

### 3.4 TUNDRA CORDILLERA HIGH SUBARCTIC (HS) ECOREGION



Martin Creek cuts deeply into shale and sandstone plateaus east of the distant Richardson Range. The Ecoregion contains elements of both the sparsely treed High Subarctic and mainly treeless Low Arctic ecoclimates; in this image looking west from the northeast corner of the Level IV Richardson Plateau HSas Ecoregion (Section 3.4.1), dark-toned conifer growth on the south-facing valley slopes indicates the influence of a High Subarctic climate.



Extensive sedge and cotton-grass fens underlain by continuous permafrost cover the lower elevation foothills and plateaus in the Tundra Cordillera HS Ecoregion. Tall shrub thickets of alder and willow are common in eroded gullies (dark green tones in background).

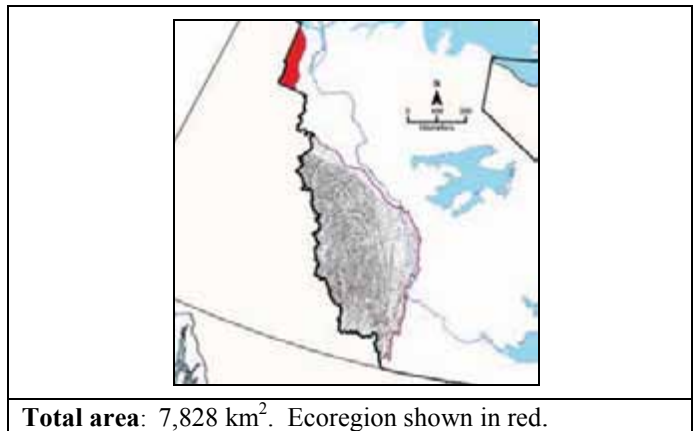


Rock cranberry is a low woody evergreen shrub that occurs throughout the Northwest Territories; its berries turn glossy red in mid-August and add splashes of colour to the tundra.

### 3.4 TUNDRA CORDILLERA HIGH SUBARCTIC (HS) ECOREGION (ecoregion label 2.3.1)\*

**Overview:** *The Tundra Cordillera HS Ecoregion is the most northerly and the coldest and driest of the Cordillera Level III Ecoregions. The Ecoregion is a landscape of tundra-dominated plateaus and low mountains between the Mackenzie Delta and the Yukon-Northwest Territories border, with a few trees in valley bottoms, lower slopes, and southern plateaus.*

\* Ecoregion labels are shown on the map in Appendix 3; refer to Section 3.1 for discussion of label assignment.



#### General Description

The Level III Tundra Cordillera HS Ecoregion includes the low mountains, plateaus and plains between the western Mackenzie Delta and the Yukon – Northwest Territories border. It is influenced by both High Subarctic and Low Arctic climates, the latter defined by the absence of trees even in sheltered locales and occurring in the far north. Elevations in the Ecoregion range from only 30 mASL on the sloping plateau along the boundary with the Mackenzie Delta west of Aklavik to over 1000 mASL in the mountains along the Yukon – Northwest Territories border. Part of the area was glaciated by the last Continental ice sheet, but the western mountains have not been glaciated for at least two million years; lower elevations are blanketed by till deposits, but upper slopes and peaks are weathered shales, sandstones and limestones. Alpine tundra or nonvegetated terrain dominates, with open subalpine woodlands at lower elevations and in valleys. Two Level IV ecoregions are defined within the Tundra Cordillera HS Ecoregion.

#### Climate

The Ecoregion's vegetation and permafrost features reflect the influence of both High Subarctic and Low Arctic climates, characterized by short, cold summers (July and August) and long, very cold winters (Ecoregions Working Group 1989). Frost probably occurs in every month especially at higher elevations and latitudes, and snowfall can also be expected every month. There are no permanent, long-term climate data collection stations in the Tundra Cordillera HS Ecoregion. Climatic statistics have been modelled over large areas using limited data from other areas; climate models at the ecodistrict level for that portion of the Tundra Cordillera HS Ecoregion within the Northwest Territories (Agriculture and Agri-Food Canada 1997) provide the following general statistics. The mean annual temperature is about  $-10^{\circ}\text{C}$ , the mean temperature in February, the coldest month, is about  $-27^{\circ}\text{C}$ , and  $16^{\circ}\text{C}$  in July, the warmest month. Mean annual precipitation is about 220 mm, with the wettest period in May through September. The mean annual daily solar input (refer to Section 1.4.2 for further explanation) is 9 to 10  $\text{mJ}/\text{m}^2/\text{day}$ , with low values of 0.1 to 0.3  $\text{mJ}/\text{m}^2/\text{day}$  in December and highs of 21.5 to 22  $\text{mJ}/\text{m}^2/\text{day}$  in June. These values are averages and are modified considerably by slope and slope aspect.

#### Topography, Geology, Soils, and Hydrology

The northern plateaus mainly occur at elevations of 500 mASL or less and are deeply dissected by numerous streams, blanketed by tills, and underlain by Mesozoic shales and sandstones. The mountains are rounded and gently ridged, reaching elevations of just over 1000 mASL, and are composed of Mesozoic and Paleozoic shales, sandstones and limestones that are often exposed at higher elevations and along valley walls. Cryoplanation terraces formed by erosion and frost action give a striking stair-like pattern to parts of the Ecoregion and are more extensive here than anywhere else in the Cordillera. Permafrost is continuous, and solifluction, frost-shattered bedrock, patterned ground, sorted and non-sorted circles, runnels and retrogressive flow slides provide abundant evidence of its influence. Cryosols are the dominant soil on the plateaus, with Regosols and weakly developed Brunisols on valley slopes and alluvial terraces; there is no soil development on frost-shattered colluvium and exposed bedrock. Seepage slopes, wetlands and small ponds are common on the plateaus.

#### Vegetation

On the plateaus, alpine and arctic tundra communities composed of sedges, cottongrasses, low shrubs and a few herbs are dominant; the disappearance of conifers in river valleys on the northernmost plateaus marks a transition to a Low Arctic climate. Krummholz colonies of spruce on south-facing slopes reach maximum elevations of less than 1000 mASL in mountain valleys along the southern boundary, and open spruce woodlands grow on the lower-elevation southern plateaus. At higher elevations, lichen crusts on bedrock and bouldery colluvium and small pocket tundra communities on finer materials in crevices and between boulders are common. Tall willow, green alder and dwarf birch shrub thickets occupy many valleys, and white spruce communities with paper birch and balsam poplar grow on south-facing slopes and on alluvial terraces below about 500 mASL.

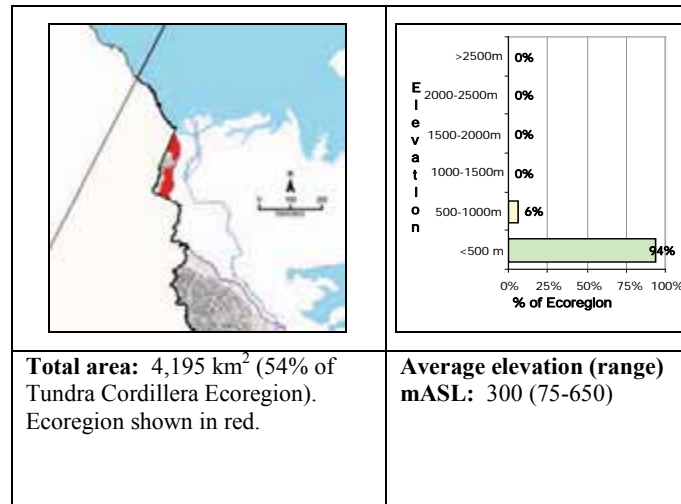
### 3.4.1 Richardson Plateau HS alpine-subalpine (as) Ecoregion (ecoregion label 2.3.1.1)\*

**Overview:** *The Richardson Plateau HSas Ecoregion is a gently sloping generally treeless plain dissected by numerous streams and dominated by alpine and arctic tundra with subalpine and subarctic woodlands and forests in the southern valleys and arctic shrublands in the northern valleys.*

**Summary:**

- Low-elevation dissected plateau between the Richardson Mountains and Mackenzie Delta.
- Dominantly arctic and alpine sedge-cottongrass tussock fens, with a few trees on the valley sides and valley floors in the southern half.

\* Ecoregion labels are shown on the map in Appendix 3; refer to Section 3.1 for discussion of label assignment.



**Total area:** 4,195 km<sup>2</sup> (54% of Tundra Cordillera Ecoregion). Ecoregion shown in red.

**Average elevation (range) mASL:** 300 (75-650)

### General Description

The Richardson Plateau HSas Ecoregion consists of two units separated by an easterly extension of the Richardson Mountains. It is bounded on the east and north by the slope break above the Mackenzie Delta, on the west by the Richardson Mountains, and on the south by a northern extension of the Peel Plain (Yukon). The Ecoregion occupies terrain mostly below elevations of 500 mASL, and is a dissected plateau with till blankets and veneers overlying shales and sandstones. The northern unit is nearly treeless arctic and alpine tundra and is transitional between High Subarctic and Low Arctic climates, with sparse tree growth only in the southern half in valley bottoms and south-facing lower slopes. The southern unit is characterized by a mostly treeless sloping plateau dissected by numerous streams and dominated by extensive arctic and alpine sedge-cottongrass tussock tundra and Krummholz black spruce on the uplands. Gullies and valley bottoms and sides are forested with white spruce, with balsam poplar and paper birch as secondary components. A sparsely treed and nearly level plateau occurs south of the Vittrekwa River. Permafrost in both subunits is continuous, as indicated by extensive patterned ground, solifluction, and polygonal peat plateaus. Slope failures from thawing permafrost are common, especially in the northern unit.

### Geology and Geomorphology

Most of the Ecoregion is a sloping plateau cut by deep valleys. Mesozoic shales and sandstones, exposed in places along rivers, underlie most of the Ecoregion. It was glaciated by the most recent Continental glaciation about 10,000 years ago and till blankets and veneers overlie bedrock (Duk-Rodkin *et al.* 2004). Retrogressive flow slides are common, especially in the smaller northern unit where permafrost is deep and continuous.

### Soils

Cryosols are dominant under sedge-cottongrass tussock tundra where permafrost is continuous. Regosols and weakly developed Brunisols are associated with somewhat warmer valley slopes and river terraces.

### Vegetation

Alpine and arctic tundra communities are dominant and are characterized by sedge and cottongrass tussock tundra with black crowberry, northern Labrador tea and a few herbs. The occurrence of trees in river valleys marks the boundary between the Low Arctic and the northern unit of the Ecoregion. Krummholz black spruce islands and very open wet black spruce – shrub – lichen woodlands occur on the southern unit. White spruce forests with birch and balsam poplar grow on the valley slopes and river terraces; forests are taller and denser on south slopes and in the southern unit. Tall willow, green alder and dwarf birch thickets are common in valleys and extend north into the treeless Low Arctic.

### Water and Wetlands

Rat River and Stony Creek originate in the Richardson Mountains to the west and flow across the southern unit of the Ecoregion to the Mackenzie Delta and the Peel River respectively. The Vittrekwa River, Stony Creek, and smaller southern tributaries occupy steep-sided deep valleys cut into shales. Many small ponds form a northwest to southeast band on the plateau terrace above the Mackenzie Delta. Wetlands are dominant on uplands, and include extensive areas of tussock sedge tundra underlain by permafrost and polygonal peat plateaus.

### Notable Features

This is the northernmost Ecoregion in the Cordillera, and the climate is influenced strongly by weather systems that approach from the Beaufort Sea.

### 3.4.1 Richardson Plateau HSas Ecoregion



The larger southern unit of the Richardson Plateau HSas Ecoregion is a gently sloping plateau with scattered trees on the uplands and denser forests in the valleys.



The smaller northern unit of the Richardson Plateau HSas Ecoregion is a deeply dissected plateau with treeless tundra on the uplands. Spruce forests grow on south-facing valley slopes, and shrublands and spruce forests grow on the alluvial terraces. The low mountains of the Richardson Mountains HSa Ecoregion lie in the distance.



Alpine and arctic tundra in the southern unit occurs near the boundary between the Richardson Plateau HSas Ecoregion and the Richardson Mountains HSa Ecoregion.



Alpine and arctic tundra in the northern unit occurs throughout the uplands; wet sedge-cottongrass tussock tundra, earth hummocks, and patterned ground are widespread and indicate a High Subarctic to Low Arctic transitional climate.

### 3.4.1 Richardson Plateau HSas Ecoregion



Subalpine woodlands with low-growing, widely spaced black spruce grow on the uplands in the southern unit. Denser forests are restricted to valleys; they are dominated by white spruce, but paper birch and balsam poplar also occur.



Subalpine white spruce forests are restricted to valleys in the northern unit; paper birch and balsam poplar are occasional.



Bedrock exposures in the Richardson Plateau HSas Ecoregion are mainly restricted to valley sides, where streams have cut down through glacial till. A sequence of thin shale and sandstone beds overlies thick dark-coloured shales in this image.

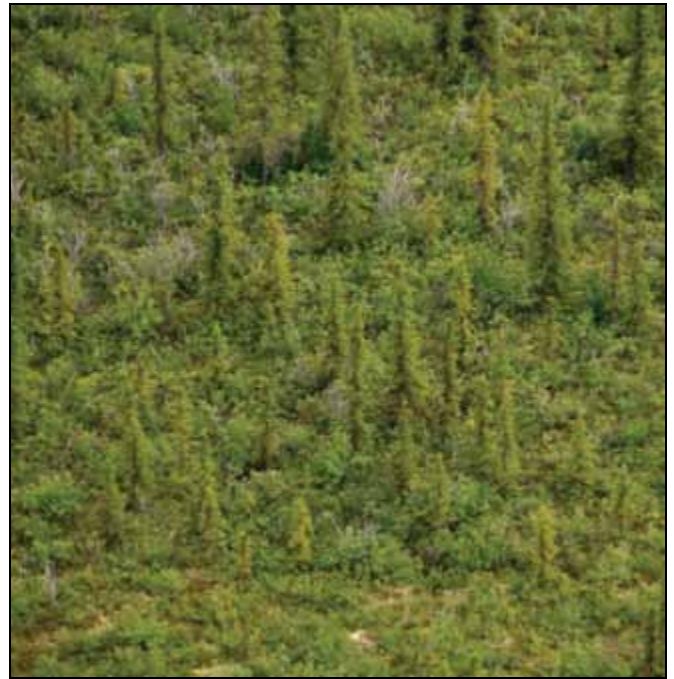


Massive slope failures occur in fine-textured shaly soils on some valley slopes. When permafrost thaws, it adds water to the soil and causes instability.

### 3.4.1 Richardson Plateau HSas Ecoregion



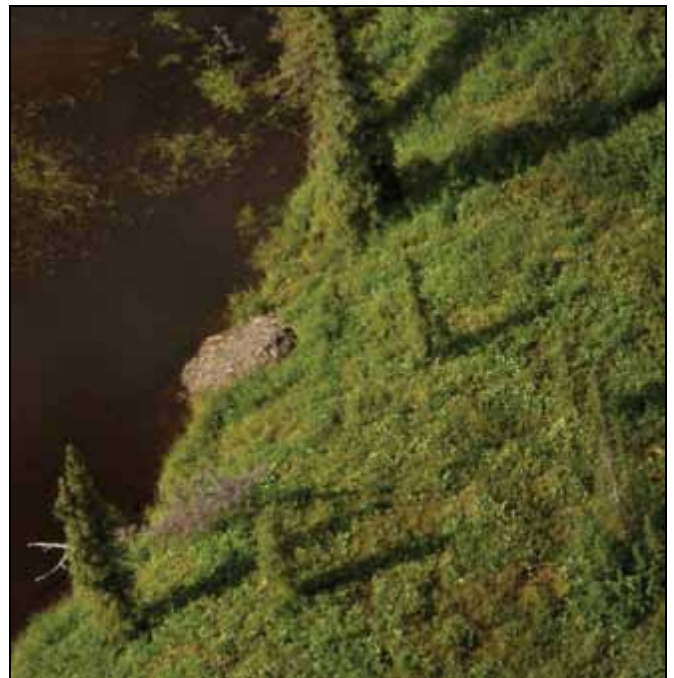
Thawing permafrost causes rapid slope failures even on very gentle slopes as shown by the semicircular flow slides. Soil also flows slowly downslope in the summer when the surface layer of permafrost thaws and produces ripples in the surface called solifluction lobes that are visible below the creek.



Woodlands on the southern unit are widely spaced low-growing black spruce with a species-poor understory of willows, dwarf birch, northern Labrador tea, a few herbs, mosses, and lichens.



Marsh ragwort grows in profusion on recently disturbed wet soils at the edges of landslides and other disturbances. Bumblebees and other insects gather pollen and nectar from these and a variety of other plants during the brief Arctic summer.



Beaver populations exist in the southern unit of the Richardson Plateau HSas Ecoregion, as shown by this beaver house along the banks of one of dozens of small ponds.

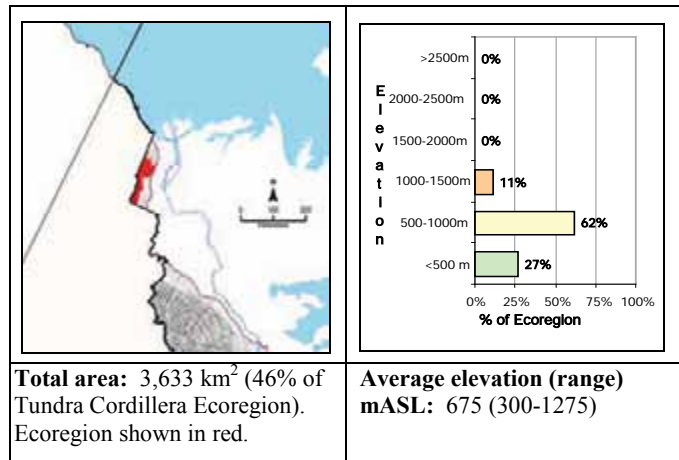
### 3.4.2 Richardson Mountains HS alpine (a) Ecoregion (ecoregion label 2.3.1.2)\*

**Overview:** *Rounded high hills and ridges with patches of arctic and alpine tundra scattered through frost-shattered bedrock and talus characterize the Richardson Mountains HSa Ecoregion.*

**Summary:**

- Dissected plateaus, rounded hills and ridges.
- Bouldery colluvium with lichen crusts on upper slopes; extensive sedge-cottongrass tussock tundra and shrub tundra associated with moist to wet fine textured soils on lower slopes; trees occur only on south slopes and in valley bottoms.

\* Ecoregion labels are shown on the map in Appendix 3; refer to Section 3.1 for discussion of label assignment.



#### General Description

The Richardson Mountains HSa Ecoregion includes the easternmost extent of the Richardson Mountains that lie mostly in the Yukon. It is about 170 km from north to south and 20 to 40 km wide. Rounded and gently ridged mountains from 500 mASL to 1000 mASL elevation occupy the centre and southern two-thirds of the Ecoregion, and gently sloping plateaus constitute the northern third. Mesozoic and Paleozoic shales, sandstones and limestones are exposed at higher elevations, but till blankets and veneers from the most recent continental glaciation cover the lower slopes. The Ecoregion is strongly influenced by both alpine and arctic climates. Higher elevations are mostly bouldery frost-shattered bedrock and colluvium, with lichen crusts and small patch communities of dwarf shrubs, mosses, and sedges. Sedge-cottongrass tussock tundra is more extensive on lower slopes where seepage is present and soils are fine textured. Tree growth is restricted to alluvial terraces and south-facing lower valley slopes. Permafrost is continuous.

#### Geology and Geomorphology

The Ecoregion includes a dissected plateau in the northern third and a series of low hills and ridges in the central and southern portions. Mesozoic and Paleozoic shales, sandstones, and limestones, often stained orange and reddish, are exposed at higher elevations and along valley walls. The most recent Continental glaciers reached the lower slopes and then receded about 20,000 years ago, leaving behind till blankets and veneers and a few rock glaciers; the higher elevations have not been glaciated for at least two million years and are part of Beringia (Duk-Rodkin 1999). Stair-like cryoplanation and pediment terraces produced by erosion and frost action are a striking feature of this Ecoregion. Continuous permafrost is indicated by the common occurrence of patterned ground, solifluction, polygonal peat plateaus, and sorted and non-sorted circles. Retrogressive flow slides that result from thawing permafrost are common especially on the northern plateau.

#### Soils

Cryosols are dominant under sedge-cottongrass tussock tundra. Regosols occur on valley slopes and river terraces and on many slopes where solifluction is active. Extensive areas of frost-shattered bedrock and bouldery talus have no soil development.

#### Vegetation

Lichen crusts are common on bedrock and bouldery colluvium, and small patch communities with dwarf shrubs, sedges, cottongrasses, and herbs occur in pockets of fine-textured materials at higher elevations. Lower slopes with fine-textured till blankets have extensive alpine-arctic shrub and sedge tundra communities; where there is seepage, sedge-cottongrass tussock tundra is often dominant. White spruce forests with birch and balsam poplar occur on alluvial terraces in the wider valleys, with open spruce-shrub woodlands and Krummholz colonies on south-facing slopes. Tall willow, green alder and dwarf birch form dense thickets in many valleys.

#### Water and Wetlands

Little Fish Creek, Almstrom Creek, Willow River, and Rat River originate in the Richardson Mts and drain to the north and east into the Mackenzie Delta. The headwaters of Stony Creek that drains into the Peel River also lie within this Ecoregion. There are several small named lakes including Horn Lake, Canoe Lake, and Miracle Lake, and a number of small lakes at the headwaters of the Rat River. Polygonal peat plateaus occur, but are uncommon.

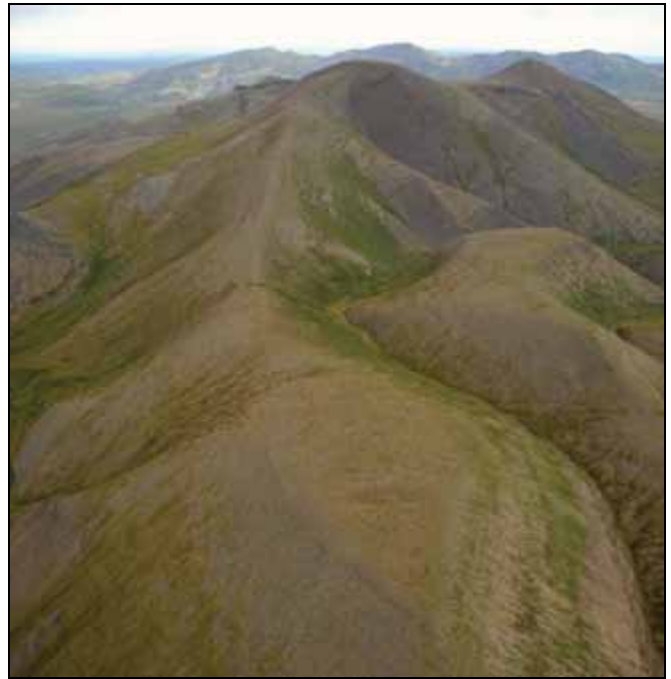
#### Notable Features

The development of cryoplanation and pediment terraces seen in the northern Richardson Mountains occurs to this extent nowhere else in the Cordillera. The Ecoregion is also the only area within the Northwest Territories that is part of Beringia, a vast unglaciated area that occupies much of the western Yukon and Alaska.

### 3.4.2 Richardson Mountains HSa Ecoregion



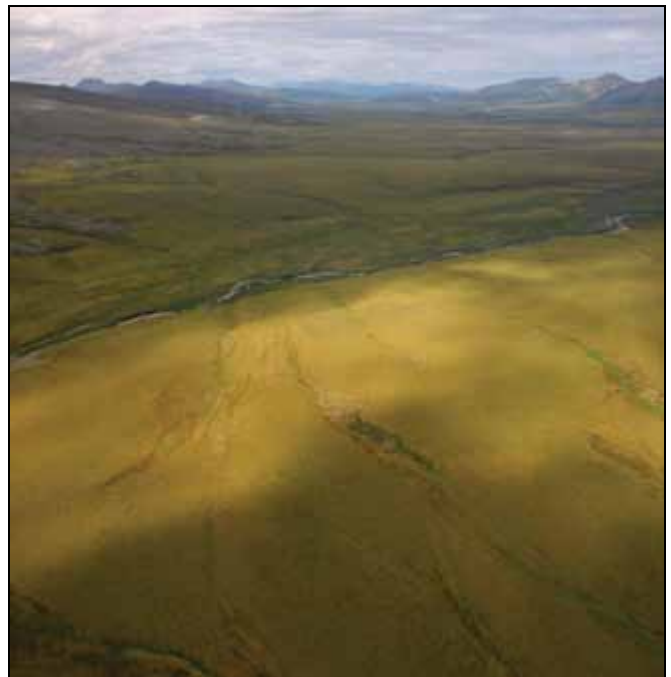
The northern third of the Richardson Mountains HSa Ecoregion is mainly a gently sloping dissected plateau with a few ridges. This view looking east toward the Mackenzie Delta down the Big Fish River shows sedge and low shrub arctic and alpine tundra on the uplands and patchy woodlands and shrublands in the valley.



Most of the Richardson Mountains HSa Ecoregion includes low, rounded mountains that are typically composed of level to gently tilted shales, sandstones and limestones that break down to coarse bouldery talus, or colluvium. Tundra is patchy and grows in areas where seepage occurs and soils are finer-textured.



The highest mountains occur in the southernmost part of the Ecoregion; the Dempster Highway angles up to the left in the upper right corner of the image. This area is considered part of Beringia, a huge area extending far to the west that has not been glaciated for at least two million years.



Treeless tundra is extensive on intermontane plateaus just east of the Yukon - Northwest Territories boundary in the southern part of the Ecoregion.

### 3.4.2 Richardson Mountains HSa Ecoregion



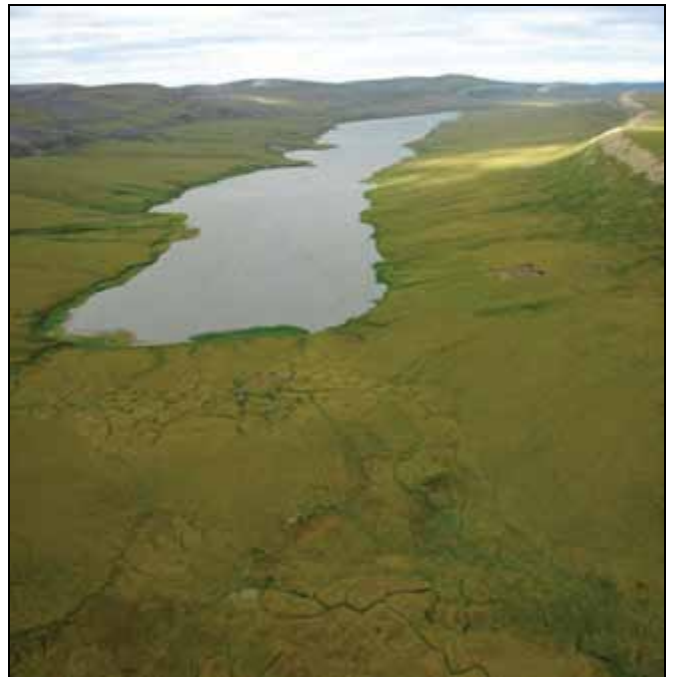
Solifluction occurs when surface layers of permafrost thaw during the summer and the saturated soil flows slowly downslope, producing lobes like those seen in the centre of this image. Solifluction is common throughout the Ecoregion.



Retrogressive flow slides also occur in association with permafrost and are more common in this Ecoregion and the Richardson Plateau HSas Ecoregion than anywhere else in the Cordillera. Fine-textured sediments become water saturated and flow downslope, tearing the tundra and exposing the permafrost that continues to thaw.



Cryoplanation terraces, produced by frost action and erosion in a climate where there is continuous permafrost, are more extensive in this Ecoregion than anywhere else in the Cordillera. The green-gold areas are moist sedge-cottongrass meadows; the gray tones are rounded lichen-covered quartzite boulders that are slowly pushed out and down by frost heaving. *Photo: J.Wilson, ENR*



This image, looking north along Canoe Lake, shows a number of geologic and permafrost features. Canoe Lake occupies an old meltwater channel where glacial rivers once flowed. High-centre polygons (rectangular cracks in the foreground) are formed by frost action in permanently frozen soil. A small retrogressive flow slide is visible above the lake in the mid-ground.

### 3.4.2 Richardson Mountains HSa Ecoregion



Bouldery colluvium with lichen crusts and patches of sedge and shrub tundra on pockets of fine-textured materials between the boulders are typical of alpine areas. Extensive wet sedge-cottongrass tussock fens impart a green tone to lower slopes in the distance.



Well-drained gravelly terraces along Scho Creek in the central portion of the Ecoregion support white spruce, balsam poplar, and paper birch forests and dense willow and alder shrublands.



Green-tinted belts of alpine tundra are associated with fine-textured shale bands that alternate with more resistant bedrock ridges and strips of bouldery colluvium. The fine undulations in the tundra belts are solifluction lobes (refer to description in upper left panel on page 40).



Extensive tundra areas in the Richardson Mountains provide good habitat for Dall's sheep.