



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

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Eastern North American Temperate Hardwood – Conifer Forest Forêts mixtes de la zone tempérée de l'Est de l'Amérique du Nord

Macrogroup CM014

Cool Temperate Forest & Woodland

D008 Eastern North American Forest & Woodland

CM014 Eastern North American Temperate Hardwood – Conifer Forest

CM014a Subhumid Eastern Temperate Hardwood – Conifer Forest

CM014b Humid Eastern Temperate Hardwood – Conifer Forest

CM014c Very Humid Eastern Temperate Hardwood – Conifer Forest

CM742 Eastern Canadian Temperate Deciduous Forest

CM744 Acadian Temperate Forest



Concept

CM014 describes the upland temperate forests of southeastern Manitoba, the upper Great Lakes region of Ontario, the southern Precambrian Shield areas of west-central Quebec and the Appalachian region of eastern Quebec. Forest canopies are primarily a mixture of cold-deciduous broad-leaved and evergreen coniferous species. Anthropogenic disturbance is a dominant factor in determining current forest composition and dynamics. Windthrow, ice loading and insect infestations are the most widespread forms of natural disturbance; fire is a factor in the western portion of the range. Dominant tree species include balsam fir (*Abies balsamea*), red maple (*Acer rubrum*), paper birch (*Betula papyrifera*), yellow birch (*B. alleghaniensis*), sugar maple (*A. saccharum*) and white spruce (*Picea glauca*). Eastern white cedar (*Thuja occidentalis*) is a common companion species throughout the range. Eastern white pine (*Pinus strobus*), red pine (*P. resinosa*) and northern red oak (*Quercus rubra*) are common canopy associates in the Great Lakes and western Quebec portions of the range; red spruce (*Picea rubens*) is an important secondary canopy constituent in the eastern part of the range. American beech (*Fagus grandifolia*) and eastern hemlock (*Tsuga canadensis*) are occasional in the southern part of the range east of the Great Lakes. Depending on overstory and site conditions, understory shrub and herb layers vary from dense to sparse. In addition to regenerating balsam fir, understories are generally rich in cold-deciduous broad-leaved shrubs, perennial herbs and, east of the Great Lakes, regenerating maples and yellow birch. Mountain maple (*Acer spicatum*), beaked hazelnut (*Corylus cornuta*), Canada fly-honeysuckle (*Lonicera canadensis*) and northern bush-honeysuckle (*Diervilla lonicera*) are common throughout the range. Typical herb/dwarf shrub species include bunchberry (*Cornus canadensis*), wild lily-of-the-valley (*Maianthemum canadense*), northern starflower (*Lysimachia borealis*), yellow clintonia (*Clintonia borealis*), wild sarsaparilla (*Aralia nudicaulis*) and rose twisted-stalk (*Streptopus lanceolatus*). Vernal ephemeral forbs like Carolina spring beauty (*Claytonia caroliniana*) and yellow trout lily (*Erythronium americanum*) are characteristic of maple-dominated stands east of the Great Lakes.

CM014 occurs at the northern extent of the mostly humid, continental cool temperate climate of eastern Canada, which is characterized by cool snowy winters and warm humid summers. Mean annual temperatures vary from 1°C to >5°C. Mean annual precipitation increases from (approximately) 600 mm near the Manitoba border to >1100 mm in some areas of eastern Ontario and Quebec. Rainfall significantly exceeds snowfall. Regional geologic and topographic features of the Shield and Appalachian physiographic regions produce an array of local site conditions. All parts of the range experienced late Pleistocene glaciation; soils are mostly Podzols, Brunisols and Luvisols developed in glacial surficial materials.

Three subtypes distinguish regional variation within this Macrogroup. Subtype CM014a [Subhumid Eastern Temperate Hardwood – Conifer Forest] describes temperate forests west of Lake Superior that occur in a generally drier climate with little or no presence of sugar maple, yellow birch or eastern hemlock. CM014b [Humid Eastern Temperate Hardwood – Conifer Forest] describes maple – yellow birch – balsam fir dominated forests east of the Great Lakes that contain significant presence of eastern white pine, red pine and northern red oak. CM014c [Very Humid Eastern Temperate Hardwood – Conifer Forest] describes maple – yellow birch – balsam fir dominated forests in the maritime-influenced climate of the eastern portion of the range, containing greater abundance of balsam fir and significant red spruce content.



Mixed forest with sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*) and eastern white pine (*Pinus strobus*) on Precambrian Shield terrain. Muskoka region, Ontario.
Source: S. Dobbyn, Ontario Ministry of Natural Resources and Forestry



Sugar maple (*Acer saccharum*) stand with yellow birch (*Betula alleghaniensis*), eastern white cedar (*Thuja occidentalis*) and balsam fir (*Abies balsamea*). The understory is dominated by evergreen wood fern (*Dryopteris intermedia*) and regenerating balsam fir. North of Sault Ste. Marie, Ontario.
Source: K. Baldwin



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Vegetation

Physiognomy and Structure

CM014 includes mainly upland forests with closed canopies, although woodlands can occur on very dry sites. Forest canopies can be coniferous, cold-deciduous broad-leaved (“hardwood”) or a hardwood – conifer mixture (“mixedwoods”), but CM014 forests are characteristically uneven-aged mixedwoods containing multiple species in the tree stratum. Vertical stand structure is typically multi-storied and tall conifers (especially *Pinus strobus* and *Picea glauca*) are often emergent above a hardwood canopy. Understory structure varies from dense to sparse, and is usually dominated by cold-deciduous broad-leaved shrubs, perennial herbs and tree regeneration. The bryophyte layer is typically sparse, except under conifer canopies. Fire cycles are shorter in the climatically drier subtype CM014a [Subhumid Eastern Temperate Hardwood – Conifer Forest], creating a generally higher proportion of even-aged stands with greater content of fire-adapted species. Subtypes CM014b [Humid Eastern Temperate Hardwood – Conifer Forest] and CM014c [Very Humid Eastern Temperate Hardwood – Conifer Forest] describe forests characterized by eastern temperate hardwood species in which fire is uncommon; stands are typically multi-aged and early seral conifers are relatively rare. Riparian and wetland forests and woodlands within the range of CM014 are described by M504 [Laurentian-Acadian Flooded & Swamp Forest].

Floristics

The main tree species of contemporary CM014 forests are *Abies balsamea*, *Acer rubrum*, *Betula papyrifera*, *B. alleghaniensis*, *Acer saccharum* and *Picea glauca*. Although it rarely dominates the uppermost canopy, *A. balsamea* is characteristic of CM014 forests across the entire range. East of the Great Lakes (subtypes CM014b [Humid Eastern Temperate Hardwood – Conifer Forest] & CM014c [Very Humid Eastern Temperate Hardwood – Conifer Forest]), the temperate hardwood species *A. rubrum*, *B. alleghaniensis* and *A. saccharum* often dominate forest canopies. *B. papyrifera* is common throughout the range wherever forest clearing has occurred, and in subtype CM014a [Subhumid Eastern Temperate Hardwood – Conifer Forest], *B. papyrifera* and *Populus tremuloides* are the main hardwood species overall. *Picea glauca* and *Thuja occidentalis* are common companion species throughout the range. In CM014a&b, *Pinus strobus* is a characteristic feature of the landscape, often as an emergent above hardwood canopies but sometimes as a dominant species in conifer stands. *Pinus resinosa*, *P. banksiana* and *Picea mariana* are common where fire cycles are shorter, especially in CM014a. *Picea rubens* is an important canopy associate in the eastern part of the range, especially in CM014c. In southern parts of the range to the east of the Great Lakes (CM014b&c), *Quercus rubra* and *Fagus grandifolia* are occasionally present, especially on warm microsites, and *Tsuga canadensis* persists in cool, humid locations. The pervasive history of post-settlement anthropogenic disturbance, together with approximately 100 years of aggressive fire suppression, have significantly affected the tree species composition of these forests, increasing the relative abundance of species like *A. rubrum*, *A. saccharum*, *B. papyrifera*, *Populus* spp. and *A. balsamea*, and decreasing *Pinus* spp., *Picea* spp. and *T. canadensis*.

Abies balsamea is a short-lived, late seral conifer species that can re-colonize sites following stand-replacing disturbance or invade existing early or mid-seral stands by seeding in from surrounding areas. It also maintains itself within stands where it is already established. Seeds of *A. balsamea* 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. It is highly shade tolerant, so seedlings persist under closed canopies for many years and are able to respond to release after long periods of suppression. In CM014 forests, *A. balsamea* usually occurs as a sub-canopy species in admixture with hardwoods although occasionally it forms mixed conifer stands with *Picea* spp. and/or *Pinus* spp. It is intolerant of fire, benefitting from longer fire cycles, and is generally more abundant and more frequently a canopy dominant in CM014c where maritime influences create very humid climatic conditions. Where fire cycles are shorter (especially in CM014a), *A. balsamea* is mostly an understory presence.

Betula papyrifera and *Populus tremuloides* are short-lived, early seral hardwood species that occur throughout the range following disturbance (including fire) and are often prevalent near settlements and in agricultural areas where forest clearing has occurred. After any disturbance that does not kill their roots they can reproduce vegetatively, *P. tremuloides* from root suckers and *B. papyrifera* from stump sprouts. They also produce abundant, light wind-dispersed seeds that can readily colonize mineral seedbeds exposed by disturbance. Both species grow rapidly in full light conditions but are intolerant of shade so do not replace themselves in a stand without further perturbation. *P. grandidentata* and *B. populifolia* (mainly in CM014c) occur under similar ecological circumstances in southern portions of the range. All of these species are more abundant in contemporary CM014 forests than they were historically because of extensive land clearing and other anthropogenic forest disturbances.

Acer rubrum has a very broad ecological amplitude, occupying a wide range of site conditions and successional stages. Its best growth is on moist, nutrient-rich sites, including swamps (described in M504 [Laurentian-Acadian Flooded & Swamp Forest]), but it is able to colonize dry, open sites and also maintain itself in closed circum-mesic stands. It is a moderately shade tolerant, early to mid-seral temperate hardwood species that reproduces both vegetatively and by seed. It vigorously sprouts from stumps and root suckers when stem death occurs, and is a prolific seed producer. Seedbed requirements are minimal, and it establishes an abundant bank of seedlings that can persist under closed canopies for several years. *A. rubrum* benefits from disturbances (other than fire), seeding into gaps, clearings and early seral stands of *Populus* spp. and *B. papyrifera*, and where already established, increasing its abundance by aggressive sprouting. It is longer lived than most early seral species, and may persist as a component of late successional stages in CM014 forests.



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Floristics (cont'd)

Betula alleghaniensis is a long-lived (>300 years), moderately shade tolerant temperate hardwood species that reproduces primarily by seed. It is a prolific producer of light, wind-dispersed seeds and generates heavy seed crops every few years. *B. alleghaniensis* maintains itself in closed forests by colonizing canopy gaps where fine-scale disturbances expose patches of mineral seedbeds. It also invades early seral stands with diffuse canopies (especially of *Populus* spp., *B. papyrifera* and *Acer rubrum*) by seeding in from surrounding areas. *B. alleghaniensis* occupies well-drained, nutrient-medium to rich circum-mesic sites in the upland forests of CM014b&c, but is susceptible to drought because of its shallow roots; it is tolerant of moist sites and often occurs in wetland forests (described in M504).

Acer saccharum is a long-lived (>300 years), shade tolerant, late seral temperate hardwood species that dominates uneven-aged stands on well-drained nutrient-medium to rich circum-mesic sites of CM014b&c forests. It can re-colonize sites following small-scale stand removal or invade existing early or mid-seral stands by seeding in from surrounding areas. It maintains itself within stands with an abundant bank of seedlings that can persist under closed canopies for many years and respond rapidly to release after long periods of suppression. It also reproduces vegetatively following stem death by stump and root sprouting. *A. saccharum* is intolerant of fire and, over the last 100 years, has benefited from fire suppression and a very long (>500 years) fire cycle, increasing its proportion of stand composition east of the Great Lakes. *A. saccharum* creates a dense forest canopy that excludes all but the most shade tolerant species in the understory, effectively favouring its own seedlings. Where early and mid-seral conifer species have been removed by selective logging or insect infestation, they are unable to re-establish in these forests unless disturbances open canopy gaps and remove broadleaf litter from the forest floor. *A. saccharum* is less cold hardy than are *B. alleghaniensis* and *A. rubrum*, and occurs less frequently in the northern portions of the range. *Fagus grandifolia* and occasionally a few other thermophilic tree species (e.g., *Fraxinus americana*, *Ostrya virginiana*) occur with *A. saccharum* in late seral stands on warm sites in southern stands of CM014b&c.

Picea glauca, *P. mariana* and *P. rubens* are mid- to late seral conifer species that usually occur as canopy associates in mixed stands, typically in association with hardwood species and/or *Abies balsamea*. Where there is an adequate seed supply, they can establish immediately following disturbance that exposes mineral seedbeds, often seeding into early seral stands where they persist in the understory and eventually grow into the canopy. These species are moderately shade tolerant and able to maintain themselves within stands. *P. glauca* also invades old fields. *P. glauca* occurs throughout the range and is probably much reduced in abundance due to logging and fire suppression. *P. rubens* is a temperate species that is prominent in CM014c where it is a characteristic component of these forests. *P. mariana* is most common in northwestern Ontario and the northern parts of the rest of the range, where it is promoted by more frequent fires.

Pinus strobus is a long-lived (>300 years), moderately shade tolerant, early to mid-seral temperate conifer species that reproduces only by seed. It establishes on open sites with mineral seedbeds, wherever there is an adequate seed supply. It is also able to invade existing early or mid-seral stands with diffuse canopies (especially of *Populus* spp., *Betula papyrifera* and *Acer rubrum*) by seeding in from surrounding areas. *P. strobus* is often dominant on drier sites with nutrient-poor coarse-textured or shallow soils where occasional fires occur. It is a common component of circum-mesic stands in CM014b, often towering above a hardwood canopy. With its thick bark, it is somewhat resistant to moderate-intensity surface fires and older individuals can persist in late seral stands for long periods. In mixed or hardwood stands, it is able to regenerate in canopy gaps if sufficient light and seedbed patches are available.

Pinus resinosa and *P. banksiana* are shade intolerant, early successional conifer species that often dominate even-aged, fire-originated stands. They are most prevalent on deep, dry sandy and coarse loamy soils where fire frequency is higher; exposed post-fire mineral seedbeds and full light conditions promote successful establishment of their seedlings. Both species are often able to maintain themselves in open stands on dry, nutrient-poor sites, where seeds are released from cones and germinate (in the case of *P. banksiana*) without fire. On circum-mesic sites they are succeeded by shade tolerant species. Within the range of CM014, *P. banksiana* occurs primarily west of Lake Superior (CM014a), where the shorter fire cycle promotes its perpetuation on the landscape. The combination of logging and fire suppression in the last 100 years has resulted in a significant decline in the abundance and ecological importance of all *Pinus* spp. in CM014 forests.

Tsuga canadensis is a long-lived (>300 years), very shade tolerant, late seral temperate conifer species that reproduces only by seed. It invades existing early or mid-seral stands by seeding in from surrounding areas, and also maintains itself within stands where it is already established. Seeds of *T. canadensis* 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. It is highly shade tolerant; seedlings, which cannot tolerate full sunlight until they are well established, persist under closed canopies for many years and are able to respond to release after long periods of suppression. *T. canadensis* grows on a wide variety of acidic soils, but prefers well-drained, nutrient-medium to rich moist sites, including swamps (described in M504). In the upland forests of CM014b&c, it is rarely dominant but often occurs in admixture with *Acer saccharum*, *A. rubrum*, *Betula alleghaniensis*, *B. papyrifera*, *Picea glauca*, *Thuja occidentalis* and/or *Abies balsamea*. Because of its longevity, it can persist in uneven-aged stands for hundreds of years in the absence of disturbance. *T. canadensis* abundance is much reduced in contemporary CM014 forests, mostly due to logging impacts.



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Floristics (cont'd)

Thuja occidentalis is a small, long-lived (>300 years), late seral conifer species that reproduces both by seed and by vegetative layering. It is most common on moist nutrient-rich sites including swamps (described in M504), but also occupies a variety of dry to moist, nutrient-rich upland sites where it forms a sub-canopy tree layer in association with any of the species described above. Seedlings are only moderately shade tolerant; in closed stands reproduction is primarily vegetative. *T. occidentalis* also invades old fields. *T. occidentalis* is intolerant of fire, benefitting from longer fire cycles or sites (e.g., islands) that are isolated from continuous fuel sources.

The understories of CM014 forests are typically characterized by regenerating *Abies balsamea*. In subtypes CM014b&c, where *Acer rubrum*, *A. saccharum* and *Betula alleghaniensis* are present in the overstory, regeneration of these tree species is typically abundant. When these species dominate the canopy, understories can be sparse because few other species are able to survive in the dense shade. The cold-deciduous broad-leaved shrubs *Acer spicatum*, *Corylus cornuta*, *Lonicera canadensis* and *Diervilla lonicera* are common throughout the range. The herb/dwarf shrub species *Cornus canadensis*, *Maianthemum canadense*, *Lysimachia borealis*, *Clintonia borealis* and *Aralia nudicaulis* are ubiquitous, occurring with low to high abundance on a broad spectrum of site conditions.

In CM014b&c, *Acer pensylvanicum*, *Viburnum lantanoides*, *V. nudum* and *Ilex mucronata* are important shrubs, while the forbs *Oxalis montana*, *Oclemena acuminata*, *Trillium erectum* and *T. undulatum* become increasingly common eastwards. *Phegopteris connectilis* and other ferns are found more frequently in the eastern portion of the range. Where *Acer* spp. dominate the overstory in CM014b&c, vernal ephemeral forbs like *Claytonia* spp. and *Erythronium americanum* are characteristic.

In CM014a, *Rosa acicularis* and *Alnus viridis* are important shrub species and *Vaccinium myrtilloides* and *V. angustifolium* are more common than in other parts of the overall range. *Eurybia macrophylla*, *Linnaea borealis*, *Oryzopsis asperifolia*, *Chimaphila umbellata*, *Fragaria* spp. and *Anemone quinquefolia* occur more frequently in CM014a than in other subtypes, and the feathermoss *Pleurozium schreberi* is more common and abundant. At the western edge of the CM014 range, species with Great Plains affinities occasionally occur.

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 CM014. Historically, natural disturbances included wildfires, windthrow, ice storms, pathogens and insect infestations. Since European settlement, forest harvesting, agricultural clearing, land conversion, urbanization, roadbuilding, and industrial (mainly mining and hydroelectric activities) and recreational development (e.g., cottages) have become the primary disturbance factors. With modern fire suppression, wildfire now plays a relatively minor role in the dynamics of CM014 forests, except on localized microclimatically or edaphically dry sites throughout the range and west of Lake Superior where drier macroclimatic conditions exist.

Prior to European settlement, the fire regime across the range of CM014 was likely of mixed severity, with low intensity surface fires occurring at relatively shorter intervals (typically in the spring or fall, especially on drier sites) and high intensity stand-replacing fires occurring at relatively longer intervals. Burn severity is variable within each fire, so a spatial mosaic of lightly and severely burned, as well as residual unburned, patches is typical on the post-fire landscape. Stand conditions that are characteristic of a shorter (historical) fire cycle, including prominence of *Pinus* spp., *Picea mariana* and *Quercus* spp., are described by subtypes CM014a [Subhumid Eastern Temperate Hardwood – Conifer Forest] & CM014b [Humid Eastern Temperate Hardwood – Conifer Forest]. Although most fire-originated stands are even-aged, the presence of long-lived *Pinus strobus* and *P. resinosa* survivors in CM014 forests can create a multi-aged post-fire demographic structure. Stands containing temperate hardwood species (mostly east of the Great Lakes) are generally resistant to fire (except in the early spring before “green-up”) because of the high leaf water content in tree and shrub layers. In general, the fire cycle lengthens eastward as more humid environmental conditions develop, but wildfires in all parts of the range are now usually extinguished before they grow to a large size.

Site moisture and nutrient status are important determinants of secondary succession following stand removal. On nutrient-rich mesic to moist sites, intense competition from tree saplings, shrubs and herbs immediately following windthrow, logging or land clearing limits the availability of microsites suitable for seed germination and early growth of tree seedlings; root or stump-regenerating hardwood species, such as *Populus* spp., *Acer* spp. and *Betula papyrifera*, are less affected by this competition. Where mineral seedbeds exist on nutrient-poor dry to mesic sites, light regimes are usually suitable for seed germination and growth of *Pinus* spp., *Picea* spp., *Populus* spp. and *Betula* spp. *Picea glauca*, *Thuja occidentalis* and, to a lesser extent, *Abies balsamea*, *B. papyrifera*, *Populus* spp. and *Pinus strobus* are old-field colonizers in the CM014 range. On all but the poorest sites, early seral stands are subsequently invaded by *A. balsamea*, *Acer* spp. and sometimes *Picea* spp. which seed in from adjacent undisturbed areas during mid- to late seral stages; over time (usually more than 100 years), these species can grow into the main canopy and eventually become dominant as early seral species decline.



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Dynamics (cont'd)

In the absence of stand removal, dynamics are more gradual through the process of mortality of individual or small numbers of canopy trees (gap phase replacement). Within these patches, small gaps develop in mature forests due to diseases, insects, fine-scale windthrow, ice damage or selection silviculture systems. Under these conditions, *A. balsamea*, *Acer* spp., *Picea* spp. and *Betula* spp. self-replace, either by seed or sprouting, if they were present in the pre-disturbance stand or if seed sources exist nearby. If mineral seedbeds are created by a disturbance, *Pinus strobus* seedlings can establish in these gaps and, depending on the light regime, potentially grow into the canopy. Multi-storied, multi-aged stand structures perpetuated by gap dynamics are generally characteristic of CM014 forests.

These forests are subject to a variety of diseases and insects that typically cause mortality to individual or small groups of trees but are also capable of creating changes in tree species dominance at both stand and landscape scales. Tomentosus root disease (*Inonotus tomentosus*) and Armillaria root rot (*Armillaria* spp.), widespread in forests of CM742, cause mortality of young trees and increase susceptibility of older trees to windthrow and insect attack. Hardwood trunk rot (*Phellinus igniarius*) affects *Acer* spp. and other temperate hardwood tree species. White pine blister rust (*Cronartium ribicola*), an introduced fungal pathogen, has contributed to the decline of *Pinus strobus*. Canopy presence of *Ulmus americana* is now negligible because of the introduced fungal pathogen Dutch elm disease (*Ophiostoma ulmi*). Beech scale (*Cryptococcus fagisuga*) and beech bark disease (*Neonectria faginata*) are an introduced insect-fungus complex that is causing extensive mortality of mature *Fagus grandifolia* in eastern North America.

Insects, such as eastern spruce budworm (*Choristoneura fumiferana*), hemlock looper (*Lambdina fiscellaria fiscellaria*) and forest tent caterpillar (*Malacosoma disstria*), are native to the range of CM014 and can cause extensive defoliation and mortality of their host tree species during periodic outbreaks. Gypsy moth (*Lymantria dispar*) is an introduced defoliator of temperate hardwoods, especially *Quercus* spp. and *Acer* spp. White pine weevil (*Pissodes strobi*) kills the leaders of *P. strobus* and *Picea* spp., restricting growth. Emerald ash borer (*Agrilus planipennis*) is an introduced beetle that kills all *Fraxinus* spp. that occur within the CM014 range.

In parts of the CM014 range, populations of white-tailed deer (*Odocoileus virginianus*) are large enough that browsing can alter stand composition and structure by selectively removing palatable understory shrubs, herbs and regeneration of certain tree species (e.g., *Thuja occidentalis*, *Tsuga canadensis* and most hardwood species).



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Environment

Climate

CM014 forests develop at the northernmost extent of the mostly humid, continental cool temperate climate of eastern Canada, generally characterized by cool snowy winters and warm humid summers (although drier west of Lake Superior). Temperature extremes are more moderate than those of the boreal region to the north and at higher elevations on the Gaspé peninsula. In general, the climate becomes increasingly humid eastwards, varying from subhumid at the western edge of the range (subtype CM014a [Subhumid Eastern Temperate Hardwood – Conifer Forest]) to humid in eastern Ontario and western Quebec (subtype CM014b [Humid Eastern Temperate Hardwood – Conifer Forest]) to very humid with maritime influences in eastern Quebec (subtype CM014c [Very Humid Eastern Temperate Hardwood – Conifer Forest]). On the Gaspé peninsula, CM014c occurs at low elevations below boreal and cold Acadian forests. Humidity increases, and temperatures are somewhat moderated, in the vicinity of the Great Lakes in Ontario.

Mean annual temperatures vary from approximately 1°C at the northern and western edges of the range (and at higher elevations of the Notre Dame Mountains in Gaspé) to >5°C at the southern extent of the range in east-central Ontario and the Quebec Eastern Townships. The growing season averages between approximately 1300 and 1900 growing degree days above 5°C (GDD), with the longest growing season occurring at low elevations in southern Quebec. Mean annual precipitation follows a strong eastward gradient, increasing from (approximately) 600 mm near the Manitoba border to >1100 mm in some areas of eastern Ontario and Quebec. Rainfall significantly exceeds snowfall.

Physiography, Geology, Topography and Soils

CM014 occurs primarily in the southern James and Laurentian physiographic regions of the east-central Precambrian Shield. South of the Shield, in the Appalachian physiographic region, CM014 forests occur in the Eastern Quebec Uplands, the Sutton Mountains, the Megantic Hills and at all but the highest elevations in the Notre Dame Mountains and the Chaleur Uplands of the Gaspé peninsula. In the St. Lawrence Lowlands physiographic province, CM014 forests occur east of approximately Granby, QC.

Most of the Shield landscapes in Ontario and western Quebec comprise rolling terrain containing numerous wetlands and lakes, with elevations largely below 500 mASL and local relief rarely exceeding 100 m. However, in the Abitibi Uplands of eastern Ontario and the Laurentian Highlands of Quebec the topography is considerably more rugged and dissected, with elevations up to 800 mASL. The geology consists of Precambrian sedimentary and crystalline rocks. The dominant features of the highland and mountainous areas in the Appalachian physiographic region are the Notre Dame Mountains and the Eastern Quebec Uplands, characterized by erosion resistant rocks derived from early Paleozoic mountain forming events. On the Gaspé peninsula, where elevations are highest, CM014 forests occur below approximately 400 mASL. Southwest of the Gaspé peninsula, elevations up to approximately 800 mASL in the Sutton Mountains and Megantic Hills support CM014 forests.

The entire range of CM014 was affected by late Pleistocene glaciation, and surficial landscape expression is dominated by glacial features and bedrock-controlled terrain. Till veneers (including bedrock exposures) are common on upland sites, while deeper deposits of glacial drift fill landscape depressions. This variable topography produces significant changes in local site moisture and nutrient status over short distances. Upland mineral soils are typically well to imperfectly drained Podzols or Brunisols (coarser textures) and Luvisols (finer textures), with Gleysols and some shallow peat deposits in moist, poorly drained locations.



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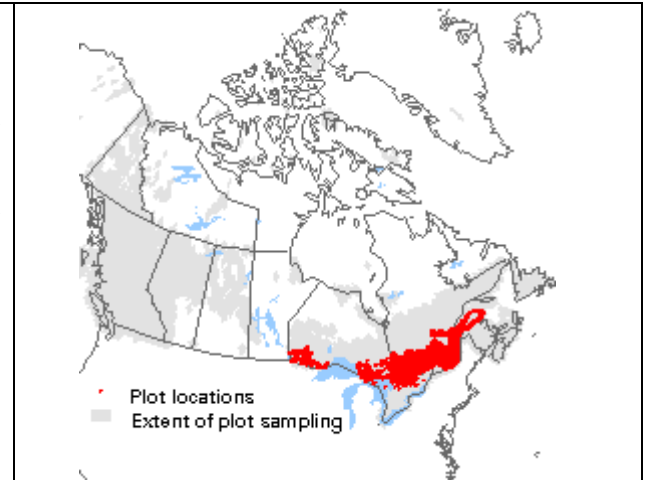
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Distribution and Geographic Range

CM014 includes the upland cool temperate forests and woodlands of southeastern Manitoba and northwestern Ontario within approximately 100 km of the international border, and of east-central Ontario and west-central Quebec south of approximately 48°N to the southern margin of the Precambrian Shield, as far east as approximately Quebec City. Its core range also includes the Saguenay and Gatineau River valleys, and the parts of Quebec south of the St. Lawrence River and east of approximately Granby. On the Gaspé peninsula, CM014 occurs around the coastal perimeter below approximately 400 mASL.



Related Concepts

CM014 includes upland forests and woodlands that have been described in provincial publications for the Balsam Fir – Yellow Birch, Sugar Maple – Yellow Birch and Sugar Maple – Basswood bioclimatic domains in Quebec, and ecoregions 4E [Lake Temagami], 4W [Pigeon River], 5E [Georgian Bay], 5S [Agassiz Clay Plain], and parts of 4S [Lake Wabigoon] in Ontario. CM014 approximates the Great Lakes – St. Lawrence Forest Region of Halliday/Rowe.

CM014 describes the Canadian expression of upland forests and woodlands that are included (in part) in USNVC M014 [Laurentian-Acadian Mesic Hardwood – Conifer Forest] and USNVC M159 [Laurentian-Acadian Pine – Hardwood Forest & Woodland].

Riparian and wetland forests and woodlands within the range of CM014 are described by M504 [Laurentian-Acadian Flooded & Swamp Forest].

Comments

CM014 describes the northernmost upland cool temperate forests of east-central Canada, characterized by a hardwood – conifer mixedwood composition with general presence of *Abies balsamea* in combination with *Betula papyrifera*, *B. alleghaniensis*, *Acer rubrum* and/or *A. saccharum*. *Pinus strobus*, *P. resinosa*, *Picea glauca* and *Tsuga canadensis* are important constituents of these forests, although much diminished on the contemporary landscape. Upland boreal forests in eastern Canada, described by M495 [Eastern North American Boreal Forest], are distinguished by general presence of *Picea mariana* and the absence of temperate species like *B. alleghaniensis*, *A. rubrum*, *A. saccharum*, *P. strobus*, *P. resinosa*, *Picea rubens* and *T. canadensis*. Understories in CM014 also include species with more southerly distributions (e.g., *Acer pensylvanicum*). South of the range of CM014, CM742 [Eastern Canadian Temperate Deciduous Forest] describes temperate hardwood forests with little conifer content and greater representation of thermophilic tree species like *Carya* spp., *Fraxinus americana*, *Fagus grandifolia*, *Quercus* spp. and *Tilia americana*. CM744 [Acadian Temperate Forest] describes temperate forests in maritime-influenced climates to the east of the range of CM014, characterized by high abundance of *A. balsamea* and *P. rubens* in combination with temperate hardwood species.



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Macrogroup CM014

Source Information

Number of Source Plots for CM014: 7705 (Canadian National Vegetation Classification. 2015. CNVC Master Database [VPro13/MSAccess 2010 format]. Natural Resources Canada, Sault Ste. Marie, ON.)

Information Sources (data):

Ministère des Ressources naturelles, de la Faune et des Parcs, Forêt Québec. 2003. Base de données des points d'observation écologique (version 2003). Gouv. du Qué., Min. des Res. nat., de la Faune et des Parcs, Forêt Qué., Dir. des inv. for., QC. (6449 plots)

McMurray, S.C., Johnson, J.A., Zhou, K., Uhlig, P.W.C. 2015. Ontario ecological land classification program - Ecological Data Repository (EDR). Ont. Min. Nat. Resour. & For., Sci. & Info. Branch, Sault Ste. Marie, ON. (1256 plots)

Concept Authors: K. Baldwin, S. Basquill, K. Chapman, M. Major, J-P. Saucier, P. Uhlig

Description Authors: K. Baldwin, J-P. Saucier, P. Uhlig

Date of Concept: November, 2016

Date of Description: April, 2019

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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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Macrogroup CM014

Comparison of Vegetation Characteristics for Eastern Temperate Forest Macrogroups

Lifeform	Species Name	n=2525	n=7705	n=4606	Species Common Name
		CM742 Deciduous	CM014 Mixed	CM744 Acadian	
Tree	<i>Tsuga canadensis</i>	****			eastern hemlock
	<i>Quercus rubra</i>	■ ■ ■ ■			northern red oak
	<i>Tilia americana</i>	■ ■ ■ ■			basswood
	<i>Fraxinus americana</i>	■ ■ ■ ■			white ash
	<i>Fagus grandifolia</i>	■ ■ ■ ■	****	****	American beech
	<i>Acer saccharum</i>	■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■	sugar maple
	<i>Acer rubrum</i>	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	red maple
	<i>Betula alleghaniensis</i>	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	yellow birch
	<i>Abies balsamea</i>	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	balsam fir
	<i>Betula papyrifera</i>	****	■ ■ ■ ■	■ ■ ■	paper birch
	<i>Picea glauca</i>	***	■ ■ ■	■ ■ ■ ■	white spruce
	<i>Pinus strobus</i>	****	****	**	eastern white pine
	<i>Picea rubens</i>		****	■ ■ ■ ■ ■ ■	red spruce
	<i>Picea mariana</i>			*****	black spruce
Shrub	<i>Cornus alternifolia</i>	**			alternate-leaved dogwood
	<i>Viburnum lantanoides</i>	***	■ ■ ■	**	hobblebush
	<i>Acer pensylvanicum</i>	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■	striped maple
	<i>Corylus cornuta</i>	■ ■ ■	■ ■ ■ ■ ■ ■	■ ■ ■	beaked hazelnut
	<i>Lonicera canadensis</i>	■ ■	■ ■	■ ■	Canada fly-honeysuckle
	<i>Acer spicatum</i>	***	■ ■ ■ ■ ■ ■	■ ■ ■	mountain maple
	<i>Diervilla lonicera</i>		■ ■ ■		northern bush-honeysuckle
	<i>Sorbus americana + S. decora</i>		■ ■ ■	**	mountain-ashes
	<i>Viburnum nudum</i>		■ ■ ■	■ ■	wild raisin
	<i>Vaccinium myrtilloides</i>		***	■ ■ ■	velvet-leaved blueberry
	<i>Kalmia angustifolia</i>			**	sheep laurel
Herb/ Dwarf Shrub	<i>Arisaema triphyllum</i>	**			Jack-in-the-pulpit
	<i>Polygonatum pubescens</i>	■ ■			hairy Solomon's seal
	<i>Maianthemum racemosum</i>	■ ■			large false Solomon's seal
	<i>Trillium erectum</i>	**	**		red trillium
	<i>Eurybia macrophylla</i>	***	■ ■ ■		large-leaved aster
	<i>Maianthemum canadense</i>	■ ■ ■	■ ■ ■ ■	■ ■	wild lily-of-the-valley
	<i>Lysimachia borealis</i>	■ ■	■ ■	■ ■	northern starflower
	<i>Streptopus lanceolatus</i>	**	■ ■	■ ■	rose twisted-stalk
	<i>Rubus pubescens</i>	**	■ ■ ■	***	dwarf raspberry
	<i>Clintonia borealis</i>		■ ■ ■	■ ■ ■	yellow clintonia
	<i>Cornus canadensis</i>		■ ■ ■	■ ■ ■	bunchberry
	<i>Oxalis montana</i>		■ ■ ■	■ ■ ■	common wood-sorrel
	<i>Coptis trifolia</i>		■ ■ ■	■ ■	goldthread
	<i>Linnaea borealis</i>		***	■ ■	twinline
	<i>Trillium undulatum</i>			■ ■	painted trillium
<i>Gaultheria hispida</i>			**	creeping snowberry	
<i>Gaultheria procumbens</i>			***	eastern teaberry	
Moss/Lichen	<i>Pleurozium schreberi</i>	**	■ ■ ■ ■	■ ■ ■ ■ ■ ■	red-stemmed feathermoss
	<i>Bazzania trilobata</i>		**	■ ■ ■	three-lobed whipwort
	<i>Hylocomium splendens</i>			■ ■ ■	stairstep 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%	



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Macrogroup CM014

Comparison of Vegetation Characteristics for Macrogroup Subtypes in CM014

Layer	Species Name	n=269	n=4061	n=3375	Common Name
		CM014a Subhumid	CM014b Humid	CM014c Very Humid	
Tree	<i>Pinus banksiana</i>	****			jack pine
	<i>Pinus resinosa</i>	■■■■■			red pine
	<i>Picea mariana</i>	■■■	****		black spruce
	<i>Pinus strobus</i>	■■■■	■■■■		eastern white pine
	<i>Populus tremuloides</i>	■■■■	****	■■■■	trembling aspen
	<i>Betula papyrifera</i>	■■■■	■■■■	■■■■	paper birch
	<i>Abies balsamea</i>	■■■■	■■■■	■■■■	balsam fir
	<i>Picea glauca</i>	■■■	■■■	■■■	white spruce
	<i>Acer rubrum</i>	■■■■	■■■■	■■■■	red maple
	<i>Acer saccharum</i>		■■■■■	■■■■■	sugar maple
	<i>Betula alleghaniensis</i>		■■■■	■■■■	yellow birch
	<i>Quercus rubra</i>			****	northern red oak
	<i>Picea rubens</i>			■■■■	red spruce
Shrub	<i>Alnus viridis</i>	***			green alder
	<i>Rosa acicularis</i>	■■			prickly rose
	<i>Vaccinium angustifolium</i>	■■	■■■		early lowbush blueberry
	<i>Diervilla lonicera</i>	■■■	■■■	***	northern bush-honeysuckle
	<i>Corylus cornuta</i>	■■■■	■■■■	■■■	beaked hazelnut
	<i>Acer spicatum</i>	■■■■	■■■■	■■■■	mountain maple
	<i>Lonicera canadensis</i>	■■	■■	■■	Canada fly-honeysuckle
	<i>Acer pensylvanicum</i>		■■■■	■■■■	striped maple
	<i>Viburnum lantanoides</i>		■■■	■■■	hobblebush
	<i>Viburnum nudum</i>		■■■	***	wild raisin
	<i>Ilex mucronata</i>		***	***	mountain holly
	<i>Taxus canadensis</i>			****	Canada yew
Herb/ Dwarf Shrub	<i>Anemone quinquefolia</i>	*			wood anemone
	<i>Mitella nuda</i>	**			naked mitrewort
	<i>Fragaria virginiana</i>	**			wild strawberry
	<i>Galium triflorum</i>	■■			three-flowered bedstraw
	<i>Chimaphila umbellata</i>	■			common pipsissewa
	<i>Oryzopsis asperifolia</i>	■■			rough-leaved mountain rice
	<i>Eurybia macrophylla</i>	■■■	■■■		large-leaved aster
	<i>Linnaea borealis</i>	■■	**	***	twinflower
	<i>Clintonia borealis</i>	■■	■■■	■■■	yellow clintonia
	<i>Streptopus lanceolatus</i>	■	■■	■■	rose twisted-stalk
	<i>Coptis trifolia</i>		■■■	■■	goldthread
	<i>Oxalis montana</i>		■■■	■■■■	common wood-sorrel
	<i>Phegopteris connectilis</i>		***	■■■	northern beech fern
	<i>Trillium erectum</i>		**	■■	red trillium
	<i>Oclemena acuminata</i>			***	whorled wood aster
	<i>Trillium undulatum</i>			**	painted trillium
<i>Osmunda claytoniana</i>			***	interrupted fern	
Moss/Lichen	<i>Pleurozium schreberi</i>	■■■■	■■■	■■■	red-stemmed feathermoss
	<i>Bazzania trilobata</i>		**	***	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%