Chapter 13: Sub-Boreal Pine — Spruce Zone

by

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LOCATION AND DISTRIBUTION

The Sub-Boreal Pine — Spruce zone (SBPS) is a montane zone that occurs on the high plateau in the west central interior of British Columbia (Figure 46). It lies south and west of the Sub-Boreal Spruce zone (SBS) in the rainshadow of the Coast Mountains. It is mostly within the area known as the Chilcotin.

The SBPS occupies the gently rolling landscape of the Fraser Plateau and the southern-most portions of the Nechako Plateau. These are high elevation plateaus. Elevations in the northern part of the zone are mostly 850-1300 m, while in the southern and western parts, near the Coast Mountains, elevations range from 1100 to 1500 m. The SBPS generally occurs at elevations above the Interior Douglas-fir zone (IDF) and below the Montane Spruce, Sub-Boreal Spruce, and Engelmann Spruce — Subalpine Fir zones on the Fraser Plateau. The Sub-Boreal Pine — Spruce zone is drained primarily by the Chilcotin, West Road (Blackwater), Dean, and Entiako rivers.

ECOLOGICAL CONDITIONS

Climate of the SBPS is continental and characterized by cold, dry winters and cool, dry summers (Figure 47). Compared to the SBS, the SBPS is drier and has similar mean daily temperatures in winter, but cooler mean daily temperatures in summer. The number of growing degree days above 5°C in the SBPS is significantly less than in either the SBS or the Boreal White and Black Spruce zones (Table 4). The cool, dry growing seasons of the SBPS result in large part from its position in the strong rainshadow of the Coast Mountains and its relatively high elevations. The low precipitation, dry air, and clear skies created by the rainshadow effect result in significant night-time radiation cooling and low overnight temperatures. Night-time frosts are common in all months. Mean annual temperatures in the SBPS range from 0.3 to 2.7°C with a mean of 1.9°C. As in the SBS, mean monthly temperatures are below 0°C for 4-5 months of the year but, unlike in the SBS, are above 10°C for only 1-3 months of the year. Mean annual precipitation ranges from 335 to 580 mm, of which 30-50% falls as snow. Peak snowpack is only 50-60 cm.

Upland coniferous forests dominate the SBPS landscape. Lodgepole pine is by far the most common tree species and, in fact, large areas of the forest contain no tree species other than lodgepole pine. Owing to an extensive fire history, the pine trees are generally young, even-aged, and often dense. Productivity of the forest is severely limited by the harsh climate.

In addition to lodgepole pine, the only common tree species of the SBPS are white spruce and trembling aspen. White spruce is common in the understory and is occasionally present in the canopy of mature pine stands on zonal sites, especially in the wetter northern and eastern parts of the zone. In the very dry, southwestern part of the zone, spruce is uncommon even in the understory of pine stands. White spruce-dominated forests occur on many of the moist sites throughout the SBPS, but these

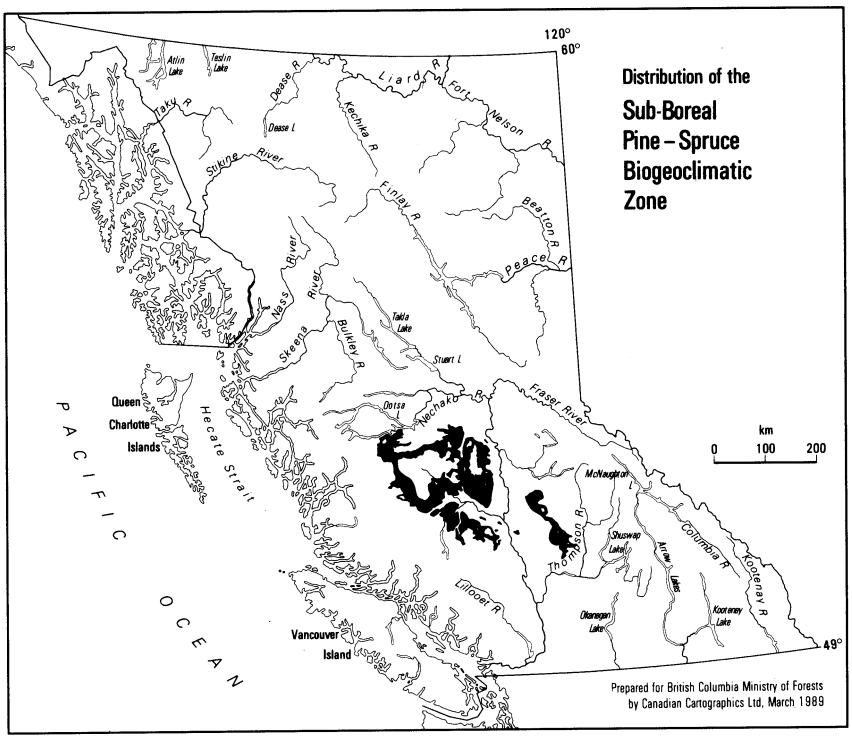

FIGURE 46. Sub-Boreal Pine — Spruce zone.

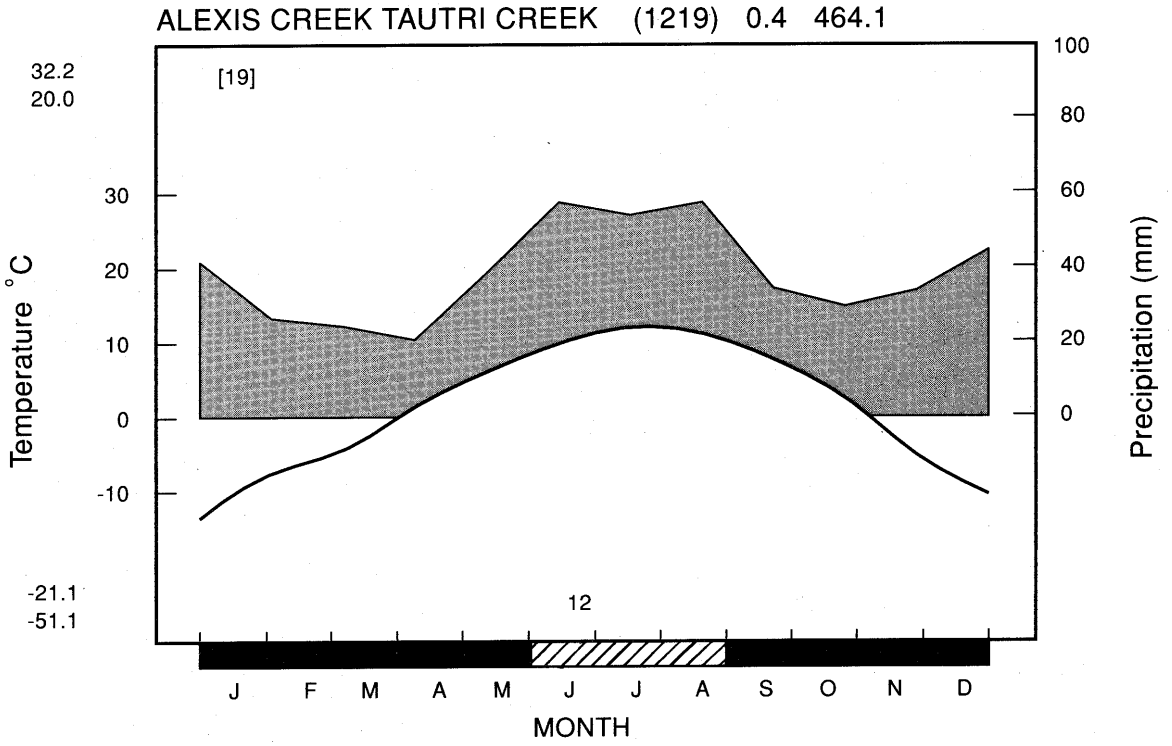

FIGURE 47. Representative climatic diagram for the Sub-Boreal Pine — Spruce zone.

spruce stands are usually small and they often ring the perimeter of non-forested wetlands. Trembling aspen is a common seral species throughout the zone but the stands it dominates are usually small.

Other tree species that occur occasionally in the SBPS are Douglas-fir, subalpine fir, black spruce, and black cottonwood. Douglas-fir occurs on some warm south-facing slopes, especially in the eastern part of the zone and near the boundary with the IDF. Subalpine fir is absent west of the Fraser River but occurs infrequently in the understory of stands east of the river. Black spruce occurs in some cold valley bottoms and in wetlands in the northern part of the zone. Black cottonwood occurs locally on the floodplains of the principal rivers, but is not common.

White spruce is the theoretical climatic climax tree species over most of the SBPS. In the very dry southwestern part of the zone, however, the abundance of pine regeneration and the virtual absence of spruce regeneration on zonal sites suggest that lodgepole pine is the climatic climax tree species. In the remainder of the zone, the dominance of pine on zonal sites has been maintained by recurrent wildfires, and pine is considered a persistent fire-climax species. In the absence of fire, succession to spruce dominance would be very slow.

Undergrowth vegetation of pine forests on zonal sites is generally low-growing and dominated by dwarf shrubs, grasses, lichens, and mosses. Lichens dominate the moss layer in the very dry southwestern part of the zone, while mosses dominate elsewhere.

Soil development in the SBPS is relatively weak and soils on zonal sites are members primarily of the Brunisol and Luvisol orders. Brunisolic Gray Luvisols and Orthic Dystric Brunisols are the most common soils on the dominant morainal deposits. The surface organic layer (humus form) is typically very thin (less than 4 cm) and has very slow rates of decomposition. On imperfectly and poorly drained sites, common soils are gleyed subgroups of Brunisolic and Luvisolic soils or Gleysols. Zonal humus forms are thin Xeromors and Hemimors.

Non-forested wetlands are abundant on the SBPS landscape as a result of the poorly developed drainage patterns on the plateau surface. Many of these wetlands are managed for hay production or grazing. Common wetland community types include shrub-carrs dominated by *Betula glandulosa* (scrub birch) and *Salix* (willow) spp., shrub fens with various *Salix* and *Carex* (sedge) species, and several types of sedge fens. Grass or sedge-dominated meadows, which are only seasonally wet, are common around the periphery of wetter types and in some better-drained but cold depressions. Acidic bogs are uncommon.

Small natural grasslands occur occasionally in the SBPS, especially on dry, south-facing slopes of glaciofluvial landforms.

The Sub-Boreal Pine — Spruce zone has a history of frequent wildfires. Effects of these fires are evident in the patchwork of different aged stands and the small number of stands more than 120 years old. A recent mountain pine beetle epidemic has resulted in extensive mortality of pine trees in the SBPS, especially in the southwest.

NOTES ON CLASSIFICATION

The area of the Sub-Boreal Pine — Spruce zone was originally (Krajina 1965) included in the northwestern portion of the Cariboo Aspen — Lodgepole Pine zone. More recently (Annas and Coupé 1979), it was reclassified as part of the Sub-Boreal Spruce zone. However, it is now considered a zone distinct from the SBS because of its colder, drier climate; its distinctive forest undergrowth with relatively abundant lichens, *Calamagrostis rubescens* (pinegrass), and *Arctostaphylos uva-ursi* (kinnikinnick); and the climax or persistent-seral status of lodgepole pine on zonal sites.

SUBZONES

Four subzones are included within the SBPS (Table 27). The driest subzone, the SBPSxc, occurs in the southwest part of the zone in an arc along the inside of the Coast Mountains as far north as the Rainbow Range. On zonal sites in this subzone (Figure 48), white spruce is poorly represented, *Arctostaphylos uva-ursi* and *Calamagrostis rubescens* dominate the herb layer, and lichens dominate the moss layer. A slightly more moist subzone, the SBPSdc, occurs in the northeast quarter of the zone. Compared to the very dry subzone, white spruce is more common, a greater number of species are well represented in the herb layer, and mosses (especially *Pleurozium schreberi* [red-stemmed feathermoss]) dominate the moss layer. An even more moist but cold subzone, the SBPSmc, occurs in the northwest corner of the zone, generally north and west of the Ilgachuz Range. Spruce is relatively well represented and mosses dominate the forest undergrowth on zonal sites. Unlike other areas of the SBPS, *Calamagrostis rubescens* is uncommon on zonal sites. This subzone is transitional to cold, dry subzones of the SBS zone. The fourth subzone, the SBPSmk, occurs in the eastern-most part of the zone, largely east of the Fraser River. It is the warmest subzone of the SBPS and includes the greatest amount of Douglas-fir. *Calamagrostis rubescens* and mosses dominate the undergrowth on zonal sites.

TABLE 27. Synopsis of subzones in the Sub-Boreal Pine — Spruce zone (SBPS)

Subzone	Code	Old code
Very Dry Cold SBPS	SBPSxc	(SBSa1)
Dry Cold SBPS	SBPSdc	(SBSa3)
Moist Cool SBPS	SBPSmk	(SBSb)
Moist Cold SBPS	SBPSmc	(SBSa2)

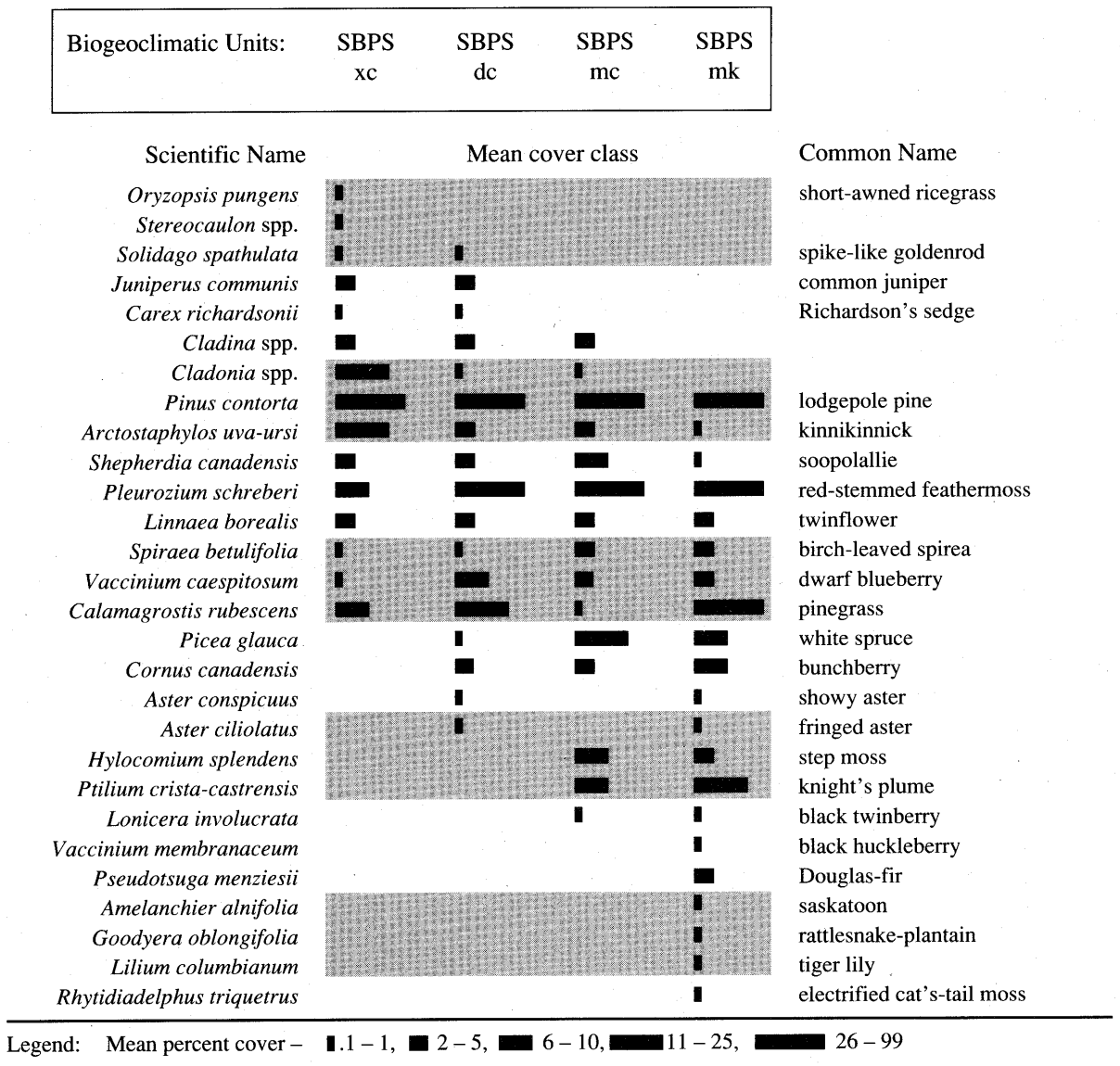

FIGURE 48. Zonal vegetation subzones of the Sub-Boreal Pine — Spruce zone.

SOME REPRESENTATIVE SITE ASSOCIATIONS

The following four site associations are common on the SBPS landscape and form a sequence of ecosystems from dry to wet in the SBPSdc (see Figure 49).

Lodgepole pine — Juniper — Feathermoss

This is the zonal and most common association of the SBPSdc. It is extensive on well and moderately well-drained morainal deposits and also occurs on finer-textured glaciofluvial deposits. Soils are mostly Brunisolic Gray Luvisols or, less often, Orthic Gray Luvisols and have a thin (3-4 cm) Hemimor humus form.

Even-aged stands of lodgepole pine with a moderately closed canopy dominate the vegetation. White spruce is seldom present in the canopy, although it occurs in the understory of most stands. Trembling aspen is sometimes present in the tree canopy, especially in young seral stands.

The shrub layer in most stands has low to moderate cover and is usually dominated by *Juniperus communis* (common juniper), *Shepherdia canadensis* (soopolallie), and *Rosa acicularis* (prickly rose). A very well-developed cover of *Juniperus communis* is present in some relatively old stands. Lodgepole pine regeneration is consistently present but usually patchy.

The herb layer is moderately well developed and dominated by *Calamagrostis rubescens* and *Arctostaphylos uva-ursi*. Other common species are *Vaccinium caespitosum* (dwarf blueberry), *Cornus canadensis* (bunchberry), *Linnaea borealis* (twinflower), *Epilobium angustifolium* (fireweed), and *Fragaria virginiana* (wild strawberry).

A well-developed cover of mosses, primarily *Pleurozium schreberi* (red-stemmed feathermoss), is present on most sites. Lichens are also consistently present but less abundant than on drier sites. Lichen species are mainly *Cladonia* spp., *Cladina* spp., *Peltigera* spp., and *Stereocaulon* spp.

Lodgepole pine — Kinnikinnick — Cladonia

This site association is very common in the two driest SBPS subzones, the SBPSxc and SBPSdc. In the SBPSdc, it includes all forested sites drier than the zonal site; in the very dry SBPSxc, it includes the zonal as well as drier sites. In the wetter climate of the SBPSmc, it includes only the driest forested sites. Thus, this association occurs on the driest sites of the SBPS zone, encompassing a broad range of site features.

Such sites are most common on well and rapidly drained morainal deposits, but are also present on sandy glaciofluvial deposits and on thin soils over bedrock. Soils are predominantly Dystric Brunisols or weakly developed Brunisolic Gray Luvisols. The humus form is most often a very thin (less than 3 cm) Xeromor or Hemimor.

The vegetation is characterized by open stands of lodgepole pine with only occasional scattered white spruce. Lodgepole pine, sometimes with a few trembling aspen, dominates the young seral stands.

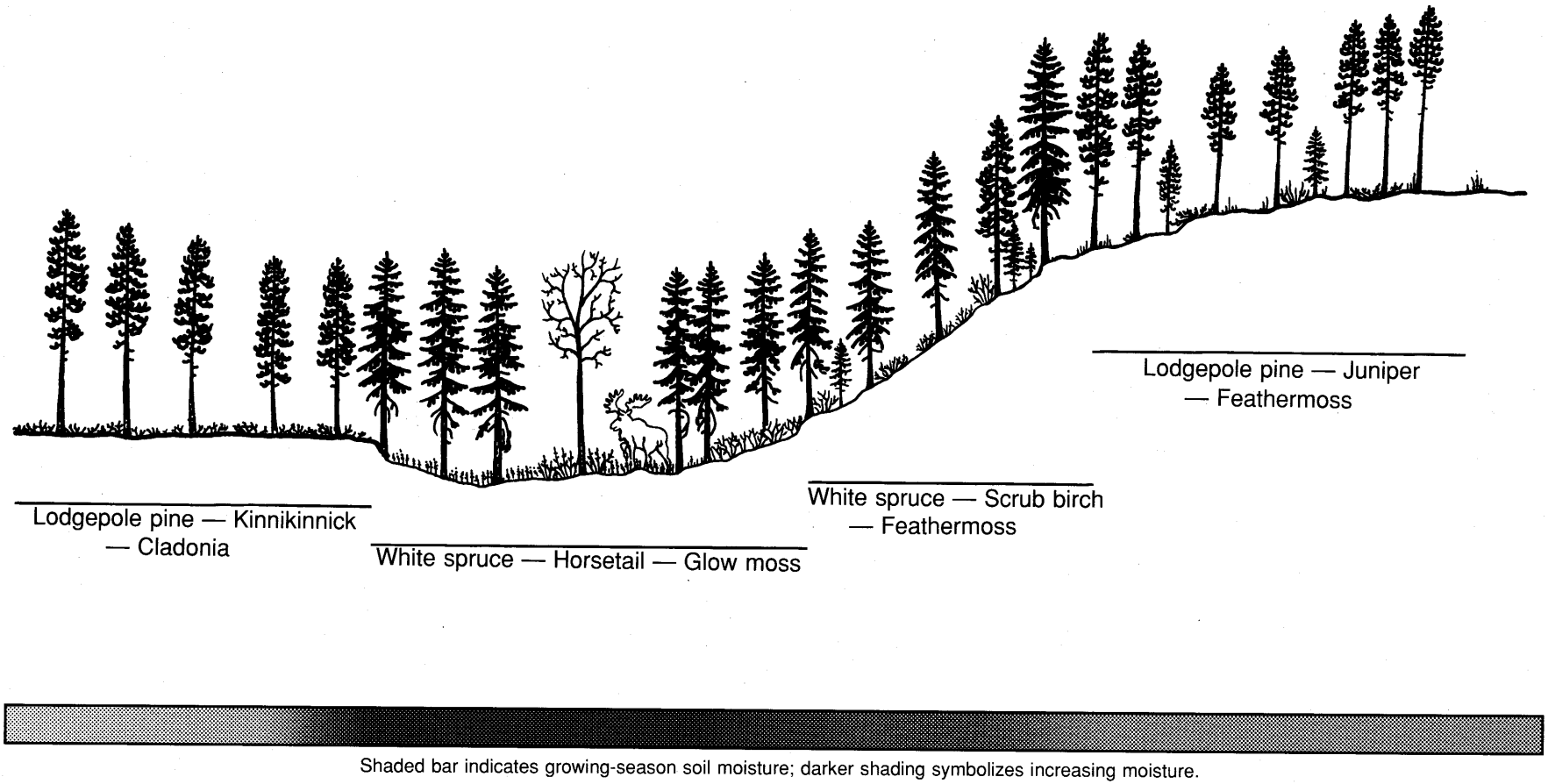

FIGURE 49. Simplified schematic diagram of topographic relationships among four common site associations of a dry subzone of the Sub-Boreal Pine — Spruce zone.

In the undergrowth, low shrubs 0.5-1 m tall cover 5-30% of the surface. *Juniperus communis* and *Shepherdia canadensis* are most abundant, but *Spiraea betulifolia* (birch-leaved spirea) and *Rosa acicularis* are also common. Lodgepole pine regeneration, 0.5 and 2.0 m tall, is often well represented but clumped. A few white spruce seedlings can be present.

The herb layer is dominated by dwarf shrubs, especially *Arctostaphylos uva-ursi* (kinnikinnick), and by a relatively small number of low herbaceous species. Common species are *Linnaea borealis*, *Solidago spathulata* (spike-like goldenrod), *Carex richardsonii* (Richardson's sedge), *Oryzopsis pungens* (short-awned ricegrass), and *Calamagrostis rubescens*.

The moss layer is dominated by lichens; species are similar to those in the Lodgepole pine — Juniper — Feathermoss association. Principal mosses are *Pleurozium schreberi*, *Dicranum polysetum* (wavy-leaved moss), and *Polytrichum juniperinum* (juniper haircap moss). A large proportion of the soil surface can lack vegetation cover over the pine needle litter.

White spruce — Scrub birch — Feathermoss

This is a common site association of moist lower slopes in the SBPSxc, SBPSdc, and SBPSmc. It occurs primarily on moderately well to imperfectly drained morainal deposits and less commonly on fluvial or lacustrine deposits. Soils are mostly Brunisolic Gray Luvisols and gleyed subgroups of Dystric Brunisols and Gray Luvisols. Humus forms are thicker (mostly 4-10 cm) than on the drier sites and are mostly Humimors, Hemimors, and Mormoders. As a result of the greater supply of moisture and nutrients, these are relatively productive sites for trees and other vegetation in the western SBPS.

Stands are dominated by white spruce with some lodepole pine.

The shrub layer is generally better developed and contains a larger number of species than in the drier site associations. Common species are *Rosa acicularis*, *Shepherdia canadensis*, *Lonicera involucrata* (black twinberry), *Juniperus communis*, *Salix glauca* (grey-leaved willow), and *Betula glandulosa* (scrub birch). Tree regeneration is predominantly white spruce.

The herb layer is relatively sparse but contains several low-growing species. Common species include *Petasites frigidus* var. *palmatus* (palmate coltsfoot), *Linnaea borealis*, *Epilobium angustifolium*, *Fragaria virginiana*, *Cornus canadensis*, and *Achillea millefolium* (yarrow).

The moss layer is moderately well developed and dominated by feathermosses, especially *Pleurozium schreberi* (red-stemmed feathermoss) and *Hylocomium splendens* (step moss). *Aulacomnium palustre* (glow moss), a moist-site moss, is usually present. Lichens are consistently present and include *Peltigera aphthosa*, *Cladonia* spp., and *Cladina* spp.

White spruce — Horsetail — Glow moss

The White Spruce — Horsetail — Glow moss association includes the wettest sites with a closed forest canopy in the SBPS. It is common in all SBPS subzones on imperfectly and poorly drained morainal or fluvial deposits, primarily at the toe of slopes and in small depressions. A water table is commonly present near the soil surface for a significant part of the growing season. Soils are primarily Gleysols but also include gleyed subgroups of Brunisols and Luvisols on the imperfectly drained sites. Humus forms include Hydromors, Histomors, and Hydromoders.

The forest canopy of mature stands is dominated by white spruce or hybrid white (Engelmann x white) spruce and only occasionally includes other species such as lodgepole pine or trembling aspen. The canopy tends to be relatively open and the trees clumped.

The shrub layer is moderately to well developed and often dominated by *Lonicera involucrata*. Other common species include *Salix* spp., *Ribes* spp. (gooseberries and currants), *Rosa acicularis*, *Cornus stolonifera* (red-osier dogwood), *Alnus tenuifolia* (mountain alder), and *Viburnum edule* (highbush-cranberry). White spruce, hybrid spruce, or occasionally black spruce are the principal species of tree regeneration. On poorly drained sites, tree seedlings establish primarily on raised microsites.

The herb layer includes many species, most of which are low-growing forbs. *Equisetum arvense* (common horsetail) is consistently present and often dominant. Other common species include *Rubus pubescens* (trailing raspberry), *Linnaea borealis*, *Petasites frigidus* var. *palmatus*, *Cornus canadensis*, *Calamagrostis canadensis* (bluejoint), and *Carex disperma* (soft-leaved sedge).

Hylocomium splendens and Mniaceae mosses (mostly leafy mosses) commonly dominate the moderately well-developed moss layer. Other common species are *Aulacomnium palustre*, *Pleurozium schreberi*, *Ptilium crista-castrensis* (knight's plume), and *Tomenthypnum nitens* (golden fuzzy fen moss).

WILDLIFE HABITATS

The factors that most influence the assemblage of wildlife species in this zone (Table 28) are its cold, dry winters and cool, dry summers; its occurrence on high elevation plateaus; and its position, in the centre of the province, leeward of the Pacific, Chilcotin, and Kitimat ranges. Wildlife that inhabit this zone are those that are adapted to either survive or avoid the long, cold winters. Moose can survive on the riparian shrubs, Caribou seek out terrestrial lichen patches in open pine forests, Black Bear spend the winter in hibernation, and most insect-eating birds migrate to warmer climates.

Wetlands are common and provide excellent habitat for the production of waterbirds, including Sandhill Cranes, sandpipers, dabbling and diving ducks, Canada Geese, and loons. The only nesting colony of White Pelican in the province occurs on Stum Lake within this zone. The wetland vegetation provides year-round forage for

TABLE 28. Selected wildlife habitats and species in the Sub-Boreal Pine — Spruce zone (adapted from Wildlife Branch 1989)

Habitat	Habitat distribution	Representative wildlife species	Wildlife species at risk[a]
Lodgepole pine forests	Extensive	Moose, Black Bear, Cougar, Lynx, Marten, Gray Wolf, Snowshoe Hare, Porcupine, Red Squirrel, Yellow-pine Chipmunk, Deer Mouse, Masked Shrew Northern Goshawk, Great Horned Owl, Northern Hawk-Owl, Barred Owl, Ruffed Grouse, Spruce Grouse, Pileated Woodpecker, Hairy Woodpecker, Gray Jay, Red Crossbill, Mountain Chickadee, Red-breasted Nuthatch, Brown Creeper	♦ Caribou
Riparian areas, wetlands, meadows, floodplains, lakes, and streams	Common	Moose, Mule Deer, Black Bear, Red Fox, Beaver, Muskrat, Meadow Jumping Mouse, Pygmy Shrew Bald Eagle, Ruffed Grouse, Trumpeter Swan, Canada Goose, Sandhill Crane, Herring Gull, Ring-billed Gull, Spotted Sandpiper, Black Tern, Eared Grebe, Common Loon, Barrow's Goldeneye, Harlequin Duck, Rusty Blackbird, Eastern Kingbird, Dusky Flycatcher, Marsh Wren, Catbird Common Garter Snake, Western Toad, Wood Frog, Spotted Frog, Long-toed Salamander	∇ American White Pelican ♦ Caribou, Grizzly Bear, Western Grebe
Spruce forests	Limited areal extent	Moose, Black Bear, Gray Wolf, Lynx, Fisher, Marten, Little Brown Myotis, Northern Flying Squirrel, Southern Red-backed Vole Great Gray Owl, Boreal Owl, Three-toed Woodpecker, Gray Jay, Magnolia Warbler, Yellow-rumped Warbler, Red-breasted Nuthatch	♦ Caribou
Open aspen forests and grasslands	Limited areal extent	Moose, Mule Deer, Black Bear, Coyote, Red Fox, Badger, Woodchuck, Yellow Pine Chipmunk, Deer Mouse, Pygmy Shrew American Kestrel, Pygmy Owl, Sharp-tailed Grouse, Northern Flicker, Yellow-bellied Sapsucker, Downy Woodpecker, Steller's Jay, Mountain Bluebird, Vaux's Swift, Boreal Chickadee Common Garter Snake, Western Toad	♦ Grizzly Bear

[a] Wildlife species and subspecies at risk are those on the preliminary Red and Blue Lists proposed in the Provincial Wildlife Strategy, B.C. Ministry of Environment (October 1989 draft).

∇ Red-listed wildlife species. These are being **considered** by the Wildlife Branch for designation as endangered or threatened in British Columbia.

♦ Blue-listed wildlife species. The Wildlife Branch considers these species "sensitive" and/or deserving of management attention. Population viability is a concern for these species because of (a) major declines in population numbers; or (b) major changes in habitat that will further reduce existing distribution. Species that are generally suspected of being vulnerable, but for which information is too limited to allow designation in another category, are included in this category.

Moose, Beaver, and Muskrat. Black Bear and the occasional Grizzly Bear also forage on vegetation here during the summer months, and some of the larger streams support spawning salmon, another food source for bears. Many birds, such as the Eastern Kingbird, Dusky Flycatcher, Marsh Wren, and Catbird, are attracted by the myriad insects that swarm over these wetlands.

The extensive pine forests provide habitat for seed-eating animals such as Red Squirrel; bark insect-eating birds such as Pileated Woodpecker, Hairy Woodpecker, Mountain Chickadee, Red-breasted Nuthatch, Brown Creeper, Hermit Thrush; and predatory animals such as Marten, Fisher, Goshawk, Great Horned Owl, and Barred Owl that feed on the insect and seed-eating animals. A few animals, such as the Spruce Grouse and Porcupine, thrive on the needles, buds, and bark of the pine trees. With the exception of terrestrial lichens for Caribou, these upland forests provide very poor forage for ungulates.

While not common, mature spruce forests provide cover for Moose, Mule Deer, and Black Bear, and the arboreal lichens provide winter forage for Caribou. Many of the seed and insect-eating birds are the same ones that occur in the pine forests, although here the snags are larger and last longer, providing better habitat opportunities for cavity-nesting birds and mammals.

Open grassland and aspen habitats are used by a variety of birds feeding on insects or succulent herbs. Birds include Sharp-tailed Grouse, Northern Pygmy-Owl, Vaux's Swift, Northern Flicker, Yellow-bellied Sapsucker, Downy Woodpecker, Steller's Jay, and Boreal Chickadee. Moose, Mule Deer, Black Bear, Grizzly Bear, and Snowshoe Hare also forage in these herbaceous-rich habitats. Large predatory mammals in these habitats include the Gray Wolf, Coyote, Red Fox, and Lynx.

RESOURCE VALUES

Timber productivity in the SBPS is low. However, the gentle terrain and small, relatively uniform size of trees allows for efficient mechanized harvesting. In recent years, timber harvesting has greatly increased in the SBPS, stimulated primarily by attempts to reduce losses of merchantable timber killed by epidemics of mountain pine beetle.

The SBPS has very low capability for agriculture. However, the numerous nonforested wetlands in the zone are extensively used for hay production and, to a lesser extent, cattle grazing. Water levels in many of the wetlands are manipulated for hay production. The abundance of *Calamagrostis rubescens* in the understory of upland forests of the eastern parts of the zone contributes to the range value of the SBPS.

Fur harvest from this zone is among the highest in the province.

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