

## High Arctic Sparse Tundra



### General Description

The *High Arctic Sparse Tundra* zone includes several islands at the northwestern edge of the Canadian Arctic Archipelago, covering an area of approximately 48,600 km<sup>2</sup>. The largest islands in the zone are Amund Ringnes, Ellef Ringnes, King Christian, Borden, Loughheed, Brock, Mackenzie King and Prince Patrick. Landcover is mostly exposed soil and rock, scattered patches or streaks of cryptogamic vegetation, and occasional small water bodies. This is a polar desert, with a very cold and very dry high arctic climate. Continuous permafrost actively modifies the surface expression of the landscape.

### Vegetation

Vegetation development is severely curtailed by the extreme climate, and is distributed according to micro-environmental conditions. On upland sites, the ground is mostly barren of vegetation. A cryptogamic crust of lichens, cyanobacteria and bryophytes develops in shallow depressions where there is some moisture. Within these crusts, occasional vascular plants reach heights of 2-3 cm. Continuous carpets of bryophytes and lichens, with scattered grasses, rushes and forbs up to 10 cm tall, develop on sites where snowmelt water accumulates, such as drainage channels, small troughs between permafrost soil features and moist fine-textured soils. There are no dwarf shrubs or sedge species in this zone; cushion growth forms are

common for the few forbs that occur. Permafrost action affects surface substrate expression, which in turn influences vegetation distribution on the landscape. Bedrock and surficial geology affect the species composition.

Vegetation cover is very sparse on sites that dry quickly in summer and have little or no winter snow cover. Crustose lichens dominate on soil and dead vegetation, including Wulfen's lichen (*Lecidella wulfenii*), false sunken disc lichen (*Megaspora verrucosa*), grey-rimmed firedot lichen (*Caloplaca cerina*), orange lichen (*Parvoplaca tirolensis*), tundra goldspeck lichen (*Candelariella terrigena*), unequal saucer lichen (*Ochrolechia inaequatula*), wart lichen (*Pertusaria octomela*) and pepper-spore lichen (*Rinodina terrestris*). On rock surfaces, species include rocktripe lichens (*Umbilicaria* spp.), tile lichens (*Lecidia* spp.) and map lichens (*Rhizocarpon* spp.). Occurrence of vascular plant species is restricted to widely scattered individuals of narrow alkaligrass (*Puccinellia angustata*), purple mountain saxifrage (*Saxifraga oppositifolia*), polar poppy (*Papaver dahlianum*), abbreviated bluegrass (*Poa abbreviata*) or Baffin Bay draba (*Draba corymbosa*).

On upland sites with some moisture, bryophyte mats and cryptogamic crusts include erect-fruited iris moss (*Distichium capillaceum*), mountain groove moss (*Aulacomnium turgidum*), rock mosses (*Racomitrium* spp.), frostwort (*Gymnomitrium corallioides*), alpine haircap moss (*Polytrichastrum alpinum*), flexible cow-hair moss (*Ditrichum*

*flexicaule*), smoky shield lichen (*Parmelia omphalodes*), firedot lichens (*Caloplaca* spp.) and star jelly (*Nostoc* spp.). The main vascular component consists of small clumps of alpine foxtail (*Alopecurus magellanicus*) and two-glumed rush (*Juncus biglumis*). Scattered individuals of nodding saxifrage (*Saxifraga cernua*), leafy stem saxifrage (*Micranthes foliosa*), polar poppy, northern woodrush (*Luzula confusa*), arctic woodrush (*L. nivalis*) and long-stalked starwort (*Stellaria longipes*) may also occur.

On moist to wet fine-textured soils, including floodplains, drainage channels, glaciolacustrine deposits and hill slopes where late-melting snow provides moisture, brightly coloured moss carpets often develop. Prominent mosses include golden erect-capsule moss (*Orthothecium chryseum*), rusty hook moss (*Scorpidium revolvens*), twiggy spear moss (*Warnstorfia sarmentosa*) and flexible cow-hair moss. Icegrass (*Phippsia algida*) is often the most abundant vascular plant on these sites, sometimes with scattered occurrences of nodding saxifrage, purple mountain saxifrage, polar poppy, alpine foxtail, Canada arctic draba (*Draba oblongata*) or arctic cinquefoil (*Potentilla hyparctica*). These sites occasionally accumulate a thin layer of organic matter, but wetlands are generally absent.

## Climate

The *High Arctic Sparse Tundra* zone occurs at very high latitudes (approximately 76°N to 78°N) on the northwest side of the Canadian Arctic Archipelago. The islands of the zone are permanently surrounded by sea ice and are exposed to constant winds blowing off the frozen Arctic Ocean. During summer months, cold fog further lowers temperatures on the windward sides of islands as water vapour from meltwater ponds on the sea ice condenses near the shore.

Overall, the climate is very cold and very dry, with an extremely short growing season and persistent snow for at least 10 months of the year. Mean annual temperature is approximately -20°C. The short growing season is enhanced by long daylengths; however frost or snow can occur any day of the year. Slope and aspect significantly influence growing conditions in this marginal climate. This is the driest

vegetation zone in Canada, with mean annual precipitation averaging between 90 and 120 mm. Most precipitation falls as snow.

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 in this marginal climate. On this arid landscape, late-lying snowbeds are critical sources of water for vegetation during 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

This zone lies mostly in the Inuitian physiographic region (Sverdrup Lowland), but the northwestern portions of Prince Patrick, Border, Brock, Meighen and Ellef Ringnes Islands occur in the Arctic Coastal Plain physiographic region.

Geology is dominated by level Mesozoic sedimentary rocks. Topography is mostly an undulating low-relief lowland with elevations <150 mASL, although there are a few minor uplands. The entire zone has been glaciated, either in the latest Pleistocene event or during previous glaciations. Much of the surficial landscape expression is dominated by glacial features and bedrock-controlled terrain. After the last glaciation, coastal areas were inundated. On the coastal plains, fluvial and marine sediments generally occur at elevations <60 mASL. Inland from the coastal plains, bedrock may be exposed or covered by a shallow mantle of till or colluvium. The plains and soft bedrock are often dissected by drainage networks, that now carry little water but provide sheltered microhabitats for vegetation. Organic deposits are rare and are usually confined to seepage areas below late-lying snowbeds; they

rarely exceed a few centimetres in thickness. Soils are predominantly Cryosols.

All portions of the zone are underlain by deep, continuous permafrost, which creates variable patterns within the surface mineral substrates. Ice wedge polygons are the most common permafrost feature, but sorted and unsorted circles and earth hummocks provide microrelief in some areas.

## Notes

The *High Arctic Sparse Tundra* zone is surrounded by the Arctic Ocean, except on a few islands (e.g., Prince Patrick Island) where, to the east and south, it borders the *Mid-Arctic Dwarf Shrub Tundra*.

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