Old Crow Basin

Taiga Cordillera Ecozone

ECOREGION 166

DISTINGUISHING CHARACTERISTICS: This ecoregion is a large physiographic basin with pediment and upland topography surrounding the Old Crow Flats Ecoregion. The ecoregion was left unglaciated during the Pleistocene, but much of the lower elevations were submerged under Glacial Lake Old Crow. The glacial lake formed when Laurentide ice blocked the former drainage outlet of the ecoregion, which was eastward to the Mackenzie Delta. This ultimately changed the direction of flow of the Porcupine River westward into Alaska and on to the Bering Sea via the Yukon River. The ecoregion contains spring and fall migration routes of the Porcupine caribou herd.

J. Meikle, Yukon Government

Figure 166-1. Confluence of the Bell and Eagle rivers. View eastward into the foothills of the Richardson Mountains, showing the extensive lowlands with thick accumulation of peat. Alluvial sites along the rivers are colonized by willow and white spruce. The ecoregion is underlain by continuous permafrost.

APPROXIMATE LAND COVER
subarctic coniferous forest, 60%
alpine/arctic tundra, 30%
lakes and wetlands, 10%

TOTAL AREA OF ECOREGION IN CANADA
14,590 km^2

TOTAL AREA OF ECOREGION IN THE YUKON
14,590 km^2

ECOREGION AREA AS A PROPORTION OF THE YUKON
3%

ELEVATIONAL RANGE
300–1,080 m asl
mean elevation 450 m asl

CORRELATION TO OTHER ECOLOGICAL REGIONS: Equivalent to **Old Crow Basin** (excluding Old Crow Flats) and **Berry Creek Ecoregions** (Oswald and Senyk, 1977) • Equivalent to **Old Crow Basin Ecoregion** excluding Old Crow Flats (Wiken et al., 1981) • Portion of **Alaskan Boreal Interior Region** (CEC, 1997) • Portion of the **Interior Alaska/Yukon Lowland Ecoregion** (Ricketts et al., 1999)

PHYSIOGRAPHY

The Old Crow Basin Ecoregion incorporates the Old Crow Pediplain, Old Crow Range and Bell River section of the Eagle Lowland physiographic units of Matthews (1986). The ecoregion is part of the Porcupine Plain and Plateau (Bostock, 1948). It includes the Old Crow Mountains, part of the Porcupine Plain, and the higher parts of the Old Crow, Bell and Bluefish basins (Hughes, 1987b).

The terrain is a uniform, gently sloped surface extending from the mountains down to the Old Crow Flats and the Porcupine River and its tributaries (Fig. 166-1). It is surrounded by the Keele Range and Dave Lord Range to the south, the Richardsons to the east and the British Mountains to the north.

Most of the ecoregion lies between 300 and 600 m asl. Only the Old Crow Range and a few other hills in the north rise higher. The highest point is in the Old Crow Range, just over 1,000 m asl.

BEDROCK GEOLOGY

Thick Tertiary and Quaternary lacustrine and fluvial sediments up to 1,200 m thick underlie all of the Old Crow Basin except a single exposure of Carboniferous shale near the mouth of Timber Creek (Morrell and Dietrich, 1993). The surrounding elevated areas are structural uplifts or resistant granite; some rivers have incised to bedrock. Large areas of outcrop are shown on regional geological maps by Norris (1981b,c,d) and the general distribution of rocks beneath the covering sediments by Wheeler and McFeely (1991).

Beneath the Old Crow Basin and the northern Old Crow Flats are a succession of transgressive passive margin deposits of the Endicott Group and stable shelf carbonate of the Lisburne Group (Norris [editors], 1997). Undated granite intrudes the Yukon–Alaska border northwest of the Old Crow Basin as Mount Ammerman. South of the Old Crow Basin and north of the Porcupine River are unnamed varicoloured clastic and carbonate rocks. These areas are cored by granitic intrusions of Middle Devonian age. The southeast lobe of the Old Crow Flats Ecoregion extends across the Aklavik Arch, where the rock succession contains unconformities between Carboniferous, Permian, Jurassic and Cretaceous rocks, indicating numerous periods of uplift. It includes part of the Bell Basin, beneath which is the structural intersection of northeast- and east-trending folds and thrusts with the north-trending Richardson Mountains (Lane, 1996). Here, river canyons expose dark clastic sedimentary rocks of the Permian Jungle Creek and Takhandit formations, the Jurassic-to-Cretaceous Parsons Group and the upper Cretaceous Eagle Plains Group.

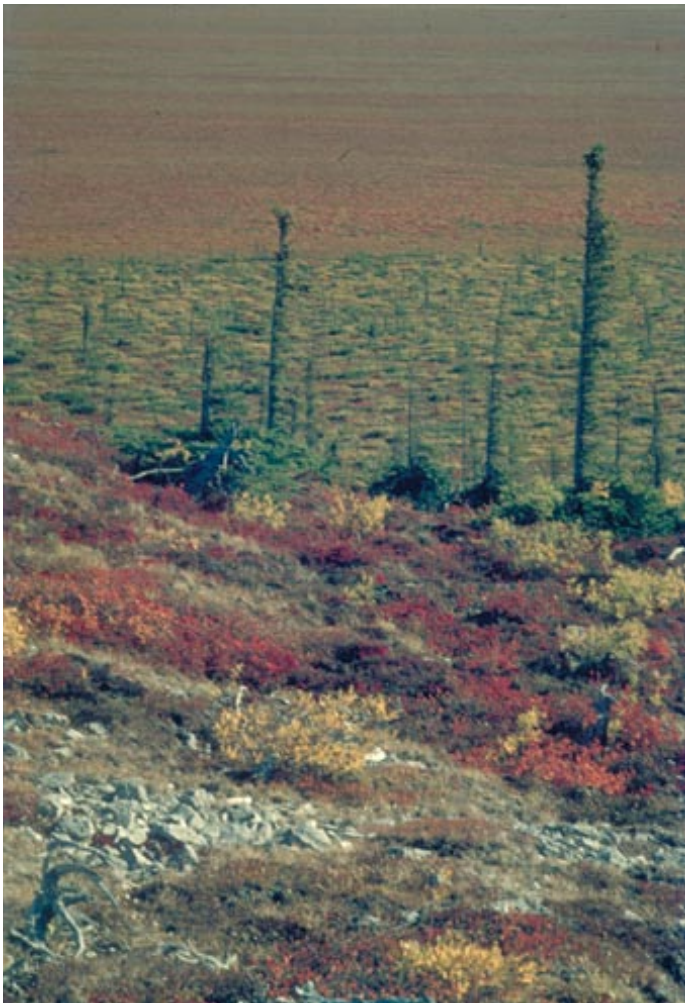
Few mineral occurrences are known here. In the Old Crow Range, lead and zinc of Sunaghun showing (Yukon MINFILE, 2001) and tungsten of the Scheelite occurrence are found in the granitic rocks. Uranium, lead and zinc are found in the Dave Lord stock (Carswell occurrence). Copper and uranium in Carboniferous rocks were investigated near the Driftwood River. Hydrocarbon potential has been tested near Whitefish Lake in the Bell Basin (Lane, 1996) and shale-like lignite is exposed nine kilometres east of Old Crow village.

The caves on the Blue Fish River, which are of much archeological importance (Cinq-Mars, 1990), are part of a widespread paleokarst developed in the Devonian Ogilvie Formation.

SURFICIAL GEOLOGY AND GEOMORPHOLOGY

This ecoregion is formed mainly of gently sloping pediment surfaces that surround the Old Crow Flats. Colluvium covers approximately four-fifths of the ecoregion (Fig. 166-2). It derives from millions of years of weathering throughout the Late Tertiary and Quaternary in the surrounding mountains. Plateau and low relief uplands are characterized by broad valleys and at least two levels of pediments.

Surficial deposits are weathered rock or fine-textured colluvium up to a few metres thick on slopes (Hughes, 1969b). This colluvium tends to be silty and clayey on pediment surfaces. On steep slopes it is gravelly to blocky overlying carbonate bedrock, platy when overlying argillite, and blocky overlying limestone and quartzite. The pediment width ranges from 5 to 10 km along the northern side of the ecoregion, where they border calcareous rocks. Pediments are developed on shale, siltstone and sandstone in the east of the ecoregion, on granite in the west, and on carbonates in the north and southwest. The depressions and seepage lines are often covered by thicker organic material. Where there is no well-defined drainage channel, a feathered drainage pattern is enhanced



M. Hoefs

Figure 166-2. Between the Old Crow Flats and the British Mountains is the Old Crow Pediplain, which includes some of the limited outcropping in the ecoregion. This area is characterized by extensive gently sloping pediment surfaces, formed by millions of years of weathering.

by vegetation growth. Well-defined meandering channels are less common (Wiken *et al.*, 1981).

Glaciolacustrine deposits and alluvial deposits cover the remainder of the ecoregion (Hughes *et al.*, 1973).

GLACIAL HISTORY

This ecoregion is located within the unglaciated terrain of the northern Yukon. However, the eastern part of this ecoregion in the lower Bell River area contains glaciolacustrine sediments over 30 m thick. These sediments record the eastern part of Glacial Lake Old Crow, which formed when the Late Wisconsinan Laurentide Ice Sheet blocked drainage of the Porcupine and Rock rivers to the east and the Peel River to the south. This diverted the Mackenzie region drainage across the continental divide about 30,000 years ago (Lemmen *et al.*, 1994; Duk-Rodkin and Hughes, 1995; see Old Crow Flats Ecoregion). In the Bell Basin, faint shoreline traces indicate that the glacial lake was more extensive than the lacustrine sediment distribution in the basin.

These sediments reveal a complex history related to the drainage dynamics in the paleo-Porcupine River Valley, now occupied by the upper Bell River and its continuation on the eastern side of the Richardson Mountains as the Rat River (Duk-Rodkin and Hughes, 1994). The ice sheet blocked eastward drainage of the paleo-Porcupine River, forming temporary glacial lakes (Fig. 166-3). Catastrophic flooding is recorded in both Rock and Rat rivers (Catto, 1986; Schweger and Matthews, 1991). At McDougall Pass, the paleo-Porcupine River thalweg is buried under 150 m of Laurentide glacial drift. The sediments in Bell Basin record inundation of the basin by a glacial lake, deposition of several glaciolacustrine units, drainage of the lake, and subsequent development of terraces and modern floodplains that inset the glaciolacustrine sediments (Hughes *et al.*, 1973).

CLIMATE

Although the climates of the Old Crow Basin and Old Crow Flats ecoregions are very similar, some areas of higher elevation in the Old Crow Basin may have slightly higher precipitation, and temperatures may be slightly more moderate.

At this latitude north of the Arctic Circle, the sun is continuously above the horizon for approximately two weeks in the summer. During the winter, the area is dominated by an arctic high-pressure system. Infrequently, a strong low-pressure system moving over the Beaufort Sea can result in brief, windy, mild spells. During the short summer, the area is under a weak low-pressure system with relatively mild and moist air. Spring and summer are delayed by almost a month compared to the southern Yukon.

Mean annual temperatures are among the lowest in the Yukon, approximately –8 to –10°C with a strong seasonal variation. The average January temperature is –30 to –35°C; the average July temperature ranges from 12 to 15°C. Extreme winter minimums are –55 to –60°C, but above freezing temperatures have briefly occurred. Extreme

J. Meikle, Yukon Government

Figure 166-3. In response to being diverted by Laurentide Ice from its course through McDougall Pass and into the Mackenzie River, the Porcupine River flows westward into the Yukon River. It is pictured here at the Ramparts where downcutting continues.

summer maximums are 33 to 35°C, but frosts can occur at any time of the year. Winters are prolonged and generally extend from October to mid-May. The North Ogilvie Mountains to the south are enough of a barrier to retard southerly winds eroding the cold air from the lower elevations. The transition from winter to summer conditions is rapid. The prolonged low angle of the sun above the horizon during winter reduces the daily cycle of temperatures during this period.

Precipitation is relatively light, amounting only to 200 to 300 mm annually. The wettest period is June through August with monthly amounts of 30 to 45 mm. This summer precipitation falls as rain, primarily showers or thunderstorms. There have been some summer months with precipitation amounts of 100 to 150 mm. The driest period is January to April, averaging 10 to 15 mm of snow monthly.

Wind data are limited, although some data are available from the village of Old Crow. Winds are generally light at less than 15 km/hr, particularly during the winter months. Periods of moderate winds, 15 to 30 km/hr, occur less than a quarter of the time, coming primarily from the northeast and less frequently from the southwest. Winds greater than 40 km/hr are common.

Representative climate information is available from Old Crow.

HYDROLOGY

The Old Crow Basin Ecoregion is situated within the Northern Hydrologic Region. The ecoregion is narrow and irregular in shape, completely enveloping the Old Crow Flats Ecoregion. Flanked by the North Ogilvie Mountains to the south, the Richardson Mountains in the east, and the British Mountains in the north, the ecoregion drains the Old Crow Flats Ecoregion and surrounding slopes. The Porcupine River flows into Alaska where it is joined by the Coleen River, a major tributary. Flow within the

ecoregion is divided by headwater tributary flows to the Old Crow River while lower reach tributaries flow directly into the Porcupine River (Fig. 166-3). The lower reaches of the north-flowing Eagle River and the southwest-flowing Bell River are the largest tributary streams of the Porcupine River. Intermediate streams include the Rock and Bluefish rivers and Lord Creek. South-flowing streams from the British–Richardson Mountains Ecoregion include the Driftwood River and Johnson, Timber and Thomas creeks. There are no lakes on the pediment surfaces surrounding the Old Crow Flats Ecoregion, however, numerous smaller, lowland and oxbow lakes are associated with the Porcupine, Bell and Eagle rivers, as well as some upland, headwater lakes. The largest waterbody is Whitefish Lake, in the southern portion of the ecoregion. The most significant wetland is the Whitefish complex, an area more similar to the Old Crow Flats than to the rest of the ecoregion.

There are no representative hydrometric stations records for the ecoregion; therefore, a regional analysis was carried out to estimate the characteristic streamflow characteristics. The ecoregion is sufficiently similar in physiography, vegetation, surficial geology and climate, to the adjacent Eagle Plains Ecoregion that streamflow characteristics may be transferred directly. The exception lies with winter low-flow characteristics, which are estimated to be approximately 50% of those in the Eagle Plains Ecoregion due to the increasing importance of permafrost with increasing latitude. Because of the very similar topography, it is estimated that annual and seasonal runoff characteristics and peak flows will be similar. As with the Eagle Plain Ecoregion, runoff is moderately low because of the relatively low relief. Within most ecosystem streams, annual streamflow is estimated to have an increase in discharge in April due to snowmelt, then rise to a peak in May. Summer rain events can produce secondary peaks, and sometimes the annual peak runoff. This is thought to be especially true of smaller streams, which more frequently experience peak rainfall events. Mean annual runoff is estimated to be moderately low with a value of 200 mm, while mean seasonal and summer flows are likewise estimated to be moderately low with values of 12 X 10^{-3} and 10 X 10^{-3} $m^3/s/km^2$ respectively. The mean annual flood and mean maximum summer flow are estimated to be 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 estimated to be relatively low, with values of 0.34 X 10^{-3} and 2 X 10^{-3} $m^3/s/km^2$, respectively. Minimum streamflow generally occurs during March or earlier with the relative magnitude among the lowest of all Yukon ecoregions, due to the increasing role of winter temperatures and permafrost on streamflow. Most small and intermediate streams frequently experiences zero winter stream flow.

PERMAFROST

The Old Crow Basin Ecoregion lies in the continuous permafrost zone. Lower elevations in the Old Crow Basin were covered by a glacial lake during the late Wisconsinan period. Permafrost was likely eradicated from beneath the lake at that time. The base of permafrost was encountered at 63 m depth in two holes drilled to provide a water supply for the community of Old Crow (EBA, 1982a); all holes drilled for construction in the community have encountered frozen ground within two metres of the surface. Annual mean near-surface ground temperatures are about –4°C (Stanley Associates, 1979). The active layer depth in the peatlands of the basin is usually greater than 40 cm and occasionally greater than 60 cm (Ovenden and Brassard, 1989).

Shallow lakes within the ecoregion are warm in summer and sufficiently deep to prevent freezing of lake-bottom sediments in winter. As a result, a talik persists beneath the lakes, many of which are sufficiently wide for the talik to penetrate though permafrost, theoretically. The lakes are oddly rectangular and oriented northeast–southwest or northwest–southeast. Their surface expression is likely unassociated with permafrost conditions, but may be a product of wind-generated currents (Mackay, 1956).

The low-lying terrain and pediment surfaces have a hummocky microtopography typical of moist taiga regions and near-surface permafrost is usually ice-rich. Ice-wedge polygons occur throughout the region, but they have not developed into the extensive networks characteristic of the Yukon Coastal Plain Ecoregion. There are well-developed, active ice wedges along the Porcupine River, growing syngenetically with floodplain deposits (Lauriol *et al.*, 1995).

Sedimentary sequences exposed in bluffs cut by the Porcupine River have been used to trace environmental conditions back to the late Tertiary (Pearce *et al.*, 1982). Ice-wedge casts in the sediments provide early evidence of permafrost in the Yukon (Burn, 1994).

SOILS

Soils in this ecoregion have formed under the influences of a strongly continental subarctic climate and unglaciated, broad, gently sloping basin topography. There have been few regional studies of the soils of the Old Crow Basin other than the ecological survey of Wiken *et al.* (1981) and a number of site-specific investigations associated with Quaternary research in the ecoregion (Morison and Smith, 1987).

Most of the landscape is composed of unglaciated pediment surfaces emanating from the surrounding ranges of the Richardson, Keele, Old Crow, Barn and British mountains. These colluvial surfaces are mantled with 1 to 2 m of fine-textured deposits supporting open black spruce forest or shrubby, tussock tundra vegetation. These soils are all characterized by shallow (<1 m) active layers and intensive frost churning and are classified as Gleysolic Turbic Cryosols, if they remain saturated through most of the growing season, or as Orthic Turbic Cryosol, if imperfectly drained. Upland areas support more forest growth and soils tend to be better drained. Paleosols composed of residual weathering products occur where older bedrock surfaces have escaped erosion (Tarnocai, 1987c). While most of the ecoregion is underlain by continuous permafrost, some permafrost-free soils, usually Eutric Brunisols, are found on well-drained, south-facing slopes in the uplands.

There are extensive wetlands near the Eagle and Bell river systems (Fig. 166-1). Here, peat accumulations may be over 2 m thick under fen and polygonal peat plateau vegetation. These wetland soils are classified as Fibric or Mesic Organic Cryosols (i.e. perennially frozen, semi-decomposed sedge and moss peat). Where the peat is less than 40 cm thick adjacent to the wetlands proper, the soils are classed as Gleysolic Turbic Cryosols.

VEGETATION

Open spruce–lichen–heath vegetation communities dominate the pediments of the Old Crow Basin. Pediment surfaces with slopes less than 5% are typically dominated by sedge and cottongrass tussocks. A sparse shrub layer of willow, shrub birch and ericaceous shrubs, and rarely black spruce, accompany the tussocks with sphagnum or other mosses between the tussocks. The stunted trees average about 4 m in height. Treeline is reached at 600 m asl (Zoltai and Pettapiece, 1973). Higher elevations of the Old Crow Range and other mountains rimming the ecoregion support scrub heath tundra (Hettinger *et al.*, 1973).

On imperfectly drained soils, open black and white spruce–lichen–heath communities are associated with earth hummocks and Orthic Turbic Cryosol soils. The understory vegetation is mainly shrub birch, ericaceous shrubs, mosses, and lichens dominated by *Cetraria*, *Cladina* and *Cladonia*. Paper birch and alder may be found on steep, east-facing slopes. Many seral stages are represented due to fire disturbance.

Lowland sites of the Bell and Whitefish basin areas are similar to those of the Old Crow Flats Ecoregion. Black spruce–lichen–heath communities dominate the frozen organic soils of the peat plateaus. Floating mats of sedges and mosses are also common. A succession of vegetation communities occurs on riparian sites (Fig. 166-4). Flood-tolerant species such as willow and alder colonize the floodplain, being taken over by white spruce and paper birch on more stable sites (Loewen and Staniforth, 1997a).

The scrub heath tundra, found on colluvial and residual slopes at higher elevations, consists of dwarf and low shrub birch and willows underlain by moss and lichen. On exposed ridges and slopes, the vegetation highlights non-sorted circles, nets and stripes. Where the underlying rocks are more resistant, rocks and boulders cover much of the surface.

C.D. Eckert, Yukon Government

Figure 166-4. Lowest elevations on this ecoregion are underlain by glaciolacustrine sediments from Glacial Lake Old Crow. The Whitefish wetland complex shown here is located in the eastern portion of the former glacial lake basin.

WILDLIFE

Mammals

The Old Crow Basin and Old Crow Flats possess the most abundant wildlife populations of the Taiga Cordillera, with many species reaching densities typical of the Boreal Cordillera of the southern Yukon. However, the diversity of rodents and ungulates is comparatively low. Grizzly bear, moose, wolverine, lynx, and marten are abundant. The Porcupine barren-ground caribou herd migrates through in spring and fall. Muskrat are abundant in the Whitefish Lake Wetlands at the confluence of the Eagle, Bell and Porcupine rivers. There is no information on populations of small rodents. A list of mammal species known or expected to occur in this ecoregion is given in Table 4.

Birds

The Porcupine and Old Crow drainages are significant nesting areas for Peregrine Falcon (Hayes and Mossop, 1978). Extensive fens and bogs associated with meandering rivers in the basin and tundra ponds on the plateaus are used by Northern Harrier, Least Sandpiper, Common Snipe, and Short-eared Owl in summer (CWS, Birds of the Yukon Database). Shrubby areas of willow, birch and alder along these watercourses provide nesting habitat for Yellow Warbler, Northern Waterthrush, and Wilson's Warbler (CWS, Birds of the Yukon Database). The Whitefish Lake complex at the confluence of the Bell, Eagle, and Porcupine rivers is an important wetland area for breeding and moulting geese and ducks (Dennington, 1985). While there is little documented information, it is known that this area supports

breeding and moulting Greater White-fronted and Canada Geese, diving ducks, and possibly Tundra Swan (Dennington, 1985; Hawkings, 1994). Wetlands support waterbirds such as Red-throated and Pacific Loons, Horned and Red-necked Grebes, American Widgeon, Mallard, Northern Pintail, Green-winged Teal, scaup, goldeneye, Red-necked Phalarope, and Mew Gull (Dennington, 1985; CWS, Birds of the Yukon Database).

Spruce forests provide breeding habitat for Sharp-shinned Hawk, Red-tailed Hawk, Merlin, Northern Hawk Owl, Great Gray Owl, Gray-cheeked Thrush, and Yellow-rumped and Blackpoll Warblers (CWS, Birds of the Yukon Database). Year-round residents include Gray Jay, Common Raven, and Spruce Grouse at their northern limit (Rand, 1946; CWS, Birds of the Yukon Database).

Upland areas of tussock tundra support Arctic breeders such as Rough-legged Hawk and Long-tailed Jaeger. As well, American Kestrel, Rock Ptarmigan, American Golden-Plover, Whimbrel, Least Sandpiper, Savannah Sparrow, and Smith's Longspur may also breed in this habitat (CWS, Birds of the Yukon Database). Gyrfalcons breed on rocky ledges in these alpine areas and small numbers of Golden Eagle may also breed here (CWS, Birds of the Yukon Database). Birds such as Willow Ptarmigan, American Robin, American Tree Sparrow, White-crowned Sparrow, and Common Redpoll occur in shrubby tundra areas associated with subalpine forests (CWS, Birds of the Yukon Database). Scattered barren ridges and rocky slopes likely host small numbers of breeding Baird's Sandpiper, Horned Lark, and Gray-crowned Rosy Finch (Godfrey, 1986).