Chapter 14: Sub-Boreal Spruce Zone

by

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LOCATION AND DISTRIBUTION

The Sub-Boreal Spruce zone (SBS) is the montane zone dominating the landscape of the central interior of British Columbia (Figure 50). It occupies the gently rolling terrain of the Nechako and Fraser plateaus and the Fraser Basin and fingers into more mountainous areas along its western, northern, and eastern boundaries. The SBS is found over a wide latitudinal range, from 51° 30′ to 59°N latitude. The zone generally occurs from the valley bottoms to 1100-1300 m elevation.

The SBS adjoins the Boreal White and Black Spruce zone in the north, the Interior Cedar — Hemlock zone in the wetter areas to the northwest and east, the Sub-Boreal Pine — Spruce zone in the dry southwest, and the Interior Douglas-fir zone in the south. The Engelmann Spruce — Subalpine Fir zone is the subalpine zone above the SBS.

ECOLOGICAL CONDITIONS

The climate of the SBS is continental, and is characterized by seasonal extremes of temperature; severe, snowy winters; relatively warm, moist, and short summers; and moderate annual precipitation (Figure 51 and Table 4). In contrast to the boreal, sub-boreal climate is slightly less continental, thus slightly warmer in January and cooler in July (Table 4). Sub-boreal winters are shorter and the vegetative season slightly longer with, in some cases, lower evapotranspiration. Mean annual temperature of the SBS ranges from 1.7 to 5°C. Average temperature is below 0°C for 4-5 months of the year, and above 10°C for 2-5 months. Mean annual precipitation data from long-term stations ranges from 440-900 mm, of which perhaps 25-50% is snow. Short-term data indicate that mean annual precipitation can range from 415 to 1650 mm in the SBS.

The SBS is part of the Canadian Boreal Forest Region (Krajina 1965). Krajina's original concept of the SBS was expanded southward following the work of Annas and Coupé (1979). Recently, a new zone, the Sub-Boreal Pine — Spruce zone (SBPS), was recognized in the driest, coldest parts of the former SBS in the south and southwest. We now consider the forests of the SBS as broadly transitional between the true montane forests of Douglas-fir to the south; the drier, colder pine — spruce forests to the southwest; boreal forests to the north; and subalpine forests at higher elevations.

Upland coniferous forests dominate the sub-boreal landscape. Hybrid white spruce (*Picea engelmannii* x *glauca*) and subalpine fir are the dominant climax tree species. Lodgepole pine, a seral species in the SBS, is common in mature forests in the drier parts of the zone and both lodgepole pine and trembling aspen pioneer the extensive seral stands. Paper birch is another pioneer tree, often on moist, rich sites. Douglas-fir is usually a long-lived seral species in the SBS, occurring abundantly on dry, warm, rich sites and as a consistent, although small, component of many mesic forests, especially in the southeastern part of the zone. Black spruce also occurs occasionally in climax upland forest.

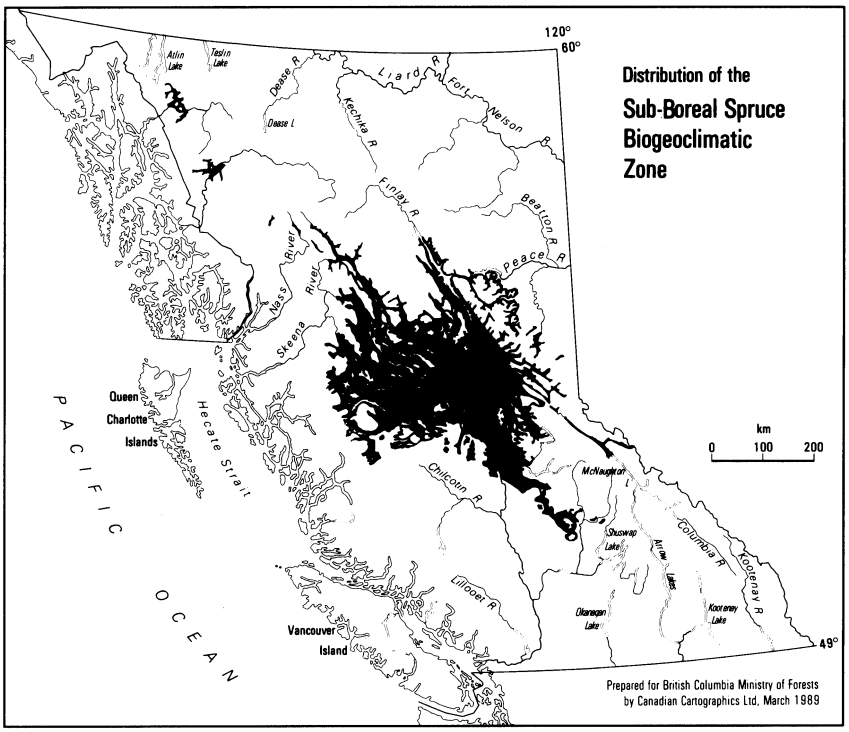

FIGURE 50. Sub-Boreal Spruce zone.

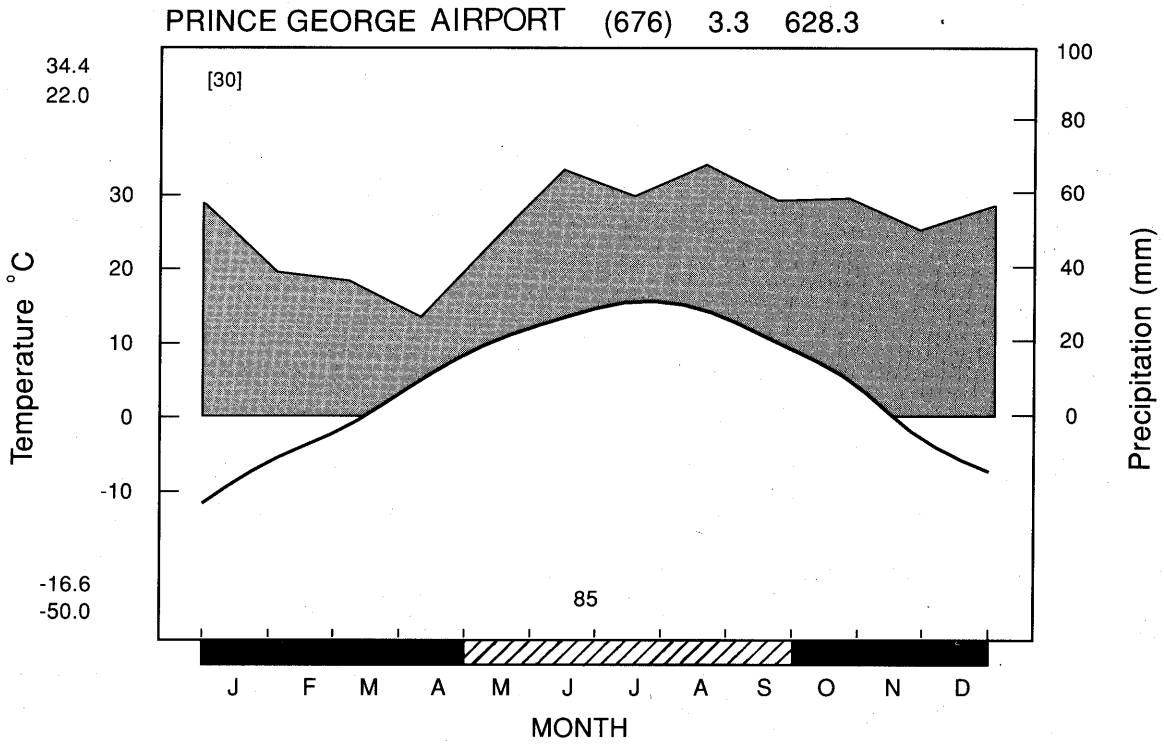

FIGURE 51. Representative climatic diagram for the Sub-Boreal Spruce zone.

Upland soils are primarily from the Luvisolic, Podzolic, and Brunisolic soil orders. Podzols and Brunisolic and Orthic Gray Luvisols are the most common soils found on the abundant morainal deposits. Imperfectly to poorly drained sites in the SBS typically have Gleysols or gleyed subgroups of Luvisols, Podzols, or Brunisols.

Alluvial forests of black cottonwood, often with a minor component of spruce, occur to a limited extent on active floodplains of the major streams and rivers.

Wetlands are common and dot the landscape in poorly drained, postglacial depressions or river ox-bows. Wetland community types include *Carex* (sedge) marshes, shrub fens of *Betula glandulosa* (scrub birch), *B. pumila* (swamp birch), and *Salix* spp. (willows), treed fens and swamps with black and hybrid white spruce, and black spruce — *Sphagnum* bogs. Acidic, nutrient-poor bogs are less common than the richer wetland types (marshes, fens, and swamps). Tamarack is a rare species in the SBS and occurs in only a few fens and swamps of the Nechako, Chilako, and Blackwater drainages.

Natural grassland and shrub-steppe are uncommon in the SBS, occurring on some warm, dry sites scattered in the major valleys.

NOTES ON CLASSIFICATION

Krajina (1965) classified much of the southern SBS as a northern subzone of his Cariboo Aspen — Lodgepole Pine zone (CALP), a zone the Ministry of Forests no longer recognizes. The dry, cold areas recognized as part of the SBS before 1988 (i.e., SBSa and SBSb) are now part of the Sub-Boreal Pine — Spruce zone.

SUBZONES

Ten subzones are recognized in the SBS (Table 29). Species characteristic of the warmer, drier subzones include Douglas-fir, *Shepherdia canadensis* (soopolallie), *Calamagrostis rubescens* (pinegrass), and *Oryzopsis asperifolia* (rough-leaved ricegrass) (Figure 52). The moister, cooler subzones typically have subalpine fir, *Rubus pedatus* (five-leaved bramble), *Petasites frigidus* var. *palmatus* (palmate coltsfoot), *Streptopus amplexifolius* (clasping-leaved twistedstalk), and *Gymnocarpium dryopteris* (oak fern).

Two of the three dry subzones occur on the Interior Plateau. The SBSdw is found in a long northwest to southeast band from about Stuart Lake to Canim Lake. The SBSdk is centred around Francois Lake and extends, at lower elevations, from Trembleur Lake in the north, to Ootsa Lake in the south. The third, the SBSdh, is found in the Rocky Mountain Trench and Fraser River valley near Valemount.

The moist subzones are found throughout the SBS zone. The SBSmh is in the Fraser and Quesnel River valleys from Alexandria and Hydraulic to Prince George.

The SBSmw is mainly in the Quesnel Highland and the SBSmm is near Clearwater. The "typical" SBS subzone is the SBSmk, ranging from Prince George — Fort St. James to Nation Lakes — Williston Reservoir. The somewhat colder SBSmc occurs at middle elevations from the Blackwater — Ootsa Lake area to Babine Lake and River.

TABLE 29. Synopsis of subzones in the Sub-Boreal Spruce zone (SBS)

Subzone	Code	Old code
Dry Hot SBS	SBSdh	(SBSh)
Dry Warm SBS	SBSdw	(SBSk)
Dry Cool SBS	SBSdk	(SBSd)
Moist Hot SBS	SBSmh	(SBSl)
Moist Warm SBS	SBSmw	(SBSc)
Moist Mild SBS	SBSmm	(SBSm1)
Moist Cool SBS	SBSmk	(SBSe2/o)
Moist Cold SBS	SBSmc	(SBSm2/e1/e/i)
Wet Cool SBS	SBSwk	(SBSj/n)
Very Wet Cool SBS	SBSvk	(SBSf)

The wetter subzones are found in the northern and eastern parts of the SBS. Part of the SBSwk occurs around Takla Lake, with the majority occurring in the east from the Peace Arm of Williston Reservoir south to the upper Quesnel River. The SBSvk occurs in mountainous terrain from the Bowron River to north of Mackenzie.

SOME REPRESENTATIVE SITE ASSOCIATIONS

The following four site associations are common on the SBS landscape. They form a typical sequence of ecosystems in the SBSmk (Figure 53).

Hybrid spruce — Huckleberry — Highbush-cranberry

The Hybrid spruce — Huckleberry — Highbush-cranberry association is common in the SBS moist and wet subzones. This association is the zonal association in the SBSmk, and occurs on "drier" sites in the SBSwk. It is mostly found on moderately well-drained sites on morainal deposits, although it can also be found on glaciofluvial deposits. Soils are a mixture of Brunisolic Gray Luvisols, Orthic Humo-Ferric Podzols, Orthic and Eluviated Dystric Brunisols, and Orthic Gray Luvisols. Hemimors are the most common humus forms.

Mature stands are usually well stocked with hybrid white spruce, lodgepole pine, and subalpine fir. Trembling aspen and paper birch are frequent components of seral stands.

The shrub layer is moderately developed with species such as *Vaccinium membranaceum* (black huckleberry), *Rubus parviflorus* (thimbleberry), *Viburnum edule* (highbush-cranberry), and *Alnus crispa* ssp. *sinuata* (Sitka alder). Advance regeneration of subalpine fir and some spruce is a consistent feature.

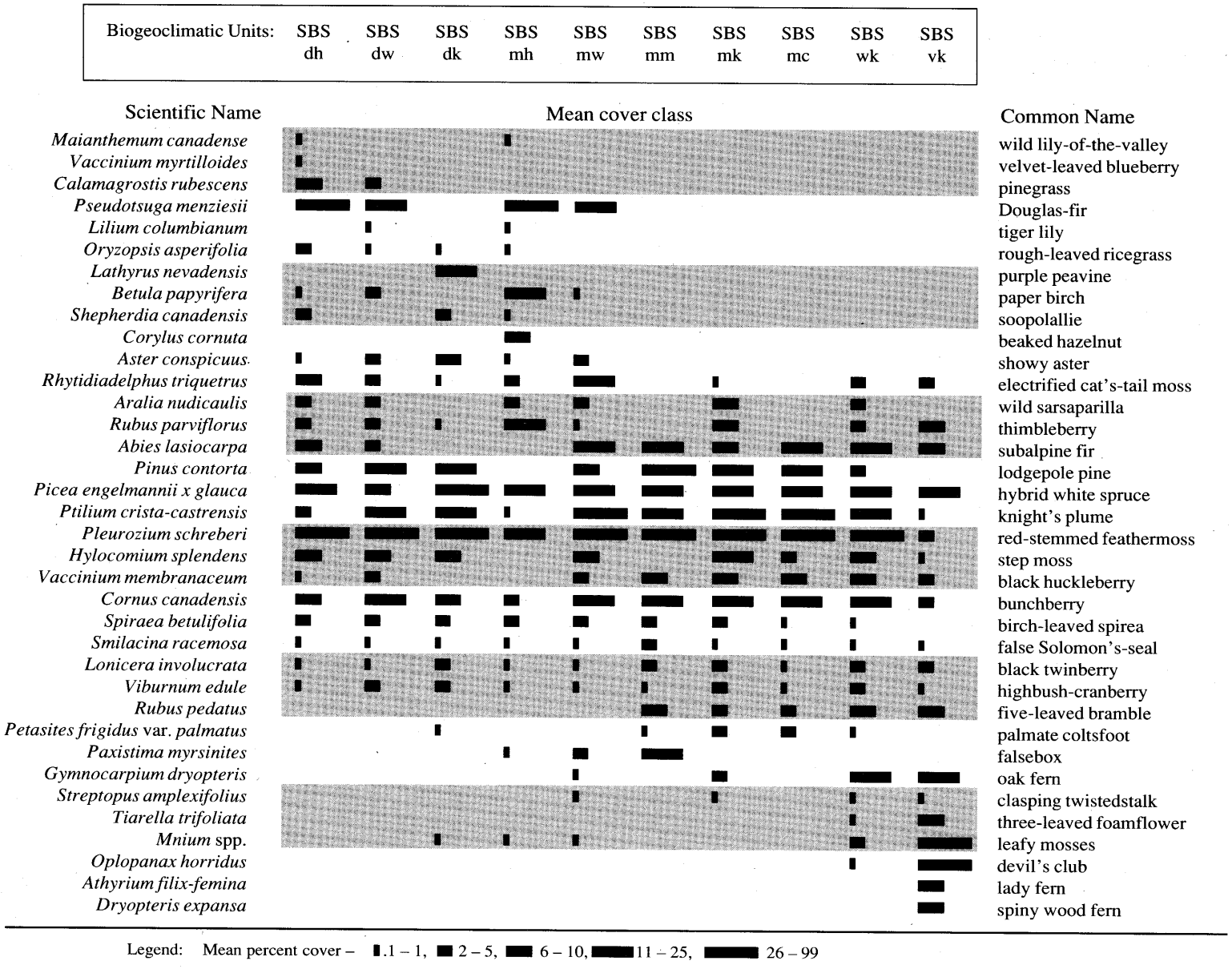

FIGURE 52. Zonal vegetation of subzones of the Sub-Boreal Spruce zone.

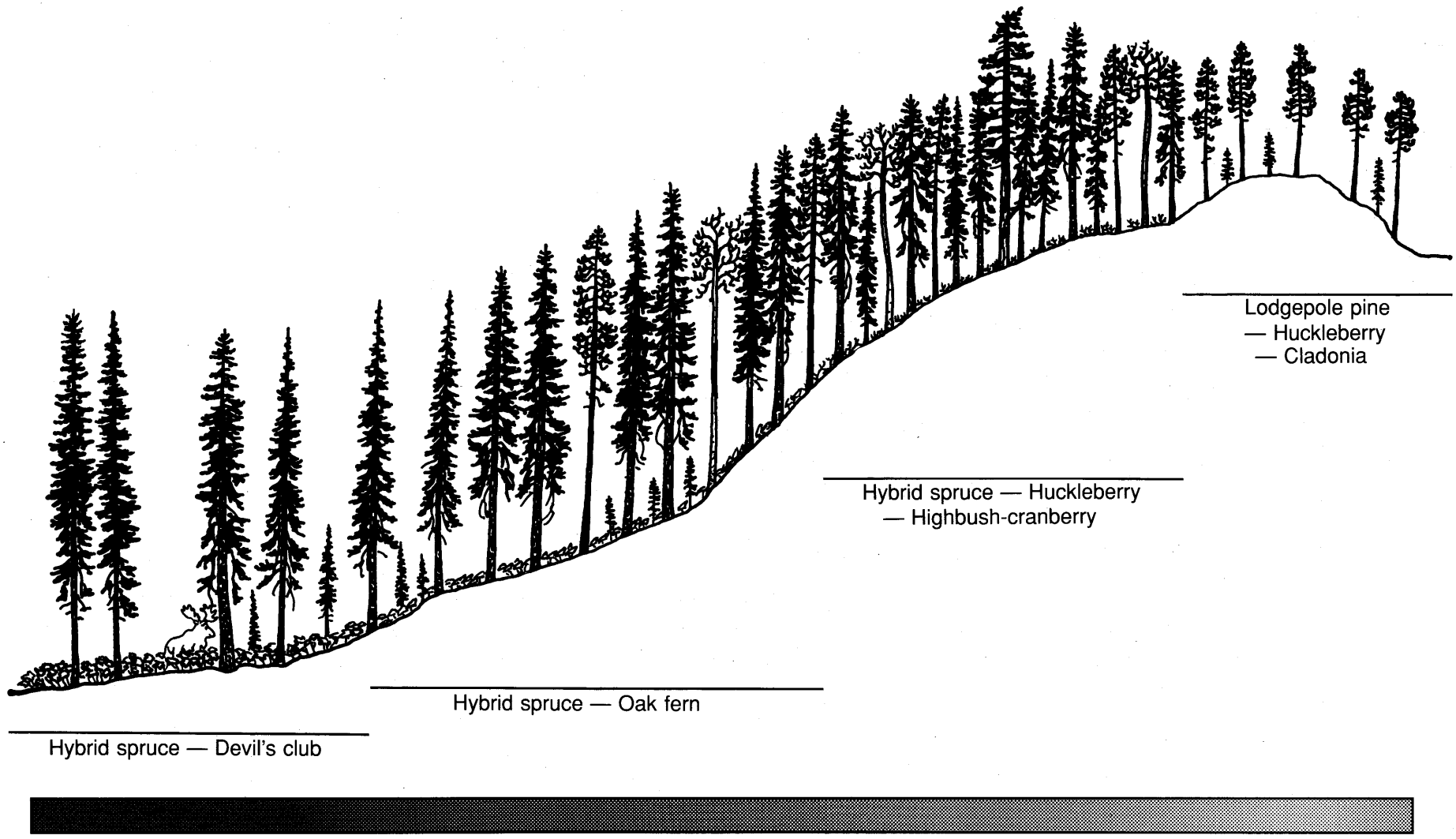

FIGURE 53. Simplified schematic diagram of topographic relationships among four common site associations of a moist, cool subzone of the Sub-Boreal Spruce zone.

Common herbs include *Cornus canadensis* (bunchberry), *Clintonia uniflora* (queen's cup), *Orthilia secunda* (one-sided wintergreen), *Linnaea borealis* (twinflower), *Smilacina racemosa* (false Solomon's-seal), *Lycopodium annotinum* (stiff clubmoss), and *Rubus pedatus*.

The well-developed moss layer is primarily composed of the mosses *Pleurozium schreberi* (red-stemmed feathermoss), *Ptilium crista-castrensis* (knight's plume), and *Hylocomium splendens* (step moss), and the lichen *Peltigera aphthosa*.

Lodgepole pine — Huckleberry — Cladonia

The Lodgepole pine — Huckleberry — Cladonia association is found on dry, nutrient-poor to -medium sites that generally occur on rapidly drained glaciofluvial, colluvial, or eolian materials in the moist, cool, and cold SBS subzones. Soils are predominantly Orthic Humo-Ferric Podzols and Eluviated and Orthic Dystric Brunisols. Typical humus forms are thin, crusty Xeromors.

These ecosystems are characterized by open stands of lodgepole pine with poorly developed shrub and herb layers, and a well-developed "moss" layer dominated by lichens.

Tree regeneration is sparse and consists of lodgepole pine with some subalpine fir and hybrid white spruce. The dominant shrub is generally *Vaccinium membranaceum* (black huckleberry) of poor vigour; *Vaccinium myrtilloides* (velvet-leaved blueberry) can be abundant in the SBSmk.

Arctostaphylos uva-ursi (kinnikinnick) is the dominant species in the herb layer.

The "moss" layer is dominated by lichens of the genera *Cladina*, *Cladonia*, *Peltigera*, and *Stereocaulon*. The most common mosses are *Polytrichum juniperinum* (juniper haircap moss) and *P. piliferum* (awned haircap moss).

Hybrid spruce — Oak fern

The Hybrid spruce — Oak fern site association is found on fresh, nutrient-poor to -rich sites throughout the moist to very wet subzones. This is the zonal association in the SBSwk. Soils are usually gleyed subgroups of Humo-Ferric Podzols, Brunisols, Gray Luvisols, or Brunisolic Gray Luvisols. Humus forms include Mormoders, Leptomoders, and Hemimors.

Subalpine fir and hybrid white spruce are the climax tree species. *Viburnum edule*, *Lonicera involucrata* (black twinberry), *Vaccinium membranaceum*, *Ribes lacustre* (black gooseberry), and *Rubus parviflorus* are common in the moderately developed shrub layer.

The well-developed herb layer is dominated by *Gymnocarpium dryopteris* (oak fern); *Cornus canadensis*, *Rubus parviflorus*, and *Clintonia uniflora* are also frequent.

The moss layer is dominated by *Pleurozium schreberi*, *Ptilium crista-castrensis*, *Hylocomium splendens*, *Bracythecium hylotapetum*, and *Mnium* spp. (leafy mosses; mostly *Plagiomnium* and *Rhizomnium* spp.).

Hybrid spruce — Devil's club

The Hybrid spruce — Devil's club site association occurs on moist, nutrient-poor to -very rich sites in the moist to very wet subzones. Such moist, rich habitats typically are found on or at the base of long, steep slopes, in ravines and gullies, and along streams. However, the Hybrid spruce — Devil's club association occurs on zonal sites in the SBSvk. Soils are generally gleyed subgroups of Gray Luvisols, Brunisols, or Humo-Ferric Podzols; Gleysols also occur. Humus forms can be Hemimors, Humimors, or Mormoders.

The tree layer comprises large but widely spaced hybrid white spruce and subalpine fir. The favourable habitat is reflected in excellent tree growth.

The dominant shrubs are *Oplopanax horridus* (devil's club), *Rubus parviflorus*, and *Lonicera involucrata*. The common herbs are *Gymnocarpium dryopteris*, *Athyrium filix-femina* (lady fern), *Tiarella trifoliata* (three-leaved foamflower), *Cornus canadensis*, and *Streptopus amplexifolius*.

The Mniaceae mosses (mostly *Plagiomnium*, *Rhizomnium*, and *Mnium*) are the most common in the moss layer along with *Brachythecium* spp., *Pleurozium schreberi*, and *Ptilium crista-castrensis*.

WILDLIFE HABITATS

Important ecological factors for wildlife in this zone are the long snowy winters, the dominance of dense spruce — subalpine fir and pine forests on gently rolling terrain, and the abundant wetlands. Wildlife that inhabit this zone (Table 30) are adapted to either survive or avoid the severe winters. Moose are the most common large ungulate; in fact, the Sub-Boreal Spruce zone represents the centre of abundance of Moose in British Columbia. Moose are well adapted to survive the severe winters of much of the SBS. Their long legs reduce the energetic costs of locomotion in deep snow and their large body generates and maintains heat efficiently.

Smaller mammals survive the winter by constructing burrows under the snow (e.g., Deer Mouse) or by travelling on top of the snow (e.g., Snowshoe Hare). Most birds migrate south in winter, but some such as the Pine Grosbeak and Red Crossbill remain year-round.

Old-growth coniferous forests in this zone provide thermal and hiding cover for Moose, as well as early winter habitat for Caribou when it is adjacent to the higher elevation Engelmann Spruce — Subalpine Fir zone. These forests also provide abundant habitat and prey for several predators such as the Gray Wolf, Fisher, Marten, and Ermine. Marten are very abundant in this zone, feeding primarily on Southern Red-backed Voles. Other common rodents include Red Squirrel, Northern Flying Squirrel, Woodchuck, and Deer Mouse.

Mature coniferous forest meets the habitat requirements of different birds for a variety of reasons. Pine Siskin, Magnolia Warbler, and Yellow-rumped Warbler all prefer coniferous trees for nesting, while the Golden-crowned Kinglet feeds on foliage

TABLE 30. Selected wildlife habitats and species in the Sub-Boreal Spruce zone (adapted from Wildlife Branch 1989)

Habitat	Habitat distribution	Representative wildlife species	Wildlife species at risk[a]
Old-growth spruce and subalpine fir forests	Extensive, dwindling	Moose, Mule Deer, Black Bear, Gray Wolf, Lynx, Red Fox, Fisher, Marten, Ermine, Big Brown Bat, Little Brown Myotis, Snowshoe Hare, Woodchuck, Red Squirrel, Northern Flying Squirrel, Southern Red-backed Vole, Deer Mouse, Pygmy Shrew Great Gray Owl, Boreal Owl, Three-toed Woodpecker, Black-backed Woodpecker, Gray Jay, Magnolia Warbler, Yellow-rumped Warbler, Pine Siskin, Ruby-crowned Kinglet, Golden-crowned Kinglet, Pine Grosbeak, White-winged Crossbill, Red-breasted Nuthatch	♦ Caribou
Riparian areas, wetlands, meadows, and floodplains	Common	Moose, Mule Deer, Black Bear, Beaver, Meadow Jumping Mouse Bald Eagle, Ruffed Grouse, Trumpeter Swan, Canada Goose, Herring Gull, Ring-billed Gull, Black Tern, Eared Grebe, Common Loon, Barrow's Goldeneye, Harlequin Duck, Rusty Blackbird Common Garter Snake, Western Toad, Spotted Frog, Wood Frog	♦ Caribou, Grizzly Bear, Western Grebe
Seral pine forests	Extensive	Moose, Mule Deer, Black Bear, Lynx, Snowshoe Hare, Porcupine, Yellow Pine Chipmunk, Deer Mouse, Southern Red-backed Vole, Deer Mouse Northern Goshawk, Great Horned Owl, Northern Hawk-owl, Ruffed Grouse, Spruce Grouse, Red Crossbill, Black-capped Chickadee	
Mixed deciduous and coniferous forests	Extensive	Moose, Mule Deer, Black Bear, Gray Wolf, Lynx, Marten, Ermine, Red Squirrel, Porcupine, Snowshow Hare, Deer Mouse Northern Goshawk, Northern Hawk-owl, Great Horned Owl, Common Raven, Northern Flicker, Downy Woodpecker, Yellow-bellied Sapsucker, Pine Siskin, Yellow Warbler, Dark-eyed Junco, Black-capped Chickadee, Chipping Sparrow	♦ Caribou, Northern Long-eared Myotis, Black-throated Green Warbler, Canada Warbler
Agricultural areas	Limited areal extent	Moose, Mule Deer, Black Bear, Coyote, Deer Mouse American Kestrel, Sandhill Crane, Canada Goose, Mountain Bluebird	
Grasslands and shrub-steppe	Limited areal extent	Rocky Mountain Elk, Mule Deer, Gray Wolf, Coyote, Black Bear American Kestrel, Ruffed Grouse	♦ Grizzly Bear

TABLE 30. Continued

[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.

insects, including the spruce budworm. Seeds from cones provide food for birds such as the Pine Siskin and Pine Grosbeak, and predatory birds like the Great Gray Owl and Boreal Owl feed on the rodent populations.

Young seral forests are created through removal of the forest canopy by logging or burning. These changes to the structure of wildlife habitat change the distribution and abundance of wildlife species. Logging prevails in this zone, so there are abundant young seral forest habitats in various stages of succession.

Some wildlife species benefit from the early successional scrub that develops after disturbance. Moose and Mule Deer will browse available forage in these shrublands, given adjacent thermal and hiding cover. Voles and mice are common, and avian predators that prefer to hunt open areas (e.g., Northern Hawk-owl and Great Horned Owl) do well in this successional stage.

Other animal species become more abundant as natural succession proceeds to lodgepole pine and aspen forests. Snowshoe Hare support an abundant Lynx population in the young seral forests. Species such as Porcupine, Red Crossbill, and Spruce Grouse occur in this type because their habitat requirements include pine.

Next to coniferous and mixed forests, the second most abundant wildlife habitat type in the SBS includes riparian areas, wetlands, meadows, floodplains, lakes, and streams. Moose forage on aquatic vegetation in shallow lakes and swamps, and on the early successional shrubs of active floodplains. Dense deciduous vegetation in riparian areas provides thermal and hiding cover for Moose. The omnivorous Grizzly Bear forages on roots, shoots, and small mammals, in a variety of wetland and riparian habitats.

The wetlands common in this zone provide excellent habitat for waterfowl. There are high breeding concentrations of Eared Grebe, Herring Gull, and Black Tern. These wetlands are the most important breeding centre in the world for Barrow's Goldeneye.

Amphibians and reptiles are poorly adapted to cold temperatures and deep snows; hence, only three amphibian and one reptile species occur in this zone. The Western Toad, Wood Frog, Spotted Frog, and Common Garter Snake are found in riparian and wetland habitats, as well as in the adjacent forests.

Agricultural areas also provide habitat for some wildlife species in the SBS. Field crops often supply forage for Moose, Mule Deer, and Canada Goose. Coyotes feed on abundant vole and mouse populations, and both the Mountain Bluebird and American Kestrel hawk insects. These man-made habitats also provide staging areas for migrating Sandhill Crane.

Natural grasslands and shrub-steppe, although scattered and uncommon, support many wildlife species. Rocky Mountain Elk are of particular note, because they are not found in any abundance elsewhere in this zone.

RESOURCE VALUES

Forest harvesting is very active in the SBS. Slightly dry and fresh sites generally have moderate capability for producing spruce and lodgepole pine; moderately dry sites have low capability for lodgepole pine; moist sites have high capability for spruce and subalpine fir growth. The SBS landscape provides large tracts of moderately productive forests and offers excellent potential for increasing fibre yields through intensive silviculture.

Most of the SBS has low capability for agriculture because of adverse climate, topography, bedrock, stoniness, or poor drainage. Lacustrine soils at the lower elevations have moderate capability, with limitations from poor soil structure and poor drainage. Alluvial deposits at lower elevations along the major rivers have the best capability for agriculture. Throughout most of the SBS, present agricultural activity is forage-based to support both cattle and dairy operations. On some of the more favourable sites, field crops and cereal grains are produced. Early seral and open mature forests, especially in the drier subzones, are used for seasonal grazing of livestock. Important range can be provided by seeding clearcuts and landings.

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

Recreational pursuits in the SBS include fishing, hunting, camping, studying natural history, cross-country skiing, and snowmobiling.

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