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

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North American Boreal Conifer Poor Swamp

Macrogroup M299

Marécages pauvres à conifères boréaux de l'Amérique du Nord

Boreal Flooded Swamp & Forest

D016 North American Boreal Flooded & Swamp Forest

M300 North American Boreal Flooded & Rich Swamp Forest

M299 North American Boreal Conifer Poor Swamp

CG0016 Atlantic Boreal Black Spruce – Balsam Fir Poor – Intermediate Treed Wetland

CG0019 Ontario-Quebec Boreal Black Spruce Poor – Intermediate Treed Wetland

CG0022 West-Central Boreal Black Spruce – Tamarack Poor – Intermediate Treed Wetland

CG0025 Subarctic Black Spruce Poor – Intermediate Treed Wetland

Concept

M299 describes nutrient-poor to medium wetland forests and woodlands throughout the boreal region of North America. These include bog and fen woodlands as well as poor to intermediate swamps, usually developed on peat deposits. This vegetation is characterized by black spruce (*Picea mariana*) and/or tamarack (*Larix laricina*) in the tree layer, overwhelming dominance of ericaceous species in the understory and ground cover of *Sphagnum* mosses. Typical understory species include common Labrador tea (*Rhododendron groenlandicum*), leatherleaf (*Chamaedaphne calyculata*), blueberries (*Vaccinium* spp.), shrub willows (*Salix* spp.), shrub birches (*Betula* spp.), bog laurel (*Kalmia polifolia*), three-leaved false Solomon's seal (*Maianthemum trifolium*), cloudberry (*Rubus chamaemorus*), small cranberry (*V. oxycoccus*) and bog rosemary (*Andromeda polifolia*). Sheep laurel (*K. angustifolia*) and rhodora (*Rhododendron canadense*) often replace *R. groenlandicum* in Atlantic Canada. Peat mosses (*Sphagnum* spp.) dominate the ground cover, but feathermosses (esp. red-stemmed feathermoss [*Pleurozium schreberi*] and stairstep moss [*Hylocomium splendens*]) are common on dry microsites (e.g., peat hummocks).

These are generally stable ecosystems that are maintained by persistently high water tables within a cold climate. M299 occurs in boreal and subarctic climates, characterized by long, cold winters and short, cool to moderately warm summers. Mean annual temperatures in the Canadian range vary from approximately -10°C in Inuvik, Northwest Territories to >3.5°C in parts of insular Newfoundland. Mean annual precipitation generally follows a west to east gradient, increasing from <300 mm in the western subarctic to as high as 1800 mm in parts of Nova Scotia and insular Newfoundland. Substrates are usually *Sphagnum*-derived peats with nutrient regimes ranging from poor to medium, depending on local site-scale hydrology. Within a stand, hummocky microtopography associated with the growth of certain *Sphagnum* spp. provides a range of micro-scale moisture and nutrient gradients. Permafrost is a feature of subarctic and some northern boreal peatlands.

Bog woodland dominated by black spruce (*Picea mariana*) and common Labrador tea (*Rhododendron groenlandicum*) in northern Alberta.
Source: L. Allen

Black spruce (*Picea mariana*) poor swamp forest with understory dominated by common Labrador tea (*Rhododendron groenlandicum*) in northwestern Ontario.
Source: K. Baldwin

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Vegetation

Physiognomy and Structure

M299 describes boreal wetland forests and woodlands (i.e., >10% cover by trees >5 m height) that are dominated by *Picea mariana* and/or *Larix laricina*. These include bog and fen woodlands as well as poor to intermediate swamps, typically developed on peatlands. Physiognomically, the tree layer is usually evergreen or deciduous coniferous, although small amounts of cold-deciduous broad-leaved species (e.g., *Betula papyrifera, Alnus incana* or *Salix* spp.) occasionally occur. Stand density is highly variable, ranging from closed moderately productive forests to open stunted woodlands. Stands often contain trees of multiple ages that vary in height from 2 to >10 m; on poor sites trees of small stature can be >100 yr. old. Although the main tree species are *P. mariana* and *L. laricina*, *Abies balsamea* can be a significant component in the Atlantic portion of the range. Understories usually have a well-developed low or dwarf shrub layer dominated by ericaceous species. The moss layer typically consists of continuous cover of *Sphagnum* mosses, feathermosses and lichens over shallow to deep peat substrates.

Floristics

Picea mariana characterizes M299 conditions across the entire (i.e., poor to medium) nutrient spectrum of these wetland forests and woodlands. *Larix laricina* occurs where the nutrient status is enhanced, even marginally, by groundwater inputs. In eastern Canada, *Abies balsamea* is consistently present on all but the poorest sites and *A. balsamea*-dominated intermediate swamps are encountered in Atlantic Canada.

Overall species diversity is low and the understory is dominated by ericaceous shrubs. *Rhododendron groenlandicum* is ubiquitous, except in Atlantic Canada where *Kalmia angustifolia* and *R. canadense* often replace it. *Vaccinium* spp. are also common: *V. myrtilloides* throughout the Canadian range except insular Newfoundland, *V. angustifolium* in eastern Canada and *V. vitis-idaea* in the northern and western portions of the range. *V. oxycoccus*, *K. polifolia* and *Chamaedaphne calyculata* are characteristic of bog and poor fen woodlands throughout the range, as are *Rubus chamaemorus* and *Maianthemum trifolium.* On sites with slightly enhanced nutrient status (intermediate fens and poor swamps), shrub birches (*Betula* spp.) and shrub willows (*Salix* spp.), as well as *Alnus incana* (mainly in eastern Canada; see Comments), are more common. These nutrient-medium sites also support greater abundance of graminoids (especially *Carex* spp.) and, primarily in western Canada, *Equisetum* spp.

The majority of these plant communities are characterized by a moss layer that is dominated by *Sphagnum* spp. However, some of the common *Sphagnum* mosses on the poorest sites (e.g., *S. fuscum*) form dense hummocks with dry exposed tops that are covered by feathermosses (typically *Pleurozium schreberi, Hylocomium splendens* and *Ptilium crista-castrensis*) and lichens (especially *Cladina* spp.). On sites with slightly enhanced nutrient status (usually intermediate fens), the moss layer is sometimes dominated by *Aulacomnium palustre* and other brown mosses (e.g., *Tomentypnum nitens, Sanionia uncinata*).

In northern parts of the range, *Vaccinium uliginosum, Empetrum nigrum* and *Rhododendron tomentosum* are common species in bog and poor fen woodlands. In eastern Canada, *Gaultheria hispidula* is ubiquitous. In Atlantic Canada, *Abies balsamea, Ilex mucronata, Viburnum nudum* (see Comments) and *Osmundastrum cinnamomeum* are important species on sites with slightly enhanced nutrient status. Some species that are characteristic of open bogs and fens (e.g., *Sarracenia purpurea*, *Drosera* spp. and *Eriophorum* spp.; see M876 [North American Boreal & Sub-boreal Acidic Bog & Fen]) are uncommon in their M299 counterparts.

Dynamics

These 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.

Enrichment of the rooting layer, typically by groundwater flow, results in the development of fen or swamp conditions because of increased supply of oxygen and macronutrients, and reduced acidity. If decomposition rates are very slow, bogs often develop from fen conditions as peat accumulates and elevates the rooting zone above contact with groundwater influences. In these cases, unless the local hydrology changes, depth of peat tends to increase over time, further reducing nutrient availability and promoting succession to open bog conditions.

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 rise in the water table can result in tree mortality and transition to open wetland vegetation. Paludification can also accompany elevated water tables in cold or humid climates, resulting in the expansion of peatlands onto neighbouring upland sites. A drop in the water table can reverse some of these effects and sometimes promote the development of more productive treed vegetation (e.g., as described in M495 [Eastern North American Boreal Forest] and M496 [West-Central North American Boreal Forest].

Cryoturbation associated with permafrost in the northern portions of the range can also disrupt plant growth on a local scale. “Drunken forests” occur when melting permafrost creates subsidence of surface substrates supporting M299 stands.

Although fires occur on peatlands, they are infrequent and of limited extent because these sites are so wet. Consequently, stands of M299 tend to be long lived and multi-aged, with trees up to or exceeding 200 years. *Picea mariana* can establish from seed under favourable conditions (e.g., suitable seedbed) but typically self-replaces on these sites by vegetative layering. *Larix laricina* usually establishes by seed.

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Environment

M299 forests and woodlands typically develop on nutrient-poor to medium peatlands. Wetlands develop where the interaction between climate and landscape results in permanent or semi-permanent water tables at or near the soil surface. Peatlands form when the rate of plant production exceeds the rate of decomposition in a wetland environment. Local peat development is influenced by abiotic factors such as geological and hydrological conditions but, since this process is ultimately dependent on high levels of soil moisture and slow rates of plant decomposition, climate is a crucial factor affecting peatland formation. Cooler temperatures reduce rates of evapotranspiration and decomposition; as a consequence, the frequency and extent of peatlands on the landscape generally increase northward wherever level terrain and surficial conditions retain water near the land surface. When water, oxygen, nutrient and temperature regimes provide the necessary conditions for tree establishment and growth, forests and woodlands are able to develop on peatlands.

Climate

M299 occurs across the boreal zone of North America. Although bogs and fens are the dominant wetland classes (see the Canadian Wetland Classification System [CWCS]) throughout the boreal, regional differences in prevalent forms (see CWCS) are a response to climatic gradients of temperature and precipitation (as well as to variations in underlying geology and geochemistry). M299 develops within boreal and subarctic climates, characterized by long, cold winters and short, cool to moderately warm summers. Mean annual temperatures in the Canadian range vary from approximately -10°C in Inuvik, Northwest Territories to >3.5°C in parts of insular Newfoundland. Growing degree days above 5°C (GDD) vary from <600 in the subarctic to >1600 in southern Manitoba. Although some high elevation Cordilleran locations in northwestern British Columbia receive >1000 mm, mean annual precipitation generally follows a west to east gradient, increasing from <300 mm in the western subarctic to as high as 1800 mm in parts of Nova Scotia (Cape Breton Island) and insular Newfoundland.

Physiography, Geology, Topography and Soils

M299 occurs in all Canadian physiographic regions except those in the arctic and on the continental shelves. Terrain and geology (in addition to regional climate) control the distribution of wetlands on the landscape. M299 stands often occur within large wetland complexes in a mosaic with other treed and non-treed bog, fen, marsh and swamp conditions that reflect local hydrological gradients.

In the subhumid climate of west-central Canada, boreal peatlands occur only in water-collecting landscape depressions or where an external water source creates wetland conditions. Fens constitute the prevalent peatland class due to groundwater inputs and the nutrient-rich geochemistry of bedrock and glacial sediments of the Interior Plains and Cordilleran physiographic regions. In the humid climate of eastern Canada, bogs constitute the most frequent peatland class in the boreal zone. Greater precipitation and the predominantly acidic, nutrient-poor bedrock of the Precambrian Shield and Shield-derived glacial soils contribute to growth of *Sphagnum* mosses that create peat surfaces that are often raised above the surrounding water table (raised bogs). The generally humid environment of eastern Canada also contributes to paludification, giving rise to expansion of peatlands onto neighbouring upland sites. Blanket bogs occasionally develop on sloping terrain in parts of the Atlantic boreal region, where maritime climatic influences result in high levels of precipitation and atmospheric humidity.

Local to regional topography and geochemistry influence hydrological characteristics such as groundwater flow and nutrient content. For example, in the Rocky Mountain foothills of Alberta, generally calcareous tills and long gentle slopes supply nutrient-rich groundwater that supports the development of locally extensive fen woodlands and swamps. Conversely, Shield landscapes tend to comprise rolling, bedrock-controlled terrain with short drainage slopes and low relief; bedrock and glacial soils in these areas are typically acidic and nutrient-poor. Under these conditions, bogs and poor fens develop in topographic depressions; M299 forests and woodlands are often found around the margins of these basins, with non-treed conditions in the center.

Substrates are usually shallow to deep *Sphagnum*-derived peats, dominated by soils in the Organic order (according to the Canadian System of Soil Classification). *Sphagnum* mosses contribute to soil acidity by sequestering cations and releasing hydrogen ions into the immediate environment. Except in the spring, standing water is less common in M299 stands than in the mineral swamps described in M300 [North American Boreal Flooded & Rich Swamp Forest]. Nutrient regimes for forests and woodlands of M299 range from poor to medium, depending on local hydrology. Within a stand, hummocky microtopography associated with growth of certain *Sphagnum* spp. provides a range of micro-scale moisture and nutrient gradients. Where thick moss accumulations elevate the peat surface above the water table, minerotrophic groundwater may be brought to the rooting zone by the capillary action of the moss, but hummock tops often remain drier. In some cases, nutrient inputs are supplied largely by precipitation and dustfall (ombrotrophy); the poorest sites may not be able to support treed vegetation.

Permafrost is a characteristic of subarctic and some northern boreal peatlands. In the northern subarctic of central Canada, permafrost features often develop (e.g., palsas, peat plateaux and ice wedge polygons); southwards, these features occur only sporadically. Depth to permafrost affects the temperature of the active peat layer and thus, the effective growing season for peatland vegetation. Elevated permafrost features such as palsas and peat plateaux sometimes raise the peat surface above the surrounding water table, resulting in bog forms (often woodlands) surrounded by open fens.

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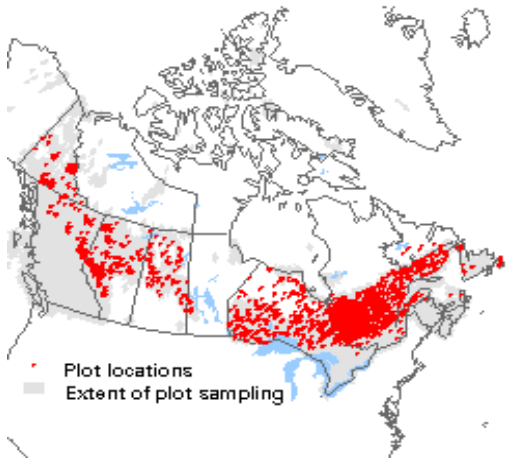
Distribution and Geographic Range

M299 wetland forests and woodlands occur throughout the entire boreal region of North America, including Alaska and the subarctic. This vegetation occurs occasionally in the northern temperate region (especially in eastern North America) where local climate, substrate and hydrological conditions create wetlands that do not support the growth of temperate species.



Related Concepts

M299 includes nutrient-poor to medium wetland forests and woodlands that have been described in provincial/territorial publications for the Boreal Low, Boreal High and Subarctic Woodland bioclimatic zones in Yukon; the Taiga Shield, Taiga Plains, Taiga Cordillera and Boreal Cordillera Level II ecoregions in Northwest Territories; the Boreal White & Black Spruce and Spruce – Willow – Birch biogeoclimatic zones in British Columbia; the Boreal Forest, Canadian Shield and Foothills natural regions in Alberta; the Boreal Shield, Taiga Shield and Boreal Plains ecozones in Saskatchewan and Manitoba plus the Hudson Plains ecozone in Manitoba; ecoregions 0E [Hudson Bay Coast], 1E [Northern Taiga Ecoregion], 2E [James Bay], 2W [Big Trout Lake], 3E [Lake Abitibi], 3W [Lake Nipigon], 3S [Lake St. Joseph] and parts of 4E [Lake Temagami], 4W [Pigeon River], 4S [Lake Wabigoon], 5E [Georgian Bay] and 5S [Agassiz Clay Plain] in Ontario; the Balsam Fir – White Birch, Spruce – Moss, Spruce – Lichen and Forest Tundra bioclimatic domains in Quebec; the Highlands ecoregion of New Brunswick; the Northern Plateau and Cape Breton Highlands ecodistricts in Nova Scotia; the Taiga and Boreal Shield ecozones in Labrador; and all of insular Newfoundland.

Boreal upland forests and woodlands are described by M495 [Eastern North American Boreal Forest], M496 [West-Central North American Boreal Forest], M156 [Alaskan-Yukon North American Boreal Forest & Woodland] and M179 [North American Northern Boreal Woodland]. Temperate wetland forests and woodlands are described by M504 [Laurentian – Acadian – North Atlantic Coastal Flooded & Swamp Forest], M028 [Great Plains Floodplain Forest], M034 [Rocky Mountain – Great Basin Montane Riparian & Swamp Forest] and M035 [Vancouverian Flooded & Swamp Forest].

Comments

M299 describes nutrient-poor to medium wetland forests and woodlands, mostly occurring on shallow to deep peat deposits, in boreal North America. These communities are characterized by *Picea mariana* and/or *Larix laricina* in the tree layer, overwhelming dominance of ericaceous species in the understory and ground cover of *Sphagnum* mosses. Nutrient-rich boreal swamp and floodplain forests, described by M300 [North American Boreal Flooded & Rich Swamp Forest], include *Populus balsamifera* and, in eastern Canada, *Fraxinus nigra* and *Thuja occidentalis* among the dominant tree species. M300 vegetation also includes a diverse suite of understory species that are characteristic of moist to wet, nutrient-rich sites (e.g., *Alnus incana, Ribes* spp., *Cornus stolonifera* and *Rubus pubescens*). M300 soils can be either organic or mineral, but peat is usually well-decomposed and typically not as deep as in M299 stands. Although overall floristics are very similar to those of M299, open boreal bogs and poor fens (i.e., <10% cover by trees >5 m height) are described separately by M876 [North American Boreal & Sub-boreal Acidic Bog & Fen].

Within M299, CNVC Groups break out four geographic subsets: CG0016 [Atlantic Boreal Black Spruce – Balsam Fir Poor – Intermediate Treed Wetland] describes these conditions in Atlantic Canada, CG0019 [Ontario-Quebec Boreal Black Spruce Poor – Intermediate Treed Wetland] in Ontario and west-central Quebec, CG0022 [West-Central Boreal Black Spruce – Tamarack Poor – Intermediate Treed Wetland] in western Canada and CG0025 [Subarctic Black Spruce Poor – Intermediate Treed Wetland] in the northern part of the range. No Group has been defined for the Alaskan-Yukon boreal region yet. Within each of these Groups, CNVC Alliances aggregate Associations that share floristic and dominance characteristics within similar nutrient regimes.

Alnus incana (grey alder) here refers to ssp. *rugosa* (speckled alder) in eastern Canada and ssp. *tenuifolia* (mountain alder) in western Canada. *Viburnum nudum* here refers to *V. nudum* var. *cassinoides* (wild raisin).

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Source Information

Number of Source Plots for M299: 2742 (Canadian National Vegetation Classification. 2015. CNVC Master Database [VPro13/MSAccess 2010 format]. Natural Resources Canada, Sault Ste. Marie, ON.)

Information Sources (data):

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Description Authors: K. Baldwin, D. Downing
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Date of Description: November, 2016

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Marécages pauvres à conifères boréaux de l'Amérique du Nord

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North American Boreal Conifer Poor Swamp

Macrogroup M299

Marécages pauvres à conifères boréaux de l'Amérique du Nord

Comparison of Vegetation Characteristics for Boreal Wetland Forest and Woodland Macrogroups

		n=2742	n=238	
Layer	**Spp**	**M299 Poor Swamp**	**M300 Floodplain and Rich Swamp**	**Common Name**
Tree	*Larix laricina*	***		tamarack
	Picea mariana	■■■■■	■■■■	black spruce
	Abies balsamea	■■■	■■■■	balsam fir
	Betula papyrifera	*	■■■■	paper birch
	Picea glauca		■■■	white spruce
	Populus balsamifera		***	balsam poplar
	Fraxinus nigra		*	black ash
	Thuja occidentalis		*	eastern white cedar
Shrub	*Betula spp.* (shrub)	***		shrub birches
	Kalmia polifolia	■■		pale bog laurel
	Chamaedaphne calyculata	■■■■		leatherleaf
	Salix spp. (shrub)	■■■	***	shrub willows
	Vaccinium myrtilloides	■■■	***	velvet-leaved blueberry
	Kalmia angustifolia	■■■■	***	sheep laurel
	Rhododendron groenlandicum	■■■■■	■■■	common Labrador tea
	Alnus incana	■■■■	■■■■■	grey alder
	Ribes glandulosum		■■■	skunk currant
	Viburnum edule		■■■	squashberry
	Cornus stolonifera		****	red-osier dogwood
	Acer spicatum		***	mountain maple
Herb/ Dwarf Shrub	*Vaccinium vitis-idaea*	***		lingonberry
	Vaccinium oxycoccos	■■		small cranberry
	Rubus chamaemorus	■■■		cloudberry
	Maianthemum trifolium	■■■	***	three-leaved false Solomon's seal
	Gaultheria hispidula	■■■	■■■	creeping snowberry
	Carex spp.	■■■	■■■■	sedges
	Rubus pubescens		■■■	dwarf raspberry
	Maianthemum canadense		■■■	wild lily-of-the-valley
	Aralia nudicaulis		■■	wild sarsaparilla
	Gymnocarpium dryopteris		**	common oak fern
Moss/Lichen	*Aulacomnium palustre*	***		ribbed bog moss
	Cladina spp.	■■■	■■	reindeer lichens
	Sphagnum spp.	■■■■■	■■■■■	peat mosses
	Pleurozium schreberi	■■■■	■■■	red-stemmed feathermoss
	Hylocomium splendens	■■■	■■■	stairstep 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%

North American Boreal Conifer Poor Swamp

Macrogroup M299

Marécages pauvres à conifères boréaux de l'Amérique du Nord

Comparison of Vegetation Characteristics for Regional Groups in M299

		n=574	n=2102	n=56	
Layer	**Spp**	**CG0022 West-Central**	**CG0019 Ontario-Quebec**	**CG0016 Atlantic**	**Common Name**
Tree	*Larix laricina*	■■■■	****		tamarack
	Picea mariana	■■■■■	■■■■■	■■■■■	black spruce
	Abies balsamea		■■■	■■■■■	balsam fir
	Betula papyrifera		***	***	paper birch
Shrub	*Betula* spp. (shrub)	■■■■			shrub birches
	Salix spp. (shrub)	■■■	■■■		shrub willows
	Chamaedaphne calyculata	***	■■■■		leatherleaf
	Rhododendron groenlandicum	■■■■■	■■■■■	■■■	common Labrador tea
	Alnus incana		■■■■		grey alder
	Kalmia polifolia		■■		pale bog laurel
	Vaccinium angustifolium		■■■	■■■	early lowbush blueberry
	Kalmia angustifolia		■■■■	■■■■	sheep laurel
	Ilex mucronata			■■■■	mountain holly
	Viburnum nudum			■■■	wild raisin
	Rhododendron canadense			■■■■	rhodora
Herb/ Dwarf Shrub	*Calamagrostis canadensis*	***			bluejoint reedgrass
	Petasites frigidus	**			arctic sweet coltsfoot
	Mitella nuda	■■			naked mitrewort
	Vaccinium vitis-idaea	■■■			lingonberry
	Vaccinium oxycoccos	■■	■■		small cranberry
	Maianthemum trifolium	■■■	■■■	***	three-leaved false Solomon's seal
	Rubus chamaemorus	■■■	■■■	■■■	cloudberry
	Carex spp.	■■■■	■■■	■■■■	sedges
	Clintonia borealis		■■	■■■■	yellow clintonia
	Maianthemum canadense		**	■■	wild lily-of-the-valley
	Osmundastrum cinnamomeum			■■■■	cinnamon fern
	Solidago macrophylla			***	large-leaved goldenrod
	Epigaea repens			**	trailing arbutus
Moss/Lichen	*Tomentypnum nitens*	■■■■			golden fuzzy fen moss
	Aulacomnium palustre	■■■			ribbed bog moss
	Cladina spp.	■■■■	■■■	****	reindeer lichens
	Sphagnum spp.	■■■■■	■■■■■	■■■■■	peat mosses
	Pleurozium schreberi	■■■■	■■■■	■■■■	red-stemmed feathermoss
	Bazzania trilobata			■■■	three-lobed whipwort

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%