Subarctic Woodland-Tundra

General Description

The *Subarctic Woodland-Tundra* zone covers an area of approximately 587,000 km² at the transition between boreal woodlands and arctic tundra. It forms a band of varying width that extends from the Mackenzie River delta in northwestern Northwest Territories (NWT) to the central Labrador coast. The northern boundary of the zone approximates the continental treeline. Landcover on upland sites is a mosaic of shrub tundra, scattered patches of woodland, and exposed soil and rock. Extensive wetlands (usually with active permafrost features) and numerous small water bodies occupy much of the overall landscape.

Vegetation

Upland sites exhibit a parkland mosaic of vegetation, with the treed component of landcover decreasing northward. Tree growth is favoured by warm aspects, wind-sheltered locations or sites where snow accumulates. Patches of woodland with small trees and understories of low shrubs and lichens are typical of lower slopes and sheltered valleys, while non-treed tundra communities occupy more exposed topographic positions. Woodland stands often occur as tree islands or ribbons in a shrubland matrix, where vegetative layering can maintain dense patches of stunted trees. Wind-exposed trees develop characteristic krummholtz growth forms as a result of physical damage by extreme cold and blowing snow and ice crystals. Tree physiognomy is evergreen coniferous, and woodland understories are typically dominated by cold-deciduous broad-leaved shrubs, conifer regeneration and lichens or bryophytes. Tundra vegetation is characterized by a mixture of low and dwarf shrubs, graminoids, forbs, bryophytes and lichens. Bedrock and surficial geology, as well as permafrost action, affect vegetation distribution and species composition.

In woodland communities, the dominant tree species are black spruce (*Picea mariana*) and white spruce (*P. glauca*). Black spruce is the main species on the Shield and on raised peat formations, while white spruce is more often prevalent in the western portion of the zone. Tamarack (*Larix laricina*) occurs in some stands. Balsam poplar (*Populus balsamifera*) occasionally occurs on warm moist, nutrient-rich sites, especially in river valleys.

Common woodland understory species include shrub birches (mainly arctic dwarf birch [*Betula nana*] and glandular birch [*B. glandulosa*]), black crowberry (*Empetrum nigrum*), common Labrador tea (*Rhododendron groenlandicum*), northern Labrador tea (*R. tomentosum*), bog bilberry (*Vaccinium uliginosum*), mountain cranberry (*V. vitis-idaea*) and fireweed (*Chamaenerion angustifolium*). Lichen species diversity is high, but the most common mat-forming species are reindeer lichens (*Cladina* spp.) and foam lichens (*Stereocaulon* spp.). Feathermosses, usually red-stemmed feathermoss (*Pleurozium schreberi*) or stairstep moss

(*Hylocomium splendens*), occur when tree canopies are closed. On raised peat formations, peat mosses (*Sphagnum* spp.) form part of the ground layer.

On acidic substrates (e.g., Shield-derived till), tundra vegetation typically includes shrub birches, willows (e.g., net-veined willow [*Salix reticulata*], grey-leaved willow [*S. glauca*]), black crowberry, bog bilberry, mountain cranberry, northern Labrador tea, moss campion (*Silene acaulis*), creeping sibbaldia (*Sibbaldia procumbens*), Bigelow's sedge (*Carex bigelowii*), arctic lupine (*Lupinus arcticus*), alpine bearberry (*Arctous alpina*) and, in the east, Lapland diapensia (*Diapensia lapponica*).

On dry to mesic calcareous substrates, entire-leaved mountain avens (*Dryas integrifolia*) dominates tundra vegetation, often in association with red bearberry (*A. rubra*), tufted saxifrage (*Saxifraga cespitosa*), purple mountain saxifrage (*S. oppositifolia*), Lapland rosebay (*Rhododendron lapponicum*), net-veined willow, arctic willow (*Salix arctica*) and several sedge (*Carex* spp.) and lousewort species (*Pedicularis* spp.).

On rock surfaces and snow-scoured sites (e.g., bedrock, boulders, frost-shattered rock, permafrost patterned ground, peat hummocks), lichens characterize the vegetation. Common terricolous species include reindeer lichens, clad lichens (*Cladonia* spp.), snow lichens (*Flavocetraria* spp.), whiteworm lichens (*Thamnolia* spp.), arctic butterfingers lichen (*Dactylina arctica*) and green witch's hair lichen (*Alectoria ochroleuca*). Species on rock surfaces include rocktripe lichens (*Umbilicaria* spp.) and map lichens (*Rhizocarpon* spp.).

Wetlands and small water bodies are common features on the landscape. Drainage can be impeded both by topography and by permafrost, and depressions in bedrock or frozen ground collect water throughout the growing season. In areas with near-surface water tables or that receive seepage, shallow permafrost can maintain moisture near the ground surface, promoting the establishment of hydrophytic vegetation (e.g., peat mosses) and leading to peat accumulation. Bogs and fens are the predominant wetland classes, although peat depths are usually shallow (<1m). Permafrost dynamics often result in peat formations that are raised above the water table, permitting bog islands to develop within a wetter fen matrix.

Bogs and poor fens are dominated by low or dwarf shrub species such as northern Labrador tea, mountain cranberry, bog rosemary (*Andromeda polifolia*), small cranberry (*Vaccinium oxycoccus*), cloudberry (*Rubus chamaemorus*), black crowberry and bog bilberry. On slightly richer sites, shrub birches (e.g., glandular birch, arctic dwarf birch, bog birch [*Betula pumila*]), willows (e.g., tea-leaved willow [*Salix planifolia*], diamond-leaved willow [*S. pulchra*]) or tussock cottongrass (*Eriophorum vaginatum*) are often abundant. Peat mosses dominate the moss layer, with red-stemmed feathermoss, stairstep moss or lichens on the tops of hummocks.

Shallow marshes and wetter fens are typically dominated by sedges and grasses, with willows, shrub birches and possibly stunted tamarack on slightly drier sites. Water sedge (*Carex aquatilis*) is ubiquitous in most of these communities, occurring in association with a variety of other graminoids such as creeping sedge (*C. chordorrhiza*), narrow-leaved cottongrass (*Eriophorum angustifolium*), Scheuchzer's cottongrass (*E. scheuchzeri*), tufted clubrush (*Trichophorum cespitosum*), pendant grass (*Arctophila fulva*) and Fisher's tundra grass (*Dupontia fisheri*). Mosses are prominent components of some of these communities, including peat mosses, scorpion mosses (*Scorpidium* spp.), mountain groove moss (*Aulacomnium turgidum*), yellow starry fen moss (*Campylium stellatum*) and golden fuzzy fen moss (*Tomenthypnum nitens*).

On coastal shorelines, beaches, tidal flats and salt marshes along the Hudson Bay coast, salt-tolerant species such as Hoppner's sedge (*Carex subspathacea*), creeping alkaligrass (*Puccinellia phryganodes*), arctic lymegrass (*Leymus mollis* ssp. *villosissimus*), common mare's-tail (*Hippuris vulgaris*) and Greenland silverweed (*Potentilla anserina* ssp. *groenlandica*) occur.

Climate

The climate of the *Subarctic Woodland-Tundra* zone is generally characterized by very long, cold winters and short, cool summers. Mean annual temperatures vary from approximately -10°C in Inuvik, NWT to -5°C in Labrador and southern Hudson Bay. Growing degree days above 5°C

average approximately 400 across the zone. The short growing season is enhanced by long daylengths; however frost or snow can occur any day of the year. Mean annual precipitation generally follows a west to east gradient, increasing from <300 mm in the west to approximately 800 mm in Labrador.

The subarctic environment is windy, and snow is significantly re-distributed from exposed locations. Snow cover protects vegetation from extreme winter cold and abrasion by wind-driven ice particles, and snowmelt provides moisture into the growing season. Slope, aspect and wind exposure control site-scale patterns of insolation, snow deposition and melting. Southerly and westerly aspects are warmer; snowmelt on these sites occurs earlier in the spring and microclimatic thermal conditions favour the survival of plant species at their northern range limits. Northerly aspects are cooler, and snowmelt occurs later, delaying the onset of the growing season. Consequently, there is considerable variation in the temperature, moisture and growing season length at the scale of microsites.

Physiography, Geology, Topography, Soils and Land Cover

The westernmost portion of this zone occurs primarily in the Interior Plains physiographic region, although a small part of the Mackenzie Delta is also included. The majority of the zone lies on the Precambrian Shield (Kazan, Hudson, James and Davis regions).

In the western NWT, the zone occurs on the Anderson, Horton and Great Bear Plains. These are underlain by level Paleozoic, Mesozoic and late Proterozoic sedimentary rocks. The topography is mostly a level to undulating plain with elevations <300 mASL, although there are several low elevation hills.

On the Precambrian Shield in eastern NWT, Nunavut, Manitoba, Ontario, Quebec and Labrador, elevations are generally <600 mASL. Most of the Shield landscapes are characterized by broad expanses of rolling terrain containing numerous wetlands and lakes with local relief rarely exceeding 100 m. The geology comprises Precambrian sedimentary and crystalline rocks. On the Hudson Bay Lowland, Paleozoic carbonate-rich strata overlie the Precambrian rocks creating a level plain with low relief and extensive wetlands.

The entire zone was affected by late Pleistocene glaciation, and surficial landscape expression is dominated by glacial features and bedrock-controlled terrain. The Mackenzie Delta consists of recent and ancient fluvial and fluvial-marine sediments. On the Shield and raised plateaux of the Interior Plains, shallow till veneers often overlie bedrock on upland sites, while deeper deposits of glacial drift fill landscape depressions. Tills are often modified by permafrost action on soils and frost-shattering of exposed rocks. On the Hudson Bay Lowland, raised sandy beach ridges from post-glacial isostatic recovery are interspersed with marine clays, often covered by peat. Mineral soils are typically Brunisols and Luvisols, with Gleysols and Cryosols in poorly drained locations. Peatlands dominated by Organic Cryosols are common and often extensive in poorly drained areas; peat depths can be >1 m. Numerous water bodies are a characteristic of the landscape.

Continuous permafrost is a characteristic of the subarctic, occurring in organic and fine- to medium-textured mineral soils. Permafrost creates variable patterns within the surface mineral and organic substrates. In many places, surficial expression is strongly modified by permafrost features such as sorted and non-sorted circles and stripes, hummocks, mounds, peat plateaux, pingos and palsas. Depth to permafrost affects the temperature of the active soil layer and thus, the effective growing season for vegetation.

Notes

Except in Ontario and parts of Manitoba and Quebec where it borders the coastlines of Hudson Bay and James Bay, the northern boundary of the *Subarctic Woodland-Tundra* zone is the *Low Arctic Shrub Tundra*. To the south, it adjoins the *Northern Boreal Woodland.*