

Chapter 7: Mountain Hemlock Zone

by

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LOCATION AND DISTRIBUTION

The subalpine elevations of the coastal mountains fall in the Mountain Hemlock zone (MH). This zone occurs all along the coast in British Columbia (Figure 22), and extends north through southeastern Alaska and south into Washington and Oregon. The MH occupies elevations of 900-1800 m in the south (lower on windward slopes, higher on leeward slopes), and 400 to 1000 m in the north. The zone occurs primarily on the Coast Mountains of the mainland and on the Insular Mountains of Vancouver Island and the Queen Charlotte Islands, above the Coastal Western Hemlock zone.

ECOLOGICAL CONDITIONS

The coastal subalpine climate is characterized by short, cool summers, and long, cool, wet winters, with heavy snow cover for several months (Figure 23 and Table 4). Mean annual temperature among the subzones varies from 0 to 5°C. Average monthly temperature remains below 0°C for 1-5 months, and above 10°C for 1-3 months. Mean annual precipitation probably ranges from 1700 to 5000 mm, of which 20% to 70% is snow. The deep winter snowpack is slow to disappear, and a short vegetative season is the result. Spring and summer are often relatively dry (especially on the south coast), whereas autumn and winter are very wet.

Mountain hemlock, amabilis fir, and yellow-cedar (as a tree, usually in moist habitats) are the most common tree species in the zone. It could be that these species depend on unfrozen ground beneath the snow cover (Krajina 1969; Brooke *et al.* 1970). Mountain hemlock and amabilis fir regenerate in abundance under the canopy of mature forest in many ecosystems, although advance regeneration of amabilis fir is often more abundant in dense, fully stocked stands. Mountain hemlock (the climatic climax species of the zone) eventually becomes established in the advanced stages of stand development, after openings of various sizes have developed in the forest canopy.

Other tree species that occur in the MH are: western hemlock and western redcedar (at lower elevations throughout the zone); Douglas-fir and western white pine (at lower elevations in the south); Sitka spruce (at lower elevations in the north); lodgepole pine (on very dry sites); subalpine fir and whitebark pine (near timberline). Subalpine fir increases in abundance in those transitional, colder portions of the MH that lie leeward of the higher elevations of the coastal mountains, along the boundary with the Engelmann Spruce — Subalpine Fir zone.

Tree growth becomes progressively poorer with increasing elevation because of the shorter growing season, increased duration of snow cover, and cooler temperatures. Forests are not continuous in the MH and are largely confined to lower elevations of the zone. With increasing elevation, the forest thins out into parkland, with trees in isolated clumps and irregular small patches, and along ridge crests where the snow melts earlier. The tree clumps form a mosaic with subalpine heath, meadow, and fen vegetation.

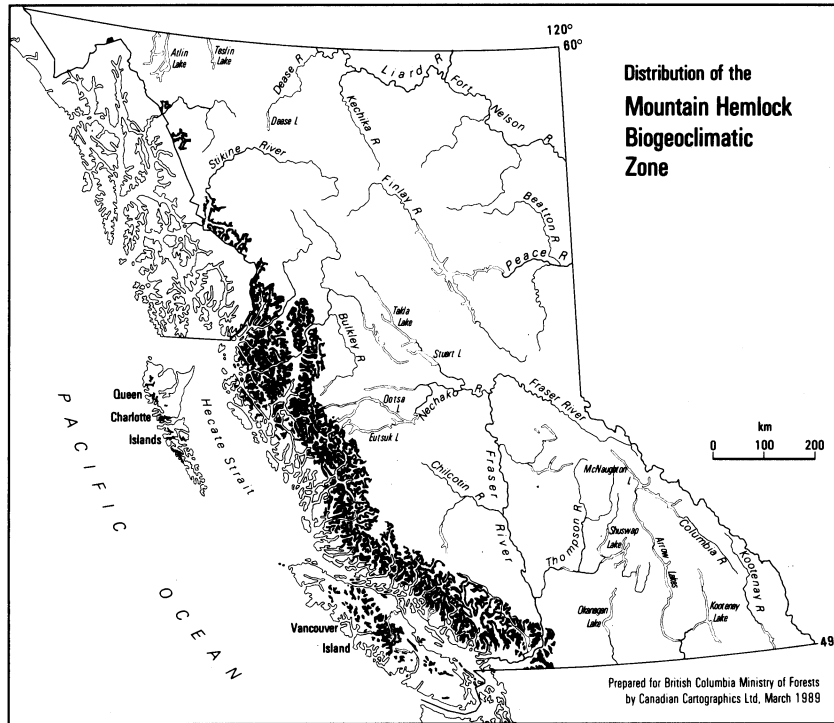


FIGURE 22. Mountain Hemlock zone.

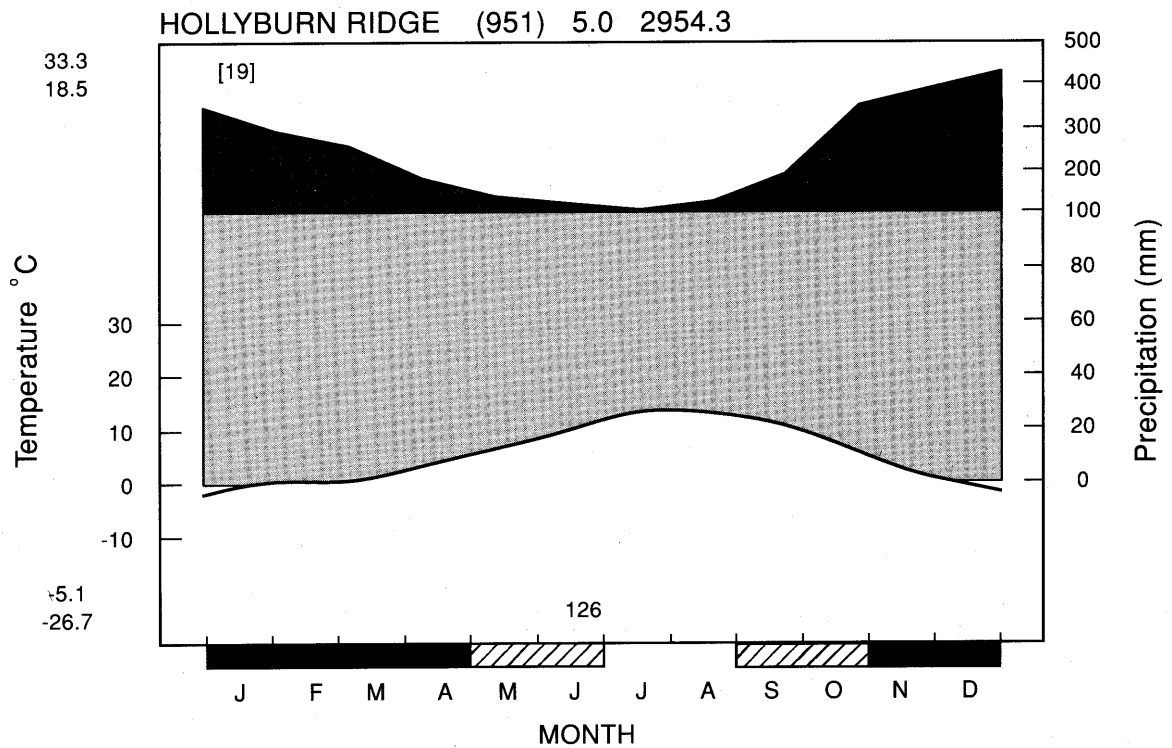


FIGURE 23. Representative climatic diagram for the Mountain Hemlock zone.

The predominance of shrubs of the family Ericaceae is a characteristic feature of the zone. *Vaccinium ovalifolium* (oval-leaved blueberry), *V. alaskaense* (Alaskan blueberry), *V. membranaceum* (black huckleberry), *Cladothamnus pyrolaeiflorus* (copperbush), *Menziesia ferruginea* (false azalea), and *Rhododendron albiflorum* (white-flowered rhododendron) can be dominants in continuous forest, and in parkland *Vaccinium deliciosum* (blue-leaved huckleberry), *Phyllodoce empetrififormis* (pink mountain-heather), *P. glanduliflora* (yellow mountain-heather), *Cassiope mertensiana* (white mountain-heather), *C. stelleriana* (Alaskan mountain-heather), and *C. lycopodioides* (club-moss mountain-heather) can join the list. The relatively low importance of herbs, the dominance of bryophytes, and the high significance of advance regeneration of amabilis fir and mountain hemlock are additional characteristic floristic features of climatic climax ecosystems.

Characteristic soil processes in the MH are the accumulation of acid, snow-compacted organic matter on the forest floor, mycelial Mor humus formation, gleying (many soils are moist to saturated throughout the year), leaching, eluviation, and illuviation. Podzols and Folisols are the predominant soils. Although the time over which soils have developed is comparatively short, they have often acquired strong morphological characteristics. The low temperature and high moisture content of most soils promote slow litter decomposition. Thus, they often have a high content of organic matter. Roots of mountain hemlock and sometimes amabilis fir are largely confined to the forest floor, indicating the essential role of the humus layers in tree regeneration and growth.

Subalpine heath is dominated by *Cassiope mertensiana* and *Phyllodoce empetrififormis* in the south; *C. stelleriana*, *C. lycopodioides*, and *P. glanduliflora* gain importance along the north coast. Common associates are *Luetkea pectinata* (partridgefoot), *Lycopodium alpinum* (alpine clubmoss), *Empetrum nigrum* (crowberry), *Vaccinium deliciosum* and/or *V. membranaceum*, *Vahlodea atropurpurea* (mountain hairgrass), *Hieracium gracile* (slender hawkweed), *Barbilophozia floerkei* (mountain leafy liverwort), and *Dicranum* spp.

In subalpine parkland, lush, diverse herb meadows colonize seepage areas and stream edges. Typical subalpine meadow species include *Veratrum viride* (Indian hellebore), *Valeriana sitchensis* (Sitka valerian), *Senecio triangularis* (arrow-leaved groundsel), *Petasites frigidus* var. *frigidus* (sweet coltsfoot), *Caltha leptosepala* (white marsh-marigold), *Leptarrhena pyrolifolia* (leatherleaf saxifrage), *Ranunculus eschscholtzii* (subalpine buttercup), *Mimulus lewisii* (pink monkey-flower), *Epilobium latifolium* (broad-leaved willowherb), *Erigeron peregrinus* (subalpine daisy), *Parnassia fimbriata* (fringed grass-of-Parnassus), *Mitella pentandra* (five-stamened mitrewort), *Pedicularis ornithorhyncha* (bird's-beak lousewort), *Castilleja miniata* (common red paintbrush), *C. parviflora* (small-flowered paintbrush), and *Arnica latifolia* (mountain arnica).

The *Carex nigricans* (black alpine sedge) association represents a very characteristic, wet, semi-terrestrial ecosystem that develops in subalpine snow basins, where snow lies on the surface for 9 months or longer each year.

SUBZONES

Four subzones are delineated in the MH (Table 15). They can be separated primarily along a gradient of continentality (hypermaritime and maritime subzones) and according to vegetation physiognomy (parkland and forested subzones) (Figure 24). Species characteristic of the hypermaritime subzones include *Blechnum spicant* (deer fern), *Chamaecyparis nootkatensis* (yellow-cedar), *Coptis aspleniifolia* (fern-leaved goldthread), *Hylocomium splendens* (step moss), and *Rhytidiadelphus loreus* (lanky moss). Species characteristic of the maritime subzones include *Abies amabilis* (amabilis fir) and *Vaccinium membranaceum*. In addition to the discontinuous forest cover, parkland subzones feature alpine elements, such as species of *Phyllodoce* and *Cassiope*.

TABLE 15. Synopsis of subzones in the Mountain Hemlock zone (MH)

Subzone	Code	Old code
Wet Hypermaritime Parkland MH	MHwhp	(cp/fp)
Wet Hypermaritime MH	MHwh	(c/f)
Moist Maritime Parkland MH	MHmmp	(ap/bp/dp/ep)
Moist Maritime MH	MHmm	(a/b/d/e)

The hypermaritime subzones occur on the outer mainland coast, outer west coast of Vancouver Island, and Queen Charlotte Islands. Most of the MH on the mainland and Vancouver Island is from the maritime subzones.

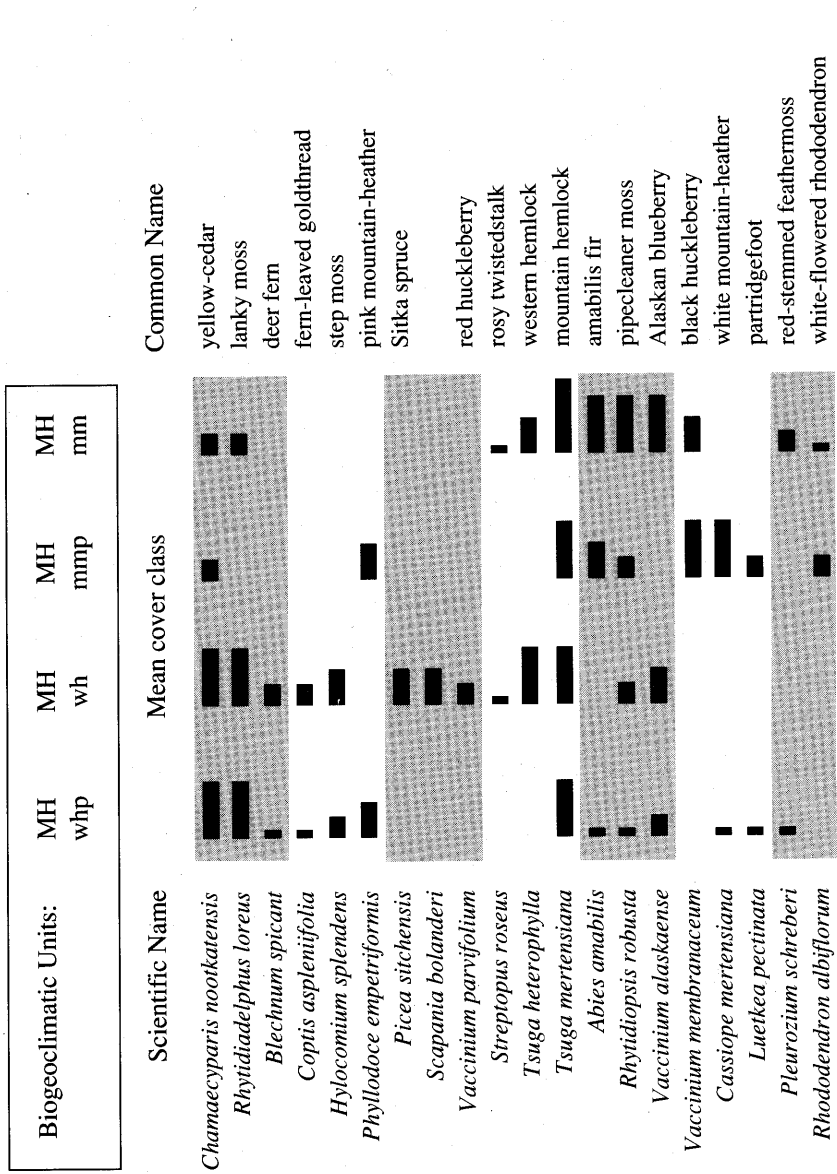
SOME REPRESENTATIVE SITE ASSOCIATIONS

The following descriptions treat four common associations found in the forested Moist Maritime MH subzone (Figure 25). The information has been drawn from an excellent study by Brooke *et al.* (1970).

Mountain hemlock — Amabilis fir — Blueberry

Fresh and nutrient-very poor to -medium sites that have a potential to develop zonal climax vegetation are represented by the Mountain hemlock — Amabilis fir — Blueberry association. These sites occupy benches, upper slopes, and broad ridges. Dominant soils are Ferro-Humic Podzols; typical humus forms are acid, compacted Mycohumimors and Mycohemimors. Some of the soils can be gleyed from temporary seepage during early summer. The soils remain wet during fall and winter due to heavy fall rains and wet winter snowpack.

Mountain hemlock and, to a lesser extent, amabilis fir dominate the well-developed tree layer. Yellow-cedar and western hemlock are minor species.



Legend: Mean percent cover – ■ .1 – 1, ■ 2 – 5, ■ 6 – 10, ■ 11 – 25, ■ 26 – 99

FIGURE 24. Zonal vegetation of subzones of the Mountain Hemlock zone.

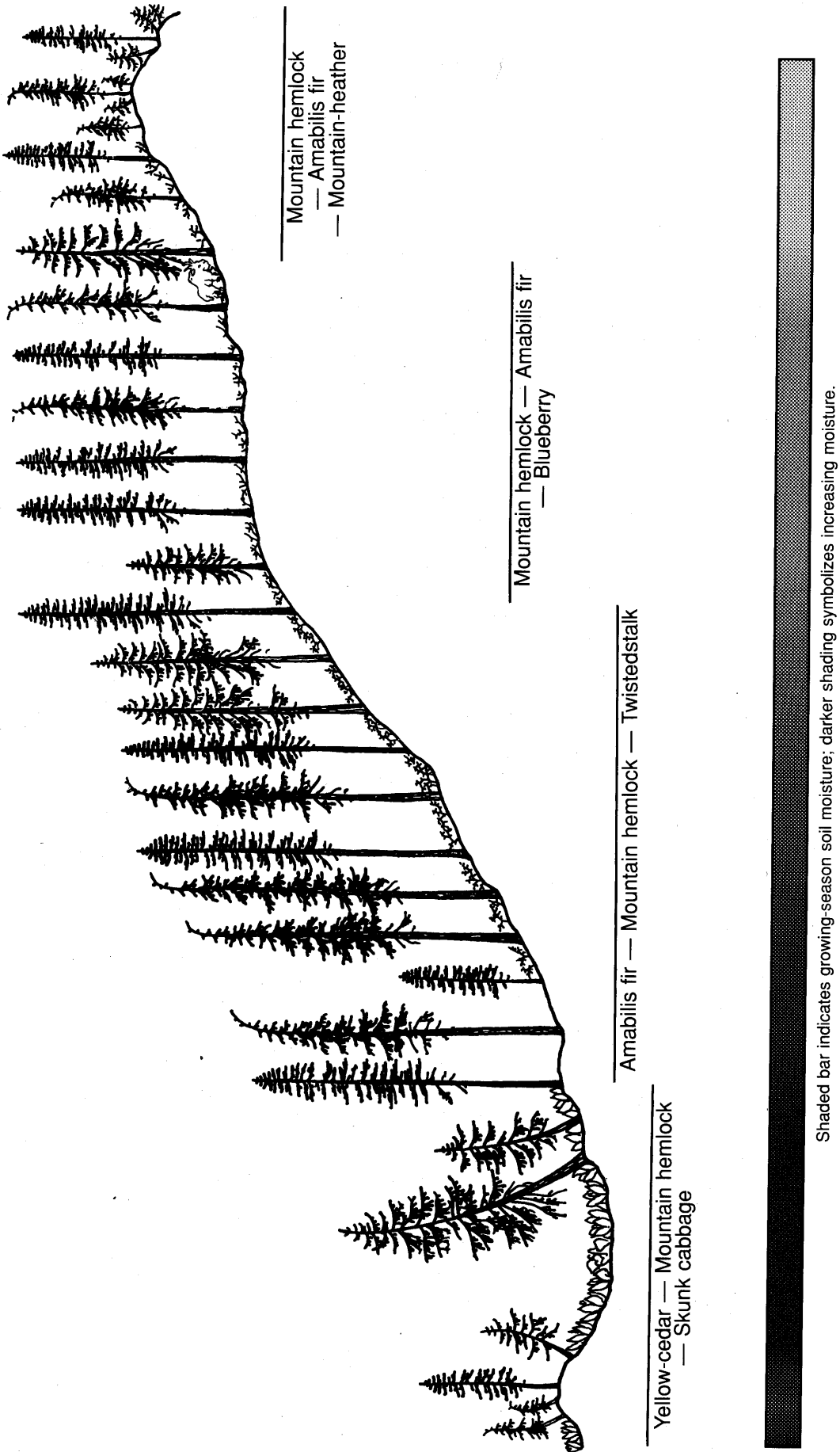


FIGURE 25. Simplified schematic diagram of topographic relationships among four common site associations in a forested, maritime subzone of the Mountain Hemlock zone.

Vaccinium alaskaense (Alaskan blueberry) and advance tree regeneration (mostly of amabilis fir and mountain hemlock) dominate the very well-developed shrub layer. *Vaccinium membranaceum*, *V. ovalifolium*, and *Menziesia ferruginea* are also typical species.

Rubus pedatus (five-leaved bramble) and *Clintonia uniflora* (queen's cup) characterize the poorly developed herb layer.

The well-developed moss layer is dominated by *Rhytidiopsis robusta* (pipecleaner moss), *Rhytidiadelphus loreus*, *Dicranum scoparium* (broom moss), and *D. fuscescens* (curly heron's-bill moss).

Mountain hemlock — Amabilis fir — Mountain-heather

This association represents slightly dry and nutrient-very poor to -medium sites that occur on and around rock outcrops of ridges and upper slopes, or on upper to lower slopes where bedrock is close to the surface. Soils are shallow and stony and range from Folisols to Podzols. Organic accumulations are thick, often greasy, and have a high water-holding capacity — a significant feature of these exposed sites. Relative to other sites, the Mountain hemlock — Amabilis fir — Mountain-heather association includes the driest of all forested sites in the subzone, and has the most open tree canopy and the densest shrub layer.

Mountain hemlock dominates the uneven, open canopy; yellow-cedar and amabilis fir are subordinate tree species.

Cladothamnus pyrolaeflorus, *Vaccinium alaskaense*, and *V. membranaceum* dominate the shrub layer. *Menziesia ferruginea*, *Rhododendron albiflorum*, and *Vaccinium ovalifolium* are also frequent. Stunted yellow-cedar often adds to the cover of the shrub layer.

Phyllodoce empetriformis (pink mountain-heather), *Rubus pedatus*, *Gaultheria humifusa* (alpine-wintergreen), *Lycopodium sitchense* (Alaska clubmoss), and *Goodyera oblongifolia* (rattlesnake-plantain) characterize the poorly developed herb layer.

Rhytidiopsis robusta, *Dicranum scoparium*, and *D. fuscescens* are the dominant bryophytes.

Amabilis fir — Mountain hemlock — Twistedstalk

This association represents moist and nutrient-rich to -very rich sites. These sites are usually located on middle to lower slopes affected by temporary or permanent seepage. Soils are deep and include Brunisols, Podzols, Regosols, and Folisols. Well-defined Ae horizons are uncommon in soils of this site association, unlike those of zonal ecosystems. Humus forms are fairly thick and typically are Moders.

The well-developed tree layer is dominated by amabilis fir and mountain hemlock. Yellow-cedar and western hemlock can also be frequent. The deep soils, and ample moisture and nutrient supply of the Amabilis fir — Mountain hemlock — Twistedstalk

site association promote excellent tree growth. Amabilis fir and yellow-cedar attain their optimum development in the MH on these sites, and the association itself is the most productive in the zone.

Vaccinium alaskaense and tree regeneration dominate the moderately developed shrub layer. *Vaccinium membranaceum* and *Menziesia ferruginea* are also common.

The herb layer is moderately well developed, generally much more so than in the zonal ecosystem. *Streptopus roseus* (rosy twistedstalk), *Rubus pedatus*, and *Clintonia uniflora* are the most abundant herbs. Other frequent species include *Streptopus streptopoides* (small twistedstalk), *Blechnum spicant*, *Tiarella unifoliata* (one-leaved foamflower), *T. trifoliata* (three-leaved foamflower), and *Gymnocarpium dryopteris* (oak fern).

Rhytidiopsis robusta dominates the moderately developed moss layer, and is often joined by *Rhizomnium nudum* (especially in depressions), *Dicranum scoparium*, and *Rhytidiadelphus loreus*.

Yellow-cedar — Mountain hemlock — Skunk cabbage

This association includes wet and nutrient-medium to -very rich sites found only in the lower portion of the subzone, usually on lower slopes below the Amabilis fir — Mountain hemlock — Twistedstalk or Yellow-cedar — Mountain hemlock — Hellebore site associations. Major environmental influences are abundant permanent seepage near the soil surface (seepage that can stagnate in depressions), impeded drainage, poor soil aeration, and thick accumulations of black, mucky or pitchy, acid organic materials. Soils are Gleysols and organics (Humisols and Mesisols). Surface organic accumulations average 50 cm thick and Histomodors or Saprimulls are the prevailing humus forms. As a result of these influences, the vegetation often has a boggy appearance with many of the tree species confined to drier, raised hummocks.

The forest canopy is typically open and irregular. Yellow-cedar and mountain hemlock are the dominant species, and they contribute most of the volume in large diameter classes. Amabilis fir, western hemlock, and western redcedar are less important trees.

Vaccinium alaskaense is the only constant dominant shrub, but is restricted to drier prominences.

Lysichiton americanum (skunk cabbage), *Veratrum viride*, and the bryophytes *Rhizomnium nudum*, *Sphagnum squarrosum*, and *Conocephalum conicum* are concentrated in wet depressions. *Rubus pedatus*, *Clintonia uniflora*, *Cornus canadensis* (bunchberry), *Streptopus streptopoides*, *Orthilia secunda* (one-sided wintergreen), and the mosses *Rhytidiadelphus loreus*, *Rhytidiopsis robusta*, and *Dicranum fuscescens* are abundant on drier mounds.

WILDLIFE HABITATS

The factors that most influence the assemblage of wildlife species in this zone (Table 16) are the long, cool, wet winters with heavy snow cover, steep rugged granitic landforms, and the zone's frequent interruptions by large glaciers. The MH has fewer wildlife species, and these species are less frequent than in other zones. Most large mammal use is in special edaphic units such as avalanche tracks and south-facing rock outcrops, or in the subalpine parklands. There are probably no reptiles and only a few amphibians in this zone.

TABLE 16. Selected wildlife habitats and species in the Mountain Hemlock zone (adapted from Wildlife Branch 1989)

Habitat	Habitat distribution	Representative wildlife species	Wildlife species at risk ^a
Old-growth and mature coniferous forests	Extensive	Black-tailed Deer, Cougar, Black Bear, Snowshoe Hare, Northern Flying Squirrel, Douglas Squirrel, Heather Vole, Southern Red-backed Vole, Columbian Mouse Greated Horned Owl, Great Gray Owl, Blue Grouse, Northern Flicker, Pileated Woodpecker, Hairy Woodpecker, Clark's Nutcracker, Common Raven, Chestnut-backed Chickadee, Red-breasted Nuthatch, Golden-Crowned Kinglet, Townsend's Warbler	◆ Grizzly Bear, Mountain Beaver, Shrew-mole, Pacific Jumping Mouse
Wetlands and streams	Limited areal extent	Black-tailed Deer, Black Bear, Water Vole	◆ Pacific Giant Salamander, Tailed Frog
Subalpine meadows and forest openings	Common, limited areal extent	Roosevelt Elk, Black-tailed Deer, Black Bear Golden Eagle, Willow Ptarmigan, White-tailed Ptarmigan	∇ Vancouver Island Marmot ◆ Grizzly Bear, Mountain Beaver
Rugged south aspects, rock outcrops, and talus	Extensive	Mountain Goat, Common Pika Blue Grouse, White-tailed Ptarmigan	
Avalanche tracks and seepage sites	Common	Mountain Goat, Roosevelt Elk, Black-tailed Deer, Black Bear	◆ 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.

The climatic climax or old-growth forests provide habitat for birds that eat bark or wood-boring insects, conifer seeds, or other birds and small mammals. Such species are the Great Horned Owl, Great Gray Owl, Clark's Nutcracker, Raven, Common Flicker, Pileated Woodpecker, Hairy Woodpecker, Chestnut-backed Chickadee, Red-breasted Nuthatch, Golden-crowned Kinglet, and Townsend's Warbler.

The Vancouver Island Marmot is found in moist, parkland or herb meadow habitat only on Vancouver Island. Willow Ptarmigan occur in subalpine meadows in the Kitimat and Boundary Ranges. In late summer and early fall, Blue Grouse often migrate up to these subalpine forests from lower elevation breeding ranges, paradoxically to spend the winter. Some populations of Mountain Goat remain on south-facing, forested, rock outcrops all winter, but most migrate to lower elevation winter ranges. Coastal Grizzly Bear often select the forests of this zone for winter denning.

RESOURCE VALUES

The MH has a low capability for forestry. A short growing season is the major factor limiting forest productivity and operability. Only a few types of ecosystems in the forested subzones are suitable for forestry, if appropriate silvicultural regimes are used. Other ecosystems are more suitable for recreation and watershed use.

The MH includes many hiking and skiing trails and ski resorts, and several major provincial parks.

Severe climate and physiography of the MH preclude agricultural use.

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