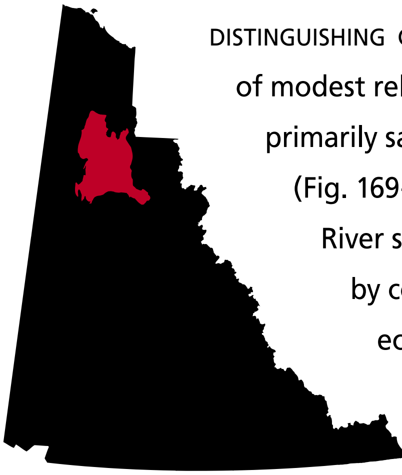
Eagle Plains

Taiga Cordillera Ecozone

ECOREGION 169



DISTINGUISHING CHARACTERISTICS: Eagle Plains Ecoregion is an intermontane basin of modest relief underlain by Devonian through Cretaceous sedimentary rocks, primarily sandstone and shale. Extensive pediments shape lower slopes (Fig. 169-1). The ecoregion drains into both the Yukon and Mackenzie River systems. Much of the area escaped glaciation, but is now underlain by continuous permafrost and periglacial features are common. This ecoregion has one of the lowest levels of mammalian diversity in the Taiga Cordillera Ecozone because habitat diversity for many species is limited.

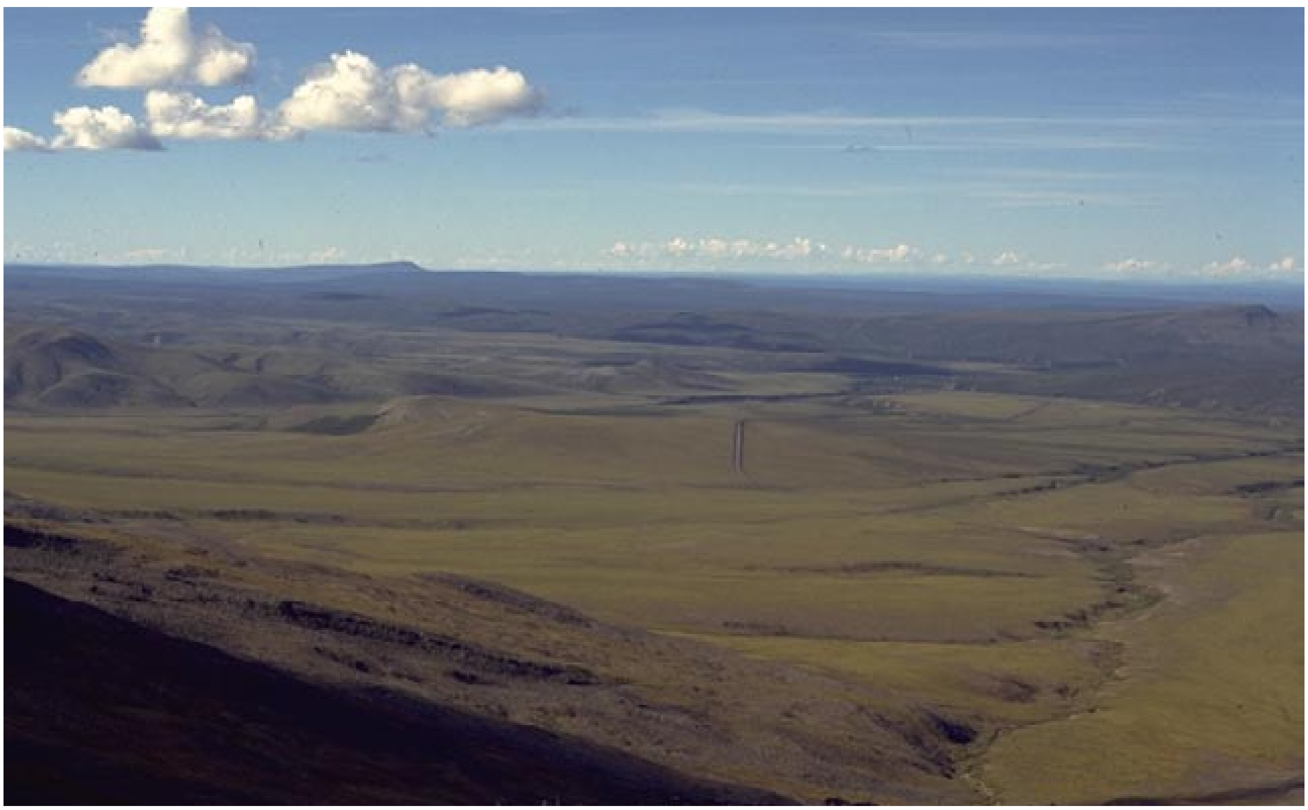


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Figure 169-1. The Eagle Plains landscape. The Eagle River valley was created from the outflow of Glacial Lake Hughes. Alluvial soils in the Eagle River valley support small stands of balsam poplar *(Populus balsamifera)* and white spruce *(Picea glauca)* forests. Mount Joyal, seen as the small peak in the horizon, is one of the higher points (925 m asl) within the ecoregion and supports alpine habitat and well-developed cryoplanation terraces.

APPROXIMATE LAND COVER
subarctic coniferous forest, 90%
mixed forest, 5%
arctic/alpine undra, 5%

TOTAL AREA OF ECOREGION IN CANADA
20,400 km^2

TOTAL AREA OF ECOREGION IN THE YUKON
20,400 km^2

ECOREGION AREA AS A PROPORTION OF THE YUKON
4%

Metres above sea level

ELEVATIONAL RANGE
250–1,110 m asl
mean elevation 560 m asl

CORRELATION TO OTHER ECOLOGICAL REGIONS: Equivalent **Eagle Plain Ecoregion** (Oswald and Senyk, 1977) • Portion of **Taiga Cordillera Region** (CEC, 1997) • Portion of **Interior Alaska/Yukon Lowland Taiga Ecoregion** (Ricketts et al., 1999)

PHYSIOGRAPHY

The Eagle Plains Ecoregion occupies the Eagle Lowland of Matthews (1986), or part of the Porcupine Plateau and Porcupine Plain as defined by Bostock (1948) and Hughes (1987).

The Eagle Plains lie between the Richardson Mountains to the east and the North Ogilvies to the west. Most of the rolling low-relief terrain lies between 300 and 600 m asl (Oswald and Senyk, 1977), although a few high points are over 1000 m asl. Both the Porcupine and Peel rivers have cut down to less than 300 m asl.

Most of the ecoregion drains north via the Whitestone, Porcupine and Eagle rivers and their tributaries to the Yukon River watershed. The southeast corner drains east via the Ogilvie, Peel and Wind rivers to the Mackenzie; however, this is probably fairly recent. The Hart, Blackstone, and Ogilvie rivers drained north to the Porcupine, but have recently been captured by the Peel River by rapid downcutting (Bostock, 1948). The walls of Aberdeen Canyon on the Peel River are about 50 m high (Fig. 169-2).

Very few lakes are found in the ecoregion except on the floodplains of the Whitestone, Porcupine and Eagle rivers. Most of these are either oxbow lakes in old meander channels or thermokarst lakes. Moose, Davis and Palmer lakes, and a few others between the Peel and Wind rivers in the glaciated part of the ecoregion, are the exception.

BEDROCK GEOLOGY

This ecoregion encompasses Devonian through Cretaceous sedimentary rocks representing an intermontane basin sandwiched between the uplifted Richardson, North Ogilvie and Dave Lord Mountain ranges. The rare outcrops are confined to downcutting streams draining into the Eagle and Rock rivers and excavations along the Dempster Highway. Over the rest of the subdued topography of the ecoregion, unvegetated areas consist of loose chips of the underlying shale and sandstone units.

The distribution of rock units at the surface is shown by Norris (1981c,e,f; 1982a,b) and the units are chronologically described by Norris (editors, 1997) and Dixon (1992). Lower- to middle

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Figure 169-2. The Aberdeen Canyon on the Peel River is cut into thickly bedded limestone overlying calcareous shale of the Hart River Formation (Carboniferous age). The gentle scarp visible in the middle distance (arrow) is the eroded face of silty deposits of Glacial Lake Hughes.

Cretaceous Eagle Plains Group, consisting of light-coloured sandstone and siltstone separated by darker shale intervals, underlies two-thirds of the ecoregion. In the central and western parts of the ecoregion, the zebra-striped patterns of these light- and dark-coloured strata outline the gently folded nature of the terrain. Beneath this unit is an erosional unconformity that systematically truncates older rock units. The gentle, southern, regional dip of the older units results in a distribution of broad bands across the southeastern and eastern third of the ecoregion. In northeast succession from the vicinity of Eagle Plains Lodge, these include the Beiderman Argillite (Lower Cretaceous), the Jungle Creek Formation (Permian), the Ettrain Formation (Upper Carboniferous), the Hart River Formation and Ford Lake Shale (Lower Carboniferous), and the Imperial Formation (Upper Devonian). Prominently exposed along the Dempster Highway are beige limestone of Hart River Formation at about km 340, conglomerate and conglomerate-rich sandstone with black shale and coal horizons of the Upper Devonian to Lower Carboniferous Tuttle Formation at km 359. Exposures of brown siltstone, sandstone and shale with nodules of the Imperial Formation exist between the Arctic Circle and the Rock River. An undivided and unnamed Paleozoic carbonate (CDb unit, now Bouvette Formation) is exposed in several thrust-cored anticlines near the Peel River.

Gentle, moderately plunging folds have north-trending axes in the western part of the ecoregion, and bend to easterly trends in the southern area. These folds and minor contraction faults developed during the Late Cretaceous Laramide Orogeny. A second, more intense regional deformation in Early Tertiary time resulted in block faulting, such as Deception Fault near the eastern edge of the ecoregion, along the geological boundary of the Richardson anticlinorium. The entire block upon which the Eagle Plains lie was displaced eastward during Early Tertiary time (Lane, 1996).

The Eagle Plains have proven hydrocarbon reserves, but no known coal or metallic mineral deposits. Three of the 11 wells drilled before an exploration moratorium in 1968 intersected porous Carboniferous and Permian sandstone in the Chance and Dagleish anticlines in the southern and southeastern part of the ecoregion. Approximate reserves in this area are $2.8 \times 10^9 m^3$ of gas and $3.1 \times 10^6 m^3$ of oil (T. Bird, *in* Hamblin, 1990).

SURFICIAL GEOLOGY

Colluvial deposits cover most of the ecoregion; the remaining areas are covered by mostly alluvial sediments along river systems with a few glaciofluvial and glaciolacustrine deposits associated with meltwater generated by glacial activity outside the ecoregion. The tectonic origin of this region has resulted in thick accumulations of colluvial deposits on ridge crests and slopes (Thomas and Rampton, 1982c). Pediment surfaces commonly have a veneer of fine colluvium generated from local upslope bedrock.

The ecoregion lies within the zone of discontinuous permafrost where permafrost is up to 200 m thick, with taliks present in major rivers (Thomas and Rampton, 1982c). Ice-wedge polygons occur in poorly drained, fine-grained soils. Modern processes include thermokarst subsidence and soil creep, cryoturbation, solifluction, and active layer detachment slides on shale.

GLACIAL HISTORY

This ecoregion is comprised dominantly of unglaciated terrain, with the exception of parts of the Nahoni Range where there is scattered evidence of a past local glaciation of undetermined age. However, glaciers outside this ecoregion have influenced the major rivers, with up to three levels of glacially controlled terraces present (Thomas and Rampton, 1982c).

Major meltwater outlets exited the eastern slopes of the North Ogilvie Mountains, near Mount Klotz and Mount Bragg, and the northern slopes of the South Ogilvie Mountains, via Ogilvie, Miner, Whitestone, Blackstone and Hart rivers, during all glacial periods known in the area. At the Late Wisconsinan maximum (ca. 30 ka; Hughes *et al.*, 1981; Schweger and Matthews, 1991), the Laurentide Ice Sheet blocked drainage of the Peel River and its southern tributaries forming Glacial Lake Hughes, and diverting the drainage northward through the Eagle River discharge channel (Duk-Rodkin and Hughes, 1995). Glacial Lake Hughes received all the water exiting the Mackenzie and Wernecke mountains and the Ogilvie, Blackstone and Hart river basins. The Eagle and Porcupine rivers were the two major contributors to the inundation of the Old Crow, Bluefish and Bell basins.

Pediment surfaces are widespread along major rivers and streams, such as the Whitestone and Ogilvie rivers and the western slopes of Richardson Mountains (Fig. 169-3). Three levels of pediments are identified in the Richardson Mountains, with ongoing development since at least the late Miocene (McNeil *et al.*, 1993; Duk-Rodkin and Hughes, 1994).

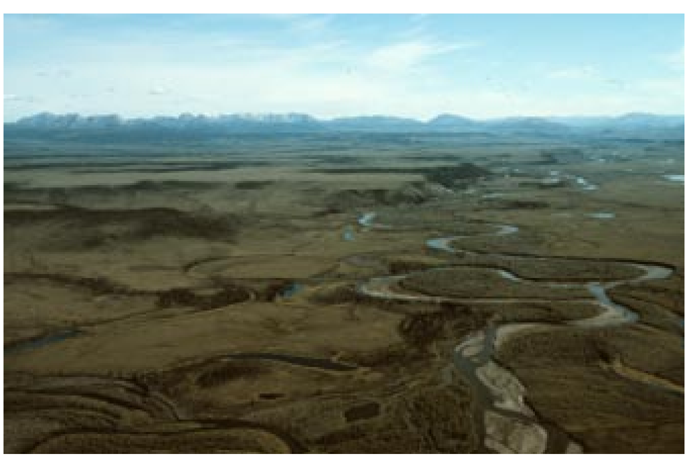
CLIMATE

Winter conditions are prolonged, usually extending from October to early May. This is due in part to the northerly latitude and the warmer south winds that infrequently erode cold air from the valleys north of the Ogilvie Mountains. This ecoregion lies near the Arctic Circle, therefore the periods of continuous sun above or below the horizon are relatively brief.

Mean annual temperatures are near –7.5°C, but there is strong seasonal variation; during the winter, there is an elevation variation though local relief is not great. Average January temperatures range from –31°C on the lower valley floors to near –25°C over the higher terrain. This is believed to be the result of relatively light winds during the winter and the settling of the coldest air in the valley bottoms. Mean July temperatures are not as dependent on elevation and are near 13°C. Extreme temperatures range from –60 to 30°C; again the extreme minimums are more common in the valley floors. Frost can occur at any time of the year.

Precipitation is moderate with annual amounts near 400 mm. Most precipitation falls as rain during the summer months, primarily in showers and thunderstorms. Mean June through August amounts are 50 to 80 mm per month. The lightest precipitation is from September through April as snow. Little to no wind data are available in this ecoregion. It is believed that winds are generally light from November to March although prolonged periods of moderate easterly winds can occur, due to predominant cells of high pressure over the northern Yukon. Frequently, strong southwesterly winds can occur as the high-pressure cells move over the central Yukon. During the summer, winds will be moderate to light and most frequently from the west or east.

Representative stations for climatic data are Eagle Plains, Parkin (closed) and, to a lesser degree, Old Crow.



A. Duk-Rodkin, Geological Survey of Canada

Figure 169-3. Pediment surfaces extend from the Richardson Mountains to the Eagle River valley, as shown above. The pediments began forming during the Late Miocene, about 5 million years ago.

HYDROLOGY

The majority of the flow out from the Eagle Plains Ecoregion is to the Porcupine River, which flows northward through the northern portion. The north-flowing Eagle River, a tributary of the Porcupine, is another large stream within the ecoregion. Intermediate Porcupine River tributary streams include the north-flowing Whitestone River and the south-flowing Johnson Creek. The ecoregion also contains the lower portion of the Rock River, which flows into the Bell River, a tributary of the Porcupine. Coverage by waterbodies is less than 1% of the ecoregion. There are no large- or intermediate-sized lakes. While there are a few upland lakes in the headwater regions of the ecoregion, the majority of waterbodies consist of lowland, oxbow lakes associated with the Porcupine and Eagle rivers. There are a few large wetlands within the Porcupine and Eagle River lowlands.

There are three historical representative hydrometric stations: Whitestone, Eagle and Porcupine rivers. Annual streamflow is characterized by an increase in discharge in April due to snowmelt leading to a peak flow in May within most ecosystem streams. Summer rain events will produce secondary peaks, and sometimes the annual peak, throughout the summer. This is especially true of smaller streams, which more frequently experience peak rainfall events. Mean annual runoff is moderately low, ranging from 173 to 233 mm with an ecosystem average of 201 mm, while mean seasonal and summer flows are likewise moderately low with values of 12×10^{-3} and 10×10^{-3} $m^3/s/km^2$, respectively (Table 2). The mean annual flood and mean maximum summer flow are moderately high and low with values of 93 X 10^{-3} and 31 X 10^{-3} $m^3/s/km^2$, respectively. The minimum annual and summer flows are relatively low with values of 3 X 10^{-3} and 20 $m^3/s/km^2$ respectively. Minimum streamflow generally occurs during March or earlier with the relative magnitude lower than most other ecoregions due to the increasing role of winter temperatures and permafrost on streamflow. Many small streams experience zero winter flows relatively frequently.

PERMAFROST

Eagle Plains Ecoregion is underlain by continuous permafrost. Ground temperature measurements at the North Cath drill site, near the border with the North Ogilvie Mountains Ecoregion, indicate permafrost thickness of 89 m (Fig. 22), but various geophysical records suggest the base of ice-bearing permafrost may be considerably deeper. Mean near-surface ground temperatures at the Eagle River bridge are –3°C (Johnston, 1980; –2.8°C in 1991–1992, Tarnocai *et al.*, 1993). Rapid permafrost aggradation has been recorded in freshly exposed sediments of Eagle River (Crampton, 1979). The active layer thickness is generally less than 1 m (Tarnocai *et al.*, 1993).

Ground ice was encountered at all sites in the ecoregion examined for granular material in association with Dempster Highway maintenance and construction (EBA, 1990a). Extensive ground-ice accumulations were delineated in near-surface horizons during drilling for the potential Dempster Highway pipeline (Michel, 1983). Examination of the isotopic characteristics of near-surface icy sediments recovered from near Eagle River indicates that the ice formed during the Wisconsinan period, when Eagle River was part of the drainage route for

S. Smith, Agriculture and Agri-Food Canada

Figure 169-4. Cross-section of a well-developed earth hummock under black spruce forest near Eagle Plains Lodge. The permafrost table undulates in a mirror image beneath the surface of the hummocks. The active layer is up to 90 cm thick under the hummock and only 30 cm thick in the mossy inter-hummock depressions (tape measure on the left). This is a good example of an Orthic Eutric Turbic Cryosol with highly cryoturbated soil horizons, typical of the soils of subarctic Canada.

M. Hoefs

Figure 169-5. Extensive black spruce–paper birch woodlands exist on well-drained uplands throughout the ecoregion.

meltwater from the Laurentide Ice Sheet to the Old Crow Basin (Michel, 1983). Ice wedges and near-surface segregated ice are the prevalent forms of ground ice.

SOILS

Soils form under a cold continental climate on the broad, gently sloping, unglaciated surfaces that characterize this ecoregion. General soil and landscape relations have been described for the ecoregion by Tarnocai *et al.* (1993).

Near-surface permafrost is extensive, and absent only from active alluvial locations and some south-facing upper slopes. On these well-drained landscape positions under open black and white spruce stands, soils are classified as Dystric Brunisols (site 3 *in* Smith *et al.*, 1990). When associated with sandstone bedrock of the Eagle Plains Group, these soils may have pH as low as 4.0 and contain large amounts of iron oxides, a reflection of long periods of weathering. In other upland sites, often at elevations just above treeline, Turbic Cryosols produce patterned ground formations including well-developed sorted and non sorted nets and stripes (site 11 *in* Tarnocai *et al.*, 1993). Turbic Cryosols associated with earth hummocks are most commonly found under open stands of black spruce, birch and larch. Active layers vary from 20 cm in the inter-hummock area to over 90 cm immediately below the hummock forms. A cross-section of a typical earth hummock near Eagle Plains Lodge is shown in Figure 169-4. Annual mean soil temperature at 50 cm depth within the earth hummocks is about –3°C (Smith *et al.*, 1998). Forest fires disrupt the thermal regime of most middle and upper slope positions, causing a lowering of the permafrost table and releasing stored frozen water. In some cases, thaw slumps are triggered, as can be seen around km 300 on the Dempster Highway.

VEGETATION

Much of the Eagle Plains Ecoregion is characterized by black spruce woodlands associated with earth hummocks. Black spruce–tussock tundra dominates the lower slopes (Zoltai and Pettapiece, 1973). At the highest elevations, over about 800 m, shrub tundra with non-sorted nets and circles occurs on plateau summits. Tussock tundra lies on level and gently sloping surfaces (Fig. 169-5).

The black and white spruce woodlands common on uplands of the Eagle Plains are typically rich in shrubs, such as Labrador tea, shrub birch, willows, alder, blueberry, rose, lowbush cranberry and spirea, over a moss and lichen groundcover. White spruce with a lichen understory is more common on better-drained sites (Russell *et al.*, 1992; Murray, 1997).

On fine-textured soils of gentle gradients and lower slopes, the black spruce–shrub tundra contains Labrador tea, shrub birch, crowberry, lingonberry and spirea (Fig. 169-6). Cottongrass tussocks dominate the groundcover, though bog cranberry, cloudberry, lichen and moss are significant. Tamarack is often a component of the canopy.

Forest fires are a significant component of the landscape ecology. Paper birch typically is the first tree species to colonize burns, although on warm, well-drained sites aspen and balsam poplar may be found (Zoltai and Pettapiece, 1973). Extensive black spruce–paper birch woodlands (Fig. 169-5) indicate the extent of old burns (Terrain Resources Ltd. 1996). Fires increase the depth of the active layer and may trigger numerous slope failures.

Willow, alder and balsam poplar colonize active alluvial deposits along the major rivers.

The shrub tundra found above 800 m is often associated with patterned ground, such as raised-centre mudboils. Shrub birch, willow and prostrate shrubs dominate the vegetation. Cottongrass tussocks are also found at higher elevations in areas of impeded drainage in the Embankment Hills.

WILDLIFE

Mammals

This ecoregion has one of the lowest levels of mammalian diversity in the Taiga Cordillera, because it does not provide suitable habitats for many of the rodent and ungulate species found elsewhere. However, many species of voles find suitable habitat here and predators such as marten, ermine and red fox are common. Barren-ground caribou of the Porcupine herd use this area primarily in the fall and winter. The herd numbered about 123,000 in 2001. Large predators such as wolf, wolverine and grizzly and black bear (Fig. 169-6) are found in low densities. Information on mammal species other than caribou is poor. Species known or expected to occur in this ecoregion are listed in Table 4.

Birds

There is key nesting habitat for Peregrine Falcon along the Porcupine and Eagle rivers (Hayes and Mossop, 1978; Peepre and Associates, 1993). Wetlands are inhabited by small numbers of Pacific and Red-throated Loons, Tundra Swan, Greater White-fronted Goose, Canada Goose, American Widgeon, Green-winged Teal, Bufflehead, Lesser Yellowlegs, Solitary Sandpiper, and Common Snipe (McKelvey, 1977; Frisch, 1987).

Common Merganser, Spotted Sandpiper, Herring and Mew Gulls, a few Bald Eagle, Belted Kingfisher, and a few Bank and Cliff Swallow colonies exist along rivers (Frisch, 1987). Swift mountain streams support breeding Harlequin Duck and American Dipper (Frisch, 1987). Riparian thickets provide breeding habitat for Willow Ptarmigan, Alder Flycatcher, Yellow Warbler, Wilson's Warbler, American Tree Sparrow, and Lincoln's Sparrow (Frisch, 1987).

J. Meikle, Yukon Government

Figure 169-6. Black bear (brown phase) with cub grazing in shrub tundra vegetation.

Upland forests provide breeding habitat for resident Northern Goshawk, Spruce Grouse, Northern Hawk Owl, Three-toed Woodpecker, Gray Jay, Common Raven, Boreal Chickadee, Pine Grosbeak, White-winged Crossbill, and Common Redpoll (Frisch, 1987). In winter, birds from higher altitudes or latitudes, including Gyrfalcon and Willow Ptarmigan, join these year-round residents (Frisch, 1987). Swainson's, Gray-cheeked, and Varied Thrushes, Bohemian Waxwing, Yellow-rumped and Blackpoll Warblers, and Dark-eyed Junco migrate north each spring to breed in these forests (Frisch, 1987). American Kestrel, Say's Phoebe, American Robin, Orange-crowned Warbler, and Chipping, Fox, and White-crowned Sparrows breed in the many forest openings and shrub habitats (Frisch, 1987). Swainson's Hawk, which is extremely rare elsewhere in the Yukon, regularly occurs in summer and is usually seen soaring over stunted spruce forest, leading to speculation that they may nest in the area.

Alpine tundra supports low numbers of Golden Eagle and Rock Ptarmigan and is probably used in summer by small numbers of Horned Lark, American Pipit, and Gray-crowned Rosy Finch (Frisch, 1987). Upland Sandpiper and Townsend's Solitaire breed in the subalpine zone (Frisch, 1987).