Chapter 12: Montane Spruce Zone

by

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LOCATION AND DISTRIBUTION

The Montane Spruce zone (MS) occurs in British Columbia at middle elevations between 53° and 49°N latitude (Figure 42). The zone extends from the northern limits of the Fraser Plateau to the U.S. border, specifically on: 1) the Southern Interior Plateau, 2) the lee side of the Coast and Cascade mountains, and 3) the southern Rocky Mountains and Rocky Mountain Trench. The MS also extends south into Washington, Idaho, and Montana. Elevations range from 1100 to 1500 m in wetter parts of the zone, and from 1250 to 1700 m in drier areas.

The MS is found elevationally above the Interior Douglas-fir (IDF) or Sub-Boreal Pine — Spruce (SBPS) zones, over most of their ranges, and below the Engelmann Spruce — Subalpine Fir zone (ESSF).

ECOLOGICAL CONDITIONS

The MS has a cool, continental climate characterized by cold winters and moderately short, warm summers (Figure 43). The climate of the zone is between that of the ESSF and the IDF (or SBPS). As well, it has similarities to that of the Sub-Boreal Spruce zone (Table 4). Mean annual temperature is 0.5-4.7°C. The average temperature is below 0°C for 5 months of the year and above 10°C for 2-4 months. Mean annual precipitation ranges from 380 to 900 mm; the growing season is sufficiently warm and dry that moisture deficits can occur, particularly in the drier subzones.

The MS was included in the ESSF of Krajina (1969). It has strong floristic affinities with the ESSF, such as climax stands of spruce and subalpine fir, and prominence of *Vaccinium membranaceum* (black huckleberry) in zonal ecosystems, as well as some affinity with the IDF as indicated by the abundance of *Calamagrostis rubescens* (pinegrass), *Paxistima myrsinites* (falsebox), and occasionally Douglas-fir in zonal ecosystems. However, the MS lacks many species characteristic of the IDF and ESSF. Thus, even though the MS is characterized as a transitional zone, it does have its own unique combination of species because of its intermediate nature. Hybrid white spruce is common, rather than Engelmann spruce. Characteristic understory species are *Lonicera utahensis* (Utah honeysuckle) and *Vaccinium scoparium* (grouseberry), in addition to those listed above.

One of the most distinctive features of the MS landscape is the extensive, young and maturing seral stands of lodgepole pine that have formed following wildfire. In wetter subzones, and on wet sites in all areas, maturing seral stands contain mixtures of lodgepole pine, hybrid white spruce, and subalpine fir. Hybrid white spruce and subalpine fir are the dominant, shade-tolerant, climax trees; however, lodgepole pine's frost tolerance, resistance to drought, and serotinous cones all favour its establishment after fire. Under the lodgepole pine canopy, frost and surface drying are reduced, and hybrid white spruce and subalpine fir can regenerate.

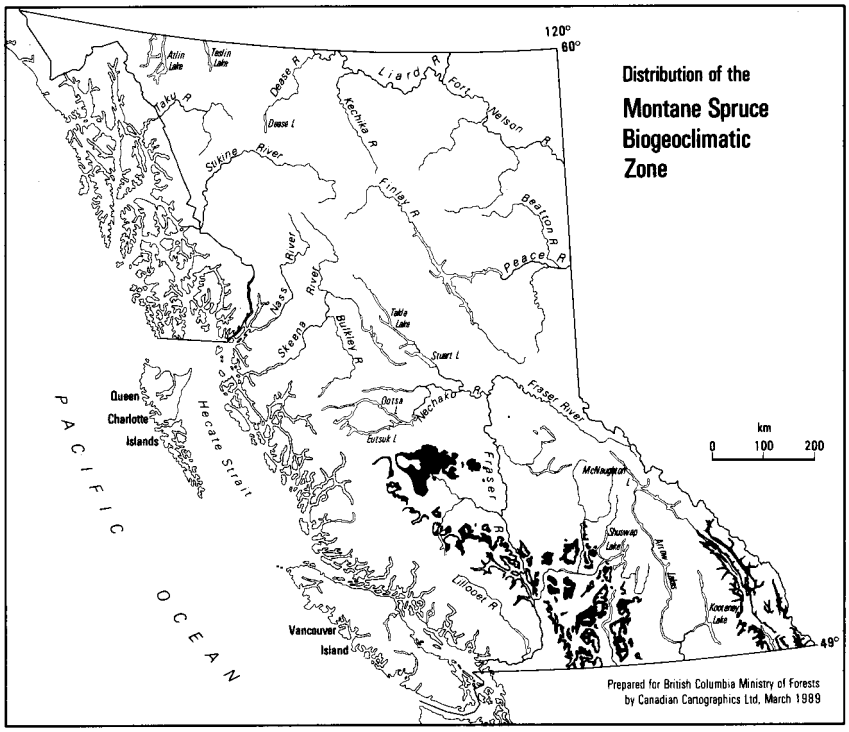


FIGURE 42. Montane Spruce zone.

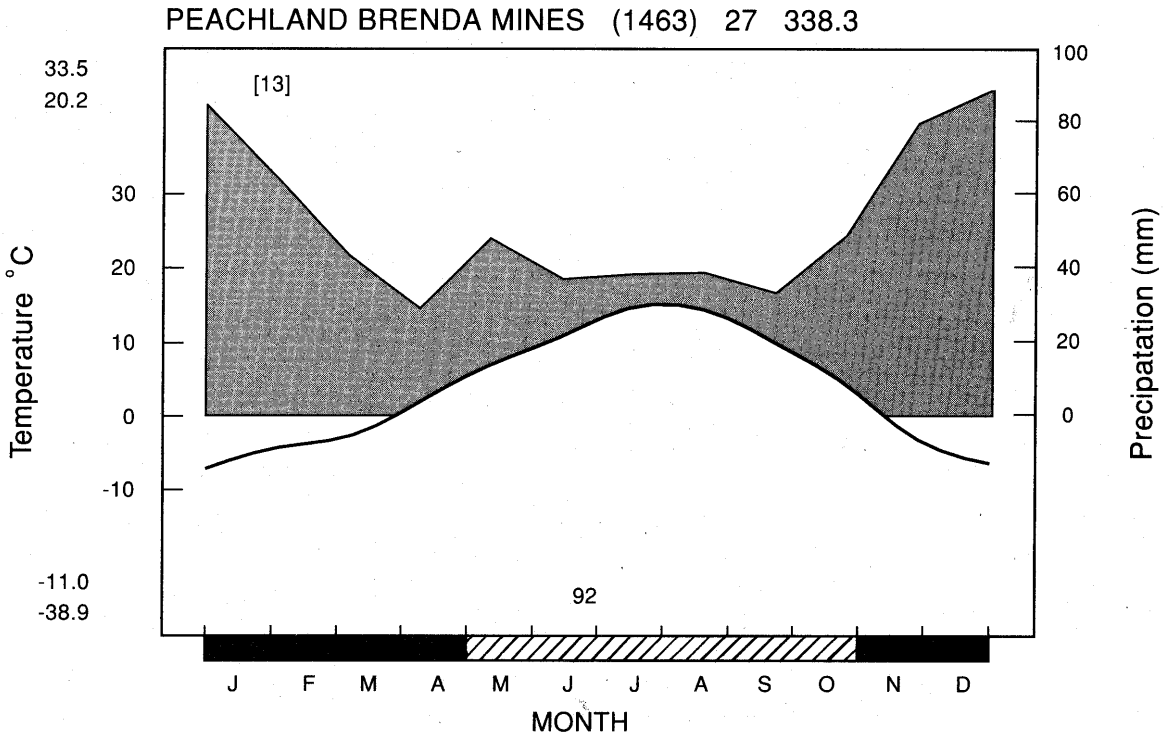


FIGURE 43. Representative climatic diagram for the Montane Spruce zone.

Douglas-fir is an important seral species in zonal ecosystems, and is a climax species on warm, south-facing slopes in the driest ecosystems. Western larch is confined to the eastern part of the zone, where it frequently occurs as a seral species after fire. Western redcedar occurs in the wetter parts of the zone, transitional to the Interior Cedar — Hemlock zone. Trembling aspen is a common seral species throughout the zone. Black cottonwood occurs on some wet sites.

On the extensive loamy to clayey morainal deposits (derived largely from volcanic bedrock), zonal and drier ecosystems have soils that are dominantly Brunisolic or Orthic Gray Luvisols and Eutric Brunisols. Humo-Ferric Podzols and Dystric Brunisols develop on coarser-textured deposits or in wetter parts of the zone. Humus forms in zonal ecosystems are commonly Hemimors and Hemihumimors, ranging from 3 to 10 cm in thickness.

Grassland ecosystems are uncommon in the MS, occurring only on south-facing upper slopes and ridges in the driest subzones. Vegetation on these sites is dominated by grasses such as *Agropyron spicatum* (bluebunch wheatgrass) and *Festuca idahoensis* (Idaho fescue).

In the mountainous topography typical of the MS, wetlands are uncommon. Where terrain is more subdued, wetlands occur more frequently. The most common wetland type consists of a fen community of *Salix* spp. (willows), *Carex* spp. (sedges), and *Aulacomnium palustre* (glow moss).

NOTES ON CLASSIFICATION

The Ministry of Forests has designated the MS as a new zone, previously included by Krajina (1969) as a southern, lower elevation part of the ESSF. The MS is closely related to several vegetation zones described by other authors in British Columbia (McLean 1970) and the adjacent U.S.A. (Franklin and Dyrness 1973; Pfister *et al.* 1977).

SUBZONES

Five subzones have been recognized in the MS (Table 25). *Vaccinium scoparium* and *Linnaea borealis* (twinflower) are characteristic of all subzones except the MSdc (Figure 44). All subzones have lodgepole pine, hybrid white spruce, *Orthilia secunda* (one-sided wintergreen), and a moderate to high cover of *Pleurozium schreberi* (red-stemmed feathermoss). Common species include *Lonicera utahensis, Paxistima myrsinites, Vaccinium membranaceum, Goodyera oblongifolia* (rattlesnake-plantain), *Calamagrostis rubescens, Arnica cordifolia* (heart-leaved arnica), *Cornus canadensis* (bunchberry), and *Chimaphila umbellata* (prince's pine).

The two coldest MS subzones occur on the lee side of the Coast Mountains. The MSxv occurs at middle to upper elevations on the western Fraser Plateau and at middle elevations on the eastern slopes of the Coast Mountains. This subzone lacks many of the common species of other MS subzones and has several species not found

on zonal sites in the others, specifically *Juniperus communis* (common juniper), *Empetrum nigrum* (crowberry), and *Cladina* lichens. The MSdc subzone occurs northwest and west of Lillooet in the Coast Mountains. It is very species-poor on zonal ecosystems, relative to other subzones.

TABLE 25. Synopsis of subzones in the Montane Spruce zone (MS)

Subzone	Code	Old code
Very Dry Very Cold MS	MSxv	(MSd)
Very Dry Cool MS	MSxk	(MSc)
Dry Cold MS	MSdc	(MSb4)
Dry Cool MS	MSdk	(MSa)
Dry Mild MS	MSdm	(MSb1/b2)

On the southern Interior Plateau, there are two subzones. The MSxk subzone occurs at mid-elevations in the central part of the Thompson Plateau and southern edge of the Fraser Plateau, from the U.S. border north to Clinton — Bonaparte Lake. The MSdm occurs on the lee side of the Cascade Mountains from Lytton to the U.S. border, on the east and south sides of the Thompson Plateau from Little Fort to northeast of Princeton, and east of Okanagan Lake in the Okanagan Highland from Lumby to the U.S. border.

In the southeast of the province, from Golden to the U.S. border, the MSdk occurs on midslopes of the Rocky Mountain Trench and in valley bottoms and lower valley slopes of the eastern Purcell and Rocky mountains.

SOME REPRESENTATIVE SITE ASSOCIATIONS

The four site associations described here are common in the MS. They form a typical sequence in the MSdm (Figure 45).

Hybrid spruce — Falsebox — Feathermoss

This zonal association is common in the MSdm.

Soils are typically well-drained Orthic and Eluviated Dystric Brunisols, Orthic Humo-Ferric Podzols, or Brunisolic Gray Luvisols, developed on thick morainal deposits composed primarily of volcanic materials. Humus forms are moderately thick (5-10 cm) Hemimors or Hemihumimors.

Lodgepole pine, hybrid white spruce, and subalpine fir form mixed, maturing seral stands. Douglas-fir can be a component of these stands.

The shrub layer is moderately well developed, consisting primarily of *Paxistima myrsinites* (falsebox), *Vaccinium membranaceum*, and a low cover of *Lonicera utahensis*. Both hybrid white spruce and subalpine fir are regenerating conifers.

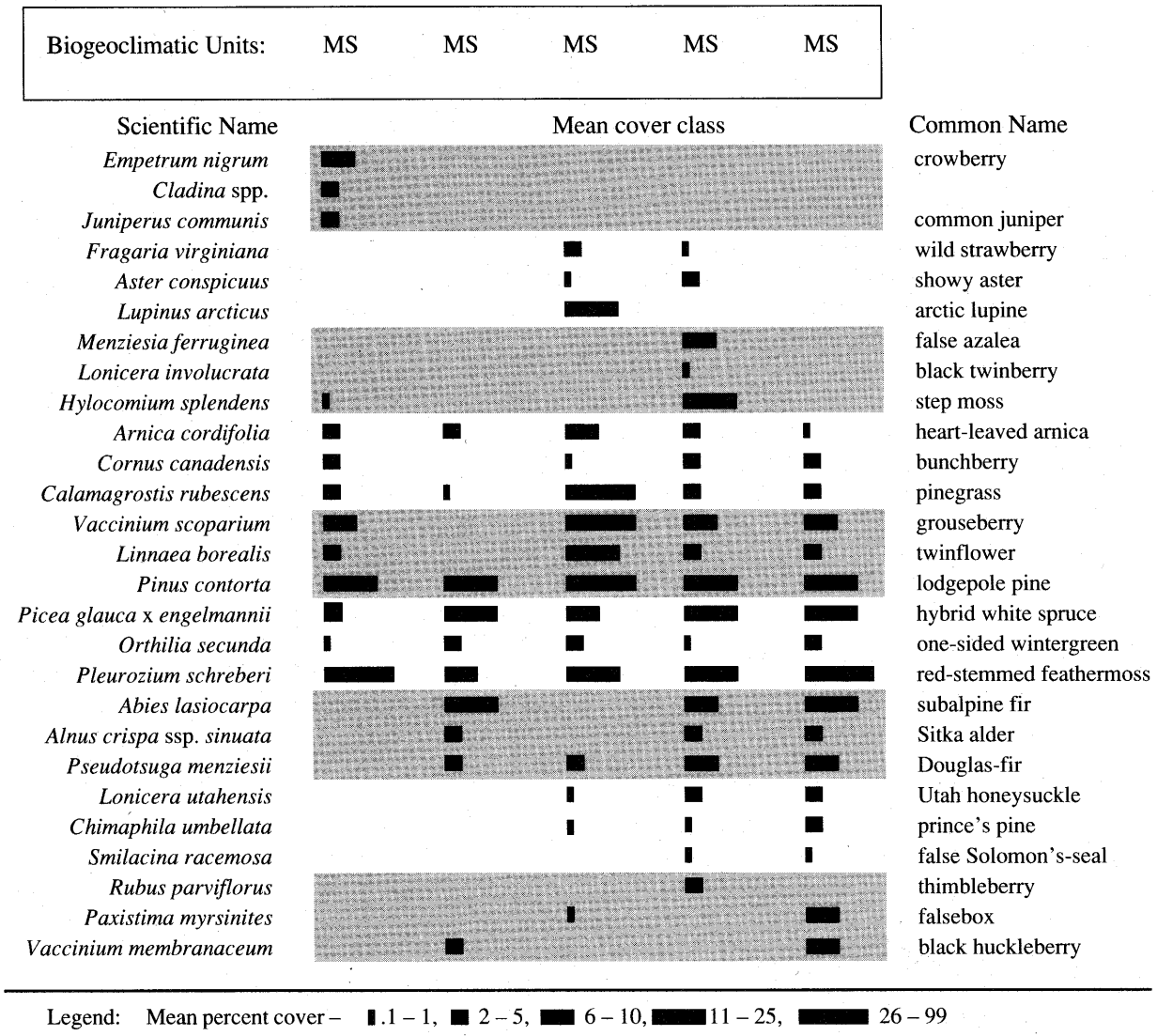
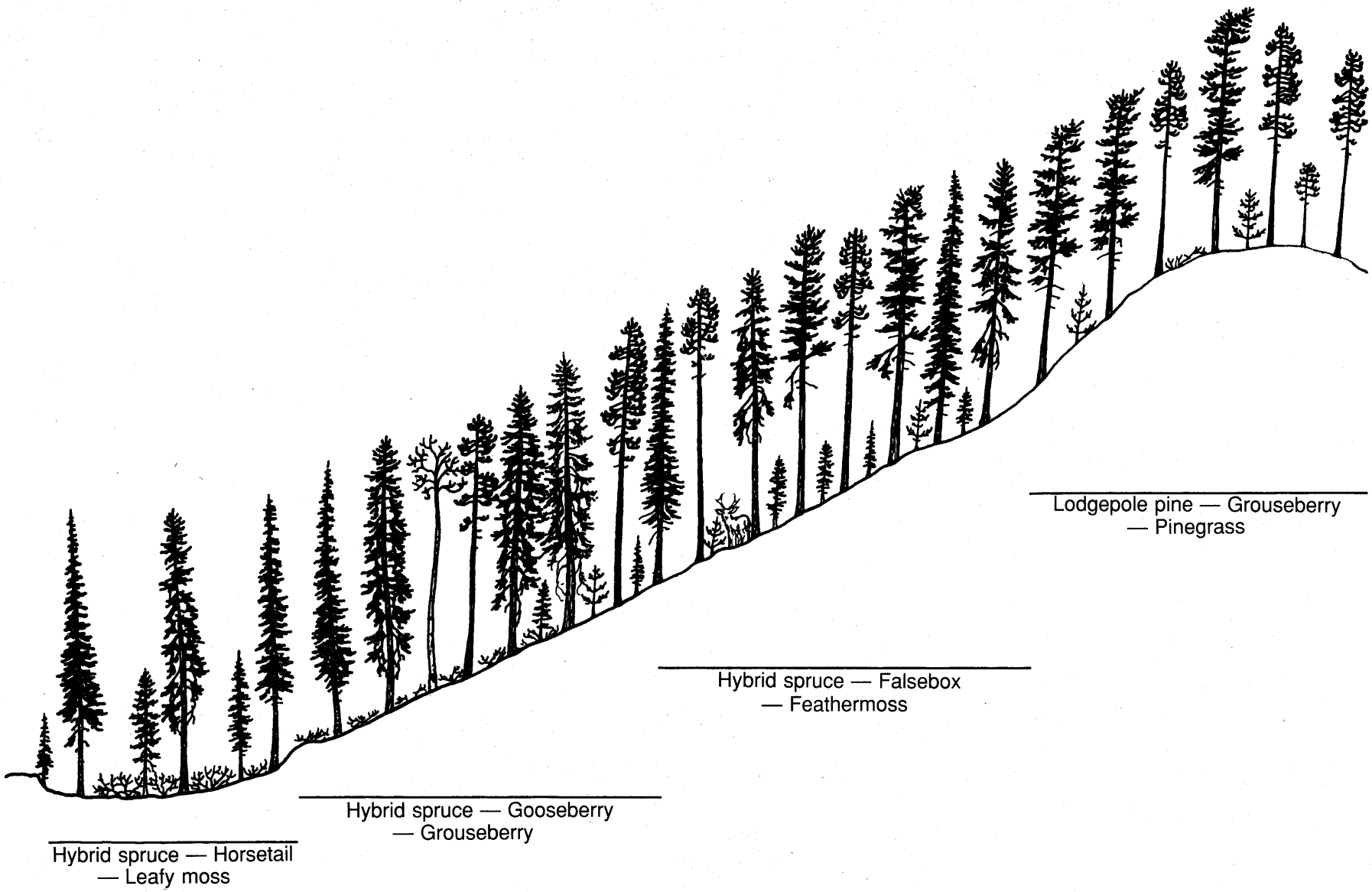


FIGURE 44. Zonal vegetation of subzones of the Montane Spruce zone.



Shaded bar indicates growing-season soil moisture; darker shading symbolizes increasing moisture.

FIGURE 45. Simplified schematic diagram of topographic relationships among four common site associations of a dry, mild subzone of the Montane Spruce zone.

Common species in the herb layer are *Vaccinium scoparium*, *Linnaea borealis*, *Orthilia secunda*, *Goodyera oblongifolia*, *Chimaphila umbellata*, and *Cornus canadensis*.

A well-developed moss layer is the dominant feature of the understory. It is composed primarily of *Pleurozium schreberi* (red-stemmed feathermoss), with lesser amounts of *Ptilium crista-castrensis* (knight's plume) and other mosses and lichens.

Lodgepole pine — Grouseberry— Pinegrass

The Lodgepole pine — Grouseberry — Pinegrass association, and other similar pinegrass-dominated site associations, are found on very dry sites in all the MS subzones except the MSxv. Soils are generally Orthic Dystric and Eutric Brunisols and Brunisolic Gray Luvisols. Humus forms are typically thin (2-4 cm) Hemimors and Hemihumimors.

These sites are characterized by open, mature seral stands of lodgepole pine, with regenerating hybrid white spruce and subalpine fir. Douglas-fir is often a component of these stands, especially on south-facing slopes.

The shrub layer is poorly developed. It contains *Lonicera utahensis*, *Paxistima myrsinites*, *Spiraea betulifolia* (birch-leaved spirea), and occasionally *Vaccinium membranaceum* and *Shepherdia canadensis* (soopolallie).

The herb layer, which dominates the understory, contains *Calamagrostis rubescens* (pinegrass), *Vaccinium scoparium* (grouseberry), and *Linnaea borealis*. *Arctostaphylos uva-ursi* (kinnikinnick) is often present.

The moss layer is poorly developed, but *Pleurozium schreberi* is usually present.

Hybrid spruce — Gooseberry — Grouseberry

This association occurs on moist and very moist, nutrient-poor to -rich sites in the MSdm and MSxk. A similar association occurs on these sites in the MSdc, but lacks *Vaccinium scoparium*. Soils are usually gleyed subgroups of Brunisols, Gray Luvisols, or Humo-Ferric Podzols. Humus forms include Hemihumimors, Mormoders, and Hemimors.

These sites support mature seral and maturing climax stands of hybrid white spruce, subalpine fir, and lodgepole pine, occasionally with scattered Douglas-fir.

The shrub layer is dominated by Ribes lacustre (black gooseberry), and also contains *Lonicera involucrata* (black twinberry), *L. utahensis*, and *Vaccinium membranaceum*. *Alnus crispa* ssp. *sinuata* (Sitka alder) and *Rubus parviflorus* (thimbleberry) can be present.

The herb layer is moderately developed and contains *Vaccinium scoparium* (grouseberry), *Orthilia secunda*, *Cornus canadensis*, *Tiarella unifoliata* (one-leaved foamflower), *Linnaea borealis*, *Rubus pedatus* (five-leaved bramble), and *Arnica cordifolia*.

The moss layer is moderately well developed with *Pleurozium schreberi* dominant.

Hybrid spruce — Horsetail — Leafy moss

This association occurs on wet, nutrient-medium to -very rich sites in most MS subzones. It generally occurs in wet depressions and receiving sites adjacent to swamps, and along streams. Soils are usually gleyed subgroups of Brunisols and Humo-Ferric Podzols; Gleysols also occur. Humus forms include Hydromoders, Humimors, and occasional Mulls.

Stands are open and dominated by hybrid white spruce, with lesser amounts of subalpine fir. The shrub layer is moderately well developed and dominated by *Ribes lacustre* and *Lonicera involucrata*.

The well-developed herb layer is dominated by *Equisetum arvense* (common horsetail), but also contains *Vaccinium scoparium*, *Cornus canadensis*, *Rubus pedatus*, and *Streptopus amplexifolius* (clasping-leaved twistedstalk).

The well-developed moss layer is dominated by *Aulacomnium palustre* and *Mnium*, *Rhizomnium*, and *Plagiomnium* spp. (leafy mosses).

WILDLIFE HABITATS

The main ecological factors affecting the fauna of this zone (Table 26) are the cold, snowy winters, short, warm summers, extensive lodgepole pine forests, and sloping mountainous topography. Wildlife that inhabit this zone are adapted to either survive or avoid the deep snows of winter. With the exception of Caribou and occasionally Moose, most ungulates migrate to lower elevations during winter to escape deep snow.

The extensive seral stands of lodgepole pine provide summer and fall range for Moose and Mule Deer, with good thermal and hiding cover in the dense regeneration thickets. Birds, such as the Three-toed Woodpecker and Black-backed Woodpecker, that forage on bark-inhabiting insects are common in the pine forests. The northern parts of the MSxv, in the western Chilcotin, contain extensive dry lodgepole pine forests with a substantial terrestrial lichen ground cover, and provide important winter habitat for Caribou.

In the mature coniferous forests of hybrid white spruce and subalpine fir, many species occur that also inhabit similar, more extensive habitats in the adjacent ESSF. Fisher, Marten, Red Squirrel, Southern Red-backed Vole, Great Gray Owl, and Red Crossbill are some examples. Moose and Mule Deer probably select these habitats because of higher forage production compared to dense seral stands of lodgepole pine.

Steep south-facing grassland slopes, though not extensive in the MS, are locally important as foraging areas for California Bighorn Sheep, Rocky Mountain Bighorn Sheep, Mule Deer, Golden-mantled Ground Squirrel, Golden Eagle, and Mountain Bluebird. Avalanche tracks, with their lush forage production, are feeding habitats for Grizzly Bear, Black Bear, Mountain Goat, Rocky Mountain Elk, and Moose. Rocky cliffs provide escape cover for Mountain Goat, California Bighorn Sheep, and Rocky Mountain Bighorn Sheep, and talus provides denning areas for Common Pika and Golden-mantled Ground Squirrel.

TABLE 26. Selected wildlife habitats and species in the Montane Spruce zone (adapted from Wildlife Branch 1989)

Habitat	Habitat distribution	Representative wildlife species	Wildlife species at risk[a]
Young seral forests	Extensive	Moose, Mule Deer, Black Bear, Lynx, Coyote, Little Brown Myotis, Snowshoe Hare, Porcupine, Heather Vole, Deer Mouse, Masked Shrew Northern Goshawk, Northern Hawk Owl, Northern Pygmy-Owl, Ruffed Grouse, Three-toed Woodpecker, Black-backed Woodpecker, Wilson's Warbler, Rufous Hummingbird, Pine Grosbeak, Western Tanager, Dark-eyed Junco, Yellow-rumped Warbler	♦ Grizzly Bear
Mature coniferous forests	Extensive	Moose, Mule Deer, Cougar, Lynx, Coyote, Black Bear, Fisher, Marten, Red Squirrel, Snowshoe Hare, Silver-haired Bat, Little Brown Myotis, Long-legged Myotis, Southern Red-backed Vole, Deer Mouse, Masked Shrew Barred Owl, Great Gray Owl, Spruce Grouse, Pileated Woodpecker, Black-backed Woodpecker, Three-toed Woodpecker, Steller's Jay, Clark's Nutcracker, Varied Thrush, Red Crossbill, Golden-crowned Kinglet, Mountain Chickadee, Red-breasted Nuthatch Long-toed Salamander	♦ Caribou, Grizzly Bear
Steep, south aspect grasslands	Limited areal extent	Rocky Mountain Elk, Mule Deer, Cougar, Golden-mantled Ground Squirrel Golden Eagle, Blue Grouse, Mountain Bluebird	♦ California Bighorn Sheep, Rocky Mountain Bighorn Sheep, Grizzly Bear
Avalanche tracks	Limited areal extent	Mountain Goat, Moose, Rocky Mountain Elk, Mule Deer, Black Bear	♦ Grizzly Bear
Rocky cliffs and talus	Limited areal extent	Mountain Goat, Common Pika, Golden-mantled Ground Squirrel Golden Eagle	♦ California Bighorn Sheep, Rocky Mountain Bighorn Sheep
Riparian areas, wetlands, meadows, floodplains, lakes, and streams	Common, limited areal extent	Moose, Mule Deer, Black Bear, Coyote, Long-tailed Weasel, Little Brown Myotis, Water Vole, Deer Mouse, Western Jumping Mouse, Meadow Jumping Mouse Ruffed Grouse, Harlequin Duck, American Dipper Western Toad, Spotted Frog, Long-toed Salamander	♦ Caribou, Grizzly Bear, Tailed Frog

[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.

Riparian areas and waterbodies are very important summer habitats for a variety of mammals, birds, and amphibians because they are, in a sense, wet islands in a matrix of fairly dry forest. Moose and Mule Deer often select these habitats in the summer to drop and rear their calves and fawns, because of the abundant forage and dense security cover. The American Dipper and Harlequin Duck can be observed foraging in fast-moving streams. Amphibians in this zone, such as the Spotted Frog, Western Toad, and Long-toed Salamander, are usually not far from a pond or stream.

RESOURCE VALUES

Forest harvesting, both for sawlogs and pulpwood, is very active in the MS. Mountain pine beetle (*Dendroctonus ponderosae*) has caused widespread mortality in mature pine stands and, during the 1980's, much of the logging in the MS concentrated on removing beetle-affected timber.

The primary agricultural use of the MS is cattle grazing. It is the second most important zone in the province, after the IDF, in providing forested summer range for cattle. Temporary forage production after fires and logging, both of seeded and native species, and forage produced by grass-sedge meadows are important. Zonal and drier ecosystems with seral stands of lodgepole pine provide some grasses (mainly *Calamagrostis rubescens*) and forbs, but forage production increases markedly after logging. Cutblocks, skid trails, and logging roads are often seeded with a variety of domestic species, notably orchardgrass (*Dactylis glomerata*) and clovers (*Trifolium* spp.).

Fur harvesting is an important resource use of this zone.

The MS is also important for recreation. Many valuable fishing, camping, and hunting areas lie within the zone. The zone is popular for other activities, such as hiking and horseback riding in summer, and cross-country skiing and snowmobiling in winter.

The zone makes an important contribution to spring and early summer runoff. In the dry Thompson Plateau and Okanagan Highland, the contribution of this runoff to overall watershed flow is important, although the early snow melt in the MS means that middle and late summer contributions are low.

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