Chapter 15: Engelmann Spruce — Subalpine Fir Zone

by

R. Coupé, A.C. Stewart, and B.M. Wikeem

LOCATION AND DISTRIBUTION 224

ECOLOGICAL CONDITIONS 224

SUBZONES 227

SOME REPRESENTATIVE SITE ASSOCIATIONS 229

Subalpine fir — Oak fern — Knight's plume 229

Subalpine fir — Huckleberry — Feathermoss 229

Subalpine fir — Devil's club — Lady fern 231

Subalpine fir — Lady fern — Horsetail 231

WILDLIFE HABITATS 232

RESOURCE VALUES 235

LITERATURE CITED 236

LOCATION AND DISTRIBUTION

The Engelmann Spruce — Subalpine Fir zone (ESSF) is the uppermost forested zone in the southern three-quarters of the interior of British Columbia (Figure 54). It lies below the alpine tundra in the Rocky Mountains, Columbia Mountains, the eastern (leeward) side of the Coast Mountains, and the southern portions of the Skeena and Omineca mountains. It is also found on the highest elevations of the Interior Plateau, south of 57°N latitude. Outside of British Columbia, the ESSF occurs in Alberta as well as in the Pacific Northwest and Rocky Mountain states. In British Columbia, it occurs at elevations of 1200-2100 m in the southwest, from 1500 to 2300 m in the southeast, and from 900 to 1700 m in the northern part of the zone.

The ESSF occurs predominantly in mountainous terrain which is often steep and rugged. However, it also occurs on some dissected high plateaus, such as the Quesnel and Shuswap highlands. The ESSF typically occurs above the Interior Cedar — Hemlock, Montane Spruce, or Sub-Boreal Spruce zones. Smaller areas are found above the southern-most portions of the Boreal White and Black Spruce zone and the subcontinental portions of the Coastal Western Hemlock zone. The Spruce — Willow — Birch zone is the subalpine zone that adjoins the ESSF along its northern boundary, and the Mountain Hemlock zone is on its western boundary. In southern British Columbia, many of the lowest elevation portions of the original ESSF (Krajina 1965) are now included in the Montane Spruce zone.

ECOLOGICAL CONDITIONS

The ESSF has a relatively cold, moist, and snowy continental climate (Figure 55). Growing seasons are cool and short while winters are long and cold. According to available data (Table 4), mostly from southeastern British Columbia, mean annual temperatures range from -2 to +2°C. Mean monthly temperatures are below 0°C for 5-7 months, and above 10°C for 0 to only 2 months. Mean annual precipitation is highly variable within the zone. Relatively dry portions of the zone receive only 400-500 mm of precipitation while wetter areas receive up to 2200 mm. Most (50-70%) of the precipitation falls as snow and maximum snowpack ranges from about 1 to nearly 4 m. Soils are commonly frozen in winter, especially in areas with relatively light snowfall where freezing occurs before there is significant snow cover.

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. The clumps of trees occur primarily in microsites that accumulate snow and thus provide protection from winter winds as well as a supply of growing-season moisture.

Engelmann spruce and subalpine fir are the dominant climax tree species in the ESSF. Spruce, which is typically the longer-lived species, usually dominates the canopy of mature stands; subalpine fir is most abundant in the understory. However, at high elevations of the zone and in some wetter areas, subalpine fir frequently dominates the forest canopy.

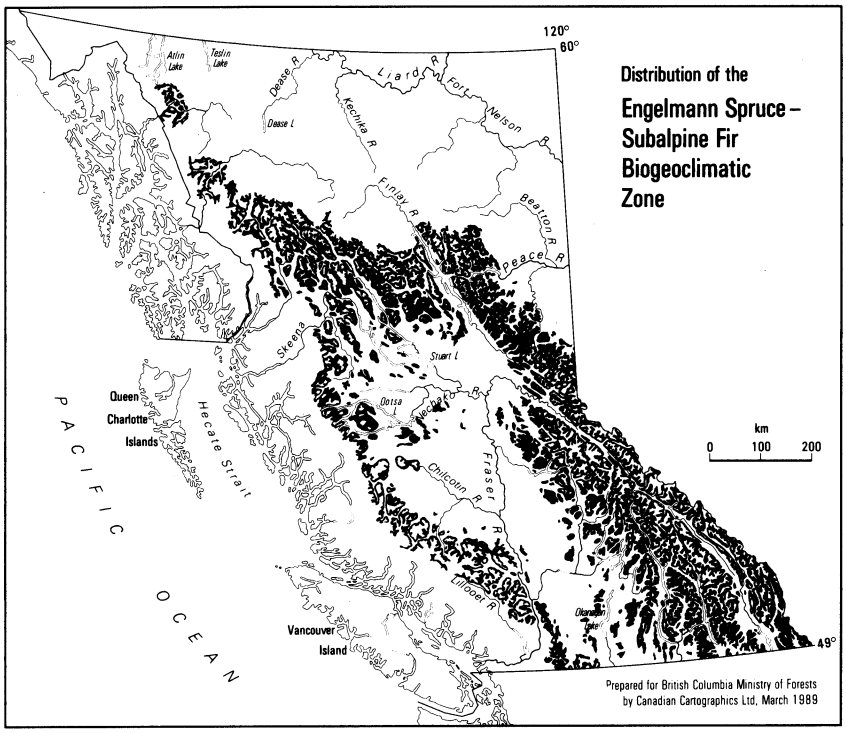

FIGURE 54. Engelmann Spruce — Subalpine Fir zone.

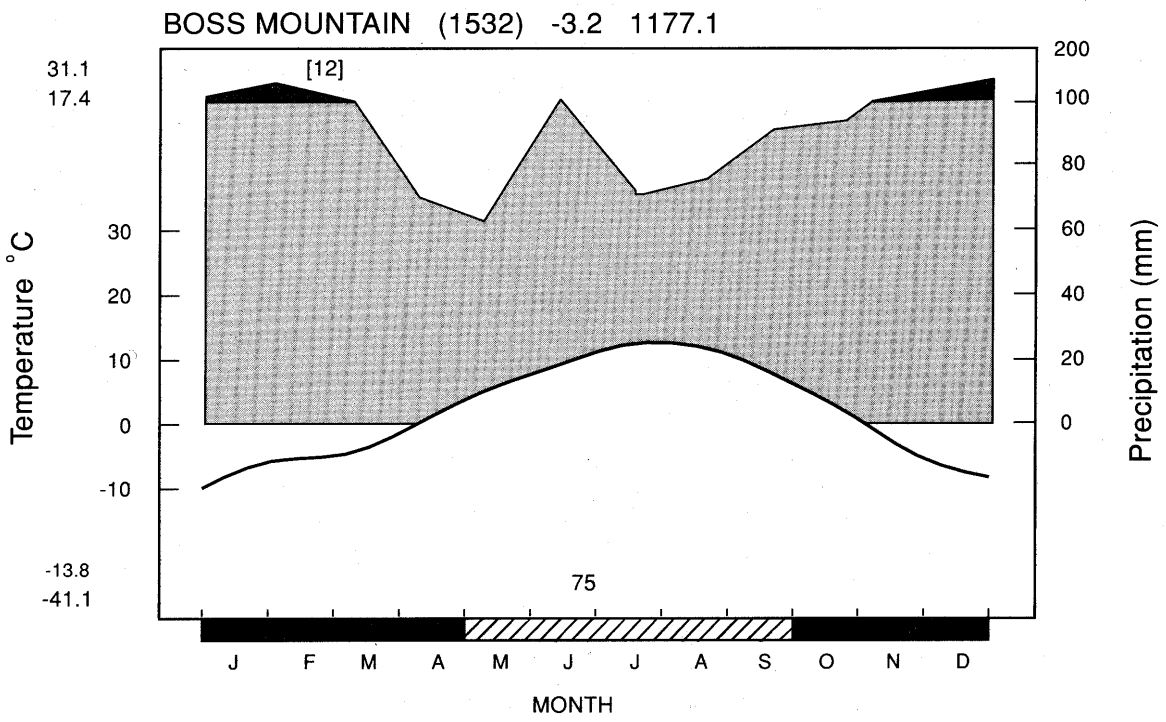

FIGURE 55. Representative climatic diagram for the Engelmann Spruce — Subalpine Fir zone.

Lodgepole pine is a widespread seral species after fire. In the driest regions of the zone, lodgepole pine forests frequently dominate the landscape. Whitebark pine, limber pine, and alpine larch also occur in this zone, usually in drier regions and on dry sites. Whitebark pine ranges north to about McBride in the east, and to the Skeena River in the west, while limber pine and alpine larch are restricted mainly to southeastern British Columbia. Mountain hemlock occurs infrequently in areas of heavy snowfall where the early snowpack probably prevents the soil from freezing. Amabilis fir occurs in areas adjacent to the Coast Mountains. Other tree species that occur commonly in lower elevation zones but occasionally in the ESSF are western white pine, Douglas-fir, western hemlock, and western redcedar. Deciduous trees are uncommon in the ESSF.

Subalpine heath that occurs at high elevations of the ESSF is closely related floristically to the heath communities of yet higher elevations in the Alpine Tundra zone. One or more of *Cassiope mertensiana* (white mountain-heather), *C. tetragona* (four-angled mountain-heather), *Phyllodoce empetriformis* (pink mountain-heather), and *P. glanduliflora* (yellow mountain-heather) dominates the heath. This heath vegetation usually develops in areas of late-lying snow.

Subalpine meadows contain a large variety of herbaceous species, often with showy flowers. Typical species throughout the ESSF include *Valeriana sitchensis* (Sitka valerian), *Veratrum viride* (Indian hellebore), *Senecio triangularis* (arrow-leaved groundsel), *Thalictrum occidentale* (western meadowrue), *Erigeron peregrinus* (subalpine daisy), *Lupinus arcticus* (arctic lupine), *Pedicularis bracteosa* (bracted lousewort), and *Castilleja miniata* (common red paintbrush). Meadows occur in open areas that are not highly exposed to winds and where the soil remains moist throughout the growing season.

Subalpine grassland is a conspicuous feature of the drier, mostly southern parts of the ESSF. These grasslands typically occur on steep, south-facing slopes in areas of base-rich bedrock. Fescue bunchgrasses are the most characteristic dominants and they include *Festuca scabrella*, *F. viridula*, or *F. altaica*, depending on the geographical area.

Snow avalanche tracks are very common in high-snowfall, mountainous portions of the ESSF. These tracks are usually occupied by a distinctive vegetation that is a tangle of tall shrub and herbaceous species. Sitka or slide alder (*Alnus crispa* ssp. *sinuata)* is the dominant shrub while *Senecio triangularis*, *Veratrum viride, Heracleum lanatum* (cow-parsnip), *Athyrium filix-femina* (lady fern), *Thalictrum occidentale*, *Urtica dioica* (stinging nettle), and *Carex* spp. (sedges) are common herbs.

Rapidly to moderately well-drained parent materials in the ESSF have podzolic soil development and are classified as Humo-Ferric Podzols. Humus forms are generally Mors (Hemimors, Hemihumimors, and Humimors).

SUBZONES

Fifteen forested subzones are currently recognized in the ESSF (Table 31 and Figure 56). This large number is due to the very broad latitudinal and elevational range of the zone and to the variability in climate, especially precipitation. The 15 subzones can be grouped into three broad climatic types: dry, moist, and wet.

The four dry climate subzones (ESSFxc, ESSFdc, ESSFdk, ESSFdv) occur in the southern third of the province in the rainshadow of the Coast and Columbia mountains. They occur primarily above the Montane Spruce zone and are characterized by abundant *Vaccinium scoparium* (grouseberry) and sparse herb cover in the undergrowth.

TABLE 31. Synopsis of subzones in the Engelmann Spruce — Subalpine Fir zone (ESSF)[a]

Subzone	Code	Old code
Very Dry Cold ESSF	ESSFxc	(ESSFd)
Dry Cool ESSF	ESSFdk	(ESSFa)
Dry Cold ESSF	ESSFdc	(ESSFel/e2)
Dry Very Cold ESSF	ESSFdv	(ESSFe3)
Moist Warm ESSF	ESSFmw	(ESSFf)
Moist Mild ESSF	ESSFmm	(ESSFo)
Moist Cool ESSF	ESSFmk	(ESSFl)
Moist Cold ESSF	ESSFmc	(ESSFk)
Moist Very Cold ESSF	ESSFmv	(ESSFv/n)
Wet Mild ESSF	ESSFwm	(ESSFc)
Wet Cool ESSF	ESSFwk	(ESSFh1/h3)
Wet Cold ESSF	ESSFwc	(ESSFc/m/b/h2/h3)
Wet Very Cold ESSF	ESSFwv	(ESSFi)
Very Wet Cold ESSF	ESSFvc	(ESSFb/w)
Very Wet Very Cold ESSF	ESSFvv	(ESSFu)

[a] Parkland subzones occur above each of the forested subzones. They are designated by the letter 'p' appended to the code (e.g., ESSFxcp is the Very Dry Cold Parkland ESSF subzone).

The moist climate group includes three Interior subzones (ESSFmv, ESSFmc, ESSFmm) and two subcontinental subzones (ESSFmk and ESSFmw). They are characterized by an ericaceous shrub layer, a sparse cover of herbs, and a relatively dense moss layer. The Interior subzones are distinguished by the presence of *Ptilium crista-castrensis* (knight's plume), *Cornus canadensis* (bunchberry), and *Arnica cordifolia* (heart-leaved arnica). The subcontinental subzones occur immediately leeward of the Coast Mountains from the Bulkley Ranges south to the U.S. border. They are distinguished by a poorly developed herb layer and the frequent occurrence of mountain hemlock and amabilis fir.

The six subzones in the wet climate group have a moderately dense ericaceous shrub layer and a very productive, luxuriant herbaceous layer on zonal sites. Characteristic species of these subzones are *Vaccinium ovalifolium* (oval-leaved blueberry), *Gymnocarpium dryopteris* (oak fern), *Tiarella unifoliata* (one-leaved foamflower), *Streptopus roseus* (rosy twistedstalk), and *Valeriana sitchensis*. Five of

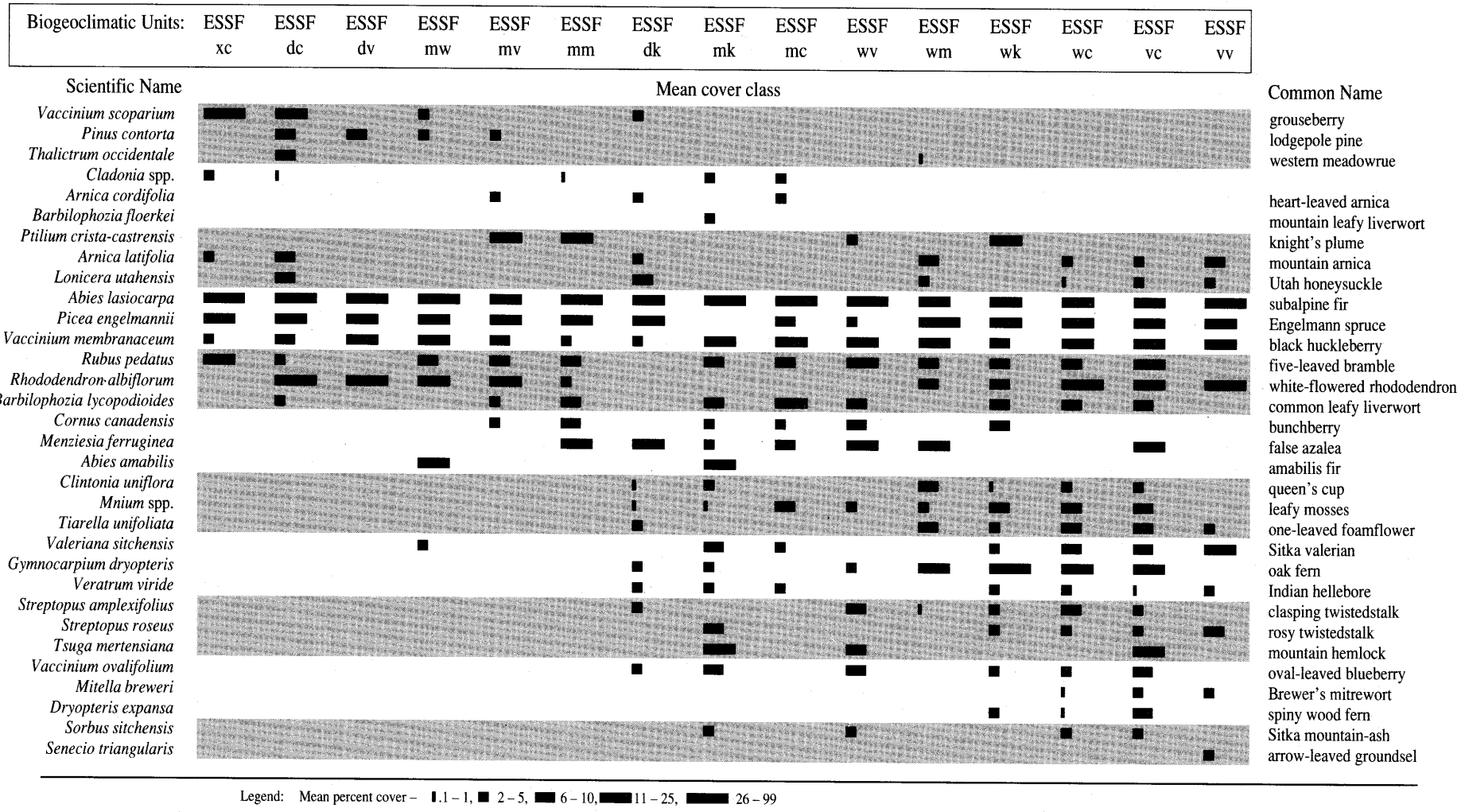

FIGURE 56. Zonal vegetation of forested subzones of the Engelmann Spruce — Subalpine fir zone.

these subzones (ESSFwm, ESSFwk, ESSFwc, ESSFvc, ESSFvv) occur in the high-snowfall areas of the Columbia and Rocky mountains of eastern British Columbia. The sixth subzone (ESSFwv) occurs in the northwestern part of the province (north of the Skeena River) on the eastern flanks of the Coast Mountains.

Fifteen parkland subzones are also recognized in the ESSF. Each forested subzone has areas of parkland above it. These areas are transitional to true alpine and are classed as separate subzones.

SOME REPRESENTATIVE SITE ASSOCIATIONS

The four site associations described below are common in the moist and wet groups of subzones and form a typical sequence of ecosystems in the ESSFwk (Figure 57).

Subalpine fir — Oak fern — Knight's plume

The Subalpine fir — Oak fern — Knight's plume site association is the zonal association in the ESSFwk. It occurs on fresh, moderately well-drained morainal and colluvial materials with a coarse loamy texture. Soils are typically Orthic Humo-Ferric Podzols with an Orthihemimor or Mycohemimor humus form.

The tree layer is most often dominated by Engelmann spruce but occasionally by subalpine fir. Lodgepole pine is an infrequent seral species.

The shrub layer is moderately well developed and dominated primarily by *Vaccinium membranaceum* (black huckleberry), *V. ovalifolium*, *Rhododendron albiflorum* (white-flowered rhododendron), and *Ribes lacustre* (black gooseberry). Small amounts of *Oplopanax horridus* (devil's club), *Lonicera involucrata* (black twinberry), and *Rubus parviflorus* (thimbleberry) are often present, especially at lower elevations. Subalpine fir regeneration is typically abundant.

The moderately well-developed herb layer is dominated by *Streptopus roseus*, *Rubus pedatus* (five-leaved bramble), *Gymnocarpium dryopteris* (oak fern), and *Valeriana sitchensis*. Species that are usually present but in lesser amounts are *Veratrum viride*, *Athyrium filix-femina*, *Lycopodium annotinum* (stiff clubmoss), *Tiarella unifoliata*, *Clintonia uniflora* (queen's cup), and *Listera cordata* (heart-leaved twayblade).

The moss layer includes *Pleurozium schreberi* (red-stemmed feathermoss), *Rhizomnium nudum*, *Ptilium crista-castrensis* (knight's plume), *Brachythecium* spp., *Rhytidiopsis robusta* (pipecleaner moss), and *Peltigera aphthosa*.

Subalpine fir — Huckleberry — Feathermoss

This association includes the driest forested sites of the ESSFwk. It occurs on slightly to moderately dry sites on ridge crests, bedrock outcrops, and on upper, south-facing slopes. Most sites are on coarse-textured morainal or colluvial materials. Soils

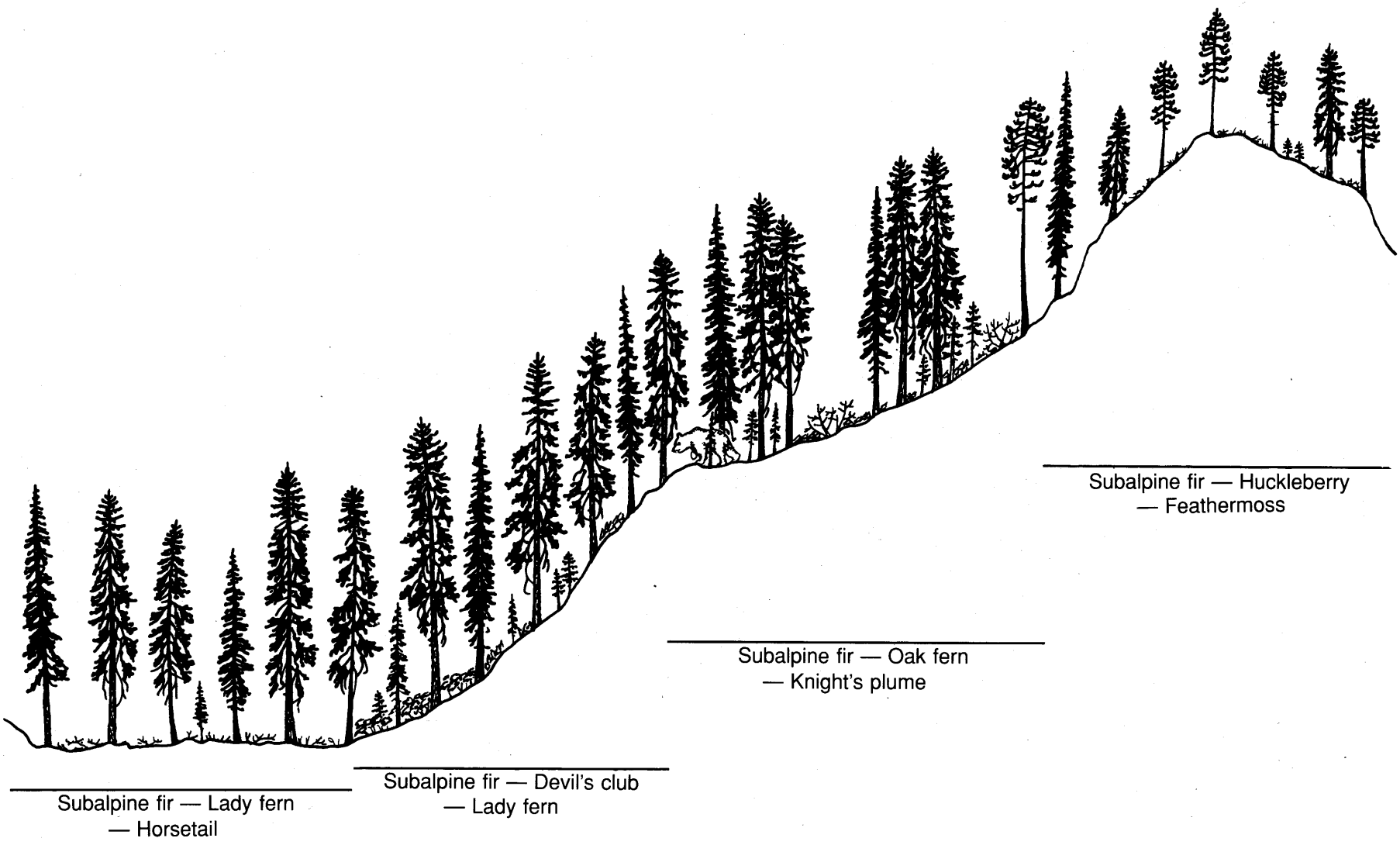

FIGURE 57. Simplified schematic diagram of topographic relationships among four common site associations of a wetter subzone of the Engelmann Spruce — Subalpine fir zone.

are typically thin, lithic phases of Humo-Ferric Podzols and Dystric Brunisols. Surface organic layers are thin, desiccated, and derived from coniferous needles, lichens, and mosses. Humus forms include Hemimors, Xeromors, and Xeromoders.

These sites are frequently occupied by long-lived seral stands of lodgepole pine. Engelmann spruce and subalpine fir are usually present in the understory.

The shrub layer is poorly to moderately well developed and typically includes *Amelanchier alnifolia* (saskatoon), *Juniperus communis* (common juniper), and *Vaccinium membranaceum* (black huckleberry). Subalpine fir and Engelmann spruce regeneration is relatively sparse.

The sparse herbaceous layer includes *Cornus canadensis*, *Hieracium albiflorum* (white-flowered hawkweed), *Linnaea borealis* (twinflower), *Clintonia uniflora*, and *Epilobium angustifolium* (fireweed).

The moss layer is usually continuous and dominated by *Pleurozium schreberi* (red-stemmed feathermoss), *Ptilium crista-castrensis*, *Dicranum* spp., and *Polytrichum juniperinum* (juniper haircap moss). Fruticose lichens, especially species of *Stereocaulon*, *Cladonia*, and *Cladina*, are usually abundant.

Subalpine fir — Devil's club — Lady fern

The Subalpine fir — Devil's club — Lady fern site association occurs on moist, moderately well to imperfectly drained, middle and lower slope positions in the ESSFmk, ESSFmm, and ESSFwv. Soils are primarily Orthic Humo-Ferric Podzols but also include Gleyed and Sombric Humo-Ferric Podzols.

Engelmann spruce and subalpine fir are the dominant tree species. Spruce is most often dominant in the moist subzones, while subalpine fir is most often dominant in the wet subzone. Western hemlock is frequently present in the ESSFwv.

The dense shrub layer is dominated by *Oplopanax horridus* (devil's club). Other common species are *Vaccinium membranaceum*, *Menziesia ferruginea* (false azalea), and *Ribes lacustre*.

Ferns, especially *Athyrium filix-femina* (lady fern), *Gymnocarpium dryopteris*, and *Dryopteris expansa* (spiny wood fern), are abundant. Other common herbs are *Streptopus roseus*, *Rubus pedatus*, *Tiarella unifoliata*, and *Veratrum viride*.

A moderate cover of mosses is present and most often includes *Brachythecium hylotapetum*, *Ptilium crista-castrensis*, *Mnium* spp. (includes *Plagiomnium* and *Rhizomnium* spp.; leafy mosses), and *Pleurozium schreberi*.

Subalpine fir — Lady fern — Horsetail

This site association occurs on very moist to wet, imperfectly to poorly drained sites on lower slopes and in depressions. Soils are Humic Gleysols or Orthic Gleysols and are typically wet throughout the growing season.

These ecosystems have relatively open forest canopies dominated by Engelmann spruce and subalpine fir. Trees occur primarily on raised microsites.

The shrub layer is poorly to moderately developed. *Ribes lacustre, Vaccinium ovalifolium, Rubus parviflorus*, and *Lonicera involucrata* are often present.

The herb layer is relatively well developed and dominated by *Equisetum arvense* (common horsetail), *Athyrium filix-femina, Senecio triangularis, Thalictrum occidentale, Gymnocarpium dryopteris*, and *Valeriana sitchensis*. Common but less abundant species include *Heracleum lanatum* (cow-parsnip), *Platanthera dilatata* (white bog-orchid), and *Tiarella unifoliata*.

A moderate cover of mosses is present. Principal species are *Ptilium crista-castrensis* and *Brachythecium* spp.

WILDLIFE HABITATS

The factors that most influence the assemblage of wildlife species in the ESSF (Table 32) are the wet, cool summers, long cold snowy winters, and steep topography. Ungulates such as Moose, Mountain Goat, Caribou, and Mule Deer are found throughout while Rocky Mountain Elk, Bighorn Sheep, White-tailed Deer, and Stone Sheep are more restricted in distribution. Moose can occasionally winter in some of the drier regions of the ESSF, but normally leave during winter to escape the deep snowfall. Mountain Goat and Caribou are best adapted to these conditions and frequently winter in the ESSF. The ESSF is one of the most productive zones for Grizzly Bear. Few reptiles occur in this zone and the only amphibians expected to be found are the Western Toad, Spotted Frog, Cascades Frog, Tailed Frog, and Long-toed Salamander.

Conifer forests make up the most common habitat in the ESSF and are important for furbearers such as Marten, Fisher, Red Squirrel, and Wolverine, as well as for a variety of seed-eating birds such as the Red Crossbill, White-winged Crossbill, Pine Siskin, and Clark's Nutcracker. In heavy snow areas, Caribou rely exclusively during the winter on arboreal lichens, which are abundant in mature conifer forests in the ESSF, particularly those adjacent to the Interior Cedar — Hemlock zone. Wildlife managers have long been concerned with the impacts of timber harvesting on Caribou in this zone because of the lichen component in old-growth forests. Other species found in old-growth habitats include the Varied Thrush, Three-toed Woodpecker, Spruce Grouse, Golden-crowned Kinglet, Red-breasted Nuthatch, Mountain Chickadee, Winter Wren, Orange-crowned Warbler, Steller's Jay, Cassin's Finch, and Hammond's Flycatcher.

Avalanche tracks are a common feature of the ESSF. These habitats are important summer range for ungulates because of the abundant, lush forage. For the same reason, avalanche tracks are also important spring and summer habitats for Grizzly Bear and Black Bear.

Young seral forests, resulting from logging and wildfire, provide habitat for a wide variety of wildlife. Many species of ungulates, and the Snowshoe Hare, select young

TABLE 32. Selected wildlife habitats and species in the Engelmann Spruce — Subalpine Fir zone (adapted from Wildlife Branch 1989)

Habitat	Habitat distribution	Representative wildlife species	Wildlife species at risk[a]
Old-growth and mature coniferous forests	Extensive	Moose, Mule Deer, Cougar, Lynx, Gray Wolf, Coyote, Black Bear, Wolverine, Fisher, Marten, Red Squirrel, Northern Flying 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, Blue Grouse, Spruce Grouse, Black-backed Woodpecker, Three-toed Woodpecker, Steller's Jay, Clark's Nutcracker, Varied Thrush, Red Crossbill, White-winged Crossbill, Pine Siskin, Hammond's Flycatcher, Cassin's Finch, Golden-crowned Kinglet, Mountain Chickadee, Red-breasted Nuthatch, Winter Wren Long-toed Salamander	∇ Spotted Owl ♦ Caribou, Grizzly Bear, Tailed Frog
Subalpine parkland meadows	Limited areal extent	Mountain Goat, Moose, Mule Deer, Rocky Mountain Elk, Black Bear, Coyote, Badger, Long-tailed Weasel, Porcupine, Hoary Marmot, Columbian Ground Squirrel, Golden-mantled Ground Squirrel Blue Grouse, Golden-crowned Sparrow, Fox Sparrow, American Robin, Rufous Hummingbird	∇ Cascade Mantled Ground Squirrel ♦ Caribou, California Bighorn Sheep, Rocky Mountain Bighorn Sheep, Grizzly Bear, Red-tailed Chipmunk
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, Three-toed Woodpecker, Black-backed Woodpecker, Wilson's Warbler, Rufous Hummingbird, Pine Grosbeak, Western Tanager, Dark-eyed Junco, Yellow-rumped Warbler, Bohemian Waxwing	♦ Grizzly Bear
Steep, rugged, south aspect grasslands	Limited areal extent	Mountain Goat, Cougar, Hoary Marmot, Golden-mantled Ground Squirrel Golden Eagle, Blue Grouse	♦ California Bighorn Sheep, Rocky Mountain Bighorn Sheep
Avalanche tracks	Common in mountains	Mountain Goat, Moose, Rocky Mountain Elk, Mule Deer, Black Bear	♦ Grizzly Bear
Rocky cliffs, talus, and sparsely vegetated rocks	Common in mountains	Mountain Goat, Common Pika, Columbian Ground Squirrel, Golden-mantled Ground Squirrel Golden Eagle	∇ Cascade Mantled Ground Squirrel, Anatum Peregrine Falcon ♦ California Bighorn Sheep, Rocky Mountain Bighorn Sheep

TABLE 32. Continued

Habitat	Habitat distribution	Representative wildlife species	Wildlife species at risk[a]
Riparian areas, wetlands, meadows, floodplains, lakes, and streams	Common	Moose, Mule Deer, Black Bear, Coyote, Long-tailed Weasel, Little Brown Myotis, Beaver, Water Vole, Deer Mouse, Western Jumping Mouse, Meadow Jumping Mouse	♦ Caribou, Grizzly Bear, Mountain Beaver, Tailed Frog, Cascades Frog
		Ruffed Grouse, Harlequin Duck, American Dipper	
		Western Toad, Spotted Frog, Cascades Frog, Long-toed Salamander	

[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.

forests during summer for the abundant forbs and shrubs. During fall, Black Bear and Grizzly Bear seek out blueberries and huckleberries, which can be very abundant in open stands. Breeding birds commonly found in the young seral forests include the Northern Pygmy-Owl, Northern Goshawk, Wilson's Warbler, Rufous Hummingbird, Pine Grosbeak, Western Tanager, Dark-eyed Junco, Yellow-rumped Warbler, Three-toed Woodpecker, Black-backed Woodpecker, and Bohemian Waxwing.

Wetlands and riparian habitats in the ESSF are frequently not as productive as equivalent areas in adjacent lower elevation zones, and have lower species diversity. Moose, Grizzly Bear, and Black Bear are commonly associated with such habitats. Swift-flowing streams are important habitats for Harlequin Duck, American Dipper, and the Tailed Frog (in extreme southeastern British Columbia).

Subalpine parkland is a common habitat at the upper elevations of the ESSF. The parkland forests of southeastern British Columbia have abundant arboreal lichens and are important for Caribou, which move up from lower elevations in late winter after the deep snows have settled. The associated meadows provide valuable summer range for many large mammals including Mule Deer, Rocky Mountain Elk, Mountain Goat, Caribou, Moose, Bighorn Sheep, Grizzly Bear, and Black Bear. Commonly observed small mammals include the Hoary Marmot, Columbian Ground Squirrel, and Porcupine. The Golden-crowned Sparrow, Fox Sparrow, American Robin, and Rufous Hummingbird are common birds of ESSF parkland.

In this zone, Mountain Goat frequently inhabit rugged south-facing terrain on a year-round basis. Mountain Sheep, which have much less tolerance to deep snow, are usually found in such subalpine habitat only in summer and fall. Blue Grouse are also

associated with these habitats, especially during winter. Golden Eagle select south-facing cliffs for nest sites (aeries), particularly where large rodents such as the Hoary Marmot and Columbian Ground Squirrel are abundant.

RESOURCE VALUES

Timber harvesting is very active in the accessible parts of the ESSF. The most productive ecosystems are those with fresh to moist moisture regimes at lower elevations of the zone. Best growth occurs in rich alluvial ecosystems and on lower slope sites which receive nutrient-laden seepage waters from upslope. Such ecosystems are highly productive for Engelmann spruce and subalpine fir.

The ESSF has very low capability for agriculture because of the adverse climate and topography. Domestic livestock grazing during the brief summer season is the only significant agricultural use. Although the zone is extensive, grazing is limited to wetlands and forest openings (McLean *et al*. 1963), mainly in drier subzones. Clearcuts can serve as transitional range and can be highly productive when seeded to domestic forages. Forage species are poorly documented, but common native forages include *Carex* spp., *Calamagrostis rubescens*, *Phleum alpinum*, *Danthonia intermedia*, and *Arnica cordifolia*, and *Vaccinium* spp. browse (McLean *et al*. 1971).

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

Recreational pursuits in the ESSF include skiing, hiking, mountaineering, hunting, and camping. Many of British Columbia's provincial and national parks include ruggedly scenic parts of the ESSF.

LITERATURE CITED

Krajina, V.J. 1965. Biogeoclimatic zones and biogeocoenoses of British Columbia. Ecol. West. N. Amer. 1:1-17.

McLean, A., T.M. Lord, and A.J. Green. 1971. Utilization of the major plant communities in the Similkameen Valley, British Columbia. J. Range Manage. 24:346-351.

McLean, A., H.H. Nicholson, and A.L. van Ryswyk. 1963. Growth, productivity and chemical composition of a sub-alpine meadow in interior British Columbia. J. Range Manage. 16:235-240.

Wildlife Branch. 1989. Regional wildlife habitat maps. B.C. Min. Environ., Victoria, B.C. 15 maps, 1:500000.