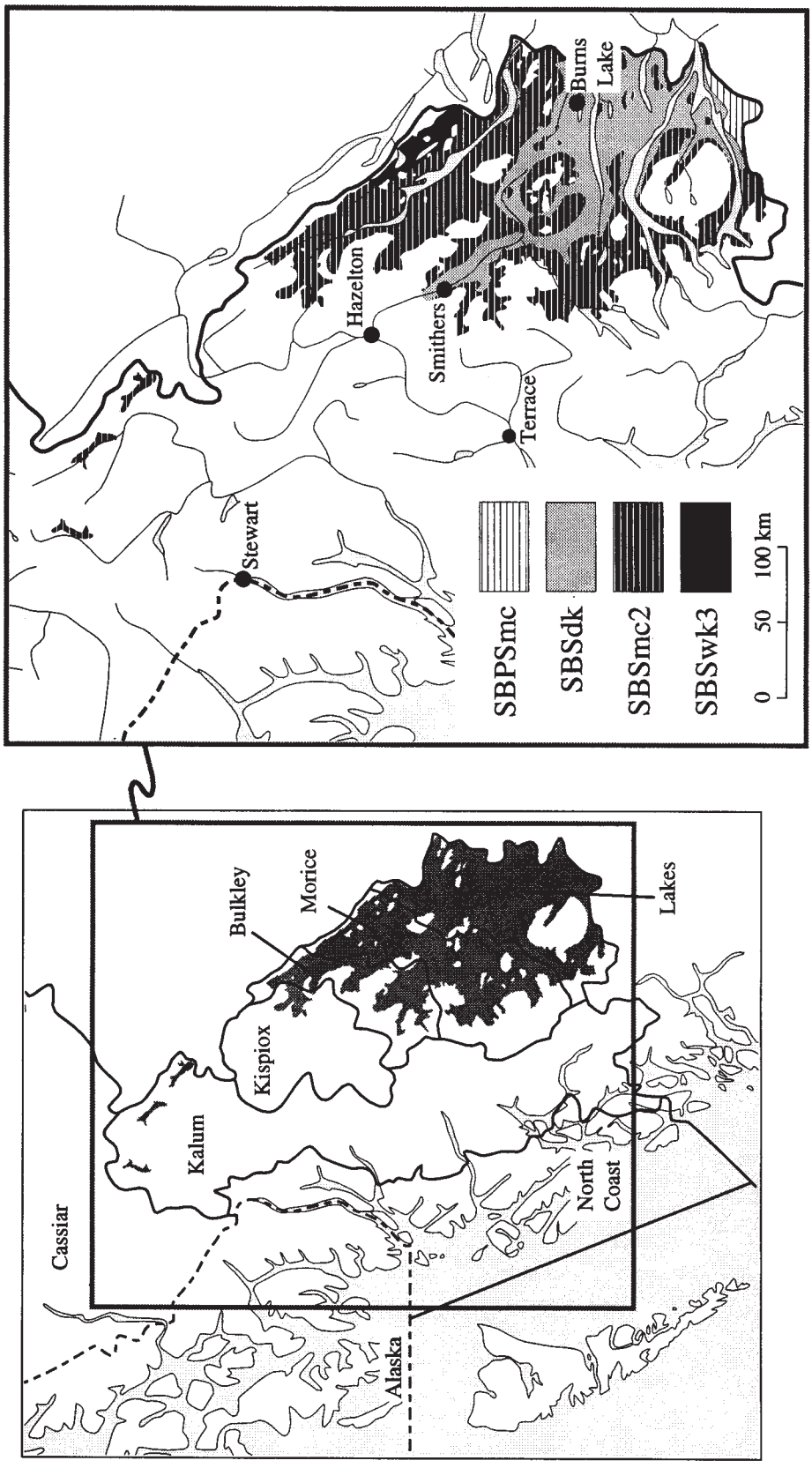
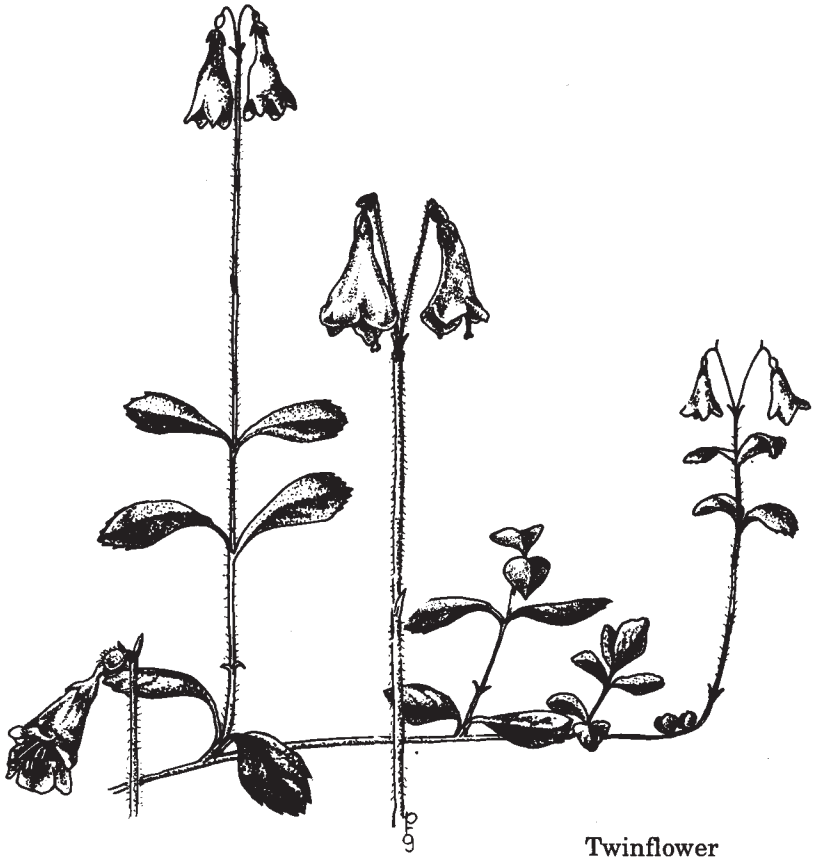


FIGURE 4.11. Distribution of SBPS and SBS subzones and variants in the PRFR, south half.

understory with its strong lichen component; and the presence of species such as common juniper and kinnikinnick that elsewhere indicate drier-than-mesic site conditions.

Subzones: (Figures 4.11 and 4.12; Table 4.7) There is only one subzone of the SBPS in the PRFR:

SBPSmc - Moist Cold subzone.



Twinflower
Linnaea borealis

TABLE 4.7. Environmental characteristics of SBPS and SBS subzones and variants in the PRFR, south half

Subzone or variant[a]	SBSdk	SBSmc2
Extent		
Area	849 383 ha	1 550 314 ha
% of PRFR, south half	7.6%	14.0%
Elevation range	500 - 750 m in the north 700 - 1100 m in the south	500 - 1050 m in the north 700 - 1100 m in the south
Distribution		
Physiographic regions	Nechako Plateau, Skeena Mtns., Hazelton Mtns.	Skeena Mtns., Nechako Plateau, Hazelton Mtns.
Major drainages	Bulkley and Endako river valleys; S. Babine Lk. shoreline, Sutherland R.; Francois, Ootsa, Cheslatta, and Netalkuz lakes	Most of Babine and Nilkitkwa drainages; upper elev. Bulkley Valley, Morice R., Nadina R.; upper Nass, Damdochax, Bell Irving rivers; Tahtsa, Whitesail, Eutsuk and Sigutlat lakes
Climate	Continental; relatively dry, warm summers with longer growing season than SBSmc2 or SBPSmc; winters cold, relatively dry; snowpack usually < 50 cm	Wetter, snowier climate than SBSdk or SBPS (snowpacks up to 1 m); summers cool, often cloudy, relatively moist; growing season intermediate length between SBSdk and SBPS
Soils		
Zonal soils	Brunisolic Gray Luvisols; Dystric Brunisols	Gray Luvisols; Dystric Brunisols; Humo-Ferric Podzols
Humus forms	Hemimors; Mormoders; < 10 cm thick	Hemimors; 8 - 10 cm thick
Vegetation[b]		
Major tree species	Sxw, Pl, At, Ep, Act	Sxw, Bl, Pl, At
Seral stands	Abundant throughout; both PI and deciduous; minor native grassland and scrub-steppe	Widespread; mainly PI-dominated; At mainly on south-facing slopes
Zonal site association	Sxw - Spires - Purple peavine	Sxw - Huckleberry

[a] For a description of the SBSwk3 refer to MacKinnon *et al*. (1990).

[b] Tree species codes are found in Appendix 3.

SBPSmc

54 928 ha
0.5%
900 - 1300 m in the north
850 - 1400 m in the south

Nechako Plateau

Entiako drainage; south of Ootsa and Netalkuz lakes

Drier, colder, more severe than SBS; short growing season marked by frost; long cold winter with low snowpack

Brunisolic Gray Luvisols; Dystric Brunisols

Hemimors; ±8 cm thick

Pl, Sw, Sb

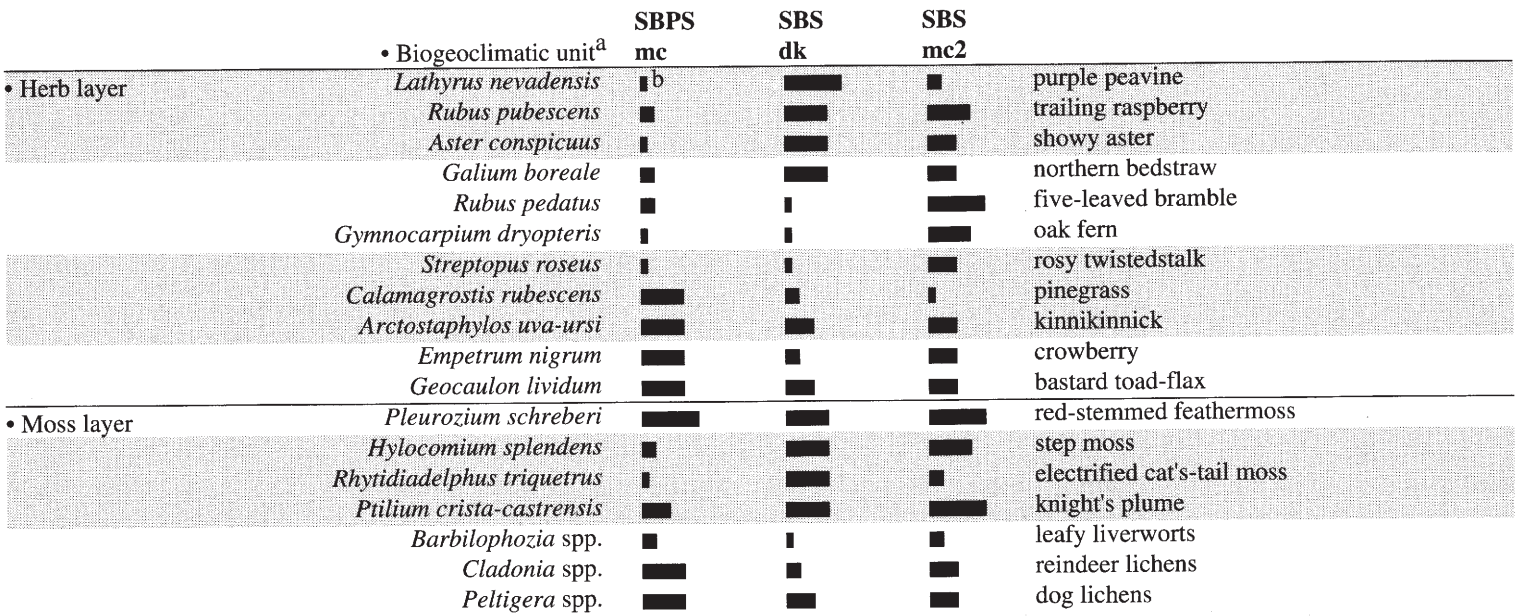
Dominant throughout; almost all Pl-dominated; At uncommon

Pl - Feathermoss - Cladina

• Biogeoclimatic unit[a]		SBPS mc	SBS dk	SBS mc2	
• Tree layer	*Picea glauca* x *engelmannii*	■[b]	■	■	hybrid white spruce
	Picea glauca	■			white spruce
	Pinus contorta	■	■	■	lodgepole pine
	Abies lasiocarpa	▮	■	■	subalpine fir
	Picea mariana	■	■	■	black spruce
	Juniperus scopulorum		■		Rocky Mountain juniper
	Pseudotsuga menziesii		▮		Douglas-fir
	Tsuga heterophylla			▮	western hemlock
	Populus tremuloides	■	■	■	trembling aspen
	Populus balsamifera ssp. *trichocarpa*	▮	■	■	black cottonwood
	Betula papyrifera		■	▮	paper birch
• Shrub layer	*Amelanchier alnifolia*	▮	■	■	saskatoon
	Rosa acicularis	■	■	■	prickly rose
	Spiraea betulifolia	■	■	■	birch-leaved spirea
	Shepherdia canadensis	■	■	■	soopolallie
	Symphoricarpos albus	▮	■	▮	common snowberry
	Prunus virginiana		■		choke cherry
	Rubus parviflorus	■	■	■	thimbleberry
	Vaccinium membranaceum	■	▮	■	black huckleberry
	Oplopanax horridus		▮	■	devil's club
	Alnus crispa ssp. *crispa*	■	■	■	green alder
	Alnus crispa ssp. *sinuata*		■	■	Sitka alder
	Juniperus communis	■	■	■	common juniper

[a] For a description of the SBSwk3 refer to MacKinnon *et al.* 1990.
[b] Bars indicate the relative abundance of plants across all site series within a biogeoclimatic unit. These bars are defined in Section 3.2.2, page 3•6.

FIGURE 4.12. Vegetation table for SBPS and SBS subzones and variants in the PRFR, south half.

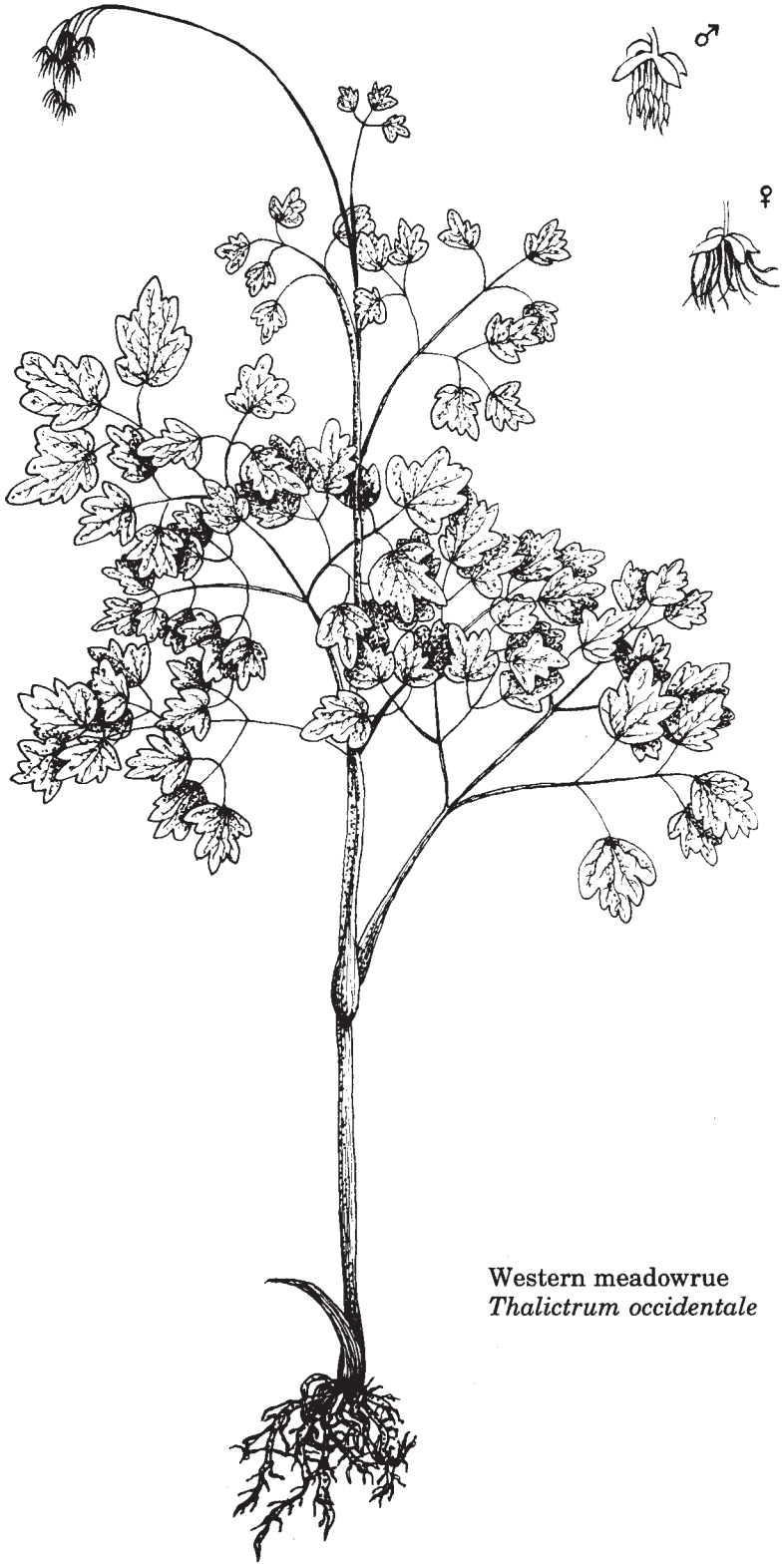


• Biogeoclimatic unit[a]		SBPS mc	SBS dk	SBS mc2	
• Herb layer	*Lathyrus nevadensis*	[b]			purple peavine
	Rubus pubescens				trailing raspberry
	Aster conspicuus				showy aster
	Galium boreale				northern bedstraw
	Rubus pedatus				five-leaved bramble
	Gymnocarpium dryopteris				oak fern
	Streptopus roseus				rosy twistedstalk
	Calamagrostis rubescens				pinegrass
	Arctostaphylos uva-ursi				kinnikinnick
	Empetrum nigrum				crowberry
	Geocaulon lividum				bastard toad-flax
• Moss layer	*Pleurozium schreberi*				red-stemmed feathermoss
	Hylocomium splendens				step moss
	Rhytidiadelphus triquetrus				electrified cat's-tail moss
	Ptilium crista-castrensis				knight's plume
	Barbilophozia spp.				leafy liverworts
	Cladonia spp.				reindeer lichens
	Peltigera spp.				dog lichens

[a] For a description of the SBSwk3 refer to MacKinnon *et al.* 1990.

[b] Bars indicate the relative abundance of plants across all site series within a biogeoclimatic unit. These bars are defined in Section 3.2.2, page 3•6.

FIGURE 4.12. (Continued)



Western meadowrue
Thalictrum occidentale

4.2.7 SBS Sub-Boreal Spruce Zone

Location and Distribution: (Figure 4.11; Table 4.2) The SBS covers most of the interior lowland forest in the south half of the PRFR. It occurs mainly on the Nechako Plateau, with some western and northwestern extensions into the Hazelton and Skeena mountains. The SBS makes up 21.6% of the south half of the PRFR. It is the main forested zone within the Lakes, Morice, and Bulkley forest districts and extends also into northeastern portions of the Kispiox and Kalum forest districts.

The SBS ranges in elevation from 500 to 1350 m. Lower elevation limits are set by the elevation of the valley bottoms. The upper elevation at which the SBS grades into the subalpine ESSF zone varies from 900 to 1350 m, depending on local topography and climatic conditions.

Climate: (Table 4.3) The climate of the SBS is primarily continental; some lingering coastal influences still reach the lower Bulkley Valley and the middle Skeena and upper Nass drainages. The sub-boreal climate is characterized by seasonal extremes of temperature, with severe, snowy winters and relatively warm, moist, and short summers. It has a longer, moister, but slightly cooler growing season than the true boreal forest, and is therefore more productive for tree growth. Annual precipitation is roughly 440 - 650 mm; less than half of it falls as snow. Soils are deeply to lightly frozen during the winter months, but there is no permafrost.

Vegetation: (Figure 4.12) Upland coniferous forests dominate the SBS landscape. Hybrid white spruce and subalpine fir are the major climatic climax tree species and often occur in mixture. Pure stands of either species are uncommon, but subalpine fir tends to dominate older stands in the higher-elevation and moister sections of the zone. Black spruce also occasionally occurs in climax forest, usually in wetlands or areas of cold air ponding. Because of the pervasive fire history of this subzone (fire-free intervals longer than 300 years are rare and most stands are probably burned every 100 years, on average), lodgepole pine and trembling aspen form frequent and extensive seral stands — with pine more abundant on coarser-textured, more acidic soils, and aspen dominating on finer-textured soils. Paper birch and black cottonwood are also common seral species. Interior Douglas-fir reaches its northwestern limit within the SBS of the PRFR, but it is uncommon. Small areas of grassland and shrub-steppe vegetation are found on some warm, dry sites scattered throughout the major valleys.

Understory vegetation on zonal ecosystems typically includes a variety of shrubs (black huckleberry, thimbleberry, prickly rose, highbush-cranberry, soopolallie, saskatoon, black twinberry, green alder, and black gooseberry), a moderately to well-developed herb layer (bunchberry, twinflower, heartleaved arnica, queen's cup, five-leaved bramble, purple peavine, and showy aster), and a well-developed feathermoss carpet (red-stemmed feathermoss, knight's plume, and step moss).

Soils: (Table 4.2) Three soil orders, Luvisols, Brunisols, and Podzols, dominate the SBS. Brunisolic and Orthic Gray Luvisols are the most common soils in the fine-textured glacial till that dominates the Nechako Plateau. These soils have an accumulation of clay in the B-horizon that can impede soil drainage and restrict root growth. Under wetter conditions or in coarser-textured soils, Brunisols, Podzolic Gray Luvisols, and Humo-Ferric Podzols are formed. In general, with increasing elevation (and thus, higher effective precipitation) there is a gradation from Luvisolic to Podzolic soils in fine-textured material and from Brunisolic to Podzolic soils in coarse-textured material. Humus thickness also increases with increasing moisture availability. The typical humus form is an Orthihemimor, 5 - 10 cm thick. Moder humus forms are common on warm, moist ecosystems with a deciduous tree component. Gleyed subgroups and Gleysols are common in imperfectly drained depressions or moisture-receiving sites, Regosols exist on active floodplains, and Organic soils occur in the many small wetlands that dot the landscape.

Differentiating Features: The SBS zone can be distinguished from adjacent ICH and CWH subzones by the absence of western hemlock (and amabilis fir, for the CWH) in the overstory, or by the general lack of any significant amount of hemlock regeneration within older stands on zonal ecosystems. It can be distinguished from the SBPS by the abundance of spruce (and subalpine fir) in the overstory of stands on zonal sites. Zonal ecosystems in the SBS do not have lodgepole pine regeneration, common juniper, or abundant *Cladonia*-type lichens on the forest floor. The transition from SBS to ESSF — at elevations ranging from 900 to 1350 m — is subtle and marked by a shift towards almost total dominance by subalpine fir, and the presence (even on zonal sites) of subalpine indicator plants such as false azalea, Sitka valerian, Indian hellebore, arrow-leaved groundsel, heron's-bill mosses, leafy liverworts, and, in the western ESSF, mountain hemlock or whitebark pine.

Subzones and Variants: (Figures 4.11 and 4.12; Table 4.7) There are three subzones of the SBS (two variants) in the south half of the PRFR:

SBSdk - Dry Cool subzone

SBSmc - Moist Cold subzone
SBSmc2 - Babine variant[8]

SBSwk - Wet Cool subzone
SBSwk3 - Takla variant[8]

The **SBSdk** is the most developed sub-boreal subzone of the PRFR. This is where almost all of the human settlement and agriculture are found. The climate is drier and warmer and the growing season is longer than in the SBSmc. Winters in the SBSdk are just as cold and possibly colder, than those in the SBSmc; there is considerably less snowfall and a shorter duration of snowpack. Major tree species include hybrid white spruce,

[8] Other variants of the SBSmc and SBSwk occur in the Prince George and Cariboo forest regions.

lodgepole pine, trembling aspen, and black cottonwood. Black spruce, subalpine fir, paper birch, and Rocky Mountain juniper are minor species and Douglas-fir is rare. The vegetation on zonal ecosystems typically has well-developed, diverse shrub and herb layers, and a moss layer that is not nearly as well developed as in the SBSmc.

The **SBSmc** is the main timber-producing sub-boreal subzone in the PRFR. It is found at higher elevations and in areas of wetter climate than the SBSdk, and it is generally poorly suited for agriculture. The climate is cooler and moister in summer; the winters are longer with deeper snowpacks. In the SBSmc, subalpine fir is abundant, Rocky Mountain juniper and Douglas-fir are absent, and seral stands dominated by trembling aspen are relatively uncommon. On zonal ecosystems, shrub and herb layers are rather sparse and the understory is dominated by a well-developed feathermoss carpet. In the PRFR, the SBSmc is represented by a single variant, the **SBSmc2**, or Babine variant.

A third subzone, the **SBSwk**, extends into the PRFR from the Prince George Forest region to the east. The **SBSwk3**, or Takla variant, occurs east of Babine Lake in the vicinity of Natowite and Tochcha lakes. This variant is of limited extent (and transitional to the SBSmc2) in the PRFR and is not described in this guide. Readers should refer to MacKinnon *et al*. (1990) or use the description provided here for the SBSmc2.

Heart-leaved arnica
Arnica cordifolia

Broad-leaved willowherb
Epilobium latifolium