



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

<http://cnvc-cnvc.ca>

## Rocky Mountain - Great Basin Montane Riparian & Swamp Forest

Macrogroup M034

Forêts montagnardes, riveraines et marécageuses des Rocheuses et du Grand Bassin

### Temperate Flooded & Swamp Forest

D193 Vancouverian Flooded & Swamp Forest

M035 Vancouverian Flooded & Swamp Forest

D195 Rocky Mountain-Great Basin Montane Flooded & Swamp Forest

**M034 Rocky Mountain-Great Basin Montane Riparian & Swamp Forest**

### Temperate to Polar Bog & Fen

D029 North American Bog & Fen

M063 North Pacific Bog & Fen



## Concept

M034 describes forests and woodlands of riparian and permanently saturated sites in the continental temperate climate of the Western Cordillera of North America. The Canadian expression of these forests occurs east of the Coast Mountains in southern, central and northwestern British Columbia (BC), and in the Rocky Mountains and foothills of southern and west-central Alberta. Forest canopies can be evergreen coniferous, cold-deciduous broad-leaved or a mixture. Floodplain sites that have experienced recent disturbance (e.g., flooding or anthropogenic disturbance) are typically dominated by cold-deciduous broad-leaved species, including black cottonwood (*Populus trichocarpa*), paper birch (*Betula papyrifera*), trembling aspen (*Populus tremuloides*), mountain alder (*Alnus incana* ssp. *tenuifolia*) and willows (*Salix* spp.). On more stable sites at lower elevations, including swamps, interior spruce (*Picea glauca* x *engelmannii*) or sometimes western red cedar (*Thuja plicata*) often dominate, while at higher elevations subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*P. engelmannii*) become prominent tree species. Stands usually have complex structure of tree, shrub and herb layers. Shrub species include willows (*Salix* spp.), red-osier dogwood (*Cornus stolonifera*), water birch (*Betula occidentalis*), bracted honeysuckle (*Lonicera involucrata*), mountain huckleberry (*Vaccinium membranaceum*), and various gooseberries or currants (*Ribes* spp.). Horsetails (especially *Equisetum arvense* and *E. pratense*) are characteristic in the herb layer, accompanied by a wide diversity of other species, including common lady fern (*Athyrium filix femina*), bluejoint reedgrass (*Calamagrostis canadensis*), bunchberry (*Cornus canadensis*), naked mitrewort (*Mitella nuda*), arctic sweet coltsfoot (*Petasites frigidus*), dwarf raspberry (*Rubus pubescens*), three-leaved foamflower (*Tiarella trifoliata*), common oak fern (*Gymnocarpium dryopteris*), soft-leaved sedge (*Carex disperma*), five-leaved dwarf bramble (*Rubus pedatus*) and arrow-leaved ragwort (*Senecio triangularis*). The moss layer is often well-developed in swamps and stabilized floodplain communities, usually including a variety of leafy mosses (*Mnium* spp., *Rhizomnium* spp. and *Plagiomnium* spp.) along with red-stemmed feathermoss (*Pleurozium schreberi*), stairstep moss (*Hylocomium splendens*) and/or glow moss (*Aulacomium palustre*).

Riparian forests and woodlands are subject to floodplain dynamics, including erosion of banks, removal of established vegetation, channelization, scouring and sediment deposition. Treed swamps are generally small stable ecosystems that are maintained by persistently high local water tables. M034 occurs in a continental temperate climate, with warm summers, cool winters and highly variable annual precipitation within its range. Mean annual temperature varies from approximately -1° to 9° C, depending on latitude and elevation. Mean annual precipitation varies from 350 mm in drier areas to >2000 mm in wetter subregional climates. Soils on actively flooded sites are poorly to moderately developed, mostly Regosols, because of ongoing deposition of silty and sandy alluvium; better soil development is present on older stabilized fluvial 'benches'. Swamp soils are typically mineral Gleysols with a peaty surface layer, although sometimes Organic soils develop.



Actively flooded riparian stands dominated by black cottonwood (*Populus trichocarpa*) and willows (*Salix* spp.), along the Bulkley River, British Columbia.

Source: W. MacKenzie, British Columbia Forest Service



Interior spruce (*Picea glauca* x *engelmannii*) stand with dense herb layer dominated by horsetails (mostly *Equisetum arvense* and *E. pratense*). Robson Valley, British Columbia.

Source: W. MacKenzie, British Columbia Forest Service



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### Vegetation

#### Physiognomy and Structure

M034 includes floodplain and swamp forests or woodlands. Overstories can be evergreen coniferous, cold-deciduous broad-leaved ("hardwood") or a conifer-hardwood mixture. Vertical structure varies from multi-storied stands with trees of multiple ages, to even-aged stands with a single-storied canopy. Typically, these forests and woodlands occur as 'linear' plant communities or in small patches on the landscape. Young stands (e.g., 'low bench' floodplains) generally have much less spatial variability than older stands although, structural diversity can sometimes be created by microsite differences in tree regeneration and growth. Dense understory vegetation is characteristic of these stands, usually dominated by broad-leaved shrubs, tree regeneration, horsetails and forbs. The moss layer can be well developed under conifer canopies, especially in swamps.

#### Floristics

Generally, M034 forests and woodlands vary in species composition depending on local site properties and disturbance history. Since the M034 range encompasses several climatic zones, additional compositional variation is introduced by the natural floristics of each zone. Sites that have experienced recent disturbance (e.g., flooding or anthropogenic disturbance) are typically dominated by cold-deciduous broad-leaved trees. The main tree species on riparian sites that experience frequent flooding and sediment deposition is *Populus trichocarpa*. Other tree species that may occur on these sites include *Betula papyrifera*, *Populus tremuloides* and, sometimes, *Picea glauca x engelmannii*. Tall shrubs (e.g., *Alnus incana* ssp. *tenuifolia* or *Salix* spp.) often dominate the most frequently flooded sites. *Cornus stolonifera* is a common shrub of actively flooded stands, and *Equisetum* spp. (mostly *E. arvense* and *E. pratense*) are the most frequently occurring herbs. In dry, warm climates, *Betula occidentalis* and *Symphoricarpos albus* are frequent components of these floodplain forests and woodlands. Where there is heavy broadleaf litterfall and/or regular sedimentation, there is typically little moss development on the forest floor.

Conifer species are more prevalent on relatively undisturbed sites, especially in swamps and on less frequently flooded riparian 'benches'. Low elevation swamps may be dominated by *Picea glauca x engelmannii* or *Thuja plicata*, while at higher elevations, *Abies lasiocarpa* [see Comments] and *P. engelmannii* are important tree species. Characteristic understory species of these sites include *Equisetum arvense*, *E. pratense* and leafy mosses of the *Mniaceae* (*Mnium* spp., *Rhizomnium* spp. and *Plagiomnium* spp.), occurring consistently in swamp and stabilized floodplain communities throughout the range. Other frequent species include *Lonicera involucrata*, *Ribes lacustre*, *Rosa acicularis*, *Cornus canadensis*, *Mitella nuda* and *Pleurozium schreberi*.

Overall, understory species vary between climatic zones, as well as in response to local soil moisture and stand canopy conditions. In swamps, typical understory species include *Calamagrostis canadensis*, *Petasites frigidus*, *Rubus pubescens*, *Carex disperma* and *Aulacomium palustre*. *Lysichiton americanus* dominates swamp understories in the warm, wet climatic areas. In moister climates, riparian understories often include shrubs such as *C. stolonifera* or *Oplopanax horridus* and herbs such as *Streptopus amplexifolius*, *Tiarella trifoliata*, *Gymnocarpium dryopteris*, *Athyrium filix-femina* and *Dryopteris expansa*. At higher elevations, streamside riparian communities and swamps generally include *Rhododendron albiflorum*, *Vaccinium membranaceum*, *Rubus pedatus*, *Senecio triangularis*, *Valeriana sitchensis* and *Trollius albiflorus*.

#### Dynamics

Riparian forests of M034 are subject to floodplain dynamics of rivers that occur in areas with spring snowmelt and, in some cases, high precipitation. This includes erosion of banks, removal of established vegetation, channelization and sediment deposition. Vegetation succession on floodplains is typically initiated by establishment of seedlings of *A. incana* ssp. *tenuifolia*, *Salix* spp. and/or *Populus trichocarpa*, usually on freshly deposited mineral sediment. These actively flooded 'low benches' are continually being formed and modified by accretion and erosion; they are frequently flooded and also strongly influenced by subsurface seepage. As these sites become more stable (i.e., less frequently flooded and elevated above the water table), several stages of *P. trichocarpa* communities develop, as trees age and flood dynamics are mitigated. Conifer species can seed into the early seral hardwood stands if there is an available seed supply from surrounding areas, but because of slower growth only become part of the canopy in older stands. These 'mid-benches' are generally characterized by mixed hardwood-conifer stands. Eventually, on the most stable sites where flooding is rare, productive conifer stands develop.

Rafted ice and logs in flow pulses may cause considerable damage to tree boles in riparian stands. Ice sheets forming in shallows can rip seedlings out of the ground with spring flows. Beavers frequently cut younger hardwoods and dam smaller channels. Livestock grazing and anthropogenic activities are major influences in altering structure and composition of riparian communities, including the introduction of non-native plant species. Fire is not a significant disturbance factor in forests and woodlands of M034.



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#### Dynamics (cont'd)

Wetlands (i.e., swamps) are generally stable ecosystems that are maintained by persistently high water tables. Local hydrology is the main ecological determinant of vegetation characteristics. Any changes to water chemistry or level of the long-term water table will affect nutrient status, degree of aeration and soil temperature in the rooting zone, and thus influence overall species composition and tree productivity. A rise or drop in the water table (either by anthropogenic activities or natural causes [e.g., beaver dams]) can result in changes to the vegetation community. A higher water table can result in tree mortality and transition to open wetland vegetation. A drop in the water table can reverse some of these effects and sometimes promote the development of more productive upland treed vegetation.

#### Environment

##### Climate

In Canada, M034 forests develop at low to high elevations in the continental temperate climate of southern and central British Columbia (BC), and of western Alberta. On the lee sides of the Coast, Cascade, Columbia and Rocky Mountains, rain shadow effects on moist Pacific air masses create relatively dry to subhumid conditions. However, areas of high orographic precipitation occur when westerly air flows rise over the mountains of interior BC and, ultimately, the Rocky Mountains. In the rain shadow of the Rockies, west-central and southern Alberta receive considerably less precipitation annually than does the windward side in BC. Overall, summers are warm, winters are cool and annual precipitation is highly variable. Mean annual temperatures vary from approximately  $-1^{\circ}$  to  $9^{\circ}$  C, depending on latitude and elevation. The growing season varies from <800 (at higher northern elevations) to 2100 (at lower southern elevations) growing degree days above  $5^{\circ}$ C (GDD). Climatically drier areas receive as little as 350 mm of total precipitation annually, whereas areas within wetter subregional climates can receive >2000 mm. Snowmelt adds significantly to soil moisture and stream flows.

##### Physiography, Geology, Topography and Soils

In Canada, M034 occurs in the southern portion of the Cordilleran physiographic region, including most mountain ranges and high plateaux of interior British Columbia (BC), in the Rocky Mountains and in their foothills of western Alberta. These forests and woodlands are found primarily in valleys at elevations from 165 mASL to >2000 mASL along the eastern side of the Coast Mountains as far north as the Yukon border; in the Skeena, Omineca and Rocky Mountains south of approximately latitude  $57^{\circ}30'$ ; in the Columbia and Cascade Mountains, Columbia Highlands and Interior Plateau of south-central BC, and in the Alberta foothills.

Geology and topography within the Canadian range of this Macrogroup are highly diverse. 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 Coast and Omineca Mountains consist predominantly of crystalline igneous and metamorphic rocks, while the rest of the Interior and all the Eastern Systems of the Cordillera comprise faulted and folded Paleozoic, Mesozoic or Tertiary sedimentary, and often carbonate-rich, rocks. The plateaux of central BC are mostly underlain by geologically recent lava deposits.

The entire Canadian range of M034 experienced Pleistocene glaciation. Glacial till blankets most of the overall area, derived from basaltic bedrock on the BC Interior Plateau, and thus reasonably rich in basic cations. In southern portions of the range, volcanic ash often forms a thin upper soil layer. In the valleys, where communities of M034 occur, fluvial and glaciofluvial materials occur along with thin till and colluvial materials on steeper slopes. Several areas were inundated by large lakes at the time of glacial retreat and are now overlain by fine-textured glaciolacustrine materials. In the Alberta foothills, calcareous tills contribute to the majority of fluvial materials, with glaciolacustrine sediments in some lower valley locations.

M034 forests develop in wetlands and in riparian areas on sites with permanently saturated soils or seasonal water table fluctuations. Floodplain communities occur along large and small permanent streams, but are most prevalent on the lower reaches of larger rivers. These locations typically experience frequent flooding, shifting channels and significant sediment deposition. Snowmelt contributes subsurface moisture to riparian areas and may also flood lower watershed reaches. Sediment and dissolved materials carried by inflowing water can make riparian sites relatively nutrient-rich. Soils are mostly poorly to moderately developed Regosols, because of ongoing deposition of silty and sandy alluvium, but better soil development (Brunisols and, occasionally, Podzols) is present on older stabilized fluvial 'benches'.

Swamps are mostly small in size, typically occurring in small landscape depressions or on poorly-drained level areas. Organic matter accumulation sometimes occurs in swamps with poorer nutrient status. Swamp soils are often Gleysols with a peaty surface layer, but sometimes Organic soils develop.





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### Distribution and Geographic Range

In Canada, M034 occurs at all elevations below treeline in the central, southern and northwestern interior of British Columbia and in the mountains and foothills of west-central and southwestern Alberta. The Canadian range is the northern portion of the global range of western North American continental, temperate montane flooded and swamp forests, which extends southward to the mountains of Arizona, New Mexico and into Mexico.



### Related Concepts

M034 includes wet forests and woodlands that have been described in provincial publications for the Sub-Boreal Spruce, Sub-Boreal Pine – Spruce, Interior Cedar – Hemlock, Interior Douglas-Fir, Ponderosa Pine, Engelmann Spruce – Subalpine Fir and Montane Spruce biogeoclimatic zones in British Columbia; and the Subalpine and Montane natural subregions in Alberta.

USNVC M034 [Rocky Mountain-Great Basin Montane Flooded & Swamp Forest] describes the rangewide characteristics of continental, temperate montane flooded and swamp forests in western North America. This CNVC factsheet describes the Canadian expression of this vegetation.

Upland forests and woodlands within the range of M034 are described by M020 [Rocky Mountain Subalpine – High Montane Forest], M500 [Central Rocky Mountain Mesic Lower Montane Forest], M501 [Central Rocky Mountain Dry Lower Montane – Foothill Forest] and M890 [Rocky Mountain Intermontane Subboreal Forest].

### Comments

M034 characterizes wetland and riparian forests and woodlands of cool continental temperate climates of the North American Western Cordillera. Floodplain and swamp forests of wet maritime temperate climates of the Pacific coast are described by M035 [Vancouverian Flooded & Swamp Forest]. Riparian forests and woodlands of the Great Plains, dominated by *Populus deltoides* ssp. *monilifera*, *Acer negundo* and *Fraxinus pennsylvanica*, are described by M028 [Great Plains Floodplain Forest]. Wet forests and woodlands of boreal climates to the north, dominated by *Picea mariana*, *Larix laricina* and *Populus balsamifera*, are described by M299 [North American Boreal Conifer Poor Swamp] and M300 [North American Boreal Flooded and Rich Swamp].

*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.



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### Source Information

**Number of Source Plots for M034:** 872 (BECMaster ecosystem plot database [VPro13/MSAccess 2010 format]).

**Information Sources (data):**

Biogeoclimatic Ecosystem Classification Program of British Columbia. 2011. BECMaster ecosystem plot database [VPro13/MSAccess 2010 format]. W.H. MacKenzie, (ed.) B.C. Min. For., Lands, and Nat. Res. Ops., Smithers, BC. Available: [www.for.gov.bc.ca/hre/becweb/resources/informationrequests](http://www.for.gov.bc.ca/hre/becweb/resources/informationrequests) (accessed: January 2020). (872 plots)

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**Description Authors:** D. Meidinger, K. Baldwin

**Date of Concept:** April, 2015

**Date of Description:** May, 2020

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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.

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### Comparison of Vegetation Characteristics for Vancouverian and Rocky Mountain Wet Forest Macrogroups

Lifeform	Species Name	n=526	n=470	n=872	Species Common Name
		M063 Pacific Bog & Fen	M035 Vancouverian	M034 Rocky Mountain	
Tree	<i>Pinus contorta</i> var. <i>contorta</i>	■■■			shore pine
	<i>Callitropsis nootkatensis</i>	■■■	***		yellow-cypress
	<i>Tsuga heterophylla</i>	■■■	■■■		western hemlock
	<i>Thuja plicata</i>	■■■	■■■■		western red cedar
	<i>Alnus rubra</i>		■■■■		red alder
	<i>Picea sitchensis</i>		■■■		Sitka spruce
	<i>Acer macrophyllum</i>		**		big-leaved maple
	<i>Populus trichocarpa</i>		***	***	black cottonwood
	<i>Picea engelmannia</i> + <i>P. glauca</i> + hybrids			■■■■	Engelmann, white & hybrid spruces
	<i>Abies lasiocarpa</i>			■■■	subalpine fir
Shrub	<i>Vaccinium uliginosum</i>	**			bog bilberry
	<i>Myrica gale</i>	■■■			sweet gale
	<i>Rhododendron groenlandicum</i>	■■■			common Labrador tea
	<i>Gaultheria shallon</i>	■■■	**		salal
	<i>Rubus spectabilis</i>		■■■		salmonberry
	<i>Lonicera involucrata</i>			■■	bracted honeysuckle
	<i>Ribes lacustre</i>			■■	bristly black currant
	<i>Rosa acicularis</i>			■	prickly rose
	<i>Alnus incana</i> ssp. <i>tenuifolia</i>			***	mountain alder
Herb/ Dwarf Shrub	<i>Trichophorum cespitosum</i>	***			tufted clubrush
	<i>Vaccinium oxycoccos</i>	■■			small cranberry
	<i>Empetrum nigrum</i>	■■			black crowberry
	<i>Kalmia microphylla</i>	■■			western bog laurel
	<i>Blechnum spicant</i>	**	■		deer fern
	<i>Lysichiton americanus</i>	**	■■■		yellow skunk cabbage
	<i>Polystichum munitum</i>		■■■		western sword fern
	<i>Carex</i> spp.	■■■■	■■■	■■■	sedges
	<i>Athyrium filix-femina</i>		■■	**	common lady fern
	<i>Tiarella trifoliata</i>		■	*	three-leaved foamflower
	<i>Equisetum arvense</i> + <i>E. pratense</i> + <i>E. sylvaticum</i>			■■■■	horsetails
	<i>Mitella nuda</i>			■	naked mitrewort
	<i>Petasites frigidus</i>			■	arctic sweet coltsfoot
	<i>Rubus pubescens</i>			■■	dwarf raspberry
<i>Gymnocarpium dryopteris</i>			**	common oak fern	
Moss/Lichen	<i>Cladina</i> spp.	■■■			reindeer lichens
	<i>Rhytidiadelphus loreus</i>	**	■■■		lanky moss
	<i>Sphagnum</i> spp.	■■■■■	■■■	***	peat mosses
	<i>Hylocomium splendens</i>	**	■■■	***	stairstep moss
	<i>Eurhynchium praelongum</i>		***		slender beaked moss
	<i>Mniaceae</i>		■■■	■■■■	leafy mosses
	<i>Brachythecium</i> spp.			■■■	ragged mosses
	<i>Pleurozium schreberi</i>	**		■■■	red-stemmed feathermoss
	<i>Aulacomnium palustre</i>			***	glow moss

#### Legend

Constancy:	Black bar >= 50%	Cover:	5 bars >= 25%	2 bars >= 1%
	Grey bar >= 30%		4 bars >= 10%	1 bar < 1%
	Asterisk >= 20%		3 bars >= 3%	