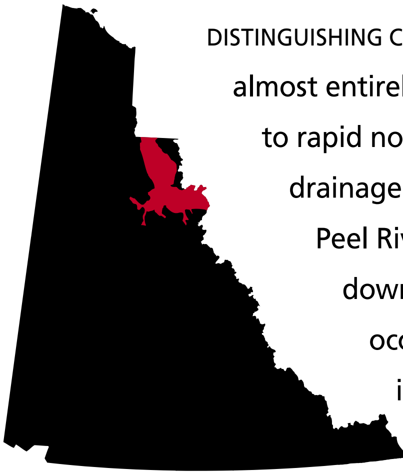
Peel River Plateau

Taiga Plain Ecozone

ECOREGION 51



DISTINGUISHING CHARACTERISTICS: This is the only ecoregion in the Yukon with landscapes almost entirely shaped as the result of Laurentide glaciation. Several canyons testify to rapid northward draining of pro-glacial lakes about 10,500 years ago. Regional drainage was rerouted northward by Laurentide Ice, in response to which Peel River tributaries, such as the Snake, Caribou, Trail and Road rivers have downcut into the plateau (Fig 51-1). Most species of large Yukon mammals occur, but only the polar representatives of most small mammal genera inhabit the ecoregion. The extensive wetlands and the broad Peel River valley support considerable bird life.

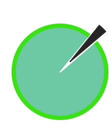
J. Meikle, Yukon Government

Figure 51-1. The northern portion of the ecoregion is deeply incised by the Caribou, Trail, Road (above; entering the Peel) and Vittrekwa rivers, which flow eastward from the Richardson Mountains (background). Numerous wetland complexes are perched on the plateau.

APPROXIMATE LAND COVER
subarctic coniferous and mixed forest, 75%
forest–tundra transition, 10%
alpine tundra, 10%
lakes and wetlands, 5%

TOTAL AREA OF ECOREGION IN CANADA
59,970 km^2

TOTAL AREA OF ECOREGION IN THE YUKON
14,810 km^2



ECOREGION AREA AS A PROPORTION OF THE YUKON
3%

ELEVATIONAL RANGE
45–1,470 m asl
mean elevation 455 m asl

CORRELATION TO OTHER ECOLOGICAL REGIONS: Largely equivalent to **Peel River Ecoregion** (Oswald and Senyk, 1977) • Portion of **Taiga Plains Region** (CEC, 1997) • Portion of the **Northwest Territories Taiga Ecoregion** (Ricketts *et al.*, 1999)

PHYSIOGRAPHY

The Peel River Plateau Ecoregion is very large, and stretches from the Beaufort Sea, along the eastern foothills of the Richardson, Mackenzie and Franklin mountains, almost to the Nahanni River (Fig. 2). A relatively small portion of it is in the Yukon.

The Yukon portion of this ecoregion incorporates the Peel Plateau and the Bonnet Plume Depression physiographic units (Mathews, 1986; Hughes, 1987b). The Peel Plateau lies between the Richardson Mountains to the west and the Wernecke Mountains to the south. It is bounded to the east by a scarp descending to the Mackenzie River valley bottom. The Bonnet Plume Depression, a lowland in the southwest corner of the ecoregion, was included in the Porcupine Plateau by Bostock (1948).

The lowest elevations in the ecoregion — less than 100 m asl — fall within the physiographic unit of the Bonnet Plume Depression, whereas higher elevations in the ecoregion are associated with the Peel Plateau, which covers the foothills and eastern flanks of the Richardson Mountains. Several ridges extend into the ecoregion northward from the Wernecke Mountains. Ridges and hills are commonly 760 m asl, but along the edge of the Wernecke Mountains elevations reach between 1,000 and 1,400 m asl. The plateau surface and higher terrace levels described by Bostock (1948) are probably evidence of Late Tertiary easterly drainage at much higher elevations than the present drainage (Mathews, 1991). Numerous small lakes are scattered over the plateau.

BEDROCK GEOLOGY

This ecoregion has little rock exposed, except for sandstone in the valleys of the Bonnet Plume and Snake rivers, and the Trevor Range. The regional bedrock distribution, largely covered by surficial deposits, is shown by Norris (1981g,h; 1982c), and the lithostratigraphy is described by Morrow (1999). The youngest rocks are Cretaceous, described by Norris and Hopkins (1977) and Yorath and Cook (1981).

The eastern part of the ecoregion is part of the Northern Interior Platform which consists of Proterozoic sedimentary rocks unconformably overlain by a Devonian to Carboniferous succession 1,900 m thick, in turn unconformably overlain by the Cretaceous strata. The Trevor Fault bisects the ecoregion from north to south. On the east, the uppermost rock is the Cretaceous Arctic Red Formation consisting of concretionary marine shale, siltstone, and lesser sandstone with small, convoluted bedding and vertical burrows. In a few places it is overlain by the Martin House Formation of glauconitic siltstone and shale.

The western side of Trevor Fault has been uplifted, likely in Middle Tertiary time. Lower Carboniferous dark grey shale, silty conglomerate, Mississippian light grey sandstone and dark grey shale are exposed in Noisy Creek and around the Trevor Range, a pop-up anticline whose core exposes the lower Paleozoic Bouvette Formation dolostone. The Cretaceous Trevor Formation consists of horizontal, broken-surface sandstone that tends to form plateaus, and locally contains beds of clay ironstone. The southwestern corner of the ecoregion is a complex of vertical and strike-slip faults of the Knorr–Richardson array; this low-lying area preserved the Cretaceous through Tertiary Bonnet Plume Formation consisting of non-marine conglomerate, sandstone and shale, with lignite seams.

Martin House Formation locally contains concretions in which ammonites may be found, as well as pale-green to pale-yellow bentonite clay seams several centimetres thick. Coal exploration leases cover the Bonnet Plume Basin, and lignite float is reported along the Peel River at 66°28'N 133°59'W. Devonian sandstone incised by the Snake River near the southern edge of the ecoregion may contain fish fossils (S. Cumba and J. Storer, pers. comm., 1997).

SURFICIAL GEOLOGY AND GEOMORPHOLOGY

Surficial deposits within this ecoregion are 80% glacial in origin — moraine, glaciolacustrine and glaciofluvial. Moraine derived from the Laurentide Ice Sheet blankets most valleys and subdued uplands. Postglacial colluvium and alluvium comprise the remaining deposits (Duk-Rodkin and Hughes, 1992a,b). Glaciofluvial terraces extend along the main rivers, except for the Peel River within the Bonnet Plume Depression, which is incised in bedrock. Colluvial deposits occupy foothills, slopes and valley sides, usually in conjunction with patches of exposed bedrock.

Alluvial plains are present along major streams (Fig. 51-2).

Modern processes are dominantly related to permafrost. Thermokarst and periglacial landforms, including occasional open system pingo development, are common in the lower Bonnet Plume and Wind rivers. On slopes, active mass wasting features include rotational slides, debris flows and retrogressive thaw flow slides along the sides of deeply incised tributaries to the Peel River. Slope instability is related to postglacial downcutting, which has been as much as 400 m in parts of the lower Peel River. Retrogressive thaw flow slides are common where ground ice has been exposed in glaciolacustrine deposits by forest fire, debris flows and regressive erosion. Thermokarst processes are widespread on these silty and clayey glaciolacustrine landforms.

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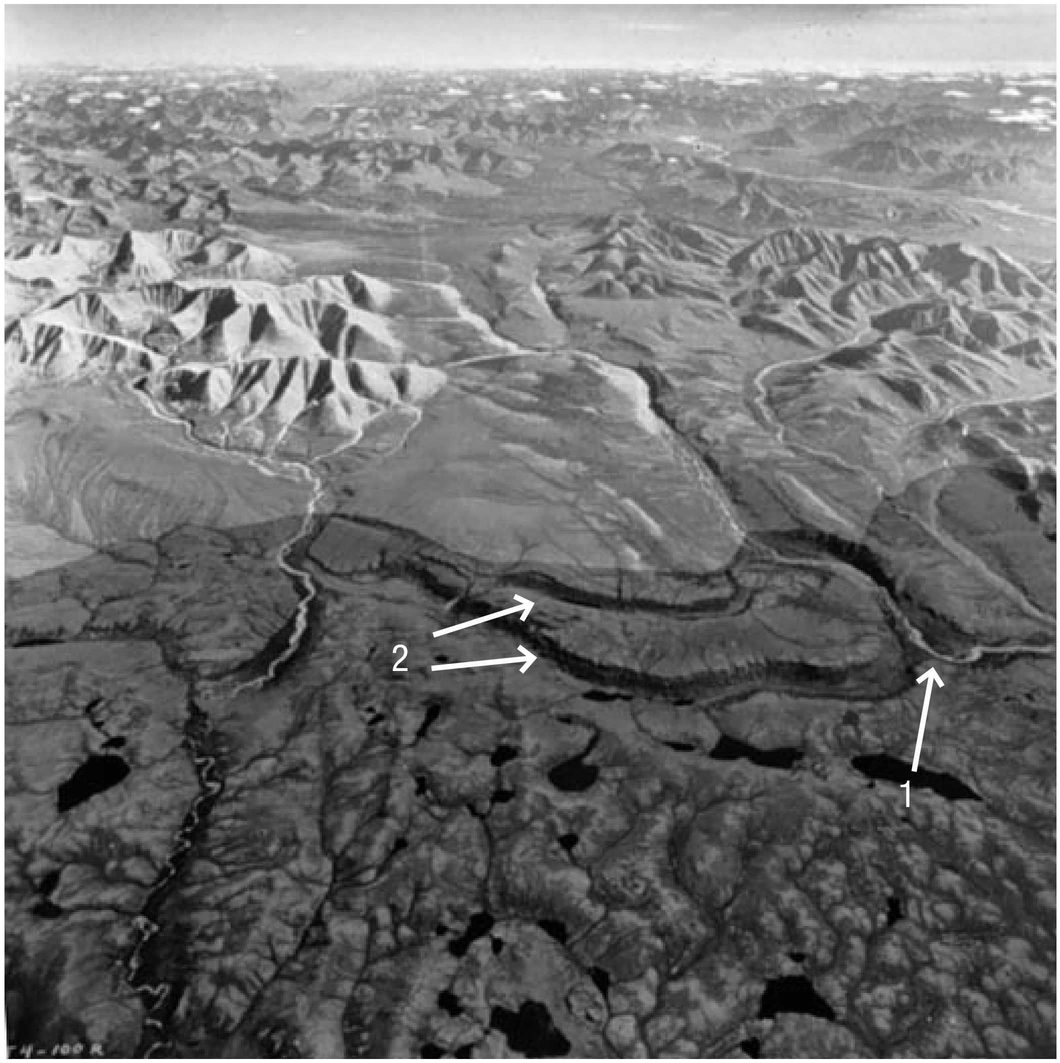
Figure 51-2. The Wind, Bonnet Plume (above) and Snake rivers begin in the Mackenzie Mountains. The Bonnet Plume and Wind rivers have extremely braided channels across the Bonnet Plume Basin. The lower Snake, by contrast, is incised deeply in the Plateau. It was diverted by Laurentide glaciation and subsequently captured by the Peel River.

Sloping terrain has the characteristic runnel drainage pattern — fine, feather-like and parallel — that is common in high latitude frozen mineral soils. Terracing, solifluction and earth stripes are common on moderate slopes at upper elevations. On gently sloped upland surfaces, sorted circles, stone nets, or polygons are often present.

GLACIAL HISTORY

This ecoregion was affected by the Late Wisconsinan Laurentide Ice Sheet in the southern Bonnet Plume Depression, and by two glaciers in the Wind and Bonnet Plume valleys. There are three well-defined Laurentide glacial limits within this ecoregion: the maximum (ca. 30 ka; Hughes *et al.*, 1981; Schweger and Matthews, 1991); the Katherine Creek Phase (ca. 22 ka; Duk-Rodkin and Hughes, 1991; 1995); and the Tutsieta Lake Phase (ca. 13 ka; Hughes, 1987a). At its maximum, the ice sheet bordered the west, south and east edge of Bonnet Plume Depression (Fig. 51-3). Drainages exiting the mountains — the Snake River, Arctic Red River, and their tributaries — were diverted through Rapitan Creek-Bonnet Plume Valley, and other minor meltwater channels and valleys that drained into the depression. Damming of the Bonnet Plume, Wind and tributary rivers in the southern Bonnet Plume Depression directed drainage westward along Hungry Creek and the lower Hart River into pro-glacial Lake Hughes (Fig. 15), which formed on the middle Peel River Valley (Duk-Rodkin and Hughes, 1995). The main outlet of Lake Hughes was the Eagle River discharge channel, which today is occupied by Canyon Creek and the headwaters of Eagle River.

During the maximum extent of the Laurentide Ice Sheet, all drainage from the Mackenzie and Wernecke mountains exited via the Eagle River discharge channel into Lake Old Crow the proglacial lake occupying the Bell–Old Crow–Bluefish Basin (Fig. 16). During the Katherine Creek Phase, the ice sheet re-advanced to a position marked by a discontinuous meltwater channel along the middle reaches of Caribou, Trail, Road and Vittrekwa rivers; Stony Creek and Barrier River; and extending north along Peel Plateau. The Katherine Creek Phase reached Bonnet Plume Basin about 35 km west of the confluence of the Peel and Snake rivers



A. Duk-Rodkin, Geological Survey of Canada

Figure 51-3. This oblique aerial photograph over the Bonnet Plume Basin, with a view southward into the Wernecke Mountains, has been shaded to show the extent of Laurentide glaciation (foreground). Noisy Creek (centre of photo) has been diverted westward where it flows out of the Knorr Range (1). Note the abandoned meltwater channels formed parallel to the glacial front (2).

and extended eastward, parallel to the mountain front a few kilometres south of the Snake River. At this time, meltwater drained into the Arctic Ocean through a system of interconnected channels via Bonnet Plume Depression. The next eastward position of the Laurentide Ice Sheet, the Tutsieta Lake Phase, impinged on the eastern edge of the ecoregion, as marked by a meltwater channel occupied by the Peel River.

CLIMATE

From within the ecoregion, little or no climate data are available. The ecoregion is east of the continental divide and, therefore, climatic controls are different from those for the rest of the Yukon. Winters are relatively long, October to late May, with frequent intrusions of Arctic air into the Mackenzie Valley. Summers are short but fairly warm, in part due to the influence of continental air masses from the interior plains to the south. Precipitation is light to moderate, enhanced by the redevelopment of Pacific storms in the Mackenzie Valley.

Mean annual temperatures are near –8°C. Average February temperatures range from –25 to –30°C. Extreme minimum temperatures are near –55°C, somewhat less cold than the interior of the Yukon. Although not common, above freezing temperatures can occur in any winter month. May temperatures are variable, ranging from –25 to 30°C. July is the warmest month, with mean temperatures near 15°C, mean minimums near 10°C, and mean maximums near 20 to 25°C. Frost can be expected at any time, however, even during summer.

Precipitation is light to moderate with annual amounts near 300 mm. July and August are the wettest months, with mean monthly amounts near 40 mm, although over 100 mm can occur in these months. The driest period is November through May, but generally 15 to 20 cm of snow can be expected each month. Winds are expected to be light to moderate at 10 to 15 km/hr with prevailing directions probably from the northwest and south.

No climate stations occur within the ecoregion but relevant data from Fort McPherson, Fort Good Hope and Norman Wells can be used to characterize the climate of the ecoregion. The most applicable data to infer Yukon conditions is from the Fort McPherson station.

HYDROLOGY

Encompassing the eastern slopes of the Richardson and Mackenzie mountains, the drainage from this ecoregion is diverse. It extends from the Mackenzie Delta in the north, through the Peel River basin, to tributaries that feed directly into the Mackenzie River. The Peel River lies near the eastern boundary of the Yukon portion of the ecoregion. This lower reach of the Peel River is unique in that it flows parallel to the Richardson Mountains, having been formed along the front of the receding Laurentide Ice Sheet (Duk-Rodkin and Hughes, 1995). The Peel River has cut a deep canyon more than 30 m below the plateau surface downstream from the mouth of the Wind River. Tributaries include the eastern flowing Vittrekwa, Road, Trail and Caribou rivers, with these largely representative of ecoregion streamflow response.

There are no large lakes within the ecoregion, while most intermediate-sized lakes are associated with wetland complexes (Chappie Lake complex, see Fig. 28). These include Hungry, Margaret, Turner, Hogan and Chappie lakes, while Lusk Lake is a higher elevation subalpine lake. Wetlands and lakes are estimated to cover about 5% of the Yukon portion of the ecoregion. The most significant wetlands are the Turner and Hogan Lakes complexes, which are on the plateau adjacent the Peel River. Smaller complexes are located in the Bonnet Plume and Vittrekwa River valleys.

There are no representative hydrometric station records for the ecoregion. Selected hydrometric stations with similar topography from nearby ecoregions were chosen to represent Peel River Plateau streamflow characteristics. Because of the relatively low relief, runoff is relatively low. Annual streamflow is characterized by an increase in discharge in early May due to snowmelt, rising to a peak later in the month within most ecosystem streams. Summer rain events do produce secondary peaks, and sometimes the annual stream flow peak, in July or August. Smaller streams are known to experience peak rainfall events more frequently than larger ones. The mean annual runoff is estimated to be 192 mm, while mean seasonal and summer flows are estimated to be 12.6×10^{-3} and 9.4×10^{-3} $m^3/s/km^2$, respectively. The mean annual flood and mean maximum summer flow are estimated to be 108×10^{-3} and 36×10^{-3} $m^3/s/km^2$, respectively. The minimum annual and summer flows are estimated to be 0.11×10^{-3} and $1.6. \times 10^{-3}$ $m^3/s/km^2$ respectively. Minimum streamflow generally occurs during March or earlier, with the magnitude among the lowest of all Yukon ecoregions, due to the increasing role of winter temperatures and permafrost on streamflow. The majority of small and some intermediate streams experience zero winter flows relatively frequently.

PERMAFROST

The continuous permafrost zone underlies the Peel River Plateau Ecoregion. Permafrost thickness of up to 625 m has been inferred from geophysical data collected near the Yukon–Northwest Territories border, but at lower elevations the depth to the base of ice-bearing permafrost appears closer to 300 m (Geological Survey of Canada, unpubl. data).

Ice-rich zones in the near-surface layers of permafrost are common; the uppermost 18.3 m of permafrost was delineated as such during geotechnical drilling at Midway Lake in a contiguous part of the ecoregion across the territorial border (EBA, 1990a). Ice wedges and lenses are regularly reported in the pediment slope grading down from the Richardson Mountains (Geocon, 1986; EBA, 1987a). On the pediment slope, these are developed into polygons, but the networks are not as extensive in glaciated terrain. About 75% of the area may be underlain by ice-rich ground (Geocon, 1986).

SOILS

Much of the ecoregion was subjected to Laurentide glaciation which produced a variety of soil parent materials derived both from local rock and from shield bedrock to the east. There have been few regional studies of the soils in the Yukon portion of this ecoregion. Sites along the Dempster Highway in the Northwest Territories portion of the ecoregion have been described by Tarnocai *et al.* (1993).

Most of the ecoregion is covered by open forests of black spruce and larch, or by extensive shrublands. Earth hummocks are associated with this forest cover and are considered to be the product of intense frost churning in these soils (Zoltai and Tarnocai, 1975). The resultant soils are classified as either Orthic or Brunisolic Turbic Cryosols. Soils derived from moraine are generally gravelly sandy-loam texture. Finer glaciolacustrine parent materials exist in association with former glacial lakes (Fig. 51-4) in the Bonnet Plume Depression. These soils tend to be wetter, support shrub or tussock vegetation along with black spruce, and have Gleysolic or Orthic Turbic Cryosol development.

Soils on the gravelly glaciofluvial deposits of the major rivers of the ecoregion tend not to contain permafrost, and support Orthic Eutric Brunisols formed under closed white spruce forest. On active, braided floodplains under shrub vegetation (Fig. 51-2), soils are typically Orthic Regosols and may be sandy, silty or gravelly in texture. Wetland soils are common in the Bonnet Plume Depression and scattered elsewhere in the ecoregion. Fibric Organic Cryosols are commonly associated with peat plateau and palsa landforms where peat accumulation of 2 to 3 m in thickness is typical (Zoltai *et al.*, 1988).

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Figure 51-4. Typical of the region is a retrogressive thaw slump on glaciolacustrine parent material. Thaw slumps are triggered by a disturbance of ice-rich sediments which then melt and produce an arcuate scar as shown in the foreground. With the exception of the small stand of spruce along the lakeshore (centre, foreground), the entire area was recently burned by a forest fire, the probable trigger of the slump.

VEGETATION

The vegetation of the Peel River Plateau Ecoregion is dominated by open stands of stunted black spruce and larch. Shrub-dominated communities occur at higher elevations. Much of the area has been burned, resulting in many mixed and deciduous communities. White spruce forests are restricted to fluvial terraces and some slopes along the major rivers.

The black spruce and black spruce–larch communities that dominate the Peel Plateau are underlain by medium to fine-textured Turbic Cryosolic soils, often gleyed, and derived from glacial parent materials. Labrador tea, shrub birch, ground shrubs such as lowbush cranberry and cloudberry, and mosses and lichens dominate the understory (LGL, 1981). Their micro-distribution is determined by earth hummocks (Zoltai and Pettapiece, 1973; Stanek *et al.*, 1981). Ericaceous shrubs dominate the tops and sphagnum mosses the inter-hummock troughs. Trees usually grow on, and often lean away from, the sides of the hummocks.

On shallow, poorly drained slopes, sedge tussocks and low ericaceous shrubs provide groundcover (Hettinger *et al.*, 1973; Stanek *et al.*, 1981; MacHutcheon, 1997). Tree density appears to be related to the time interval since the area was burned (Hettinger *et al.*, 1973). Initially, after a fire the tree density increases, but gradually the canopy thins out.

In old burns on drier sites, mixed forests of balsam poplar, paper birch, white spruce, green alder and willow have an understory of Labrador tea, lowbush cranberry and cloudberry (Hettinger *et al.*, 1973; Kennedy, 1992; MacHutcheon, 1997).

Along the lower portions of the Peel and Wind rivers, closed white spruce alluvial forests are found on well to imperfectly drained Eutric Brunisols. These sites typically host a shrub understory of mountain alder, willow and rose with a groundcover of horsetail, mustard and moss. On less stable sites along major rivers, mixed balsam poplar floodplain communities are more common. These are successional to the white spruce communities and dominated by balsam poplar, white spruce, mountain alder, and horsetail.

Numerous wetland complexes, dominated by small lakes and peat plateau bogs, are scattered on the plateau surface (Fig. 51-5). Sparse stunted black spruce with *Cladinia* lichen understory, shrubs, lichen, and moss dominate veneer bogs, common in the Bonnet Plume Basin (LGL, 1981).

Figure 51-5. View westward toward the Richardson Mountains. Wetlands, including peat plateau bogs, fens and shallow water, occur throughout the ecoregion.

Because this ecoregion is in the continuous permafrost zone, sparse black spruce and larch bogs dominate even alluvial terraces, such as are found along the Bonnet Plume River. Understory vegetation consists of shrub birch, willow, Labrador tea and other ericaceous shrubs (Hettinger, 1973; Stanek *et al.*, 1981; C.E Kennedy, writ. comm., 1992). Sites subject to frequent flooding have become tall willow or willow–alder swamps. Floodplain marshes along riverbanks are colonized by horsetail. Fens are dominated by *Carex aquatilis*.

Shrub-dominated communities are common at higher elevations on gently sloping south and southwest facing slopes. These low shrub communities with scattered alder clumps, shrub birch, Labrador tea, cloudberry, alpine blueberry, lowbush cranberry, and sedges, mosses and lichen, are associated with earth hummocks and Turbic Cryosols (Stanek *et al.*, 1981).

WILDLIFE

Mammals

Many of the taiga and alpine mammals of the Yukon occur in the Peel River Plateau including grizzly bears, wolves and wolverines. The ranges of two small populations of Dall sheep, occurring in the Richardson Mountains, extend into the Peel River Plateau at key mineral licks (Barichello *et al.*, 1987). Barren-ground caribou from the Porcupine herd occasionally winter here, east of the principal winter range (Fancy *et al.*, 1994). Moose occupy suitable habitats along river drainages.

Collared pika, arctic ground squirrel, singing vole and chestnut-cheeked vole are common. A list of mammal species known or expected to occur in this ecoregion is given in Table 4. Many of the rodent and ungulate species found in the southern Yukon are absent, resulting in relatively low diversity. There is little known of the small mammal populations of the area.

Birds

There is limited documented information on the bird life of the Yukon portion of the Peel River Plateau (Dennington, 1985; Frisch, 1987). There is speculation that Harris's Sparrow, a species not yet documented in the Yukon, may occur, along with Gray-headed Chickadee, which has not been confirmed breeding in the territory.

The wetlands of Chappie Lakes are used by staging Sandhill Crane, and staging and nesting Tundra Swan, Greater and Lesser Scaups, Surf Scoter, Red-necked Grebe, and Canada Goose (Dennington, 1985; Hawkings, 1994). Another wetland complex of potential importance is Hungry Lake, found in the extreme western portion of this ecoregion, where Tundra Swan and Bald Eagle occur in summer (Frisch, 1975; Peepre and Associates, 1993). Sandhill Cranes nest in the Northwest Territories portion of this ecoregion (Frisch, 1987), and Lesser Yellowlegs, Solitary and Upland Sandpipers, and Common Snipe occur in wetlands and open areas (Frisch, 1987).

The Peel River itself supports breeding Common Merganser, Canada Goose, Semipalmated Plover, Spotted Sandpiper, Herring Gull, and Belted Kingfisher. The Peel River, lower Wind River and their tributaries also support nesting Peregrine Falcon, Gyrfalcon, Bald Eagle, and a few Osprey (Yukon Wildlife Branch, 1977; Peepre and Associates, 1993).

Forested areas of the Northwest Territories section of this ecoregion are known to provide breeding habitat for Red-tailed Hawk, Merlin, American Kestrel, Olive-sided Flycatcher, Gray-cheeked and Varied Thrushes, Yellow, Yellow-rumped, Blackpoll, and Wilson's Warblers, Dark-eyed Junco, Chipping Sparrow, Rusty Blackbird, Pine Grosbeak, and Common Redpoll (Frisch, 1987). Year-round forest residents probably include Gray Jay, Common Raven, and Boreal Chickadee (Frisch, 1987).

Shrubby tundra areas near treeline support Northern Shrike, American Robin and American Tree and Savannah Sparrows (Frisch, 1987). Willow Ptarmigan inhabit this shrub tundra zone and adjacent subalpine forests throughout the year (Brown, 1979; Frisch, 1987).