Hyland Highland

Boreal Cordillera Ecozone

ECOREGION 182

DISTINGUISHING CHARACTERISTICS: Cordilleran ice sheets during the Late Pleistocene blanketed much of the ecoregion with fine-textured morainal and well-defined, sandy, gravelly glaciofluvial deposits (Fig. 182-1). Most of the ecoregion drains into the Liard River through south flowing tributary rivers. Permafrost is relatively rare. Dominated by coniferous forests, the Hyland Highland Ecoregion is home to moose, black bear, grizzly bear, and woodland caribou. Thermal springs and associated vegetation are features of this ecoregion.

J. Meikle, Yukon Government

Figure 182-1. The Crow Plateau within the Hyland Highland Ecoregion was glaciated from the west (left to right) creating a gently rolling landscape. Elongated sandy and gravelly landforms include eskers several kilometres long. Numerous small lakes are frequented by Trumpeter Swans in summer. The extensive upland forests provide good habitat for species such as Pine Marten.

APPROXIMATE LAND COVER
boreal coniferous and mixed wood forest, 90%
alpine tundra, 5%
lakes and wetlands, 5%

TOTAL AREA OF ECOREGION IN CANADA
25,860 km^2

TOTAL AREA OF ECOREGION IN THE YUKON
14,661 km^2

ECOREGION AREA AS A PROPORTION OF THE YUKON
3%

ELEVATIONAL RANGE
300–1,900 m asl
mean elevation 1,050 m asl

CORRELATION TO OTHER ECOLOGICAL REGIONS: Western portion of **Liard River Ecoregion** and eastern portion of the **Beaver River Ecoregion** (Oswald and Senyk, 1977) • Portion of **Cordillera Boreal Region** (CEC, 1997) • Portion of **Northern Cordilleran Forests** (Ricketts et al., 1999)

PHYSIOGRAPHY

The Hyland Highland Ecoregion consists of the Hyland Highland and the Liard Ranges (Mathews, 1986) or the Hyland Plateau and Liard Plateau physiographic units of Hughes (1987b) and Bostock (1948). Bostock and Hughes have separated the Hyland and Liard plateaus along the Toobally Lakes, differentiated by the presence of intrusive rocks in the Hyland Plateau.

The highland is an elevated area higher than neighbouring plains and plateaus, but lacking the rugged summits of mountains or ranges. The Liard Ranges in the Yukon, though no higher than parts of the Hyland Plateau, are southern extensions of the La Biche, Tlogotsho and Kotaneelee ranges, part of the Mackenzie Mountains.

The highest points in the ecoregion are on the Yukon–Northwest Territories border, in the Tlogotsho Range at 1,902 m asl and between the Coal and Rock rivers at 1,900 m asl. Most of the ecoregion lies above 900 m asl. The lowest elevation is on the floodplain of the Liard and the lower La Biche rivers, which are less than 300 m asl. Local relief is usually between 300 and 750 m.

Large rivers flow southward toward the Liard River, thus dissecting the plateau area. From west to east, the upper reaches of the Coal and Rock rivers flow south, the Beaver, Whitefish and La Biche southeast. Except for Toobally Lakes, the lakes are small and uncommon, and typically occur at creek headwaters.

BEDROCK GEOLOGY

All but the northeastern fifth of this ecoregion lies within the Yukon and is underlain primarily by sedimentary rock. Abundant rock exposure lies in the Kotaneelee and La Biche ranges in the east, along secondary drainages in the central part, and in the west on north-trending ridges and flanking gullies. Where outcrops are sparse, overlying colluvium reflects the bedrock, which is predominantly limey in the southern and eastern areas, but consists of black shale, sandstone, clay and coal under the low areas to the north. A coarse-grained syenite body, about 8 km long, lies 25 km east of Toobally Lakes, and several granitic intrusions lie between Coal River and the Northwest Territories border (Abbott, 1981c).

This entire ecoregion is within the miogeocline (continenetal shelf of ancient North America). The eastern three-quarters of the ecoregion is the southern extent of both the Franklin Mountains and the adjacent Mackenzie Mountains; both are fold-and-thrust belts. The western quarter is part of the Omineca Belt where the metamorphic grade and degree of deformation is higher. Bedrock geology and isolated outcrop locations are shown on regional maps by Gabrielse and Blusson (1969), Gabrielse *et al.* (1973) and Douglas (1976). The bedrock of selected areas has been mapped in more detail by Abbott (1981c), Currie *et al.* (1998) and hydrocarbon exploration (unpublished). These later studies have contributed to the regional synthesis by Gordey and Makepeace ([compilers], 2001).

Along the eastern edge, the Lower Cretaceous Fort Saint John Group shale, siltstone and sandstone fills broad synclines, between which protrude topographic heights exposing grey-banded chert and sandstone of the Permian Fantasque Formation and shale, sandstone and limestone of the Carboniferous Mattson Formation. These anticlines range from symmetrical box-folds to steep west-dipping and gentle east-dipping limbs, and have sinuous traces (Currie *et al.*, 1998). Underlying Devonian limestone is a potential reservoir for natural gas (Morrow *et al.*, 1990), although the only producing gas wells to date are located immediately to the southeast in the Muskwa Plateau Ecoregion (National Energy Board, 1994).

Paleozoic sediments, which generally get older to the westward, lie under the Whitefish and upper Beaver River drainages. The Carboniferous Mattson Formation lies within the core of major synclines; the resistant, unvegetated character of the thick sandstone mid-section is particularly apparent on Last Mountain (Fig. 1 *in* Gabrielse and Blusson, 1969). Anticlines expose Devonian, Mississippian and older sandstone and carbonate in the south. These units "shale-out" northward into the Besa River Formation which consists of black, brown and green shale, regionally showing elevated barium and base metal content in soil and stream silt. Farther west are Silurian–Devonian black and grey dolomite underlain by the Middle Ordovician Sunblood Formation dolomite in the south, which trends south to the eastern part of the Liard Plain Ecoregion, and black shale of the time-equivalent Road River Formation in the north. Barite nodules in the Besa River shale, and numerous lead–zinc vein and skarn occurrences in the Paleozoic carbonate units are the known mineral potential of this area.

The Rock River valley is underlain by eastward-directed thrusts that were active during late Mesozoic contraction. The overriding western side in the Toobally Lakes area consists of uplifted Late Proterozoic to Lower Cambrian volcanic rocks and the Rabbitkettle Limestone of dark grey silty limestone and phyllite. The upper Coal River and West Coal River drainages in this ecoregion are underlain by dark shale, gritty quartzite, limestone, quartz pebble conglomerate, and maroon shale of the Late Proterozoic to Cambrian Hyland Group. (Fig. 182-2) Copper, tin and tungsten showings, as well as lead–zinc vein and skarn occurrences, are scattered over the western region. Coal exploration licences currently cover the area between Coal River and the Northwest Territories border, which contains several very thick layers of lignite and sub-bituminous coal.

SURFICIAL GEOLOGY

Although this part of the Yukon was subjected to several glaciations since the late Tertiary, the present surface deposits are associated with the last glaciation. The Liard Lobe of McConnell ice, which originated in the Selwyn Mountains (Jackson, 1994), moved through the western half of the Coal River map area in an east to northeastward direction, as indicated by drumlins found in the southwest corner of the map and in the Coal and Rock river valleys. Alpine areas, at elevations higher than 1,050 m, consist of bedrock slopes and summits covered by a veneer of colluvium, thin moraines over bedrock, and weathered and mass-wasted bedrock. Moraine on lower slopes can be more than 30 m thick. The moraine is a mixture of cobbles, sand, silt and minor clay. Sporadic permafrost can be found in low-relief, poorly drained moraine covered by thick organic deposits. Large glaciofluvial deposits lie around Scoby Creek and Quartz Creek, and on the floor and lower slopes of the Rock River and Coal River valleys north of Quartz Creek.

J. Meikle, Yukon Government

Figure 182-2. The Beaver River, like the LaBiche to the east and the Coal to the west, have been deflected eastward from their pre-McConnell Glaciation channels. In this view, the Beaver River cuts through the Beavercrow Ridge, creating a relatively rare look at the Lower Paleozoic shelf strata underlying this ecoregion.

Glaciolacustrine deposits are present in the Rock River valley on the present floodplain, and in the Coal River valley north of the West Coal River fork. Slumping of these sediments is expected as the streams undercut their banks.

Unstable colluvial and alluvial fans are the most common landform associated with mass movement hazards in this area. The movement of sediments on slopes (e.g. solifluction) is limited to north-facing slopes and higher elevations where alpine permafrost may be present. Extensive shale deposits are prone to large slumps. Local till and widespread glaciolacustrine deposits rich in clay and ice have produced extensive debris flows and slumps (Smith, 2000). In the eastern part of the ecoregion, mass movements are mostly triggered by failure of the Mattson Formation sandstone along steeply dipping bedding planes with attendant flow of overlying unconsolidated deposits. Failure can be triggered by undercutting of slopes by rivers, slumping of underlying bedrock, and permafrost degradation. Slumping can be expected along the Coal and Rock rivers where streams undercut glaciolacustrine deposits.

GLACIAL HISTORY

The Hyland Highland Ecoregion follows a band along the Yukon–Northwest Territories boundary and includes the headwaters of the northern tributaries to the Liard River. This ecoregion was completely covered by the last Cordilleran Ice Sheet. It contains a drainage network of rivers and meltwater channels reflecting the varying dominance of separate ice masses. The Cordilleran Ice Sheet moved northward during the McConnell Glaciation from the Cassiar Mountains and the northwestern Rocky Mountains. However, the northwestern part of this ecoregion was affected by eastward-flowing glaciers emanating from Mount Laporte in the Logan Mountains, and extended about 20 km east of the Yukon–Northwest Territories boundary (Fig. 182-1). The ice sheet from the south moved across the Northwest Territories boundary draining into the South Nahanni River Basin. The maximum extent of the Cordilleran Ice Sheet occurred about 23 ka (Klassen, 1987; Duk-Rodkin and Hughes, 1991; Lemmen *et al.*, 1994; Duk-Rodkin, 1996).

Glacial Lake Nahanni was formed at the Laurentide maximum (ca. 30 ka) with an outlet to the southwest. At this time, glaciers were likely forming in the highest ranges of the Cordillera and had not yet reached their maximum extent. At its maximum, the Cordilleran Ice Sheet blocked the drainage of Lake Nahanni to the southwest causing the formation of an outlet to the east along the Mackenzie Mountain front. At this time, the Laurentide Ice Sheet was retreating from its maximum position, but still blocked the South Nahanni valley, forming a canyon between the Laurentide Ice Sheet and the mountain slope. The Cordilleran Ice Sheet barely crossed the continental divide and built a series of deltas into Glacial Lake Nahanni.

CLIMATE

No climate stations exist within this ecoregion, but some inferences can be made using Fort Liard (Northwest Territories) and Smith River (British Columbia). This ecoregion is subject to intrusions of arctic air that have moved southward up the Mackenzie Valley, and to clouds and moisture from storms originating over the Pacific and redeveloping in northeastern British Columbia and northwestern Alberta. These redeveloping storms are particularly significant in spring and early summer when warm heavy rains fall on remaining snowpacks and cause flooding.

Mean annual temperatures are near –4°C, ranging from averages near –20°C in January to near 13°C in July. Extremes in the lower valley floors probably range from near –55 to near 30°C. Summers are probably fairly warm from June through August, although some frost can occasionally be expected even during these months. Prolonged cold spells could be expected from November through mid-April.

Precipitation is moderate with annual amounts of 500 to 600 mm. The heaviest precipitation occurs from June through August, with monthly amounts averaging 60 to 80 mm. Much of this rain would be showers and thunderstorms, but periods of prolonged rain could occur with the redeveloping storm centers.

No wind data are available, but periods of prolonged easterly winds could be expected, particularly during the winter months. Local strong winds could also occur with the summer thunderstorms.

Climate information could be inferred using data from Smith River and Fort Liard.

HYDROLOGY

The Hyland Highland Ecoregion is situated within the Interior Hydrologic Region (Fig. 8). The ecoregion drains the Hyland and Liard plateaus, which are areas of moderate relief. The Yukon portion of the ecoregions drains primarily southward into the Liard River, which forms the southern boundary within British Columbia. Major streams include the Beaver, Whitefish, La Biche, upper Coal and Rock rivers. With no major lakes, the area of waterbodies is small. The only intermediate-sized lakes are the Toobally Lakes, though there are numerous small lakes within the Beaver, Whitefish and Coal River headwaters. Located largely within the Coal and Beaver headwaters, wetland coverage is relatively small.

There are three representative active and historical continuous hydrometric stations within the ecoregion: Beaver River within the Yukon, and Grayling River and Teeter Creek within British Columbia. Annual streamflow is characterized by an increase in discharge in May due to snowmelt at lower elevations, rising to a snowmelt peak in June. Approximately 50% of the time, annual peak flow is due to intense summer rain events. Mean annual runoff is moderate, with values ranging from 185 to 271 mm, with an ecosystem average of 249 mm. Mean seasonal and summer flows are moderately low, with values of 12×10^{-3} and 10×10^{-3} $m^3/s/km^2$, respectively. The mean annual flood and mean maximum summer flow are moderately low, with values of 62×10^{-3} and 33×10^{-3} $m^3/s/km^2$, respectively. The timing of the minimum annual streamflow is variable, ranging from January to March, but generally occurring during March. The mean annual minimum and mean summer minimum flows are relatively high and moderately low, with values of 1.8 X 10^{-3} and 3.3 X 10^{-3} $m^3/s/km^2$, respectively.

PERMAFROST

There is little permafrost in Hyland Highland Ecoregion, principally because terrain elevation is less than the Selwyn Mountains to the north or Rocky Mountains to the south. Harris (1986) estimated that permafrost would be continuous above an elevation of 1,500 m, but most of the area is below this level. Permafrost distribution is sporadic and most likely in organic soils and at wet sites.

SOILS

The soils in this ecoregion have formed on rolling or inclined uplands with extensive hills and incised river valleys. Moraine and colluvial deposits cover much of the upland, while the valley floors are often filled with terraced or hummocky glaciofluvial sands and gravels. Where moraines are fine-grained, Brunisolic Gray Luvisols are common. On coarser materials and all glaciofluvial deposits, soils are generally classified as Eutric and Dystric Brunisols (Zoladeski and Cowell, 1996). Permafrost is discontinuous and scattered. Cryosols are limited to alpine environments and some north-facing lower slopes that are imperfectly drained and support thick veneers of moss and peat, which insulate the ground against summer thaw, and some bog wetland forms. Mineral soils are classified most often as Orthic Turbic Cryosols.

There are a few isolated peaks and massifs with alpine environments where patterned ground is common. Patterned ground is primarily non-sorted circles associated with Orthic Turbic Cryosols. Wetlands are common in major valley systems. These are primarily northern ribbed fens and peat plateau bogs. Under peaty ridges and bog islands within the fens and under the peat plateau bogs, permafrost may be found.

VEGETATION

The Hyland Highland Ecoregion is dominated by open boreal forest. Only a small portion of the ecoregion reaches above treeline between 1,200 and 1,350 m. The moderate precipitation received in this area, most of which falls in spring and summer, and fairly warm summers are reflected by good forest growth on favourable sites (Fig. 182-3). The most productive forest areas occur along the La Biche, Beaver, and Coal rivers, where trees reach 20 m or more on the best sites in their first 100 years of growth.

White spruce dominates the well-drained fluvial terraces of the major rivers. The understory is usually rich in shrubs such as highbush-cranberry, rose, alder, dogwood, lingonberry, feathermosses and horsetail (Fig. 182-4). Balsam poplar is often a component of the canopy, especially in younger stands. As an early colonizer with willow of recent floodplain deposits, young balsam poplar often forms dense shrub or low tree thickets.

Black spruce grows in cool, poorly drained bogs on lowland fluvial or lacustrine sites. It is often associated with organic soils. Willow, shrub birch,

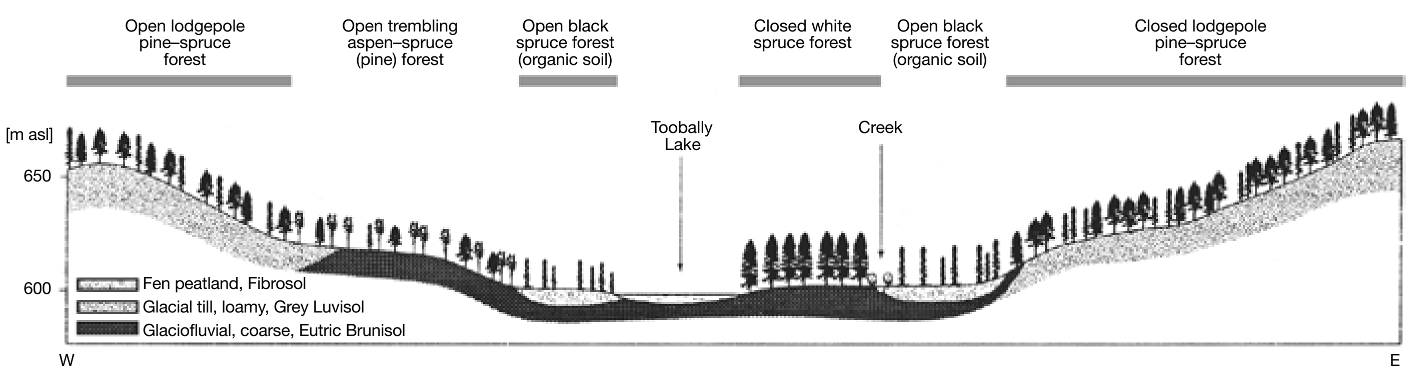

Figure 182-3. Cross-section showing the relationship of soil and vegetation distribution across a typical landscape in the Hyland Highland Ecoregion (adapted from Zolakeski and Cowell, 1996).

Labrador tea and alpine blueberry are common with a range of mosses, which reflect the moisture and nutrient status of the site. Black spruce bogs are usually associated with permafrost and Cryosol soils. Larch may be present on nutrient-rich sites. Black spruce is also the climax tree species on upland moraine or glaciofluvial deposits. Feathermoss and ground shrubs such as lingonberry, shrub birch, Labrador tea and crowberry usually dominate the understory. On drier sites, lichens can have prominent cover. On these nutrient-poor sites, lodgepole pine is often present, as it is usually the first conifer to colonize the drier sites after fire. It provides the cover for black spruce to establish in the understory and later take over the canopy (Kuch [editor], 1996). Pure stands of pine predominate in many old burns (Davis *et al.*, 1983b).

Subalpine fir with shrub birch and lichen is prevalent at higher elevations (Fig. 182-5), replacing spruce as the dominant tree species.

Fen wetlands dominated by sedges and willows are common along the major river valleys. Natural springs on the Beaver River and Larsen Creek also host numerous species that are rare in the Yukon (Fig. 182-6). These species could be part of a refugia with pockets of vegetation, such as poison ivy (*Toxicodendron rydbergii*) and poverty oatgrass (*Danthonia spicata*), not known anywhere else north of 55°N. There are other rare species found in the Whitefish and Tropical creek areas.

The above populations are disjunct and may represent a remnant of a distribution that was at one time larger. The plants of the glacial refugia are found on the Kotaneelee Ridge. Those species are Beringian in distribution such as Porsild's poa (*Poa porsildii*) and Yukon groundsel (*Senecio yukonensis*). They are arctic alpine species.

WILDLIFE

Mammals

A number of woodland caribou herds range across the Yukon and Northwest Territories border. Of these, the best studied is the Nahanni herd estimated at about 900 in 2001. Other caribou

C.D. Eckert, Yukon Government

Figure 182-4. Well-developed riparian forests are found along the floodplain of the Beaver and other large rivers in the ecoregion. This site is composed of white spruce with a feathermoss–horsetail understory. Highbush-cranberry *(Viburnum edule)* is the most common shrub in the community.

J. Meikle, Yukon Government

Figure 182-5. On the north-facing aspect of the Beavercrow Ridge, white spruce forests give way to subalpine fir, above which is a minor willow and shrub birch zone, with extensive alpine communities along the crest. The sedimentary strata are dipping to the southeast.

J. Meikle, Yukon Government

Figure 182-6. Hot springs in this ecoregion occur along deep-seated faults. Yukon occurrences of vascular plants, such as beggarticks (*Bidens cernua*; inset), Indian paintbrush (*Castilleja miniata*) and poison ivy (*Toxicodendron rydbergii*) are known in the Yukon almost exclusively from these springs.

are known to live in the alpine blocks of the upper Hyland, Coal, and La Biche watersheds in the Yukon. These caribou and the Nahanni herd all appear to use a large wintering area within Nahanni National Park and south of the park. The southernmost portion of this wintering area is near Jackpine Lake in the upper Beaver watershed. Their range use is known only from movements of a few satellite radio-collared caribou. A caribou herd with limited seasonal movements just south of the Yukon–British Columbia border has a northern fringe of its range in Yukon in the Larsen Lake area of the Beaver Watershed. Moose have not been surveyed in much of the region but surveys taking in the eastern portion of the Liard Basin and the lower La Biche indicate moose densities similar to Yukon averages of 150 to 250/1000 km^2. Marten are the most economically important fur-bearer in this region, which still has a few trappers living much of the year in the bush. Trappers in the Beaver Watershed have caught 200 to 250 marten in some years, indicating some rich marten habitat in this region. A few fisher are also caught each year. Hares and lynx are generally caught in relatively low numbers, possibly because of the high proportion of mature and old forests and the scarcity of early- to mid-successional forests. In general there has been relatively little wildlife work in this remote region. Mammal species known or expected to occur in this ecoregion are listed in Table 4.

Amphibians

The boreal toad (*Bufo boreas*), common throughout northern British Columbia, enters the Yukon only in the southeast (Fig. 182-7). The boreal toad is restricted to areas of high snowfall and geothermal activity, where ground freezing is limited and it can burrow below the frost line. It is known to occur in this ecoregion which hosts numerous geothermal sites. The wood frog (*Rana sylvatica*) is common in this ecoregion.

L. Mennell

Figure 182-7. The range of the boreal toad reaches its northern limit in southeast Yukon. It has been observed as far west as the Meister River in the Liard Basin Ecoregion and has been observed at Toobally Lakes and the lower Beaver River in the Hyland Highland Ecoregion. It is considered rare in Yukon.

Birds

Significant numbers of Trumpeter Swans breed in the Toobally Lakes area, along with numerous dabbling and diving ducks (CWS, Birds of the Yukon Database). The north end of North Toobally Lake serves as a spring staging area for Trumpeter Swan and ducks (Dennington, 1985), while the outlet of South Toobally Lake is important in both spring and fall as a staging area (Dennington, 1986a). Other important wetlands include Larsen Lake and the upper Whitefish River (Fig. 182-8) (Dennington, 1985; McKelvey and Hawkings, 1990). Lee Lake, just west of the confluence of the Beaver River, and Larsen Creek, and the Beaver River Wetland, northwest of the confluence of the Beaver and Whitefish rivers, provide important breeding habitat for a variety of waterfowl as well as Pied-billed Grebe, American Coot, and Sora (Eckert *et al.*, in prep.). Songbirds associated with these wetlands include Western Wood-Pewee, Common Yellowthroat, Le Conte's and Swamp Sparrows, and Red-winged and Rusty Blackbirds (Eckert *et al.*, in prep). Lee Lake is one of only two Yukon locations where Marsh Wren has been documented (Eckert *et al.*, in prep.).

C.D. Eckert, Yukon Government

Figure 182-8. A clutch of trumpeter swan eggs in the upper Whitefish River wetland. As the species returned from the brink of extinction, these were the first observed nesting locations in the Yukon.

Productive and diverse forests, especially along the Beaver, Smith and Whitefish rivers, and Larsen and Siwash creeks provide important breeding habitat for many species. These include some that occur at the northwest edge of their range such as Blue-headed Vireo, Cape May Warbler, Bay-breasted Warbler, Ovenbird, Mourning Warbler, and Rose-breasted Grosbeak (Sinclair, 1998; Eckert *et al.*, in prep.). Riparian balsam poplar stands, especially the extensive forests at the Whitefish River delta, provide important breeding habitat. High densities of Least Flycatchers occur here, as well as Yellow-bellied Sapsucker; Hammond's Flycatcher; Swainson's Thrush; Warbling Vireo; Tennessee, Yellow; Magnolia, Yellow-rumped and Bay-breasted Warblers; Northern Waterthrush; Rose-breasted Grosbeak; and White-throated Sparrow (Eckert *et al.*, in prep.).

Riparian white spruce forests support especially high densities of Tennessee and Bay-breasted Warblers. Other inhabitants include Three-toed and Black-backed Woodpeckers; Golden-crowned Kinglets; Swainson's and Varied Thrushes; Blue-headed Vireos; Western Tanagers; Cape May and Yellow-rumped Warblers; Chipping and White-throated Sparrows; and Evening Grosbeaks. Yellow-bellied Sapsucker, Magnolia Warbler and American Redstart exist in areas of mixed white spruce, deciduous trees and tall shrubs (Sinclair, 1998; Eckert *et al.*, in prep.).

Black spruce forests provide breeding habitat for Gray Jay, Boreal Chickadee, Ruby-crowned Kinglet, Hermit Thrush, Tennessee Warbler, Yellow-rumped Warbler, Dark-eyed Junco, and Pine Siskin. Lodgepole pine forests support Common Nighthawk, Gray Jay, Red-breasted Nuthatch, Yellow-rumped Warbler and Dark-eyed Junco. Higher elevation treeline in the Kotaneelee Range provides breeding habitat for Blue Grouse; Dusky Flycatcher; Townsend's Solitaire; and White-throated, White-crowned and Golden-crowned Sparrows (Eckert, 1999a). Cedar Waxwing is most common in the Hyland Highland and Muskwa Plateau ecoregions, although it occasionally occurs further west in the Yukon (Eckert, 1995a). Year-round residents include Ruffed and Spruce Grouse, Three-toed and Black-backed Woodpeckers, Gray Jay, Common Raven, Boreal Chickadee, and White-winged Crossbill (Canadian Wildlife Service, unpubl.).