

## Low Arctic Shrub Tundra



### General Description

The *Low Arctic Shrub Tundra* zone covers an area of approximately 605,000 km<sup>2</sup> in a band of varying width that extends from the Alaska border in northernmost Yukon to the western coast of Hudson Bay, and then from the eastern coast of Hudson Bay to the northern Labrador coast. The southern boundary of the zone approximates the continental treeline. Landcover on upland sites is a mosaic of patchy to continuous low vegetation and exposed soil and rock. Extensive wetlands and numerous small water bodies are common, but particularly prevalent on the coastal plains of Yukon and western Northwest Territories (NWT). Continuous permafrost actively modifies the surface expression of the landscape and significantly influences vegetation distribution.

### Vegetation

Vegetation is distributed according to micro-environmental conditions; cover can be sparse in harsh environments, grading to continuous on favourable sites. It is characterized by a mixture of low and dwarf shrubs, graminoids, forbs, bryophytes and lichens. Shrub height is dependent on wind exposure, soil conditions and winter snow cover, often exceeding 40 cm on moist, nutrient-rich sites in the southern portion of the zone. Permafrost action affects surface substrate expression, which in turn influences vegetation distribution on the landscape. Bedrock and surficial geology affect the species composition.

On dry to moist acidic mineral substrates (e.g., Shield-derived till) with some winter snow cover, vegetation is dominated by low or dwarf shrubs, including shrub birches (especially arctic dwarf birch [*Betula nana*] and glandular birch [*B. glandulosa*]), willows (e.g., net-veined willow [*Salix reticulata*], grey-leaved willow [*S. glauca*], bearberry willow [*S. uva-ursi*]), black crowberry (*Empetrum nigrum*), bog bilberry (*Vaccinium uliginosum*), mountain cranberry (*V. vitis-idaea*) and northern Labrador tea (*Rhododendron tomentosum*). Green alder (*Alnus viridis*) occurs on wind-protected moist sites, especially in the western part of the zone. Herb species include moss campion (*Silene acaulis*), creeping sibbaldia (*Sibbaldia procumbens*), Bigelow's sedge (*Carex bigelowii*), northern woodrush (*Luzula confusa*) and arctic lupine (*Lupinus arcticus*). Bryophytes include red-stemmed feathermoss (*Pleurozium schreberi*) and staircase moss (*Hylocomium splendens*).

At the southern margin of the zone (i.e., near treeline), scattered occurrences of stunted trees (especially black spruce [*Picea mariana*], white spruce [*P. glauca*], tamarack [*Larix laricina*] and balsam poplar [*Populus balsamifera*]) are found in sheltered low-elevation river valleys and on some south- or west-facing slopes where micro-topography favours the establishment of snowbeds.

On drier, more wind-exposed sites with acidic substrates (e.g., Shield-derived till), alpine bearberry (*Arctous alpina*) and, in the east, Lapland diaspensia (*Diapensia lapponica*) occur. In Labrador, hoary rock moss (*Racomitrium lanuginosum*) may be the only species on the most exposed ridges. Four-angled mountain heather (*Cassiope tetragona*) and

snowbed willow (*Salix herbacea*) are found on sites with late-melting snowbeds.

On dry to mesic calcareous substrates, entire-leaved mountain avens (*Dryas integrifolia*) dominates the vegetation 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 (*Cladina* spp.), 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 [*Sphagnum* spp.]) and leading to peat accumulation. Bogs and fens are the predominant wetland classes, although peat depths are usually shallow (<1m). Cryogenic features (e.g., low-centre polygons) are typical of wet terrain and affect the distribution of vegetation communities by influencing drainage patterns and substrate forms.

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 and shrub birches 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 usually prominent components 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*).

Coastal shorelines, beaches, tidal flats and salt marshes are dominated by salt-tolerant species such as Hoppner's sedge (*Carex subspathacea*), creeping alkaligrass (*Puccinellia phryganodes*), arctic lymegrass (*Leymus mollis* ssp. *villosissimus*), oysterleaf (*Mertensia maritima*), saltmarsh starwort (*Stellaria humifusa*), Greenland silverweed (*Potentilla anserina* ssp. *groenlandica*) and seabeach sandwort (*Honckenya peploides*).

## Climate

The climate of the *Low Arctic Shrub Tundra* zone is generally characterized by very long, cold winters and short, cool summers. Mean annual temperatures vary from approximately -11°C at the western end of the zone to -7°C in the east. Growing degree days above 5°C average <300 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 arctic 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 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 western portion of this zone occurs in parts of the Cordilleran, Arctic Coastal Plain and Interior Plains physiographic regions. The majority of the zone lies in the Kazan, James and Davis regions of the Precambrian Shield, although there is a small expression at Cape Churchill in the Hudson region.

In Yukon, the zone occurs on the Yukon Coastal Plain, in the British and northern Richardson Mountains, and on the northern portion of the Porcupine Plateau. Geology comprises Paleozoic and Mesozoic sedimentary rocks. The topography varies from rugged mountains with elevations >1000 mASL to more subdued rounded hills to a gently sloping coastal plain that reaches sea level at the Beaufort Sea. In the western NWT, the zone occurs on the Anderson and Horton Plains as well as on a portion of the Mackenzie Delta. These are underlain by level Paleozoic 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, Quebec and Labrador, elevations are generally <600 mASL, except in northern Labrador where a series of mountain ranges reach 1650 mASL. The Kazan and James Uplands exhibit characteristic Shield landscapes, with broad expanses of rolling terrain containing numerous wetlands and lakes, and local relief rarely exceeding 100 m. The Davis region includes the higher George Plateau and Labrador Highlands, containing the Torngat Mountains. Shield 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.

The majority of the zone was affected by late Pleistocene glaciation, with the exception of northern Yukon which remained unglaciated during this period (Beringia). In glaciated areas, surficial landscape expression is dominated by glacial features and bedrock-controlled terrain. In the unglaciated areas of northern Yukon, surficial materials comprise fine to coarse-textured colluvium from weathering of ancient bedrock, and fluvial or marine deposits, often covered by peat, along the coastal plain. 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. Peatlands are common and sometimes extensive in poorly drained areas; peat depths are usually <1m. Mineral and organic soils are predominantly Cryosols. Numerous small water bodies are a characteristic of the landscape.

All portions of the zone are underlain by continuous permafrost, which 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, pingos and palsas; and ice wedge, low-centre and high-centre polygons. Depth to permafrost affects the temperature of the active soil layer and thus, the effective growing season for vegetation.

### **Notes**

In inland areas, the *Low Arctic Shrub Tundra* zone is bounded to the north by the *Mid-Arctic Dwarf Shrub Tundra*. In parts of Yukon and western NWT, this zone extends to the Beaufort Sea and, in western Nunavut, it reaches the coast of the Coronation Gulf. In the central part of the zone, it is divided by Hudson Bay, where it includes the islands along the eastern shore. In eastern Quebec and Labrador the northern boundary is Ungava Bay, and its eastern boundary is the Atlantic Ocean. To the south, the

zone transitions into the *Subarctic Woodland-Tundra*, except in northern Yukon where it borders directly on the *Northern Boreal Woodland* and, at higher elevations, parts of the *Subarctic Alpine*

*Tundra* where latitudinal and elevational treelines merge.

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