



Canadian National Vegetation Classification (CNVC) Classification nationale de la végétation du Canada

<http://cnvc-cnvc.ca>

Central Rocky Mountain Mesic Lower Montane Forest

Macrogroup M500

Forêts mésiques des montagnes de faible altitude du centre des Rocheuses

Cool Temperate Forest & Woodland

D194 Rocky Mountain Forest & Woodland

M890 Rocky Mountain Intermontane Subboreal Forest

M020 Rocky Mountain Subalpine – High Montane Forest

M500 Central Rocky Mountain Mesic Lower Montane Forest

CM500a Southern Mesic Rocky Mountain Low Montane Forest

CM500b Typic Mesic Rocky Mountain Low Montane Forest

CM500c Northern Mesic Rocky Mountain Low Montane Forest

M501 Central Rocky Mountain Dry Lower Montane – Foothill Forest



Concept

M500 describes lower montane forests in warm to cool, moist to wet, temperate climates in the North American Western Cordillera. In Canada, M500 forests occur in the northwestern and southeastern portions of the British Columbia (BC) interior. These are typically evergreen coniferous forests dominated by western hemlock (*Tsuga heterophylla*) and/or western red cedar (*Thuja plicata*), often consisting of tall, long-lived trees in stands that may persist for centuries. Stand-replacing fires occur less frequently than in other forests of the BC interior; gap dynamics driven by pathogens, insects and windthrow prevail. Common tree species associates include subalpine fir (*Abies lasiocarpa*), Rocky Mountain Douglas-fir (*Pseudotsuga menziesii* var. *glauca*), lodgepole pine (*Pinus contorta* var. *latifolia*) and hybrids of white spruce (interior spruce [*Picea engelmannii* x *glauca*]; Lutz spruce [*P. x lutzii*]). In the warmest parts of the Canadian range, western white pine (*Pinus monticola*), western larch (*Larix occidentalis*), ponderosa pine (*Pinus ponderosa*) and grand fir (*Abies grandis*) also occur. Trembling aspen (*Populus tremuloides*) and paper birch (*Betula papyrifera*) commonly occur following disturbance. Common understory shrubs include black huckleberry (*Vaccinium membranaceum*), falsebox (*Paxistima myrsinites*), western thimbleberry (*Rubus parviflorus*), devil's club (*Oplanax horridus*), oval-leaved blueberry (*Vaccinium ovalifolium*), Rocky Mountain maple (*Acer glabrum*) and saskatoon (*Amelanchier alnifolia*). Typical herb/dwarf shrub species include single-flowered clintonia (*Clintonia uniflora*), bunchberry (*Cornus canadensis*), three-leaved foamflower (*Tiarella trifoliata*), twisted-stalks (*Streptopus* spp.), five-leaved dwarf bramble (*Rubus pedatus*), common pipsissewa (*Chimaphila umbellata*), wild sarsaparilla (*Aralia nudicaulis*) and twinflower (*Linnaea borealis*). Ferns often constitute an important component of the herb layer, especially common oak fern (*Gymnocarpium dryopteris*) and common lady fern (*Athyrium filix-femina*). Frequently occurring mosses are red-stemmed feathermoss (*Pleurozium schreberi*), knight's plume moss (*Ptilium crista-castrensis*), staircase moss (*Hylocomium splendens*), pipecleaner moss (*Rhytidiopsis robusta*) and electrified cat's-tail moss (*Rhytidiadelphus triquetrus*).

In Canada, M500 occurs within a continental temperate climate with warm summers, cool winters and high annual precipitation. These forests grow best on well to imperfectly drained sites with high soil moisture. Mean annual precipitation is highly variable throughout the Canadian range, typically 700 to 1400 mm on average. Where precipitation is lower, sites rely on moisture inputs from snowmelt and stands often occur on lower/toe slopes or on cool aspects. Mean annual temperatures vary from approximately 2.5° to 8° C, depending on latitude and elevation; soils typically don't freeze in the winter. M500 forests occupy the low to mid-elevations (up to approximately 1500 mASL) in mountains and highlands in southeastern and northwestern BC, wherever precipitation levels are sufficient. All parts of the range experienced Pleistocene glaciation; soils are mostly Podzols, Luvisols and Brunisols developed in glacial surficial materials. Three subtypes characterize regional variation in the Canadian range of M500: CM500a [Southern Mesic Rocky Mountain Low Montane Forest] describes forests in southeastern BC near the international border; CM500b [Typic Mesic Rocky Mountain Low Montane Forest] is the typical condition for the main portion of the Canadian range in southeastern BC; CM500c [Northern Mesic Rocky Mountain Low Montane Forest] describes forests in northwestern BC in the lee of the Coast Mountains.



Toposequence of western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*) forests near Prince George, BC. Hemlock dominates the drier upper slopes and cedar the moister lower positions.
Source: D. Meidinger



Western red cedar (*Thuja plicata*) dominated stand with an open understory in southeastern BC.
Source: British Columbia Forest Service



Canadian National Vegetation Classification (CNVC) Classification nationale de la végétation du Canada

<http://cnvc-cnvc.ca>

Central Rocky Mountain Mesic Lower Montane Forest

Macrogroup M500

Forêts mésiques des montagnes de faible altitude du centre des Rocheuses

Vegetation

Physiognomy and Structure

M500 includes upland forests with closed to somewhat open canopies characterized by tall, long-lived, evergreen coniferous tree species. Cold-deciduous broad-leaved (“hardwood”) species are sometimes present in the tree stratum; deciduous conifers are common in some areas of the southern Canadian range (especially in subtype CM501a [Southern Mesic Rocky Mountain Low Montane Forest]). Stands are sometimes composed of just one tree species, but more often are of mixed composition. Vertical stand structure is typically multi-storied, but can be single-storied after stand-replacing disturbance. Understory structure varies from dense to sparse, and is usually dominated by cold-deciduous broad-leaved shrubs, conifer regeneration and perennial herbs. The moss layer is typically well developed, especially under conifer canopies. Some of these forests are among the most productive of any Canadian forests. Riparian and wetland forests and woodlands within the range of M500 are described by M034 [Rocky Mountain-Great Basin Montane Riparian & Swamp Forest].

Floristics

In the Canadian range of M500, *Tsuga heterophylla* and *Thuja plicata* are the characteristic tree species, often dominating uneven-aged stands (particularly in older forests). *Abies lasiocarpa* (see Comments) and hybrids of *Picea glauca* (*Picea engelmannii* x *glauca* in all subtypes; also *Picea xlutzii* in subtype CM500c [Northern Mesic Rocky Mountain Low Montane Forest]) are common associates, while younger stands may contain *Pinus contorta* (see Comments). *Populus tremuloides* and *Betula papyrifera* are often present but do not dominate, except in some early seral stands. *Pseudotsuga menziesii* (see Comments) co-occurs over all but the northernmost portions of the range (i.e., in CM500a [Southern Mesic Rocky Mountain Low Montane Forest] & CM500b [Typic Mesic Rocky Mountain Low Montane Forest]). *Larix occidentalis*, *Pinus monticola*, *Abies grandis* and occasionally *Pinus ponderosa* occur in the southern part of the Canadian range (CM500a&b). *Abies amabilis* occurs occasionally in the northwestern part of the range (CM500c).

Tsuga heterophylla and *Thuja plicata* are late seral species that regularly produce large seed crops. When a seed source is present, they can re-colonize sites following stand-replacing disturbance or invade existing early or mid-seral stands (usually of *Pinus contorta* or *Populus tremuloides*) by seeding in from surrounding areas. These species also maintain themselves within stands where they are already established. Their seeds are able to germinate and survive on seedbeds of mineral soil, litter, moss, thick humus and dead wood as long as substrate moisture is sufficient. Seedlings are highly shade tolerant, persisting under closed canopies for many years while maintaining the ability to respond to release after long periods of growth suppression. Once in the main canopy they dominate uneven-aged stands. *T. heterophylla* and *T. plicata* are also able to regenerate vegetatively within the closed canopy stands that are characteristic of M500. These are large (often >30 m tall), long-lived species that survive as mature trees for hundreds of years in the absence of disturbance. The relative dominance of *T. heterophylla* vs. *T. plicata* is partly related to site conditions, with *T. plicata* prevalent on moister sites.

Picea spp. can establish immediately following fire or other disturbance that exposes mineral soil seedbeds if there is an adequate seed supply. *Picea* spp. also seed into existing early seral stands, where they are moderately shade tolerant and can eventually grow into the canopy. *Abies lasiocarpa* is a shade tolerant late seral species with reproductive ecology similar to *T. heterophylla* and *T. plicata*. *A. lasiocarpa* and *Picea* spp. are cold-tolerant species whose seedlings are better able to establish on colder soils and in frost pockets than are those of *T. heterophylla* and *T. plicata*. In colder parts of the range, deep snow cover is important to prevent soil freezing, to which the shallowly rooted *T. heterophylla* and *T. plicata* are intolerant.

Pseudotsuga menziesii is a long-lived early seral species that is common in southern portions of the Canadian range of M500 (especially CM500a) but generally restricted to warm aspects elsewhere. It establishes from seed in open stands or following fire that exposes mineral soil seedbeds. With its thick bark, it is somewhat resistant to moderate-intensity surface fires and older individuals can persist in stands for long periods. *Pinus contorta*, *Betula papyrifera* and *Populus tremuloides* are also early seral, fire-adapted species; they often form even-aged stands following stand-replacing fire.

Unlike other *Abies* spp., *A. grandis* does not readily establish beneath a closed canopy. Within the Canadian range of M500, it is confined to southernmost British Columbia (CM500a) where it occurs primarily on moist, nutrient-rich sites in mixed early or mid-seral stands.



Canadian National Vegetation Classification (CNVC) Classification nationale de la végétation du Canada

<http://cnvc-cnvc.ca>

Central Rocky Mountain Mesic Lower Montane Forest

Macrogroup M500

Forêts mésiques des montagnes de faible altitude du centre des Rocheuses

Floristics (cont'd)

Species composition of the understory reflects local climate and stand-scale canopy closure; diversity is usually relatively high. Common shrubs throughout the Canadian range of M500 include *Vaccinium membranaceum*, *Paxistima myrsinites*, *Rubus parviflorus*, *Oplopanax horridus*, *Vaccinium ovalifolium* (see Comments), *Acer glabrum*, *Ribes lacustre*, *Amelanchier alnifolia* and *Menziesia ferruginea*. Understory forbs include *Clintonia uniflora*, *Cornus canadensis*, *Tiarella trifoliata*, *Streptopus lanceolatus*, *S. amplexifolius*, *Rubus pedatus*, *Chimaphila umbellata*, *Aralia nudicaulis*, *Prosartes hookeri*, *Goodyera oblongifolia*, *Linnaea borealis*, *Orthilia secunda* and *Maianthemum racemosum*. Ferns often constitute an important component of the herb layer, especially *Gymnocarpium dryopteris*, *Athyrium filix-femina* and *Dryopteris expansa*. Common mosses are *Pleurozium schreberi*, *Ptilium crista-castrensis*, *Hylocomium splendens*, *Dicranum* spp., *Rhytidiopsis robusta*, *Brachythecium* spp. and *Rhytidiadelphus triquetrus*. *Mnium* spp., *Plagiomnium* spp. and *Rhizomnium* spp. are common on moist sites.

In central and southern British Columbia (CM500a&b), *Berberis aquifolium*, *Spiraea lucida*, *Rosa gymnocarpa*, *Lonicera utahensis*, *Symphoricarpos albus*, *Shepherdia canadensis*, *Corylus cornuta* and *Taxus brevifolia* are more frequent. *Abies grandis*, *Holodiscus discolor*, *Philadelphus lewisii* and *Physocarpus malvaceus* are found mostly in CM500a in the southernmost parts of the Canadian range. In the northwestern part of the range (CM500c), some species indicate a coastal influence, e.g., *Vaccinium parvifolium*, *Lathyrus nevadensis*, *Rhytidiadelphus loreus*; overall CM500c has a greater frequency and abundance of species found in cooler or northern climates, including *Abies lasiocarpa*, *Viburnum edule*, *Rosa acicularis*, *Rubus pedatus* and *Cornus canadensis*.

Dynamics

Environmental site characteristics, plant species autecology, seed/propagule availability, and disturbance history (i.e., type, severity and frequency) influence secondary succession trends within the forests of M500. Wildfires, windthrow, pathogens and insect infestations are the most widespread forms of natural disturbance throughout the range of M500. Forest harvesting, agricultural conversion, settlement clearance and other industrial activities (e.g., mining) are also significant disturbance factors in some areas. In some river valleys, forests of M500 have been flooded by large hydro-electric reservoirs.

Stand-replacing fire is a dominant disturbance factor in these forests although natural fire cycles vary with climatic conditions across the Canadian range, from intermediate (100-270 years) to long (270-500 years). In the wetter climates of the M500 range, fires are relatively rare. Historically, in these areas, late seral *Tsuga heterophylla*, *Thuja plicata*, *Picea* spp. and *Abies lasiocarpa* forests were prevalent although recent forest harvesting and disturbances associated with settlement have reduced the old forest component on the landscape. In drier climatic areas of the M500 range, fires are more frequent, creating a spatial mosaic of burned and residual patches on the landscape. In these areas, late seral stands are often restricted to small patches that have wetter site conditions associated with slope position (toes, depressions, canyons) or finer-textured soils. Overall, in these drier areas, early seral species such as *Larix occidentalis*, *Pinus monticola*, *Pinus contorta*, *Pseudotsuga menziesii*, *Populus tremuloides* and *Betula papyrifera* are more prevalent in the species mix, often codominating with *T. heterophylla* and/or *T. plicata*. In the prolonged absence of fire, *T. heterophylla* and *T. plicata* (and to a lesser extent *Picea* spp. and *A. lasiocarpa*) become dominant over time and self-replace by gap dynamics when death of individual trees creates canopy openings that release seedlings from the understory.

These forests are susceptible to root and butt rot pathogens, especially armillaria root disease (*Armillaria ostoyae*), annosus root disease (*Heterobasidion annosum*), Schweinitzii butt rot (*Phaeolus schweinitzii*), rust-red stringy rot (*Echinodontium tinctorium*), laminated root rot (*Phellinus weirii*) and red ring rot (*Phellinus pini*). The interaction between root-rot pathogens and windthrow results in gap formation in most mature stands.

Periodic insect outbreaks are a natural part of the ecology of these forests. Western hemlock looper (*Lambdina fiscellaria lugubrosa*) is the most serious defoliator of *T. heterophylla* and western spruce budworm (*Choristoneura occidentalis*) primarily attacks *P. menziesii* populations, although *A. lasiocarpa* and *Picea* spp. are also affected by these insects. Similarly, Douglas-fir beetle (*Dendroctonus pseudotsugae*), mountain pine beetle (*D. ponderosae*) and spruce beetle (*D. rufipennis*) have histories of episodic outbreaks in these forests. High-severity outbreaks of any of these insects interact with windthrow and fire events to influence stand development and succession.



Canadian National Vegetation Classification (CNVC) Classification nationale de la végétation du Canada

<http://cnvc-cnvc.ca>

Central Rocky Mountain Mesic Lower Montane Forest

Macrogroup M500

Forêts mésiques des montagnes de faible altitude du centre des Rocheuses

Environment

Climate

In Canada, M500 develops at low to mid-elevations in interior British Columbia (BC) wherever incursions of mild, wet Pacific air masses provide relatively high precipitation. In the northwestern portion of the range, these air masses penetrate the Coast Mountains through the large valleys of the Nass, Skeena and Stikine Rivers. In southeastern BC, areas of high orographic precipitation result when westerly air flows rise over the Columbia and Rocky Mountain Ranges. Colloquially, this area is sometimes referred to as the “interior wet belt” of British Columbia. In general terms, the climate is continental temperate, with warm summers, cool winters and high annual precipitation.

Mean annual precipitation typically varies from approximately 700 to 1400 mm, but can be as low as 500 mm in drier parts of the range. Up to 50% of annual precipitation is snow, but rain can also occur during winter months. Snowmelt adds significantly to soil moisture. Summer precipitation varies from approximately 200 to 450 mm throughout the Canadian range and most sites do not experience a growing season moisture deficit, although sites in the drier areas will have a slight deficit. Mean annual temperatures vary from approximately 2.5° to 8° C, depending on latitude and elevation. Deep snowpacks and moderate winter temperatures prevent soils from freezing, which is important for the survival of *Tsuga heterophylla* and *Thuja plicata*. The growing season generally averages between approximately 1200 and 2100 growing degree days above 5°C (GDD), depending mostly on latitude and elevation, however growing seasons <1200 GDD occur at the highest elevations.

Physiography, Geology, Topography and Soils

In Canada, M500 occurs in the southern and central portions of the Interior System of the Cordilleran physiographic region and on the western side of the southern Rocky Mountains of the Eastern System. In British Columbia (BC), these forests are found in the valleys and lower slopes of the Columbia Highlands, the Columbia Mountains, the southern Rocky Mountains and much of the adjacent Rocky Mountain Trench, from elevations as low as 400 mASL up to 1550 mASL. In northwestern BC, M500 forests occur mostly in the Nass Basin and Skeena Mountains between 100 mASL and 1100 mASL.

The terrain of the Cordilleran physiographic region is a complex mixture of high mountains (up to 3000 mASL), plateaux, hill systems, valleys and trenches. The northwestern portion of the M500 range comprises primarily faulted and folded sedimentary rocks. The southeastern portion of the Canadian range comprises mostly faulted and folded Paleozoic, Mesozoic or Tertiary sedimentary and metamorphic, often carbonate-rich, rocks.

The entire Canadian range of M500 experienced Pleistocene glaciation. Glacial till blankets most of the area, but valley bottoms also include glaciofluvial and recent fluvial materials. Steeper slopes and higher elevations often have colluvial materials. Volcanic ash often forms a thin upper soil layer in the southeastern range. Soils are variable but are commonly well to imperfectly drained Podzols, Luvisols and Brunisols. Stands of M500 are generally found on all slopes and aspects but are most productive on well to imperfectly drained sites with high soil moisture. In warmer drier climates, these sites occur on moist, cool lower/toe slopes and valley bottoms. In colder climates, *Tsuga heterophylla* and *Thuja plicata* are often excluded from valley bottoms because of cold air drainage.



Canadian National Vegetation Classification (CNVC) Classification nationale de la végétation du Canada

<http://cnvc-cnvc.ca>

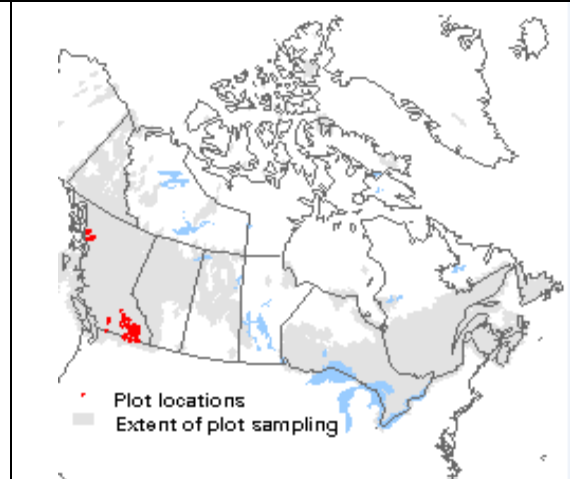
Central Rocky Mountain Mesic Lower Montane Forest

Macrogroup M500

Forêts mésiques des montagnes de faible altitude du centre des Rocheuses

Distribution and Geographic Range

In Canada, M500 includes low to mid-elevation forests in the southeastern and northwestern interior of British Columbia (BC). In southeastern BC, it occurs in the Columbia Mountains, on the windward side of the Rocky Mountains, and in the Shuswap and Quesnel highlands. In northwestern BC, it occurs in the lee of the Coast Mountains in parts of the Skeena, Nass and Stikine/Iskut River basins. The Canadian range is the northern portion of the global range of climatically moist lower montane forests of the central North American Cordillera, extending southward into Montana, Idaho, Washington and Oregon.



Related Concepts

M500 includes upland forests and woodlands that have been described in provincial publications for the Interior Cedar – Hemlock biogeoclimatic zone in British Columbia.

USNVC M500 [Central Rocky Mountain Mesic Lower Montane Forest] describes the rangewide characteristics of moist lower montane forests of the central North American Cordillera. This CNVC factsheet describes the Canadian expression of this vegetation, which includes conditions treated (at least in part) in USNVC Groups G211 [Central Rocky Mountain Mesic Grand Fir – Douglas-fir Forest] and G217 [Central Rocky Mountain Interior Western Red-cedar – Western Hemlock Forest].

Riparian and wetland forests and woodlands within the range of M500 are described by M034 [Rocky Mountain-Great Basin Montane Riparian & Swamp Forest].

Comments

M500 characterizes lower montane forests of warm, moist to wet, continental temperate climates (and moist sites of drier climates) in the Western Cordillera of North America. Lower montane forests and woodlands in drier climates (and dry sites of moist climates) of the warm interior of British Columbia (BC) are included in M501 [Central Rocky Mountain Dry Lower Montane – Foothill Forest]. Low elevation subboreal forests in central BC are described by M890 [Rocky Mountain Intermontane Subboreal Forest]. Low elevation forests of maritime temperate climates near the Pacific coast are described by M024 [Vancouverian Coastal Rainforest]. Higher elevation montane and subalpine forests contiguous with the range of M500 are characterized by M020 [Rocky Mountain Subalpine – High Montane Forest].

Abies lasiocarpa here refers to both *A. lasiocarpa* (subalpine fir) and *A. bifolia* (Rocky Mountain alpine fir), as well as their hybrids, as recognized by VASCAN.

Pinus contorta here refers to variety *latifolia* (lodgepole pine).

Pseudotsuga menziesii here refers to variety *glauca* (Rocky Mountain Douglas-fir).

Vaccinium ovalifolium here includes *V. alaskaense* (Alaska blueberry), according to VASCAN.



Canadian National Vegetation Classification (CNVC) Classification nationale de la végétation du Canada

<http://cnvc-cnvc.ca>

Central Rocky Mountain Mesic Lower Montane Forest

Macrogroup M500

Forêts mésiques des montagnes de faible altitude du centre des Rocheuses

Source Information

Number of Source Plots for M500: 2509 (BECMaster ecosystem plot database [VPro13/MSAccess 2010 format]).

Information Sources (data):

Biogeoclimatic Ecosystem Classification Program of British Columbia. 2015. BECMaster ecosystem plot database [VPro13/MSAccess 2007 format]. W.H. MacKenzie, ed. B.C. Min. For., Lands, and Nat. Resour. Ops., Smithers, BC. Available: www.for.gov.bc.ca/hre/becweb/resources/information-requests. (accessed June 2015). (2509 plots)

Concept Authors: D. Meidinger, W. MacKenzie, K. Baldwin, USNVC

Description Authors: D. Meidinger and K. Baldwin

Date of Concept: April, 2015

Date of Description: July, 2017

References

- Anderson, M.D. 2003. *Pinus contorta* var. *latifolia*. In: Fire Effects Information System. U.S. Dept. Agric., For. Serv., Rocky Mt. Res. Stn., Fire Sci. Lab., Missoula, MT, US. Available: <http://www.fs.fed.us/database/feis/plants/tree/pinconl/all.html> (accessed: August 13, 2015).
- Arsenault, A. 1998. Disturbance ecology in forests of the Interior Cedar – Hemlock Zone. Pages 16-17 in M. Jull, D. Coxson, S. Stevenson, D. Lousier, and M. Walters, eds. Ecosystem dynamics and silviculture systems in Interior Wet-belt ESSF and ICH Forests: workshop proc. June 10-12, 1997. Prince George, BC. UNBC Press, Prince George, BC.
- Banner, A.; MacKenzie, W.; Haeussler, S.; Thomson, S.; Pojar, J.; Trowbridge, R. 1993. A field guide to site identification and interpretation for the Prince Rupert Forest Region. B.C. Min. For., Research Branch, Victoria, BC. Land Manage. Handb. No. 26.
- Bostock, H.S. 1970. Physiographic subdivisions of Canada. Geol. Surv. Can. Econ. Geol. Rep. No. 1. Pages 10-30 in: R.J.W. Douglas (ed.) Geology and economic minerals of Canada. Geol. Surv. Can., Ottawa, ON.
- Boulanger, Y.; Gauthier, S.; Burton, P.J. 2014. A refinement of models projecting future Canadian fire regimes using homogeneous fire regime zones. *Can. J. For. Res.* 44(4):365-376.
- Braumandl, T.F.; Curran, M.P. 1992. A field guide for site identification and interpretation for the Nelson Forest Region. B.C. Min. For., Research Branch, Victoria, BC. Land Manage. Handb. No. 20.
- British Columbia Ministry of Forests, Lands and Natural Resources Operations. 1995. Root disease management guidebook [online]. BC Min. For., Lands and Nat. Resour. Op., Resources Practices Branch. Victoria, BC. Available: <https://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/root/roottoc.htm> (accessed: July 31, 2017).
- British Columbia Tree Species Selection Working Group. 2017. Tree species silvics and comparisons [online]. BC Min. For., Lands and Nat. Resour. Op., Victoria, BC. Available: <http://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/silviculture/tree-species-selection/tool-introduction/tree-species-silvics-and-comparisons> (accessed: July 31, 2017).
- Brouillet, L.; Coursol, F.; Meades, S.J.; Favreau, M.; Anions, M.; Bélisle, P.; Desmet, P. 2010+. VASCAN, the database of vascular plants of Canada. Available: <http://data.canadensys.net/vscan/search> (accessed: September 2015).
- Church, M.; Ryder, J.M. 2010. Physiography of British Columbia. Pages 17-45 in R.G. Pike, T.E. Redding, R.D. Moore, R.D. Winker and K.D. Bladon eds. Compendium of forest hydrology and geomorphology in British Columbia. B.C. Min. For. Range, For. Sci. Prog. and FORREX Forum for Res. and Ext. in Nat. Resour., Victoria and Kamloops, BC.
- Cooper, S.V.; Neiman, K.E.; Steele, R.; Roberts, D.W. 1987. Forest habitat types of northern Idaho: A second approximation. U.S. Dept. Agric., For. Serv., Intermountain Res. Stn., Ogden, UT, US. General Technical Report INT 236.
- Ecological Stratification Working Group. 1995. A national ecological framework for Canada. Agric. and Agri-Food Can., Res. Branch, Centre Land and Biol. Resour. Res., and Environ. Can., State of Environ. Direct., Ecozone Analysis Branch, Ottawa/Hull, ON/QC.
- Ecoregions Working Group. 1989. Ecoclimatic regions of Canada. W. Strong and S.C. Zoltai (compilers). Sustain. Dev. Branch, Can. Wildlife Serv., Conserv. and Prot., Environ. Can., Ottawa, ON. ELC Series No. 23.
- Environment Canada. 2015. Canadian climate normals, 1961-1990. Gov. Canada, Available: http://climate.weather.gc.ca/climate_normals/index_e.html (accessed: January 29, 2015).



Canadian National Vegetation Classification (CNVC) Classification nationale de la végétation du Canada

<http://cnvc-cnvc.ca>

Central Rocky Mountain Mesic Lower Montane Forest Forêts mésiques des montagnes de faible altitude du centre des Rocheuses

Macrogroup M500

References (cont'd)

- Flora of North America Editorial Committee. 2007+. Flora of North America north of Mexico, vols 27, 28, 29. Oxford University Press, New York and Oxford. Available: <http://www.mobot.org/plantscience/bfna/BFNAMenu.htm> (accessed: November, 2015).
- Franklin, J.; Dyrness, C.T. 1973. Natural vegetation of Oregon and Washington. U.S. Dept. Agric., For. Serv., Pac. NW For. & Range Exp. Stn., Portland, OR, US. General Technical Report PNW 8.
- Gadd, B. 2014. Geology of the Canadian Rockies and Columbia Mountains (summary), plus geological time scale [online]. Available: <http://www.bengadd.com/BenGaddDownloads.htm> (accessed: July 31, 2017).
- Hare, F.K.; Hay, J.E. 1974. The climate of Canada and Alaska. Vol. 11, pages 49-192 in: R.A. Bryson and F.K. Hare (eds.) World survey of climatology. Elsevier Scientific Publishing Company, Amsterdam, The Netherlands.
- Howard, J.L. 1996. *Populus tremuloides*. In: Fire Effects Information System [online]. U.S. Dept. Agric., For. Serv., Rocky Mt. Res. Stn., Fire Sci. Lab., Missoula, MT, US. Available: <http://www.fs.fed.us/database/feis/plants/tree/poptre/all.html> (accessed: May 27, 2015).
- Li, T.; Hélie, R. (compilers). 2014. Ecozones of Canada / Écozones du Canada [map]. Canadian Council on Ecological Areas / Conseil Canadien des Aires Écologiques, CA. Scale 1:25,000,000.
- MacKenzie, W.H. 2015. Climate summaries for biogeoclimatic zones and subzones. BC Min. For., Lands and Nat. Resour. Op., Research Branch. Smithers, BC. Unpublished data.
- McLean, J.A.; van der Kamp, B.; Behannah, A.L. 2005. Forest pest management. pp. 527- 557 in: S.B. Watts & L. Tolland (eds.) Forest Handbook for British Columbia. 5th ed. Faculty of Forestry, University of British Columbia. Vancouver, BC. Available: http://web.forestry.ubc.ca/fetch21/FirstPestMgmtCh/First_Pest_Mgmt_Chapter.pdf (accessed: May 27, 2017).
- Meidinger, D.; McLeod, A.; MacKinnon, A.; DeLong, C.; Hope, G. 1988. A Field Guide for Identification and Interpretation of Ecosystems of the Rocky Mountain Trench, Prince George Forest Region. B.C. Min. For., Research Branch, Victoria, BC. Land Manage. Handb. No. 15.
- Meidinger, D.; Pojar, J. (eds.). 1991. Ecosystems of British Columbia. B.C. Min. For., Research Branch, BC. Spec. Rep. Series No. 6.
- Pfister, R.D.; Kovalchik, B.L.; Arno, S.F.; Presby, R.C. 1977. Forest habitat types of Montana. U.S. Dept. Agric., For. Serv., Intermountain Res. Stn., Ogden, UT, US. General Technical Report INT 34.
- Reid, M.S.; Schulz, K.A.; Meidinger, D.; Faber-Langendoen, D. 2015. Macrogroup Detail Report: M500 *Tsuga heterophylla* - *Abies grandis* - *Larix occidentalis* Lower Montane Forest Macrogroup [9 Jun 2015]. United States National Vegetation Classification. Fed. Geogr. Data Comm., Washington DC, US.
- Soil Classification Working Group. 1998. The Canadian system of soil classification. NRC Research Press, Ottawa, ON. Agric. and Agri-Food Can. Pub. 1646.
- Soil Classification Working Group. 2001. Soils of Canada [map]. Scale 1:6,500,000. Agric. and Agri-Food Can. Res. Br., Available: sis.agr.gc.ca/cansis (accessed: May 12, 2016).
- Steen, O.A.; Coupé, R.A. 1997. A field guide to forest site identification and interpretation for the Cariboo Forest Region. B.C. Min. For., Research Branch, Victoria, BC. Land Manage. Handb. No. 39.
- Steinberg, P.D. 2002. *Pseudotsuga menziesii* var. *glauca*. In: Fire Effects Information System. U.S. Dept. Agric., For. Serv., Rocky Mt. Res. Stn., Fire Sci. Lab., Missoula, MT, US. Available: <https://www.fs.fed.us/database/feis/plants/tree/psemeng/all.html> (accessed: July 31, 2017).
- Stevenson, S.K.; Armleder, H.M.; Arseneault, A.; Coxson, D.; DeLong, S.C.; Jull, M. 2011. British Columbia's Inland Rainforest – Ecology, Conservation, and Management. UBC Press, Vancouver, BC.
- Tesky, J.L. 1992. *Thuja plicata*. In: Fire Effects Information System. U.S. Dept. Agric., For. Serv., Rocky Mt. Res. Stn., Fire Sci. Lab., Missoula, MT, US. Available: <https://www.fs.fed.us/database/feis/plants/tree/thupli/all.html> (accessed: July 31, 2017).
- Tesky, J.L. 1992. *Tsuga heterophylla*. In: Fire Effects Information System. U.S. Dept. Agric., For. Serv., Rocky Mt. Res. Stn., Fire Sci. Lab., Missoula, MT, US. Available: <https://www.fs.fed.us/database/feis/plants/tree/tsuhet/all.html> (accessed: July 31, 2017).
- Uchytel, R.J. 1991. *Abies lasiocarpa*. In: Fire Effects Information System. U.S. Dept. Agric. For. Serv. Rocky Mt. Res. Stn., Fire Sci. Lab., Missoula, MT, US. Available: <http://www.fs.fed.us/database/feis/plants/tree/abibal/all.html> (accessed: May 26, 2015).
- USDA, Forest Service. 2017. Western forest insects & diseases – rots and decays [online]. U.S. Dept. Agric., For. Serv., Pac. NW Reg. Available: https://www.fs.usda.gov/detail/r6/forest-grasslandhealth/?cid=fsbdev2_027359#rtop (accessed: July 31, 2017).



Canadian National Vegetation Classification (CNVC) Classification nationale de la végétation du Canada

<http://cnvc-cnvc.ca>

Central Rocky Mountain Mesic Lower Montane Forest Forêts mésiques des montagnes de faible altitude du centre des Rocheuses

Macrogroup M500

References (cont'd)

USNVC [United States National Vegetation Classification] Database. 2016. United States National Vegetation Classification Database Ver. 2.0. Fed. Geogr. Data Comm., Veg. Subcomm., Washington DC, US. Available: <http://usnvc.org> (accessed: March 10, 2016).

Williams, C.K.; Kelly, B.F.; Smith, B.G.; Lillybridge, T.R. 1995. Forest plant associations of the Colville National Forest. U.S. Dept. Agric., For. Serv., Pac. NW For. & Range Exp. Stn., Portland, OR, US. Gen. Tech. Rep. PNW GTR 360.

Wong, C.; Sandmann, H.; Dormer, B. 2004. Historical variability of natural disturbances in British Columbia: A literature review [online]. FORREX – Forest Research Extension Partnership, Kamloops, BC. FORREX Series 2. Available: www.forrex.org/publications/forrexseries/fs12.pdf.

The information contained in this factsheet is based on data and expert knowledge that is current to the date of description. As new information becomes available, the factsheet will be updated.

Suggested Citation: Meidinger, D.; Baldwin, K. Central Rocky Mountain Mesic Lower Montane Forest [online]. Sault Ste. Marie, Ontario, Canada: Canadian National Vegetation Classification. July, 2017; generated 31-October-2017; cited **ENTER DATE ACCESSED**. 10 p. Canadian National Vegetation Classification Macrogroup: M500. Available from <http://cnvc-cnvc.ca>. System Requirements: Adobe Acrobat Reader v. 7.0 or higher. ISSN 1916-3266.



Canadian National Vegetation Classification (CNVC) Classification nationale de la végétation du Canada

<http://cnvc-cnvc.ca>

Central Rocky Mountain Mesic Lower Montane Forest

Macrogroup M500

Forêts mésiques des montagnes de faible altitude du centre des Rocheuses

Comparison of Vegetation Characteristics for Rocky Mountain Forest Macrogroups

Lifeform	Species Name	n=2509	n=2627	n=1821	n=5225	Species Common Name
		M500 Mesic Low Montane	M501 Dry Low Montane	M890 Subboreal	M020 Subalpine	
Tree	<i>Tsuga heterophylla</i>	■■■■■				western hemlock
	<i>Thuja plicata</i>	■■■■				western red cedar
	<i>Pinus ponderosa</i>		****			ponderosa pine
	<i>Pseudotsuga menziesii</i> var. <i>glauca</i>	■■■■■	■■■■■	***		Rocky Mountain Douglas-fir
	<i>Pinus contorta</i> var. <i>latifolia</i>	****	■■■■	■■■■■	■■■■	lodgepole pine
	<i>Picea engelmannii</i> x <i>glauca</i>	■■■	****	■■■■■	****	interior spruce
	<i>Abies lasiocarpa</i>	■■■■■		■■■■■	■■■■■	subalpine fir
	<i>Picea engelmannii</i>				■■■■■	Engelmann spruce
Shrub	<i>Vaccinium ovalifolium</i>	■■■				oval-leaved blueberry
	<i>Lonicera utahensis</i>	**			**	Utah honeysuckle
	<i>Acer glabrum</i>	■■■	***			Rocky Mountain maple
	<i>Oplopanax horridus</i>	■■■■■		****		devil's club
	<i>Rubus parviflorus</i>	■■■		■■■		western thimbleberry
	<i>Paxistima myrsinites</i>	■■■	■■■			falsebox
	<i>Berberis aquifolium</i>		■■			holly-leaved barberry
	<i>Symphoricarpos albus</i>		■■■			thin-leaved snowberry
	<i>Shepherdia canadensis</i>		■■■	■■■		soapberry
	<i>Spiraea lucida</i>	**	■■■	■■		shiny-leaved meadowsweet
	<i>Rosa acicularis</i>		■■	■■		prickly rose
	<i>Lonicera involucrata</i>			■■■		bracted honeysuckle
	<i>Vaccinium membranaceum</i>	■■■		■■■	■■■■■	mountain huckleberry
	<i>Rhododendron albiflorum</i>				■■■■	white-flowered rhododendron
<i>Menziesia ferruginea</i>	***			****	false azalea	
Herb/ Dwarf Shrub	<i>Athyrium filix-femina</i>	***				common lady fern
	<i>Gymnocarpium dryopteris</i>	■■■■■		****	****	common oak fern
	<i>Tiarella trifoliata</i>	■■■		***	■■■	three-leaved foamflower
	<i>Clintonia uniflora</i>	■■■		■■	***	single-flowered clintonia
	<i>Chimaphila umbellata</i>	■■■	**	**		common pipsissewa
	<i>Orthilia secunda</i>	■■	*	■	■■	one-sided wintergreen
	<i>Linnaea borealis</i>	■■■	■■■	■■■	■■■	twinflower
	<i>Calamagrostis rubescens</i>		■■■■■	■■■■■		pine reedgrass
	<i>Eurybia conspicua</i>		■■■	■■		western showy aster
	<i>Fragaria virginiana</i>		■	■		wild strawberry
	<i>Arnica cordifolia</i>		***	■■	■■■	heart-leaved arnica
	<i>Rubus pubescens</i>			■■		dwarf raspberry
	<i>Vaccinium caespitosum</i>			■■		dwarf bilberry
	<i>Chamerion angustifolium</i>			■		fireweed
	<i>Cornus canadensis</i>	■■■		■■■	■■■	bunchberry
	<i>Rubus pedatus</i>	■■■		■■■	■■■	five-leaved dwarf bramble
<i>Valeriana sitchensis</i>				■■■	Sitka valerian	
<i>Vaccinium scoparium</i>				■■■■■	grouseberry	
Moss/ Lichen	<i>Rhytidiopsis robusta</i>	■■■■■			***	pipecleaner moss
	<i>Hylocomium splendens</i>	■■■■■	***	■■■■■	****	stairstep moss
	<i>Pleurozium schreberi</i>	■■■■■	■■■■■	■■■■■	■■■■■	red-stemmed feathermoss
	<i>Ptilium crista-castrensis</i>	■■■■■		■■■■■	***	knight's plume moss
	<i>Cladonia</i> spp.		■■	■■■	■■■	clad and reindeer lichens

Legend

Constancy:
Black bar >= 50%
Grey bar >= 30%
Asterisk >= 20%

Cover:
5 bars >= 25%
4 bars >= 10%
3 bars >= 3%
2 bars >= 1%
1 bar < 1%



Canadian National Vegetation Classification (CNVC) Classification nationale de la végétation du Canada

<http://cnvc-cnvc.ca>

Central Rocky Mountain Mesic Lower Montane Forest

Macrogroup M500

Forêts mésiques des montagnes de faible altitude du centre des Rocheuses

Comparison of Vegetation Characteristics for Macrogroup Subtypes in M500

Lifeform	Species Name	n=234	n=1913	n=362	Species Common Name
		CM500a Southern Low Montane	CM500b Typic Low Montane	M500c Northern Low Montane	
Tree	<i>Abies grandis</i>	****			grand fir
	<i>Pinus monticola</i>	■■■			western white pine
	<i>Larix occidentalis</i>	■■■			western larch
	<i>Pseudotsuga menziesii</i> var. <i>glauca</i>	■■■■	■■■■		Rocky Mountain Douglas-fir
	<i>Thuja plicata</i>	■■■■	■■■■■	■■■■	western redcedar
	<i>Tsuga heterophylla</i>	■■■■	■■■■■	■■■■■	western hemlock
	<i>Pinus contorta</i> var. <i>latifolia</i>	■■■		■■■■	lodgepole pine
	<i>Abies lasiocarpa</i>	***	■■■	■■■■	subalpine fir
	<i>Picea engelmannii</i> x <i>glauca</i>	***	■■■■		interior spruce
	<i>Picea xlutzii</i>			***	Lutz spruce
Shrub	<i>Rosa gymnocarpa</i>	■■			dwarf woodland rose
	<i>Berberis aquifolium</i>	■■			holly-leaved barberry
	<i>Lonicera utahensis</i>	■	**		Utah honeysuckle
	<i>Spiraea lucida</i>	■■	**		shiny-leaved meadowsweet
	<i>Amelanchier alnifolia</i>	■■	**	**	saskatoon
	<i>Acer glabrum</i>	■■■	■■	***	Rocky Mountain maple
	<i>Paxistima myrsinites</i>	■■■■	■■■		falsebox
	<i>Rubus parviflorus</i>	■■■	■■■	■■■	western thimbleberry
	<i>Vaccinium membranaceum</i>	■■■	■■■	■■■	mountain huckleberry
	<i>Vaccinium ovalifolium</i>		■■	■■■■	oval-leaved blueberry
	<i>Ribes lacustre</i>		■■	**	bristly black currant
	<i>Oplopanax horridus</i>		■■■■	■■■■	devil's club
<i>Menziesia ferruginea</i>		***	■■■	false azalea	
Herb/ Dwarf Shrub	<i>Pteridium aquifolium</i>	■■			bracken fern
	<i>Prosartes hookeri</i>	■■■	**		Hooker's fairybells
	<i>Aralia nudicaulis</i>	■■■	■■■	***	wild sarsaparilla
	<i>Chimaphila umbellata</i>	■■■	■■■	■■■	common pipsissewa
	<i>Clintonia uniflora</i>	■■■	■■■	■■■	single-flowered clintonia
	<i>Cornus canadensis</i>	■■■	■■■	■■■	bunchberry
	<i>Streptopus</i> spp.	*	■■	■■	twisted-stalks
	<i>Tiarella trifoliata</i>	***	■■■	***	three-leaved foamflower
	<i>Gymnocarpium dryopteris</i>		■■■■	■■■■	common oak fern
	<i>Athyrium filix-femina</i>		■■■		common lady fern
	<i>Rubus pedatus</i>		■■■	■■■	five-leaved dwarf bramble
Moss/Lichen	<i>Rhytidiopsis robusta</i>	■■■■	■■■■		pipecleaner moss
	<i>Dicranum</i> spp.	■■■	■■■	■■	broom mosses
	<i>Pleurozium schreberi</i>	■■■■	■■■■	■■■■	red-stemmed feathermoss
	<i>Hylocomium splendens</i>		■■■■	■■■■■	stairstep moss
	<i>Mniaceae</i>	**	■■■	■■■	leafy mosses
	<i>Ptilium crista-castrensis</i>		■■■	■■■■	knight's plume moss
	<i>Rhytidiadelphus triquetrus</i>	***	■■■	■■■	electrified cat's-tail moss

Legend

Constancy:
Black bar >= 50%
Grey bar >= 30%
Asterisk >= 20%

Cover:
5 bars >= 25%
4 bars >= 10%
3 bars >= 3%
2 bars >= 1%
1 bar < 1%