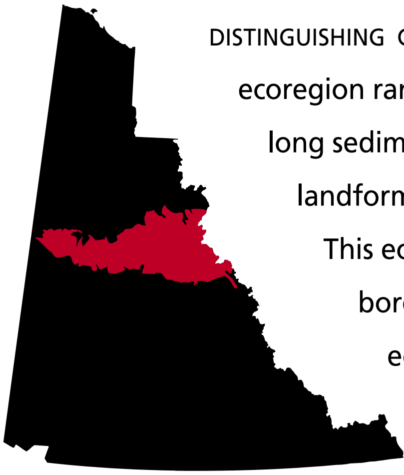
Mackenzie Mountains

Taiga Cordillera Ecozone

ECOREGION 170



DISTINGUISHING CHARACTERISTICS: The sedimentary rocks that underlie much of the ecoregion range in age from Early Proterozoic to Middle Jurassic, a 1.6 billion year long sedimentary record exposed in few other places in Canada. Spectacular landforms are associated with multiple glaciations and periglacial weathering. This ecoregion encompasses a significant ecological transition from the boreal in the south to the taiga in the north. The Yukon portion of the ecoregion is home to some of the largest woodland caribou herds in the territory.

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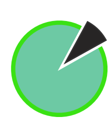
Figure 170-1. Broad U-shaped valleys and bare mountain ridges characterize the Wernecke Mountains in the Mackenzie Mountains Ecoregion. This southward view in the upper Snake River drainage shows braided streams with small aufeis remaining in midsummer (right side of photo) and small lakes contained within a glaciofluvial complex from the most recent McConnell glaciation. Half of the area of this ecoregion lies above treeline, which at this latitude is about 1200 m asl.

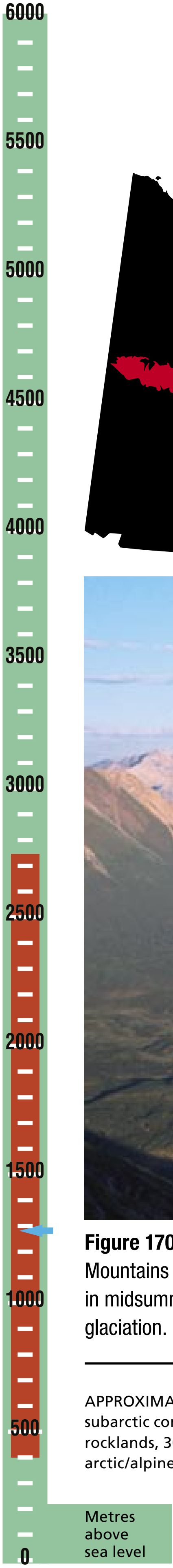
APPROXIMATE LAND COVER
subarctic coniferous forest, 50%
rocklands, 30%
arctic/alpine tundra, 20%

TOTAL AREA OF ECOREGION IN CANADA
86,460 km^2

TOTAL AREA OF ECOREGION IN THE YUKON
42,900 km^2



ECOREGION AREA AS A PROPORTION OF THE YUKON
9%



ELEVATIONAL RANGE
400–2,750 m asl
mean elevation 1,290 m asl

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

PHYSIOGRAPHY

This ecoregion includes the South Ogilvie and Wernecke (Fig. 170-1) mountains, a broad band of mountains conventionally thought of as separating northern Yukon from central Yukon. It also encompasses much of the Mackenzie Mountains proper; the Bonnet Plume Range and the Knorr Range in northeastern Yukon, and the northern portions of the Backbone and Canyon ranges (Matthews, 1986) of the Northwest Territories. Within the South Ogilvie Mountains of the Yukon, the Tombstone and Cloudy ranges are spectacular ranges in the westernmost portion of this ecoregion.

The relief is generally between 750 and 1,500 m. Only a few peaks exceed 2,100 m elevation, although the highest, Mount McDonald in the Bonnet Plume Range, is more than 2,740 m asl. The floodplain of the Bonnet Plume River as it exits the ecoregion is the lowest elevation in the ecoregion at less than 600 m asl.

These mountains form part of the Mackenzie–Yukon hydrologic divide. They drain southward into the Yukon River and the Bering Sea, and north to the Mackenzie and Beaufort Sea. To the south are the headwaters of the Stewart, Nadaleen, McQuesten and Klondike rivers; to the north, they begin the Ogilvie, Blackstone, Hart, Wind, Bonnet Plume and Snake rivers. Lakes are few and small in the ecoregion.

BEDROCK GEOLOGY

The entire ecoregion lies within the Cordilleran Foreland Fold and Thrust Belt (Gabrielse and Yorath [editors], 1991). The rock units and structures largely define the landscape. Resistant carbonate protrudes as steep and rugged ridges, clearly revealing mountain-scale folds, while recessive siltstone, shale and major faults underlie intervening valleys. This is particularly evident in the southern Ogilvie and Wernecke mountains where older rocks are exposed in an erosional window. Second, distinctive peaks in the Tombstone and Antimony ranges are cored by syenite to quartz diorite intrusions. The intrusive rocks are frost-fractured along vertical joints, resulting in sheer cirque walls and blocky talus (Fig. 170-2). Bedrock of the ecoregion has been mapped (Green, 1972; Blusson, 1974; Norris, 1982c,d; Thompson, 1995) and is described in Gabrielse and Yorath (editors, 1991; chapters 5–9), which includes coloured illustrations (Plates 3–10, 13–15 and 29 *in* Gabrielse and Yorath [editors], 1991) of the spectacular geology exposed in the ecoregion.

The sedimentary rocks range from Early Proterozoic to Middle Jurassic, a 1.6 billion year sedimentary record exposed in only a few other places in Canada. Sandstone, siltstone, and a prominently weathered orange-brown, thinly bedded dolomite, older than 1,750 Ma, constitute the Wernecke Supergroup (Delaney, 1981). Succeeding units, including dark-coloured shale, thick- and thin-bedded dolomite and sandstone comprise the overlying Fifteenmile (Thompson, 1995) and Pinguicula (Thorkelson and Wallace, 1995) groups in the western half of the ecoregion, and Mackenzie Mountain Supergroup east of the Snake River. From 750 to about 600 Ma, maroon shale, sandstone and conglomerate reflect widespread rifting (Mustard and Roots, 1997) and glaciation (Eisbacher, 1981).

All these older rocks are unconformably overlain in the northern part of the ecoregion by thick-bedded, grey and white Paleozoic carbonate in the west and sandstone in the east. This renewed continental shelf setting is called the Mackenzie Platform. The southern third of the ecoregion is part of the Selwyn Basin. Between them is the Dawson Fault, a reactivated boundary. Selwyn Basin is defined by a deep-water succession of grit and shale (the Hyland Group, part of Windermere Supergroup) overlain by black shale and chert, the Road River Group, with mafic volcanic lenses, minor limestone and siltstone units of Cambrian and Ordovician age. North of Dawson and around the Tombstone Mountains is a thrust panel of quartzite, black argillite and limestone of Upper Paleozoic through Jurassic age. Sub-circular 90 and 94 Ma granitic stocks intruded both folded sedimentary rocks and thrust faults.

The distribution of metallic minerals varies greatly within this broad ecoregion. Entire ranges of sedimentary strata are almost devoid of mineralization, but some structures and rock units have many known occurrences and, therefore, high potential for ore deposits. The Bonnet Plume Range contains uraniferous mineral brannerite; abundant iron as hematite; and traces of copper, barium, cobalt and gold in irregularly shaped breccia bodies (Archer and Schmidt, 1978). A very large hematite iron deposit lies in the headwaters of the Snake River. Significant lead- and zinc-rich veins occur in the south end of the Bonnet Plume Range, as well as in the southern Wernecke and Ogilvie

Figure 170-2. Steep walls result from exfoliation of syenite in the Tombstone Range. Vertical joints in the rock allow water to penetrate and freeze, incrementally levering out large slabs from the bedrock core. Talus blocks are then reduced in size by physical and chemical weathering, and with time become vegetated by moss and lichen.

mountains. Numerous copper–zinc–lead showings are known in the western Wernecke Mountains near the Hart River volcanogenic massive sulphide deposit. A similar deposit, in Upper Paleozoic quartzite, indicates a prospective horizon for more of these deposits along the southern edge of the ecoregion (Turner and Abbott, 1990). The Tombstone and adjacent stocks contain large, low-grade concentrations of uranium (Bremner, 1994) and adjacent skarn hosts copper–gold (Marn 116B#056) as well as possible porphyry-style gold, copper or molybdenum occurrences. Areas underlain by Devonian to Carboniferous black shale of Imperial Formation or Earn Group have high background barium, zinc, lead and arsenic concentrations, and host local barite and nickel–platinum stratiform deposits. Coal seams are abundant in the Bonnet Plume drainage and near the Monster River, at the northeastern and northwestern edges of the ecoregion.

SURFICIAL GEOLOGY AND GEOMORPHOLOGY

Colluvial deposits cover approximately 70% of the area, while glacial deposits, primarily within glaciated valleys, cover about 25%. The remaining 5% includes organic, alluvial and lacustrine deposits.

Modern processes include landslides, rotational slumps, rock fall, and debris flows. Landslides have occurred around Tombstone Mountain and the headwaters of the Wind and Bonnet Plume rivers. Retrogressive thaw–flow slides are developed mainly in lacustrine deposits within discontinuous permafrost. Periglacial features such as pingos, cryoplanation terraces, solifluction lobes, stone polygons, and rock glaciers are present.

The very long exposure of surfaces to weathering, frost shattering and soil creep has resulted in well-developed colluvial blankets on most surfaces at middle to high elevation and thick alluvial fans and aprons in valley bottoms. These deposits can also be subjected to slope- and permafrost-related processes and disturbed surfaces are usually susceptible to retrogressive thaw slides, or detachment slides common on soliflucted surfaces. Several large rockslides in the 30 to 50 X 10 m^3 class are indicative of possible rapid and severe mass movements, sometimes affecting the drainage of rivers, as was the case in the past with the Bonnet Plume River. A few slides were mapped (Thomas and Rampton, 1982a) in the Ogilvie Mountains between 64°15'N and 64°25'N. Another large slide was mapped on the west side of Lake Creek (Vernon and Hughes, 1966). The sedimentary rocks in the area are prone to such catastrophic slumps when the bedding plane is subparallel and steeper than the slope surface (Ricker, 1974).

Solifluction and soil creep are present on many of the hillside and valley walls and are often an indication of permafrost presence. Colluvial fans and talus cones are considered to be unstable and, in many cases, ice-rich. Valley bottoms are occupied by fluvial and morainal sediments and are often overlain by peat deposits of variable thickness, with evidence of patterned ground or cryoturbation. Palsa bogs have been mapped throughout the ecoregion and ice wedges are common in fine-grained sediments. Following disturbance, some of the melting ice wedges can leave depressions up to 3 m wide and 2 m deep.

Rock glaciers and debris-covered glaciers, as well as ice-cored or ice-rich talus cones, are abundant in the Yukon portions of the ecoregion. Active rock glaciers show unvegetated steep fronts (Fig. 170–3) and are usually located at elevations above 1,820 m. Inactive rock glaciers are mostly vegetated, have a rounder front profile, and usually begin at elevations as low as 1,000 m asl. Rock glaciers occupy northeast- to northwest-facing cirques, and occasionally more southerly aspects, particularly in the Wernecke Mountains. Debris-covered glaciers can be as thick as 60 m and head in cirques with steep, north-facing headwalls.

Braided rivers have unstable channels and are subject to seasonal flooding after ice thaw and rain storms. Expansive river icing (aufeis) takes place on most streams. In addition, alluvial and colluvial fans are usually susceptible to erosion and channel migrations.

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Figure 170–3. A rock glacier in the Bonnet Plume Range, cored by ice at its snout and fed by repeated rockfall at its head.

GLACIAL HISTORY

A record of several pre-Reid glaciations starting in the late Pliocene is preserved in the South Ogilvie Mountains portion of the ecoregion. These glaciations are recorded in the Tintina Trench and along the northern slopes of the South Ogilvie Mountains (Duk-Rodkin, 1996). Evidence of the youngest two glaciations, the Reid (ca. 200 ka) and the McConnell (ca. 23 ka), is found in most mountain valleys (Duk-Rodkin, 1996; Kennedy and Smith, 1999). The extent of glaciers during older glaciations was greater than during subsequent ones, a pattern observed throughout the northern Cordillera. Morphologic evidence of glaciation is widespread and is mainly related to the last two glacial periods (Vernon and Hughes, 1966; Duk-Rodkin, 1996).

The Wernecke Mountains portion of the ecoregion was largely covered by the Cordilleran Ice Sheet. The western margin of this ice sheet formed valley glaciers that merged with local glaciers from the South Ogilvie Mountains. Cordilleran valley glaciers also extended westward to the Hart River area and towards the Tintina Trench during pre-Reid glaciations. During the Reid Glaciation, main and local valley glaciers coalesced in the central part of this ecoregion. Local ice caps may also have been present. During the McConnell Glaciation, glaciers occupied only about 50% of cirques thought to have been active during the Reid Glaciation (Vernon and Hughes, 1966). Cordilleran glaciers during the McConnell Glaciation did not reach the central part of this ecoregion. Pre-Reid moraines are absent or subdued and highly colluviated. Reid-age features are also subdued compared to the well-preserved features of the McConnell Glaciation.

In the northern part of the region, the Snake and Bonnet Plume river valleys were affected by the Late Wisconsinan Laurentide Ice Sheet (ca. 30 ka; Hughes *et al.*, 1981; Schweger and Matthews, 1991). At its maximum extent, the ice sheet blocked the drainage of all streams in the Mackenzie and Wernecke mountains, creating a meltwater channel system that crossed divide areas of the Canyon Ranges, exited through a meltwater channel connecting the Arctic Red, Snake, and Bonnet Plume rivers and the Bonnet Plume Depression, and drained into Glacial Lake Hughes (Duk-Rodkin and Hughes, 1995).

CLIMATE

The mountains of the ecoregion act as a second major barrier to air masses moving off the Gulf of Alaska inland. The barrier generates a wet belt, particularly along the southern slopes. These mountains are also formidable enough to stop shallow layers of cold arctic air from reaching the central and southern Yukon.

Mean annual temperatures are near –6°C. There is a seasonal variability, but locally it is not as marked as in many other Yukon ecoregions due to the consistently high elevations here. Mean January temperatures are near –25°C and in July near 8°C. Extreme temperatures from near –50 to 30°C have occurred in the valley floors but probably only range from –35 to 15°C over the highest terrain. In part due to the higher elevations, thawing temperatures can occur in all the winter months and frosts at anytime during the summer.

Precipitation is relatively heavy, particularly over the eastern portions of this ecoregion. Typical annual amounts range from 450 to 600 mm, higher in some years. The heaviest precipitation occurs in July and August with monthly amounts of 50 to 70 mm. Even during the summer, this precipitation can occasionally be in the form of snow, particularly over the higher terrain. The least amount of precipitation is from December to May with monthly amounts of 20 to 30 mm.

Little wind data are available in this ecoregion. The prime storm tracks trend well south or north of this area, so prolonged periods of light winds are expected. However, periods of strong winds may occur due to the higher elevations and funneling effects within the extensive mountain peaks and ranges.

The only climate station that exists in this ecoregion is Klondike. Some inferences could be made using historical data from Ogilvie, Elsa and Tungsten.

HYDROLOGY

The Mackenzie Mountains Ecoregion straddles the divide between the Yukon and Peel river drainage basins. The ecoregion drains the Ogilvie and Wernecke mountains in the central Yukon, as well as the Backbone Ranges of the western Northwest Territories. Major streams include the Hart, Wind, Bonnet Plume, Snake and upper Stewart rivers in the Yukon, as well as the Arctic Red, Mountain and Twitya rivers in the Northwest Territories. Smaller streams include the Beaver, McQuesten, North Klondike, Chandindu and Fifteenmile rivers. The ecoregion is very rugged with considerable relief, and as such, the streamflow characteristics typify that of a high-energy mountain system. A few of the higher mountain peaks contain cirque glaciers. There are no major lakes, though there are numerous intermediate and small upland lakes including Bonnet Plume, Ortell, Fairchild, Pinguicula and Kathleen lakes. Wetland coverage is primarily limited to the upper reaches of the major river valleys (Fig. 170-4).

There are four representative hydrometric stations within the ecoregion: Bonnet Plume and North Klondike within the Yukon portion of the ecoregion, and the Twitya and Mountain rivers within the

Northwest Territories portion of the ecoregion. Annual streamflow is generally characterized by a gradual increase in discharge in the spring, rising to a peak in June or July due to snowmelt inputs. The exception lies within small headwater basins immediately downstream of the glaciated area. In these basins, peak flows occur in July or August due to high elevation snowfield and glacier melt. Many of the headwater streams are steep and relatively short; therefore, streamflow response tends to be rapid and flashy. On these smaller streams, approximately 40% of the annual maximum flows are due to intense summer rainstorm events. Some small steep streams are susceptible to mud flows triggered by these summer rainstorms. Mean annual runoff is moderately high with values ranging from 350 to 445 mm, with an ecosystem average of 377 mm. Mean seasonal and summer flows are likewise moderately high with values of 25 X 10^{-3} and 20 X 10^{-3} $m^3/s/km^2$, respectively. The mean annual flood and mean maximum summer flow are moderate with values of 92 X 10^{-3} and 52 X 10^{-3} $m^3/s/km^2$, respectively. Minimum streamflow generally occurs during March or April in the southern portion of the ecoregion, and earlier in the northern portion. The mean annual minimum and mean summer minimum flows are moderately high and high with values of 1.3 X 10^{-3} and 8.3 X 10^{-3} $m^3/s/km^2$, respectively.

PERMAFROST

The Mackenzie Mountains Ecoregion straddles the southern boundary of the continuous permafrost zone. Permafrost is found throughout the ecoregion because of its elevation, with near-surface ground temperatures usually above –4°C (Harris *et al.*, 1983b). At Keno Hill, just south of the ecoregion, Wernecke (1932) reported 135 m of permafrost. Placer miners working in the upper reaches of creeks in the Mayo District, also near the southern border of the ecoregion, regularly encounter frozen ground and ground ice in surficial deposits. Similar conditions could be expected within this ecoregion.

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Figure 170-4. A valley-bottom, headwater fen wetland in the upper Bonnet Plume River in the Wernecke Mountains portion of the ecoregion. These headwater fens are the most common form of wetland in the ecoregion.

The Dempster Highway crosses the western portion of the ecoregion. Inspection of geotechnical records from drilling associated with highway maintenance and construction indicates an increase in permafrost occurrence with distance north of Tintina Trench. During a detailed investigation at km 60 to 78, permafrost was encountered in 56% of 165 holes (Department of Highways and Public Works Canada, 1974). Brown (1967) reported permafrost continuous above alpine treeline along the road, with ice wedge networks developed in plateau areas. Ice-rich ground is mainly encountered in moraine and colluvial deposits on hillsides, but when these overlie gravel, the coarse material may be cemented by a matrix of ice (EBA, 1990b). Moist valley-bottom sediments contain ground ice (EBA, 1990b) and thermokarst lakes. There are relatively few pingos in the ecoregion, because surficial materials are predominantly fine-grained. There are a few palsas in some of the valleys.

Occasionally, high, north-facing cirques host debris-covered glaciers, presumably relict from Neoglacial periods (Vernon and Hughes, 1966; Hughes, 1983a). Rock glaciers are also found in the northern portion of the ecoregion, but these occur over a wider range of elevations (Vernon and Hughes, 1966). Above treeline, the ground exhibits features common to periglacial terrain: solifluction lobes on slopes, and a range of patterned ground features at flatter sites. Cryoplanation terraces are evident above glacial limits (e.g. Hughes, 1983b). Extensive bedrock outcrops are frost-weathered throughout the ecoregion, with talus accumulations at their bases.

There is considerable seasonal groundwater flow through the active layer in this terrain, with regular growth of frost blisters in valley floors (Pollard and French, 1984), and persistent development of ice in river channels each winter (Harris *et al.*, 1983b).

SOILS

Strong relief and a continental climate characterize this mountainous ecoregion. Valley bottoms experience very cold winter temperatures and permafrost-affected soils are predominant in the ecoregion. There has been little detailed soils work done in the Yukon portion of the ecoregion except for the area around the Tombstone Range in the South Ogilvie Mountains (sites 17–23 *in* Tarnocai *et al.*, 1993; Kennedy and Smith, 1999).

Soils have formed primarily from colluvial parent materials derived from a variety of lithologies of sedimentary and metamorphic origin. Bedrock outcrops and felsenmeer are common along ridges and summits. Alpine tundra environments exhibit patterned ground formations associated with Turbic Cryosols; in the more level topography of mountain passes, ice-wedge formations underlie most of the soil surface. Upper slope colluvium is coarse and often without near-surface permafrost. Eutric and Dystric Brunisols form depending on the reaction of the parent geologic materials; where materials are more unstable, Regosols are most common. Lower- and mid-slope positions vary in texture and in temperature regime. Warmer aspects often support Brunisols and associated spruce forest. Cooler aspects and moister sites tend to have Cryosol development under open stands of black spruce.

Most of the ecoregion has been subject to localized valley glaciation so that moraine and glaciofluvial materials are found on most valley bottoms. Eutric Brunisols are formed on gravelly glaciofluvial deposits; however, most finer-textured materials have Turbic Cryosol formation. This is particularly true in the higher elevations and mountain passes (Kennedy and Smith, 1999). There are no extensive wetlands in this ecoregion, although localized depressions on valley floors contain ribbed fens and occasional peat plateau bogs. All are underlain, at least in part, by permafrost, and the soils are both Gleysolic Turbic Cryosols and Organic Cryosols.

VEGETATION

The vegetation of the Mackenzie Mountains Ecoregion is primarily alpine tundra interfingered with valleys of taiga forest. The steep mountains separated by narrow valleys have lichen-ground shrub alpine tundra on summits and slopes, sparsely vegetated scree slopes, and shrub-dominated subalpine valleys or treed valleys at lower elevations (Fig. 170-5). Treeline is around 1,200 m asl, though slightly lower in the South Ogilvie Mountains in the west of the ecoregion (Oswald and Senyk, 1977). Lodgepole pine and subalpine fir are largely absent from the ecoregion. No systematic regional vegetation surveys exist for this ecoregion except in the proposed Tombstone Park area in the western corner (Kennedy and Smith, 1999).

Shrub- and herb-rich white spruce communities are found on low-elevation alluvial sites and similar, though often less diverse, communities are found along the sides of valleys. Shrubs include Labrador tea, willow, rose, soapberry and alpine blueberry; horsetail, lupine, and bear root characterize the herb layer. Typically, white spruce may be found on the sides of the valleys while shrub birch communities dominate coarser valley deposits. Stands of black and white spruce or mixed stands of spruce, aspen, paper birch and balsam poplar are found at low elevations (LGL, 1981; Stanek *et al.*, 1981; Kennedy, 1992; MacHutcheon, 1997).

Balsam poplar, willow and alder colonize recent floodplain deposits that are permafrost free. These communities typically have an understory of diverse forbs. Tall willow–sedge swamps establish along creek drainages and lake margins with a groundcover dominated by sedges and moss, with other graminoids and sparse but diverse forbs (Kennedy and Smith, 1999). Seepage sites on mountain slopes host a diverse forb community (Fig. 170-6). Poorly drained, gently sloping lower slopes, with near surface permafrost and Gleysolic Turbic Cryosol soil formation, are dominated by low shrub tussock tundra. Sedge tussocks with Labrador tea, shrub birch and other ground shrubs constitute this community. Tall willow swamps indicate drainages with deeper active layers.

Shrub birch–willow communities dominate middle elevations. These communities are found both on mountain slopes and on river terraces in subalpine valleys (Russell et al., 1992; MacHutcheon, 1997; Kennedy and Smith, 1999). On drier sites with Brunisolic soils, Dryas and ground shrubs such as net-veined willow, lowbush cranberry, Labrador tea and lichen underlie the shrub birch. Juniper and kinnikinnick grow on the driest sites. Scattered white spruce may be present at lower elevations. On moister sites, willow predominates with Dryas, moss, lichen, and commonly bearberry, lowbush cranberry, alpine blueberry, cloudberry, and sometimes horsetail.

At the highest elevations (>1,500 m), exposed sites and steep, unstable slopes may be bare rock or rock and rubble. Rock lichens such as *Umbilicaria* spp. colonize the rubble talus while very sparse forbs,

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Figure 170-5. Scattered stands of boreal forest are present in valley bottoms along the southern fringes of the ecoregion. South-facing slopes support closed forest (white spruce where well drained, black spruce elsewhere). Stand structure and age are controlled by fire history. View northward toward the Nadaleen Range, from the lower Nadaleen River valley.

Figure 170-6. Above treeline (1,200 m elevation) in the upper Stewart River valley, are verdant slopes of monkshood *(Aconitum delphinifolium,* blue), goldenrod *(Solidago multiradiata)*, wild sweet pea *(Hedysarum boreale,* pink) and other wildflowers. These well-drained slopes are free of near-surface permafrost and receive long summer sun. An important factor is abundant seepage from melting snow at higher elevations. Runoff from the dolomite, argillite and siltstone ranges tends to be alkaline and enhances the diversity of plant communities.

graminoids and bryophytes establish in sheltered pockets (Kennedy and Smith, 1999). Lichen, *Dryas* spp., dwarf willow and ericaceous shrubs dominate more gentle slopes usually associated with patterned ground and Turbic Cryosol soils (Jingfors and McKenna, 1991). White mountain heather communities are common on mesic to moist sites with northerly aspects and where snow persists late in the season. Periglacial features such as solifluction lobes and patterned ground are outlined by vegetation patterns. Steep slopes are often very sparsely vegetated.

WILDLIFE

Mammals

Grizzly bear and wolverine, indicators of ecosystem health, are abundant here, though wolves are not. Woodland caribou of the Bonnet Plume and Hart River herds range in the north and the Redstone herd ranges in the southeastern part of the ecoregion. The Bonnet Plume herd, numbering about 5,000, and the Redstone herd, numbering 5,000 to 10,000, are among the largest woodland caribou herds in the Yukon. Dall sheep are found in the northern and eastern sections of the ecoregion and Stone sheep are more common to the south and west (Barichello *et al.*, 1989a).

Collared pika, singing vole, and Ogilvie Mountains lemming are characteristic small mammals. The Ogilvie Mountains lemming may be the only mammal species restricted to the Yukon, and occurs in only one other ecoregion (North Ogilvie Mountains Ecoregion). The deer mouse, least chipmunk, and hoary marmot reach their northern range limits here. Most mammal species have received little attention and ranges can only be estimated. Species known or expected to occur in this ecoregion are listed in Table 4.

Birds

Few documented bird records exist for this remote ecoregion. Overall, waterbird populations are low; there are few wetlands. Swift-flowing mountain streams are inhabited in summer by Harlequin Duck and Wandering Tattler, and possibly year-round by American Dipper (Osgood, 1909; Frisch, 1987). Small numbers of Trumpeter Swans breed in the upper reaches of the Stewart River (McKelvey and Hawkings, 1990). Mew Gull and Belted Kingfisher breed on some lower elevation lakes and rivers while Solitary and Spotted Sandpipers occur along the shores and marshes of these scattered wetlands. Riparian thickets of willow, alder, and birch support breeding songbirds such as Alder Flycatcher, Orange-crowned Warbler, Yellow Warbler, Northern Waterthrush, Savannah Sparrow, and Lincoln's Sparrow (Frisch, 1987).

Spruce forests provide breeding habitat for Merlin, Northern Flicker, Swainson's Thrush, Yellow-rumped Warbler, Blackpoll Warbler, and Dark-eyed Junco (Osgood, 1909; Frisch, 1975). Peregrine Falcon nests on bluffs overlooking the forested valleys (Osgood, 1909; Canadian Wildlife Service, unpubl.). Year-round residents include Northern Goshawk, Northern Hawk Owl, Three-toed Woodpecker, Gray Jay, Common Raven, and Boreal Chickadee (Frisch, 1987).

At higher elevations, Townsend's Solitaire nest in open subalpine forests, while Upland Sandpipers favour tundra just above treeline (Frisch, 1987). Near treeline, shrub birch and willow provide breeding habitat for Willow Ptarmigan; Northern Shrike; Wilson's Warbler; and American Tree, White-crowned, and Golden-crowned Sparrows (Frisch, 1987; Sinclair, 1996). Exposed, rocky slopes support small numbers of White-tailed Ptarmigan, Northern Wheatear, Gray-crowned Rosy Finch (Sinclair, 1995), and possibly Horned Lark (Osgood, 1909; Frisch, 1975; Sinclair, 1996). Golden Eagle and Gyrfalcon nest on cliffs and ledges, while Snow Bunting is known to breed on north-facing cirques with areas of permanent snow (Osgood, 1909; Frisch, 1975). Surfbird, a species whose Canadian breeding range is restricted to the mountains of the northern Yukon, inhabits heath-covered slopes (Frisch, 1987). Alpine tundra provides breeding habitat for Rock Ptarmigan, Short-eared Owl, and American Pipit (Frisch, 1975; Canadian Wildlife Service, unpubl.).