ECOREGIONS OF YUKON TERRITORY

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Front cover photographs

Top: Kathleen Lake south of Haines Junction

Middle: Kaskawulsh Glacier in St. Elias Mountains

Bottom: Valley wetlands and Itsi Mountain Range. Lat. 63°05'N, Long. 130°12'W

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ABSTRACT

A reconnaissance level biophysical survey of the Yukon Territory was conducted during 1975. Twenty-two ecoregions were recognized and described in terms of the biophysical data available, either collected during the survey or from literature reviewed. The primary feature used to segregate and describe the ecoregions was the vegetation on different landforms under a regional climate. This was augmented by describing the distribution and extent of permafrost, geological history and terrain features.

The lower elevation terrain in southern Yukon Territory is mostly forested with a variety of boreal coniferous and hardwood tree species. With increasing elevation and latitude, the tree density declines and the dominant vegetation becomes arctic and alpine tundra. Shrub communities have a high frequency and cover, especially across the ecotone from forest to tundra. Ground vegetation, primarily moss cover, plays a significant role in the development and persistence of permafrost.

The relationship among several biophysical parameters is discussed in light of available information. Research of a more intensive nature is necessary to establish more detailed correlations.

RÉSUMÉ

On eu recours à des envolées de reconnaissance pour effectuer un relevé biophysique sur le Territoire du Yukon au cours de l'année 1975. L'on reconnaît 22 écorégions, décrites en termes de données biophysiques disponibles, provenant du relevé ou de la littérature spécialisee qu'on a consultée. La première caracteristique utilisée pour différencier et décrire les écorégions fut la végétation selon la physiographie et les climats régionaux. On accentua davantage en decrivant la distribution et l'étendue du pergélisol, l'historique géologique et les paysages.

Le terrain à plus basse altitude dans la partie sud du Territoire du Yukon est surtout peuplé d'une variété de résineux et de feuillus boréaux. A mesure qu'augmentent l'altitude et la latitude, la densité des arbres décroît et la végétation dominante est remplacée par la toundra arctique et alpine. Les arbustes sont fréquents et touffus, particulièrement dans l'écozone situé entre la forêt et la toundra. La végétation au sol, surtout formée d'une couverture de mousse, joue un rôle important dans le développement et la persistance du pergélisol.

Les auteurs dissertent sur la corrélation entre plusieurs paramètres biophysiques à la lumière des renseignements disponibles. Des recherches de nature plus intensive seront nécessaires à l'établissement de nouvelles corrélations plus détaillées.

ACKNOWLEDGMENTS

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INTRODUCTION

In describing the characteristics of a regional landscape, the bedrock and surficial geology, climate, soils and vegetation are important factors to consider. Bedrock geology provides information about the origin and the physical and chemical composition of parent materials. Glacial history gives information on the possible source, depth, type and stratification of materials. Under the influence of climate and time, the landscape evolves in a particular manner, giving rise to specific surface features and vegetation patterns. In northern environments, landscape definition and vegetation distribution are further complicated by the presence or absence of permafrost and the occurrence and frequency of extensive fires. Recognition of these often subtle differences in biological and physical characteristics allows for the subdivision of the land into ecological units.

The interest in mineral and petroleum exploration, recreation, tourism, hydroelectric development, wildlife management, forest harvesting and land development in the Yukon bolsters the need to establish land use policies and resource management guidelines. However, policies based on ecological criteria require knowledge of the land, its biota, capability and suitability to support a range of uses.

To assess the characteristics of land, one needs generalized information on a regional basis and detailed, site specific information on a local basis. The different levels are associated within a hierarchical framework so that the broader aspects give information on the amount and distribution of landscapes, whereas site specific data yields information on a single landscape on which various interpretations, including its productive capacity and sensitivity, can be made.

Several systems have been developed for classifying land, and each is designed to produce a certain partitioning of the landscape for one or more purposes, depending on the interests of the creator (Rowe 1971). These systems have been reviewed by Loucks (1962), Rowe (1962) and Burger (1972) among others. In northwestern North America, Daubenmire (1952), Krajina (1969) and Franklin and Dyrness (1969) classified land based primarily on climax vegetation, but included or integrated certain environmental parameters. A considerable amount of information is required to determine the climax vegetation because seral stands predominate everywhere, and the problem increases northward due to the slower growth rate of trees and the high incidence of widespread and repetitive fires.

Canada Land Inventory developed a biophysical land classification system (Lacate 1969) that appeared suitable for classifying large areas of inaccesible land. The system, of national scope, is hierarchial, beginning with Land Regions as the broadest unit, which are defined as areas of land characterized by a distinctive regional climate as expressed by vegetation. Land Regions are subdivided into Land Districts, which are areas of land characterized by a distinctive pattern of relief, geology, geomorphology and associated regional vegetation. Land Districts are partitioned into Land Systems, throughout which there is a recurring pattern of landforms, soils and vegetation. Land Systems may be divided into Land Types, the basic unit of the biophysical system, which are areas of land on a particular parent material possessing a fairly homogeneous combination of soil and chronosequence of vegetation.

In rugged mountainous areas, such as much of the Yukon, the regional climate is modified and complicated by the macrorelief. In placing boundaries of regions, the major topographic differences must be given consideration, in that they have a profound effect on climate, and often dictate the location of climatic boundaries. Topographic features can also be seen on aerial photographs and satellite images, while differences in climate cannot unless there is a corresponding detectable difference in vegetation pattern that is solely related to climate.

In this study, the presence or absence of tree species, the occurrence and surface expression of permafrost, and topography were primary criteria in placing the boundaries. Since this may be construed to mean more than a vegetational response to regional climate, the term "Ecoregion" was used, in a sense similar to Loucks (1962), Zoltai and Tarnocai (1974) and Tarnocai et al. (1976).

The ecoregion is the broadest unit in a hierarchical classification system. Within it, units similar to the Land District, Land System and Land Type can be defined. As one proceeds through the scheme, the units become smaller, require more information for their definition, are more homogeneous in climatic, physical and biological respects and more specific interpretations can be made concerning them.

There is a certain degree of homogeneity within an ecoregion that permits some interpretations to be made that have application to broad planning and management. A particular ecoregion will have certain physical and biological attributes that makes it more amenable to certain types of uses than another ecoregion. Within an ecoregion, a particular part of a landform is capable of supporting similar vegetation if the physical characteristics of the parent material are similar, but a climatic gradient may exist that prevents strictly identical situations. These factors will have a greater degree of variability among ecoregions than within a particular ecoregion. If one determines a certain use or assesses the biomass production for a part of a landform within an ecoregion, then that same use or rate of production could be expected from that same part of the landform wherever it occurs in the ecoregion, other things being equal.

The descriptions that follow present the methods used in the survey and a broad overview of the physiography, geology, watersheds, climate and glacial history, soils, permafrost and vegetation of the Yukon. Each ecoregion is then described in greater detail, with the material organized to facilitate making comparative references.

The primary purpose of this report is to present a broad-scale ecological partitioning of the Yukon within which more detailed work can be performed. A brief discussion concerning terrain interrelationships is presented to point out some factors to be considered in analyzing northern environments. The Appendices provides a glossary of terms, list of plant and tree species, as well as tabular data on soil analyses and timber volumes.

METHODS OF SURVEY

Prior to initiation of field work, summer and winter Landsat imagery, physiographic and geological maps and some conventional photography were obtained, and pertinent literature (Roberts-Pichette 1972, Gunn 1973) was reviewed. Working maps were constructed at a common base scale of 1:1 000 000, indicating forest regions (Rowe 1972), physiographic units (Bostock 1965), bedrock and surficial geology (numerous authors cited later) and some climatic conditions (Kendrew and Kerr 1955; Burns 1973, 1974). These were superimposed and tentative units were derived.

Reconnaissance flights over much of the Yukon were conducted with a fixed-winged aircraft. During the flights, the terrain and tentative boundaries were checked and areas for more detailed investigation were located. Helicopter flights allowed low level reconnaissance and ground observations; however, these were restricted to areas south of about 65°N. latitude because of logistics and time. Numerous road observations were made in accessible areas.

At each ground checkpoint, the landform, slope, drainage, aspect and elevation were recorded. A soil pit was dug; the profile was described and samples, of at least the B horizon, were obtained for laboratory analyses. The vegetation was recorded according to ocular estimates of height and coverage of each species and life form. Flowering plants, lichens and bryophytes were collected for identification and as voucher specimens.

In the laboratory, the plants were identified according to the authorities as indicated in Appendix A. The soil samples were analyzed according to standard methods as indicated in Appendix C.

The ecoregion boundaries were delineated on a physiographic map (scale: 1:1 000 000) with the aid of satellite images. In the process, some topographic situations, for example mountains, may be included in an ecoregion other than the one they should be because the limits of mapping scale prevent their separation. The boundaries were drawn on maps at a scale of 1:250 000 for use in an information retrieval system and for the production of forest statistics (Appendix D). For inclusion in this report, the boundaries were also located on a satellite mosaic at a scale of 1:2 500 000.

DESCRIPTION OF THE YUKON TERRITORY

1. Geographic Setting

The Yukon Territory is situated in the northwestern part of Canada (Fig. 1). It shares its southern boundary along latitude 60°N with British Columbia and the western boundary borders Alaska along 141°W longitude. The Beaufort Sea forms its northern extent and the eastern boundary is an irregular line following a height of land from about 136° 30'W longitude in the north to about 124°W longitude in the south. The vertical projection of the Yukon Territory boundary encloses about 482 681 km^2. (Note: This figure, based on area calculations using the Universal Transverse Mercator grid system, is

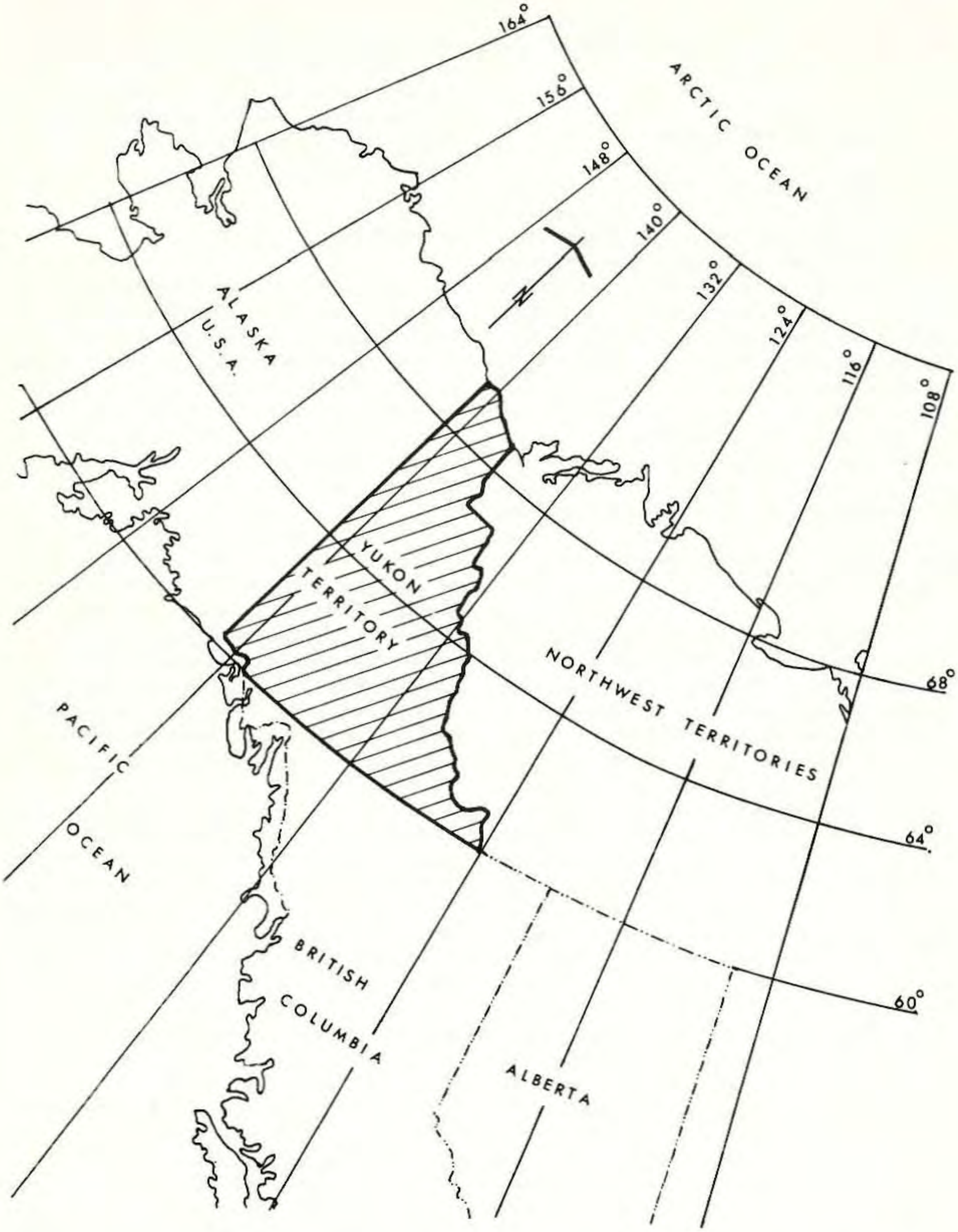


Figure 1. Location of the Yukon Territory in relation to northwestern Canada and Alaska, U.S.A.

53 644 km^2 less than the commonly published area of the Yukon which is 536 325 km^2.) The location of most roads and towns are indicated in Fig. 2 to serve as reference points.

2. Physiography and Geology

The physiography ranges from a coastal plain in the extreme north to the massive St. Elias Mountains in the southwest corner. This mountain range contains numerous high peaks, including Mount Logan at 6 050 m above sea level (a.s.l.), the highest mountain in Canada and the second highest in North America. Between these two extremes exist extensive plateaus, lowland plains with little relief, and several mountain ranges, some with spectacular peaks rising abruptly from the base terrain and others with a more subdued nature. Two conspicuous fault lines are evident. The current topography was formed as a result of glaciation, erosion, solifluction and aeolian and volcanic ash (Fig. 3) deposition on the original mountainous terrain. These processes are still operative today, resulting in modification or alteration of existing topographic features.

The Canadian Cordillera was divided into three systems by Bostock (1965), all of which enter the Yukon (Fig. 4). The Eastern System, composed primarily of sedimentary rocks, has three parts, the Rocky Mountains, Mackenzie Mountains and Arctic Mountains. This system is represented in the Yukon by the Mackenzie, Richardson and British mountains, the Liard, Peel and Arctic plateaus, the Bonnet Plume Basin and the Arctic Coastal Plain. The Western System, dominated by intrusive rocks, is composed of the Coast and St. Elias mountains, the Duke Depression and Kluane Range. Between the Eastern and Western systems lies the Interior System composed of a mixture of volcanic, sedimentary and metamorphic rocks with outcroppings of intrusive rocks (Fig. 5). The Porcupine Plateau, Keele and northeastern Ogilvie mountains are mostly composed of sedimentary rocks. The southwestern Ogilvie, Wernecke, Hess, Logan, Pelly, Cassiar, Dawson, Nisling and Ruby mountains and intervening plateaus contain massive intrusive rock bodies. The Tintina Valley cuts through the Interior System and the Shakwak Valley occurs at the border between the Interior and Western systems; both are oriented in a northwest-southeast direction.

The elevation, in general, declines from south to north. Most plateaus in the south-central portion are above 900 m a.s.l., whereas in the northern portion they are below 600 m elevation. Mountains are generally most rugged in the southern and eastern portions, but the Dawson, Nisling and Ruby ranges are more subdued than the mountains in central Yukon. In the south, lakes are generally confined within valleys, except for the Wellesley Basin, whereas in the north they are common in depressions on plateaus, as well as in valleys.

3. Watersheds

The Yukon is drained through six major watersheds (Fig. 6), each composed of several tributaries. Southerly flowing rivers usually freeze in a progressively downstream direction, whereas northerly flowing rivers are frequently hampered by the freezing of water at downstream points often resulting in the formation of aufeis. This condition is particularly common in the northern half of the Yukon.

The southeast corner, comprising about 12% or 57 922 km^2 of the Yukon is drained southward by the Liard River. Major tributaries include the Rancheria, Meister, Frances, Hyland, Coal, Rock, Beaver and La Biche rivers. This watershed drains most of the Logan and Cassiar Mountains and the southeast portion of the St. Cyr Range. Frances Lake is by far the largest in the watershed; Finlayson, McEvoy, McPherson, Tillei, Sambo, Simpson, Watson, and Toobally lakes are of moderate size.

The Aishihik Basin, the eastern portion of the St. Elias Mountains and the northwestern part of the Coast Mountains are drained to the south by the Alsek River, which crosses the extreme northwest corner of British Columbia and a portion of Alaska to enter the Gulf of Alaska. This watershed comprises about 4% or 19 302 km^2 of the Yukon. Major tributaries include the Aishihik, Dezadeash, Kaskawulsh and Dusty rivers. Aishihik, Dezadeash and Sekulmun lakes are relatively large; Kathleen, Mush and Bates lakes are of moderate size.

The Yukon River watershed comprises approximately 54% or 260 653 km^2 of the Yukon Territory and drains to the northwest. Major tributaries include the White, Donjek, Nordenskiold, Takhini, Teslin, Nisling, Pelly, Macmillan, Stewart and Klondike rivers. The Yukon River traverses Alaska to empty into the Bering Sea, a total length of over 3 680 km. Many large lakes are present, including Teslin, Tagish, Bennett, Marsh, Laberge, Wellesley and Kluane, the largest in the Yukon.

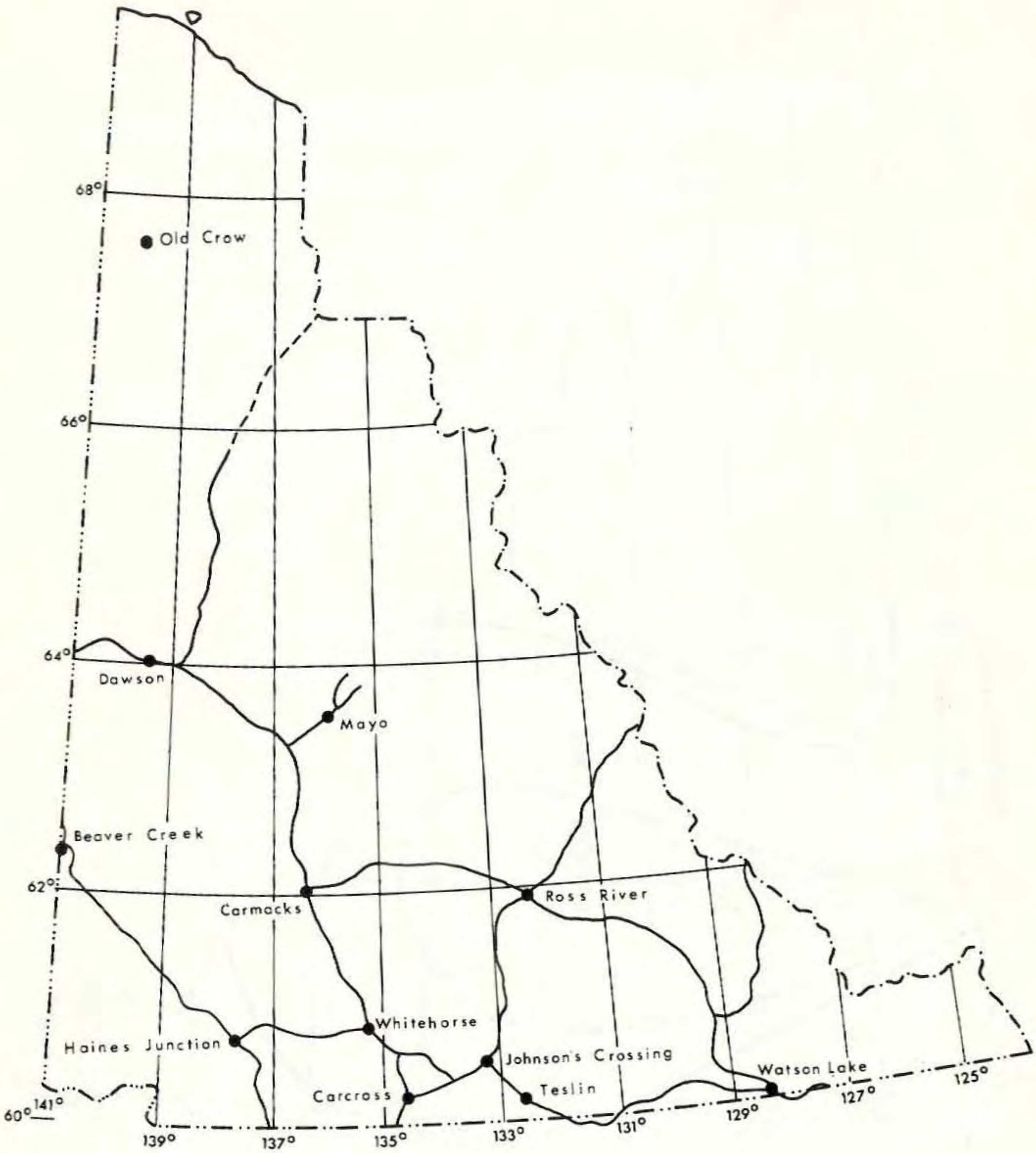


Figure 2. Location of roads and towns in the Yukon Territory.

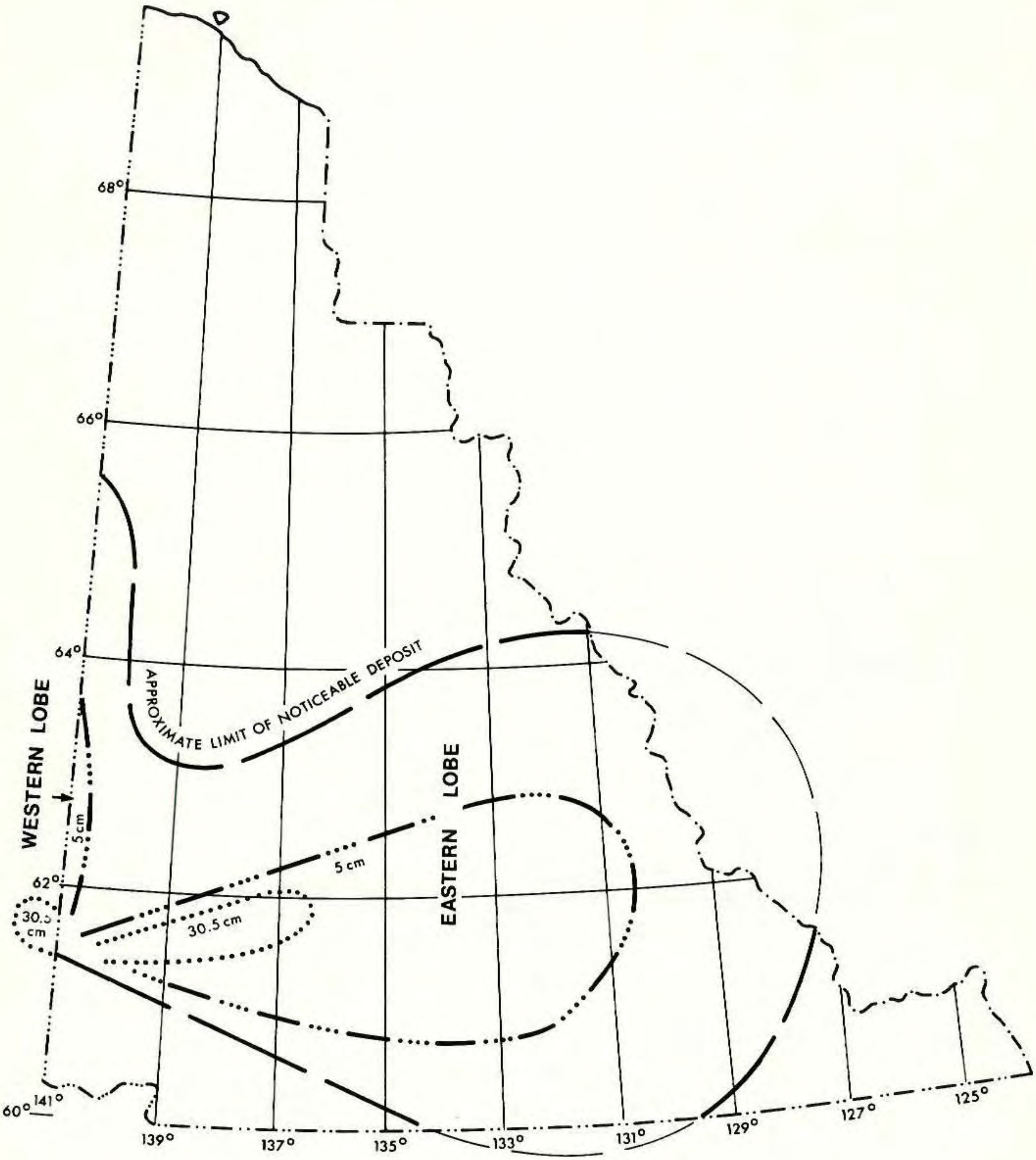


Figure 3. Extent and approximate depth of volcanic ash deposits (White River source). The eastern lobe was deposited about 1220 years B.P., the western lobe about 1900 years B.P. Adopted from Hughes, Rampton and Rutter (1972).

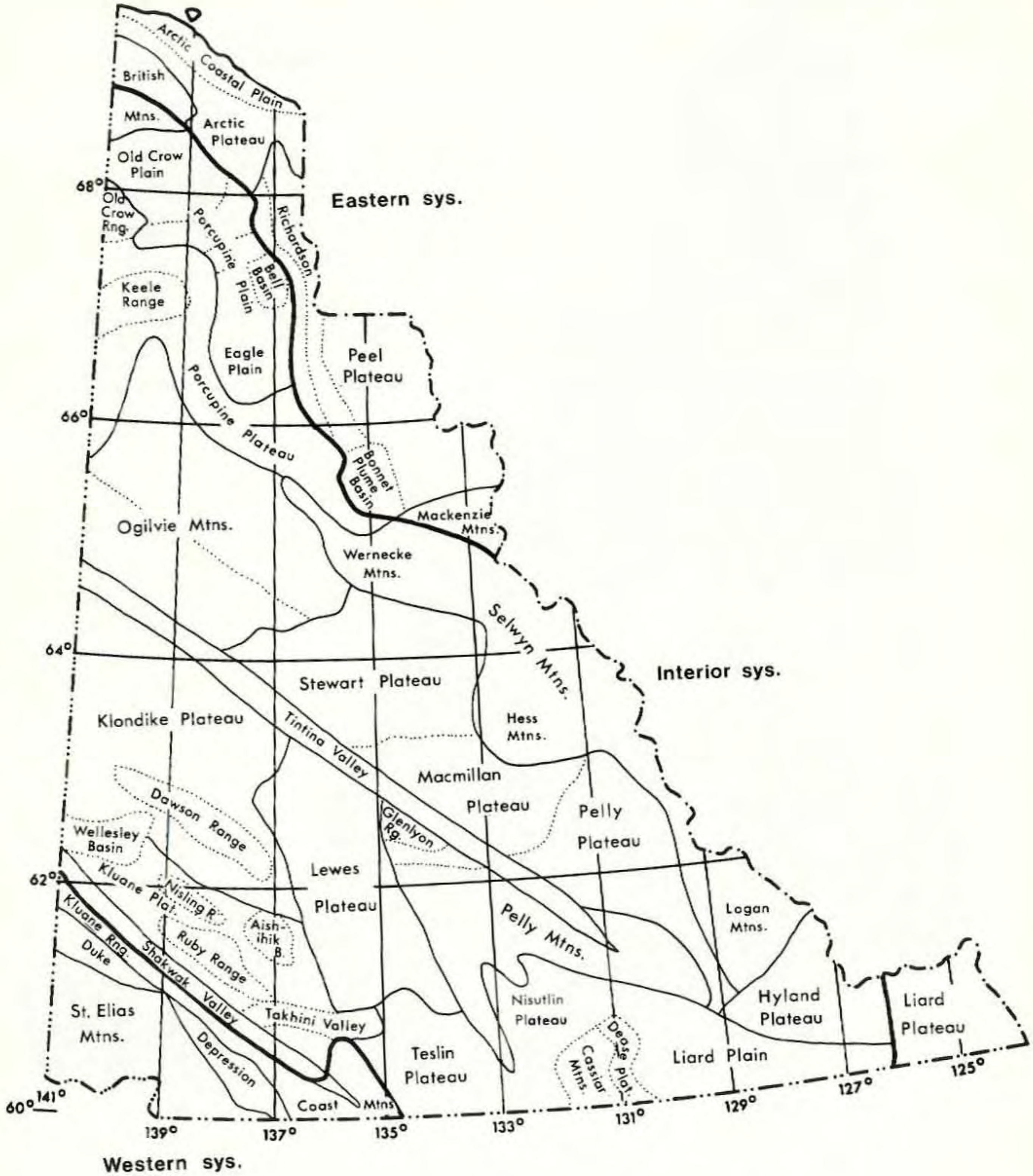


Figure 4. Physiographic subdivisions according to Bostock (1965).

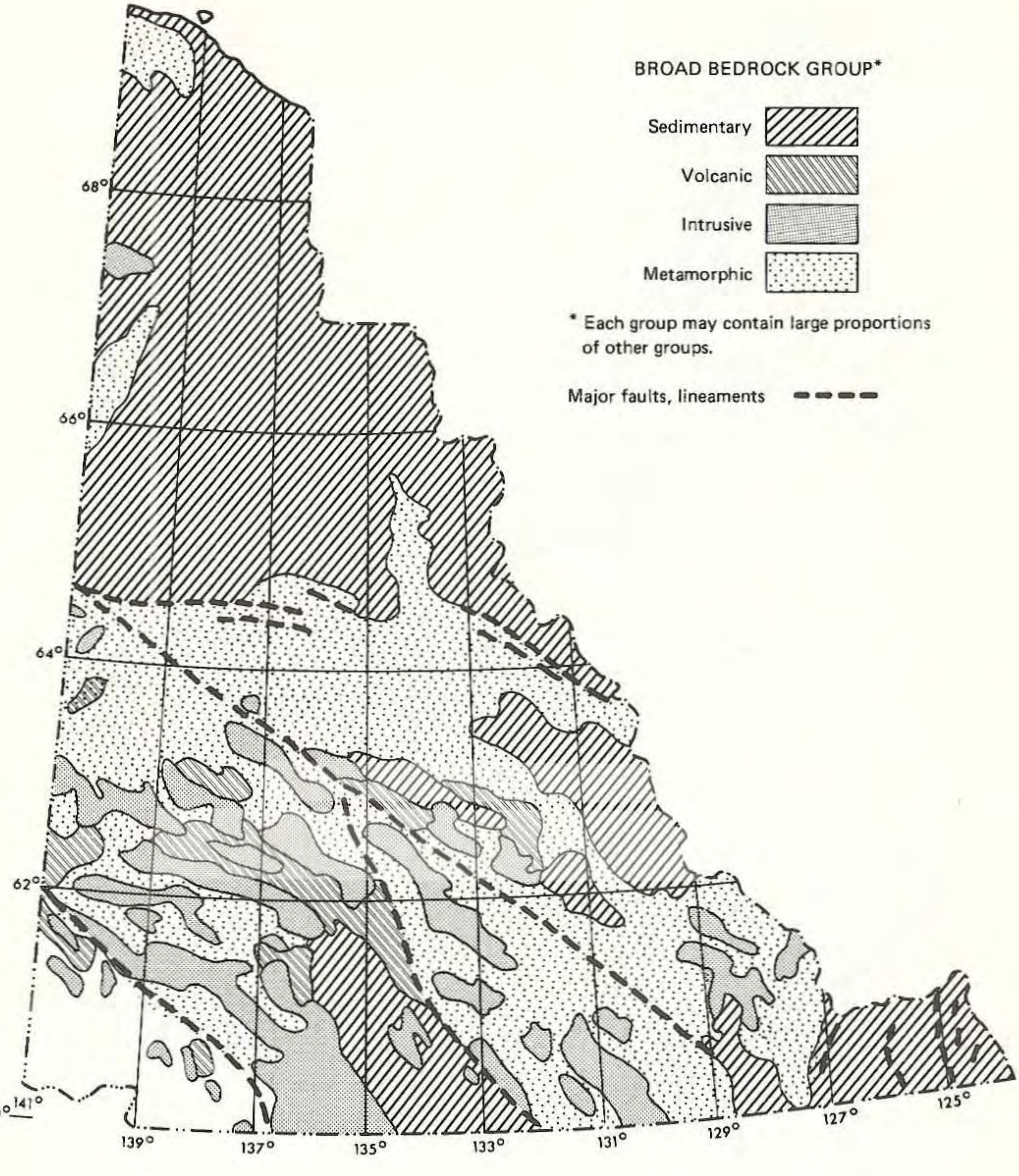


Figure 5. Generalized geology adopted from Douglas and MacLean (1963), Tempelman-Kluit (1974) and G.S.C. O.F. Map 87.

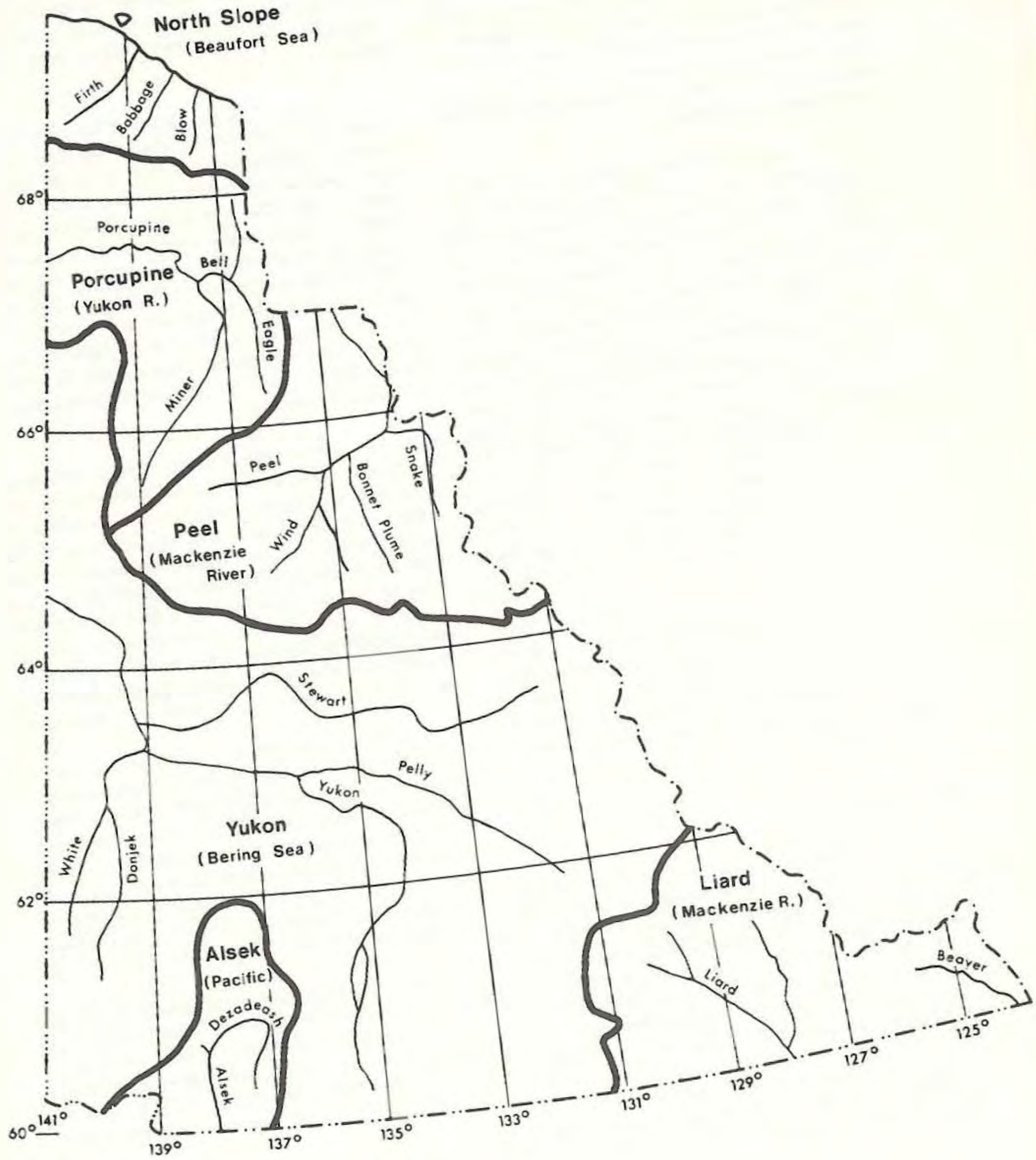


Figure 6. Major drainage systems. Destinations indicated in brackets.

The Peel River watershed drains about 14% or 67 580 km^2 of the Yukon, providing drainage for the main portion of the Wernecke Mountains, the northwestern portion of the Ogilvie Mountains and the southwestern portion of the Richardson Mountains. Major tributaries include the Ogilvie, Blackstone, Hart, Wind, Bonnet Plume, Snake and Vittrekwa rivers. Several small lakes occur in the watershed, especially in the Bonnet Plume Basin.

The Porcupine River watershed drains about 12% or 57 922 km^2 of the Yukon, including the southern portion of the British Mountains, the western portion of the Richardson Mountains and the northeastern portion of the Ogilvie Mountains. The Porcupine River drains into the Yukon River at Fort Yukon, Alaska and is actually a part of the Yukon watershed system. However, since the regional climate and physiography of the Porcupine River area is considerably different from the Yukon River watershed to the south, the two portions are treated as separate watersheds. Major tributaries include the Rock, Eagle, Whitestone, Miner, Bluefish, Bell, and Old Crow rivers. Small- to moderate-sized lakes are abundant in the watershed, especially in the Bluefish, Bell and Old Crow basin areas. Many of these lakes are oriented in a northwest-southeast direction.

The remaining portion of the Yukon, about 4% or 19 302 km^2, indicated in Fig. 6 as North Slope, drains northward directly into Beaufort Sea. Major drainages include the Big Fish, Blow, Babbage, Firth and Malcolm rivers. Small lakes are abundant along the coastal plain, but are generally absent in the mountainous portion.

4. Climate

The climate of the Yukon Territory is typified by long cold winters and short warm summers with mean annual temperatures below freezing (Table 1). January is usually the coldest month and July the warmest, although highest maximum temperatures may occur in August. Precipitation is generally low throughout, but increases with elevation. July, August or September are frequently the wettest months. Several climatic parameters for part of the Yukon are included in the climatological studies by Burns (1973, 1974) and the annual mean precipitation isohyets are shown in Figure 7.

Three major climatic areas were recognized, the northern part primarily influenced by weather patterns from the Arctic Ocean, the large central portion enduring a cold continental climate, and the southwestern portion receiving moderating marine influences from the Pacific Ocean. Topographic variations cause alterations within these climatic regions.

The St. Elias Mountains effect a partitioning of water-laden clouds from the Pacific Ocean so that windward slopes receive much more precipitation than leeward slopes; Yakutat, Alaska, on the southern slope, receives 3364 mm, as opposed to Burwash and Haines Junction, on the north side of the mountains, which receive about 280 mm per year. The Pacific Ocean influence extends into the upper Yukon River valley. Carcross and Whitehorse are located on the lee side of mountains, and the precipitation is less than at Teslin, Johnson's Crossing and Mile 75 of Haines Road, which lie on the windward side of mountains (Table 1).

A continental climate occurs throughout southeastern and central Yukon, where winter temperatures are colder and summer temperatures warmer than areas under the marine influence. The magnitude of the temperature extremes increases from the southeast (mean January and July temperatures at Watson Lake are -25°C and 15°C, respectively) to the northwest (mean January and July temperatures at Dawson City are -29°C and 16°C, respectively). The precipitation is variable, depending on proximity, elevation and position of mountains.

The northern part of the Yukon is influenced by weather patterns from the Arctic Ocean and temperatures are cold in winter and cool in summer. Precipitation is low. This situation probably extends over much of the Eagle Plain. The southern part of the Porcupine Plateau receives more rain and is perhaps warmer than points northward as indicated by sporadic meteorological data from along the Dempster Highway and inferred from Burns (1973, 1974).

During part of the summer, daylight is continuous north of the Arctic Circle and is interrupted only by short periods of darkness in southern Yukon. Winter daylight is the opposite, being nonexistent north of the Arctic Circle and of short duration in southern Yukon during a portion of the season.

5. Glacial History

St. Elias, Cordilleran and Canadian Shield ice affected various parts of the Yukon during at least two periods, once during early Wisconsin time 40 000+

* Based on 25-year or more data

Table 1

	Lat.	Long.	Elev. (m)	Temp (°C) Annual	May-Sept	Jan.	July	Precip. (mm) Annual	June-Aug.
Haines Rd. M75	59°47′	136°36′	884	-3	6	-20	9	761	143
Watson Lake*	60°07′	128°49′	685	-3	11	-25	15	434	147
Carcross	60°11′	134°41′	661	-1	9	-19	13	226	69
Tuchita	60°55′	129°15′	759	-5	9	-31	13	605	155
Teslin*	60°10′	132°45′	701	-1	10	-20	13	326	99
Johnsons x	60°29′	133°20′	690	-3	9	-26	13	346	132
Whitehorse*	60°43′	135°04′	698	-1	11	-19	14	260	98
Haines Jct.*	60°45′	137°35′	599	-3	9	-21	12	281	90
Tungsten	61°57′	128°15′	1143	-6	7	-27	11	605	214
Ross River	61°59′	132°27′	698	-7	9	-35	13	253	102
Burwash	61°22′	139°03′	801	-5	8	-30	12	283	144
Anvil	62°22′	133°23′	1173	-4	7	-25	11	368	135
Carmacks	62°06′	136°18′	521	-5	10	-34	14	247	107
Ft. Selkirk*	62°49′	137°22′	437	-5	11	-30	15	276	113
Beaver Ck.	62°23′	140°53′	663	-7	9	-34	13	412	229
Mayo*	63°36′	135°53′	495	-4	11	-27	15	293	117
Dempster	64°27′	138°13′	991	-7	7	-28	11	453	157
Dawson City*	64°04′	139°26′	324	-5	11	-29	16	325	140
Old Crow	67°34′	139°50′	274	-10	8	-36	14	192	92
Shingle Pt.*	68°57′	137°13′	55	-10	4	-25	11	173	99
Komokuk B.*	69°35′	140°11′	9	-11	2	-24	7	125	71

years before present (B.P.) and once during late Wisconsin time (13 000 to 14 000 years B.P.). Earlier ice advances were reported by Bostock (1966); Vernon and Hughes (1966); Hughes et al. (1969) and Hughes (1972).

The ice masses covered southern and eastern Yukon (Fig. 8) and lobes extended westward in the vicinity of the present Tintina Valley, Bonnet Plume Basin and Arctic Coastal Plains. Alpine valley glaciers, contemporary with the continental ice masses, originated locally in the Ogilvie, Wernecke, British and, possibly, Richardson mountains (Hughes 1972; Hughes et al. 1969). Rocks from the Canadian Shield were transported into the Yukon and deposited over the northern glaciated areas. The ice masses smoothed the topography of plateaus and lower mountains, scoured valleys, impounded temporary lakes, changed the direction of water flow in some rivers and deposited glaciofluvial, morainal and lacustrine materials.

The unglaciated portion consists of most of the Klondike, Porcupine and Arctic plateaus, the Porcupine Plain and portions of the Ogilvie, Wernecke and British mountains and western slopes of the Richardson Mountains. In contrast to the glaciated portion, the topography and surface material of the unglaciated portion is largely the result of weathering of local bedrock, and subsequent aeolian and fluvial erosion and deposition.

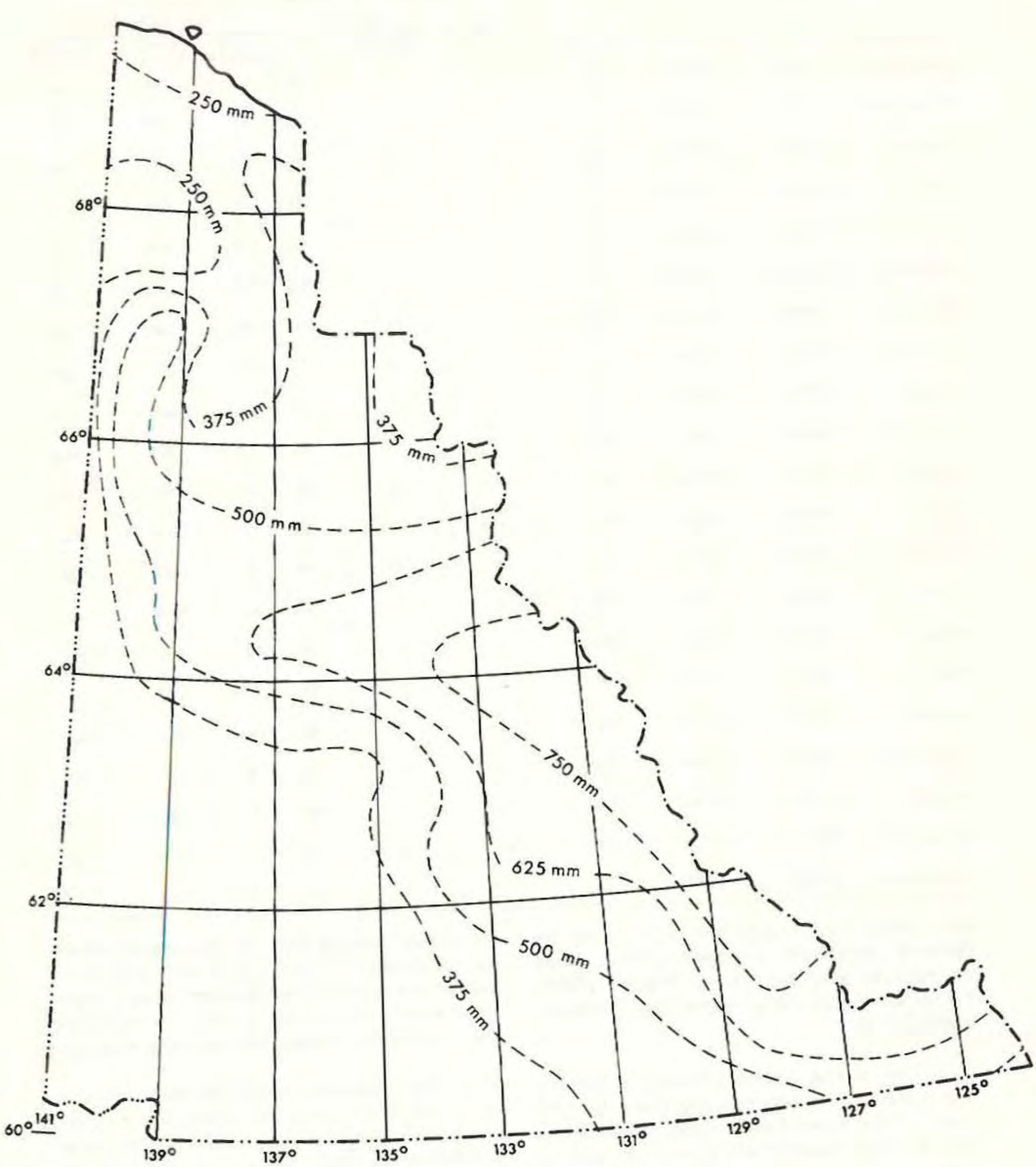


Figure 7. Annual mean precipitation isohyets modified from Burns (1973).

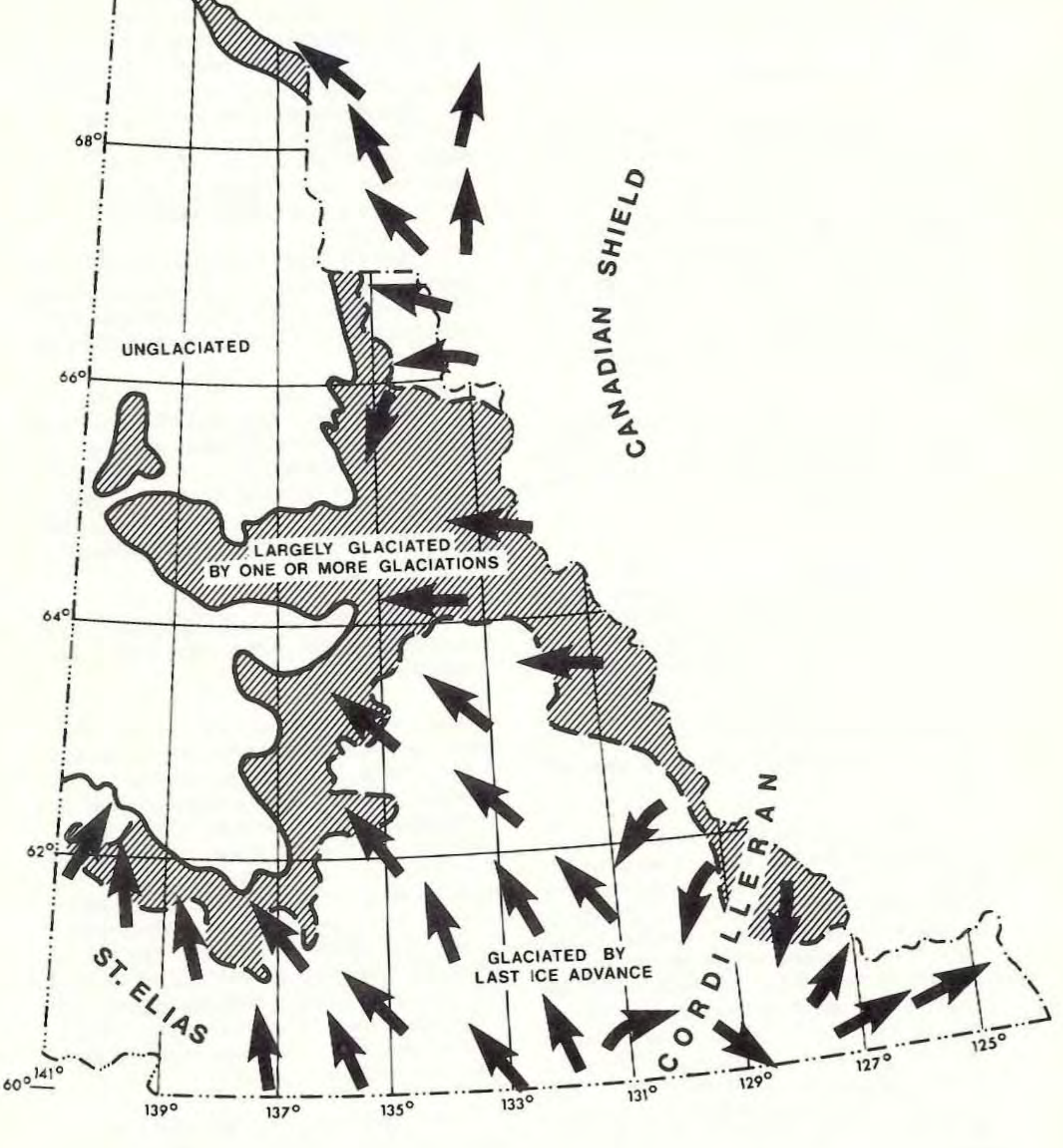


Figure 8. Ice sources, glacial limits and flow patterns (Hughes 1972; Hughes, et al. 1969; Bostock 1966; Prest, et al. 1967)

6. Soils

In much of the Yukon, climate appears to override the influences of other soil-forming factors. With increasing latitude and elevation, and the associated lower temperature regime, perennially frozen terrain and features resulting from cryoturbation become more common and widespread.

Aspect plays a strong role in affecting environmental conditions. In the low elevation, drier areas of south central Yukon, soils on steep south-facing aspects often support grassland vegetation, interspersed with aspen and exhibit Chernozemic soil development. In the same locality, soils on north-facing aspects are frequently perennially frozen, have hummocky surfaces and support open black spruce/moss vegetation. Aspect differences occur throughout the Yukon, but are most noticeable in forested areas.

Loess, most prominent in the unglaciated portion of the Yukon (Fig. 8), and volcanic ash (Fig. 3) have both chemical and physical effects on the underlying soil.

Loess deposits vary in depth, being shallow to nonexistent on steep slopes, and deep in depressions and on gently sloping valley terrain. Because of its silty nature, loess has a high water-holding capacity and hence is readily frozen. The thaw, or active layer, in these deposits is often very shallow and the permafrost table is near the surface. Cryoturbation, and surface forms resulting from this process (i.e., hummocks), is common on these deposits.

Volcanic ash deposits are generally deep and coarse-textured near the source, grading to very shallow, fine-textured material at the outermost limits of deposition. As with the loess, redistribution by wind and water has altered depth and texture locally. Medium- to fine-textured ash (Appendix C, Ash texture) has a fairly high water-holding and storage capacity which has some effect on humidifying the underlying soil. High concentrations of aluminum and, to some extent, iron are present in the ash (Appendix C, Iron and Aluminum content of ash). These metals are released through weathering and deposited in the underlying soil modifying its chemistry.

Brunisolic development is common on a host of materials throughout the southern half of the Yukon. In the warmer, somewhat more moist, low elevation areas in the southeast, Dystric Brunisols (Canada Soil Survey Committee 1976) and, to a lesser extent, Humo-Ferric Podzols (Lavkulich 1973) are most common on acidic, coarse-textured, glaciofluvial, colluvial and morainal deposits. Eutric Brunisols generally occur on calcareous, medium- to fine-textured fluvial, glaciofluvial, glaciolacustrine and morainal materials. Luvisols develop most commonly on fine-textured glaciolacustrine and, to some extent, on morainal deposits (Day 1962). Humo-Ferric Podzols occur in alpine areas associated most often with coarse, non-calcareous materials.

Regosolic soils are encountered on recent floodplains (Appendix C, Profile No. 5) and on steep colluvium. Gleysols are frequently found adjacent to recent floodplains, bogs, fens, and on gentle seepage slopes.

Organic soils (fens, bogs) (Tarnocai 1973; Day 1974) are common in lowland areas and often have permafrost features, such as peat plateaus and palsas. They are generally Fibrisols or Mesisols, depending on fibre content, and when associated with a frozen layer, are Fibric Organic Cryosols or Mesic Organic Cryosols.

Mineral soils displaying cryogenic forms (i.e. hummocks, circles, stripes, etc.) occur in some lowland areas and in the alpine.

Central Yukon is somewhat drier and slightly cooler than the southern part. Soil developments are similar; however, the cryogenic expression is more pronounced. Alpine areas are plentiful and patterned ground features, such as sorted and non-sorted circles and stripes, are abundant. Generally, Eutric (Appendix C, Profile No. 1) and Dystric (Appendix C, Profile No. 3) Brunisols and Turbic Cryosols occur on various materials from lowland to alpine environments. Podzols occur in the alpine, though they may be infrequent (Appendix C, Profile Nos. 2 and 4). Minor areas of Luvisols occur on fine-textured glaciolacustrine deposits. Chernozemic soils and soils transitional to Chernozems occur on steep south-facing slopes at lower elevations, but are sparse.

Soil development in unglaciated areas does not appear to differ markedly from that of glaciated areas. Where the loess cap is sufficiently thick, both Eutric and Dystric Brunisols have developed within the loess itself. Soils developed in the underlying material are generally deeper and are largely Brunisols, but some Luvisols occur.

In the rugged mountains throughout the southern half of the Yukon, Regosols occur in colluvium on slopes. Frost action is intense and scree, rock rivers and felsenmeer are common. Most high elevation valleys contain cryogenic soils typical of tundra regions to the north. These soils most nearly fit the Brunisolic order, being turbated forms of Cryic Eutric or Cryic Dystric Brunisols. Where permafrost is deep or absent, as in some coarse-textured deposits, Dystric and Eutric Brunisolic soils develop. Abundant permafrost features, such as peat hummocks, palsas and peat plateaus, are common in organic soils.

Soils developed in alpine meadows on moderately sloping topography often have a dark surface layer in which a considerable amount of humus has been incorporated. These soils are Alpine Eutric or Dystric Brunisols, and are often turbated.

In the northern half of the Yukon, permafrost becomes the dominant factor affecting soil formation (Zoltai and Pettapiece 1973). Coarse-textured soils, where permafrost is deep, have Brunisolic developments. Finer-textured soils, with inhibited internal drainage, are most often strongly cryoturbated, and are likely Turbic and Static Cryosols. Organic deposits frequently exhibit peat polygons and plateaus. Organic soils are generally Fibric Organic and Mesic Organic Cryosols.

7. Permafrost

Brown (1967, 1973, 1974, in press) divided permafrost in the Yukon into two zones; the continuous zone in the north and the discontinuous zone in the south (Fig. 9).

In the continuous zone, permafrost exists everywhere beneath the land surface. Thickness of permafrost is about 100 m at the southern boundary and increases to the north. The active layer is variable in thickness, but generally extends to permafrost.

The discontinuous zone is subdivided into two subzones, the widespread subzone, where permafrost predominates, and the scattered subzone, where permafrost is localized. The permafrost thickness varies from a few metres in the south to about 100 m at the northern boundary. The active layer thickness is variable, and may or may not extend to the permafrost table. Occasionally a layer of ground between the active layer and the permafrost table remains unfrozen throughout the year.

In the Cordillera, permafrost may be continuous at higher elevations and discontinuous at lower elevations. In Figure 9, the area indicated as having permafrost in the Cordillera is approximately equivalent to the mean annual air temperature isotherm of -10°C (Brown, in press).

Permafrost distribution is determined by climate. Variations in local terrain conditions are responsible for the occurrence of permafrost in the discontinuous zone and variations in thickness of the active layer in both the continuous and the discontinuous zones.

Perennially frozen terrain gives rise to recognizable surface features (Washburn 1958, 1973; French 1976). The ground surface pattern and degree of expression are dependent on local climate, landform, topographic position, hydrology, vegetation, soil and rock type, snow cover and fire history.

8. Vegetation

The vegetation consists of boreal forest and tundra on a worldwide or formation scale (Eyre 1963; Riley and Young 1966). These two formations were delineated as regions by Rowe (1972) for the forest regions of Canada. He further divided the boreal region into two subregions: the predominantly forest and the forest and barren. The predominantly forest subregion was subdivided into the Dawson (B.26a), Central Yukon (B.26b), Eastern Yukon (B.26c), Kluane (B.26d) and Upper Liard (B.24) sections (Fig. 10). The forest and barren subregion was divided into the Lower Mackenzie (B23b) and the Alpine Forest-Tundra (B.33) sections.

Some vegetation studies were conducted in portions of the Yukon, such as Porsild (1951) along the Canol Road; Drew and Shanks (1965) in the upper Firth River Valley; Hettinger et al. (1973) north of the 66th parallel; Douglas (1974) in the Alsek River area, and Hoefs et al. (1975) on Sheep Mountain. Other cursory observations or plant collections were made in accessible areas which gave indications of species distributions. The Forest Management Institute, Canadian Forestry Service, conducted some forest surveys in southeastern Yukon (Peaker 1968; Hirvonen 1968; Wallace 1970), and Hansen (1953) investigated postglacial tree distribution through pollen profiles.

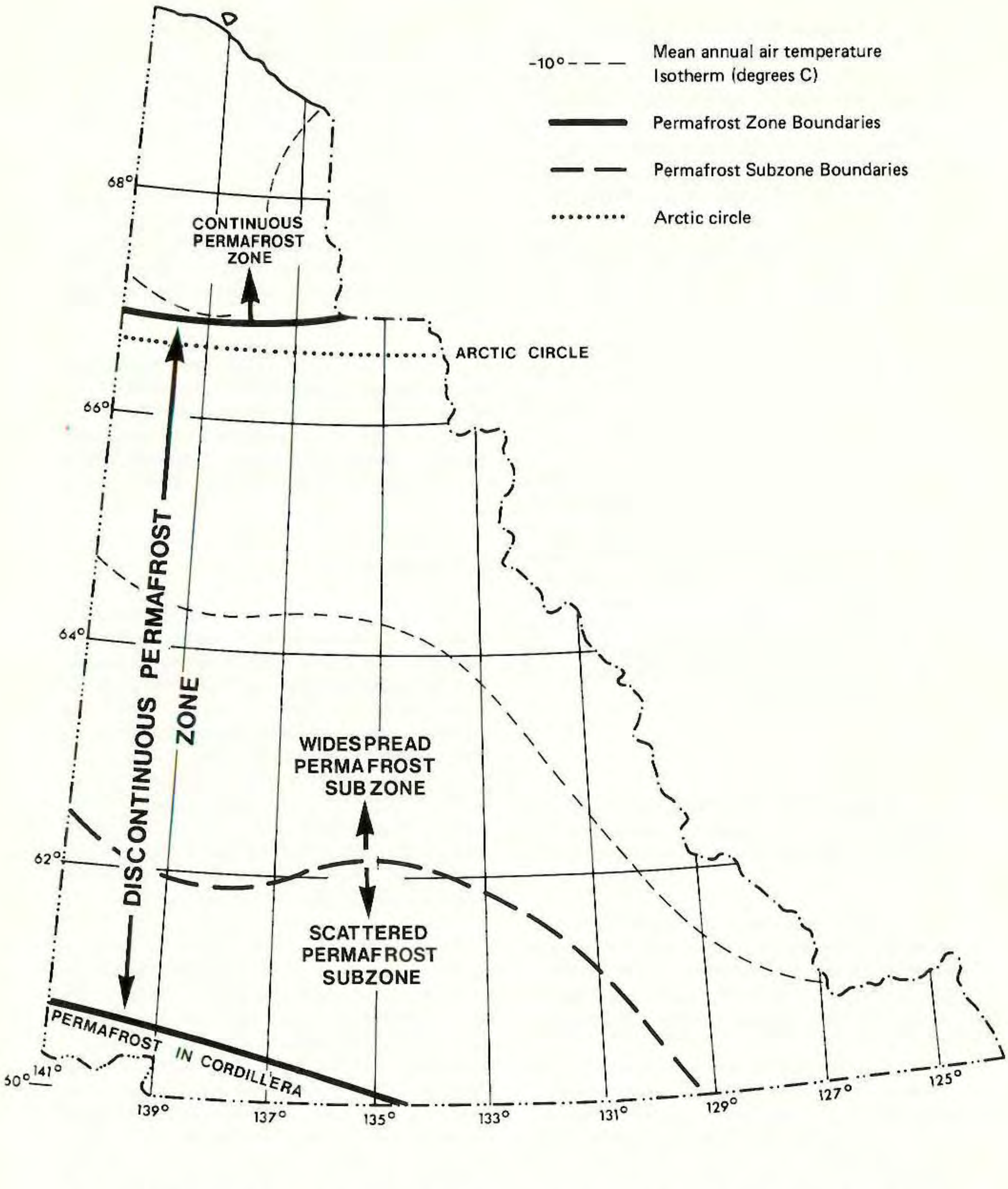


Figure 9. Permafrost zones and subzones and mean annual air temperature isotherms adopted from Brown (in press).

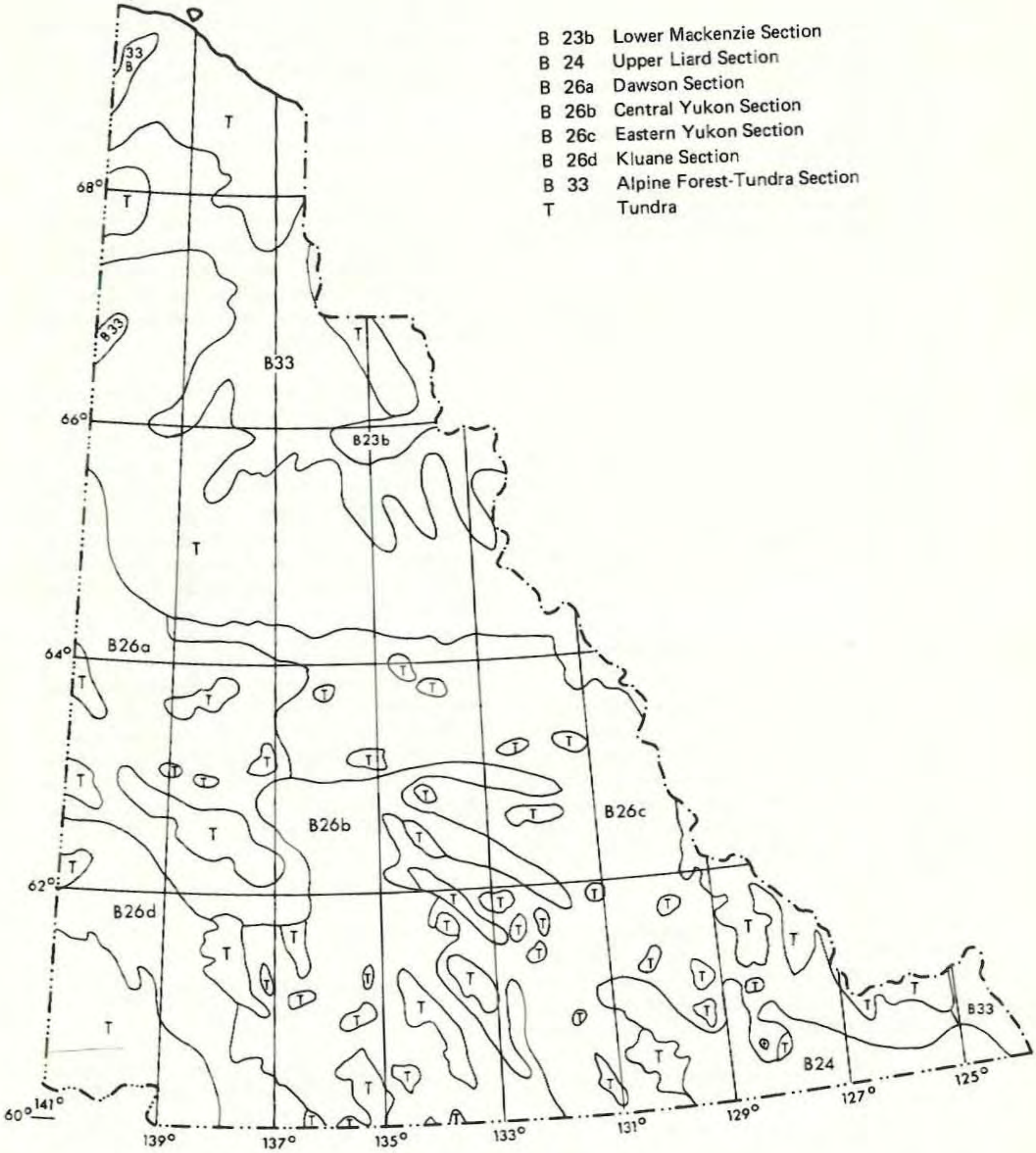


Figure 10. Forest regions adopted from Rowe (1972).

Trees cover most of the plateaus and valleys in the south and form closed to open canopies, depending on site conditions. The southeastern part has the greatest proportion of closed-canopy forests and the greatest number of tree species, which include white spruce, black spruce, larch, alpine fir, lodgepole pine, aspen, balsam poplar and paper birch (Appendix A). To the west and north, the stands become more open and discontinuous. Larch, alpine fir and lodgepole pine are generally absent, but larch occurs north of the Selwyn Mountains, and alpine fir occurs to a limited extent in the northwestern part of the Klondike Plateau.

White spruce and black spruce would be the climatic climax species on moderate- to well-drained sites in the south central and eastern areas, but current stands contain lodgepole pine and, to a much lesser extent, aspen as a result of fire. Black spruce forms edaphic climaxes in poorly drained areas. In the southwestern portion, black spruce or mixed black and white spruce form the climatic climax due to the incidence of permafrost developing under mature forests, as indicated by Viereck (1970). Currently, stands consist of black and white spruce, aspen, balsam poplar and paper birch, mixed in various proportions or pure. Succession after fire usually starts with willow, aspen and balsam poplar. Occasionally, black spruce may be an initial invader.

Alpine fir is the primary alpine timberline species throughout the south central and eastern areas, but it is replaced by white spruce westward and northward. Several species occur near the arctic treeline, but white and black spruce are the most prevalent. White spruce, aspen and balsam poplar extend along protected situations almost to the Arctic Ocean.

Shrub communities are restricted to recent alluvial sites, disturbed areas, wetlands and near treeline in southern Yukon, except where they occur under a forest canopy. Their incidence increases northward, especially on higher plateaus and protected slopes of mountains. Willows, shrub birch, soapberry and alder are the most prevalent species on better-drained sites; ericaceous shrubs, frequently with willows and shrubby cinquefoil, occur on poorly-drained sites.

Tussock fields, either of sedge or cottongrass, occur in southern Yukon, but increase in ground coverage northward to form the predominant vegetation of the arctic tundra. They occur on imperfectly drained sites where seasonal frost lasts for a significant portion of the year. The tussocks may be hummocky, especially where permafrost is present. High water tables supported by permafrost may permit tussock development on gentle slopes. Trees, particularly black spruce and larch, and shrubs, mainly ericads and willows, may occur in tussock fields, and forbs, lichens and mosses are usually present.

Grassland is restricted to steep, dry, south-facing slopes along the Yukon and Pelly rivers on morainal, colluvial and glaciofluvial material. Shrubs, such as sagewort and rose, and several forbs occur in the grasslands. These areas are very dry during the summer and, because of the position on steep slopes, are susceptible to erosion.

Alpine tundra consists of several communities, ranging from sedge meadows or tussock fields to pioneer colonization of lichens on rocks. The wetter areas, common on gently sloping to depressional terrain with an accumulation of organic matter, possess vegetation similar to that described for tussock fields. The mesic alpine vegetation is characterized by a combination of prostrate shrubs, mainly ericads and willows, grass, sedge, forbs, lichens (<u>Cetraria</u>, <u>Alectoria</u>, <u>Cladina</u>, <u>Cladonia</u>, <u>Peltigera</u>), mosses (<u>Aulacomnium</u>, <u>Bryum</u>, <u>Dicranum</u>, <u>Pleurozium</u>, <u>Polytrichum</u>) and <u>Sphagnum</u>. Mineral soil at the surface is usually stony, and permafrost is either deep or absent. The soils are well-drained and tend to dry out during summer if the snow-free period is sufficiently long. Rock fields may have only crustose or fruticose lichens growing on the rocks, and members of the mesic alpine vegetation growing in interstices between rocks.

ECOREGIONS OF THE YUKON TERRITORY

Twenty-two ecoregions (Fig. 11) are recognized and described in terms of physiography, drainage and geology, climate, glaciation, surface deposits, terrain and vegetation. Technical terms are used throughout the text to provide concise and exact descriptions of various phenomena. The Appendices, which provide a glossary of terms, as well as the scientific names for the plant and tree species observed, should be used so that a clear understanding of each ecoregion results.

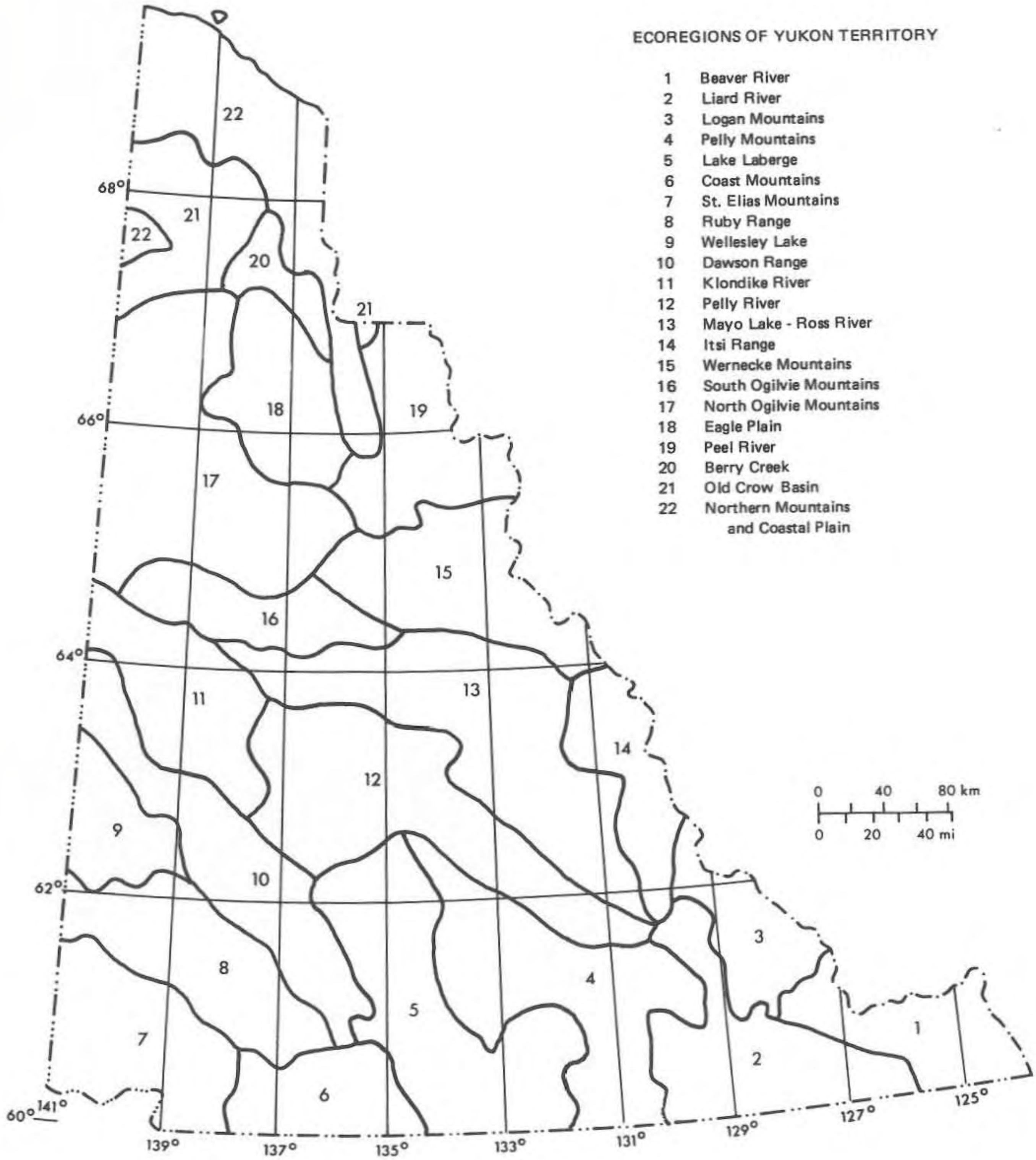
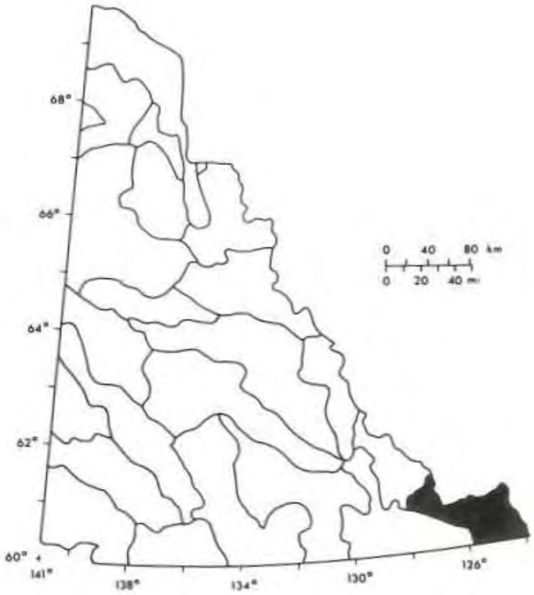


Figure 11. Ecoregions of Yukon Territory.

1. Beaver River Ecoregion (area: 15 905 km²)
Plate I



Physiography: The Beaver River Ecoregion comprises about 3.3% of the Yukon and is characterized by relatively low relief with broad, undulating plateaus and hills rising to 1350 m a.s.l. The highest peak is 1900 m. The height of land on the north and east sides of this unit forms the boundary between the Yukon and northwest Territories. The eastern portion lies within the Liard Plateau and the western portion lies within the Hyland Plateau physiographic subdivisions of Bostock (1965).

Drainage: The La Biche, Whitefish, Beaver, Rock and Coal rivers originate in the mountains along the northern boundary of this ecoregion and enter the Liard River south of the Yukon Border. The larger lakes include Gusty, Upper Toobally, Larsen, Fantasque, Jackpine and Spruce lakes.

Geology: The Liard Plateau is underlain largely by sedimentary rocks, composed mainly of dolomite, limestone, shale, siltstone and sandstone, with minor inclusions of metamorphic complexes, whereas the Hyland Plateau contains intrusive bodies, consisting primarily of granodiorite and quartz diorite.

Climate: The estimated annual precipitation increases from about 500 mm in the west to over 625 mm in the east. Mean annual temperatures are in the vicinity of -4°C to -7°C (Burns 1973, 1974), winter and summer averages being approximately -28°C and +13°C, respectively.

Glaciation and surficial deposits: The area was glaciated on several occasions. During the last advance, ice moved across the area in an easterly to northeasterly direction and the Liard Plateau was heavily scoured, leaving only a thin mantle of till, with much exposed bedrock, on upland surfaces. Morainal, glaciofluvial and some lacustrine material was deposited in valley bottoms and along lower slopes. The Hyland Plateau was blanketed with deep deposits of medium- to fine-textured morainal material. Coarse glaciofluvial and recent alluvial materials of variable textures are extensive in valleys (Bostock 1965).

Terrain features: The unit lies within the widespread permafrost subzone of Brown (in press), except for the southeast corner which lies within the scattered permafrost subzone. Poorly drained basins at lower elevations most often have patterned fen and peat plateau complexes. Fenlands do not have permafrost. Sphagnum hummocks and sedge hummocky tussocks occur on moderately well-drained sites. Open black spruce-hummocky terrain is not well developed on north aspects. Peat plateaus and blanket bogs (Plate XXII, page 77) often occur in the higher elevation valleys and alpine situations. Solifluction features, bare-center circles or stripes are not pronounced, mainly because of the subdued nature of the topography and the presence of vegetation cover (Plate XXII). No volcanic ash deposits were observed.

Vegetation: The vegetation is characterized by nearly continuous, usually open-growing forests with trees attaining, but seldom exceeding, heights of 18 m. The area is included in the B33 and B26c forest regions of Rowe (1972), and only a small portion of the terrain extends above treeline, which occurs at about 1200-1350 m a.s.l. Black and white spruce are common and form the climax tree species on most sites. Black spruce is most abundant on poorly drained sites and white spruce on better drained ones. Lodgepole pine is the dominant species as a result of fires and often forms pure stands

PLATE I (Beaver River Ecoregion)

a) White and black spruce in Coal River Valley; wetlands are abundant.
Lat. 61°13'N, Long. 127°16'W

b) Open spruce - lichen forest and bog-fen complex.
Lat. 60°37'N, Long. 125°47'W

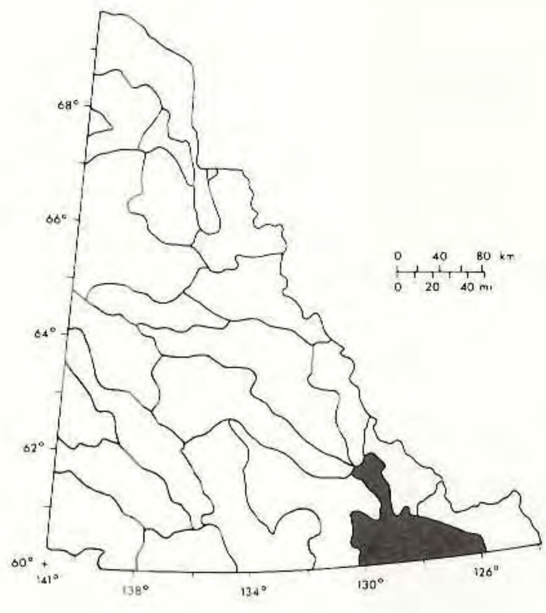
c) Subalpine fir and willow–shrub birch.
Lat. 61°47'N, Long. 128°15'W

covering vast areas. Larch frequently accompanies black spruce on poorly drained sites, but is not abundant. Paper birch, aspen and balsam poplar are sparsely distributed throughout. Alpine fir is prevalent in the subalpine.

The understory vegetation consists of feathermoss, often in combination with willow, alder, soapberry and rose. Lichens are prevalent on drier sites, including rapidly drained soils, tops of hummocks and peat plateaus. In poorly drained areas, Labrador tea, blueberries, crowberry, willow and sphagnum are common. Shrub birch and willow form associations in the subalpine and extend above tree line. Lichens are common in the shrub communities and become dominant or very conspicuous at higher elevations. Prostrate willows and ericaceous shrubs occur in the alpine along with forbs, grasses, sedges and lichens.

2. Liard River Ecoregion (area: 21 725 km^2)

Plate II



Physiography: The Liard River Ecoregion occupies about 4.5% of the Yukon, and is comprised of the Liard Plain, the southern portion of the Hyland and Pelly plateaus and the northern part of the Dease Plateau (Bostock 1965). The terrain lies mostly below 900 m elevation, but rolling hills up to 1200 m are common. The highest peak is 1887 m a.s.l.

Drainage: The Liard River and its tributaries provide drainage to the southeast and eventually empty into the Mackenzie River. There are several lakes in the unit; the larger ones include Tillei, Frances, Sambo, Simpson, Stewart, Watson, Blind and lower Toobally.

Geology: Most of the area is underlain by sedimentary and, to a lesser extent, metamorphic rocks. Shale, slate, conglomerate, limestone, chert, argillite and dolomite are common. Granitic intrusions occur in the northeast part, generally within the Hyland Plateau.

Climate: Meteorological data from Watson Lake and Frances Lake indicate an annual precipitation of about 430 mm (Table 1). Precipitation increases from about 400 mm in the lee of the Cassiar and Pelly mountains to about 625 mm in the northeastern and eastern portions of the ecoregion (Fig. 7). The mean annual temperature is about -3°C at an elevation of 685 m, with a January mean of about -25°C and a July mean of 15°C.

Glaciation and surficial deposits: At least three ice advances have covered most or all of the area. Ice moving northerly from the Cassiar Mountains was apparently deflected eastward by the Pelly Mountains and a further deflection occurred when the Cassiar ice came in contact with ice moving southward from the Selwyn and Logan mountains.

As a result, glacial debris was deposited throughout the area, leaving a deep mantle of morainal, glaciofluvial and lacustrine deposits. Few rock outcrops remain.

Terrain features: The ecoregion occurs mainly within the discontinuous, widespread permafrost subzone of Brown (in press); the southwest corner is in the scattered permafrost subzone. Thick accumulations of organic matter occur in poorly drained valley situations; perennially frozen features, e.g. peat plateaus and peat hummocks associated with patterned string fen landforms, are common in these locations (Plate XXIII, page 78). Palsas occur infrequently (Plate XXIII). Open black spruce hummocks, often with sphagnum, are present on some north-facing slopes. Pro-

PLATE II (Liard River Ecoregion)

a) Spruce and lodgepole pine forests in Liard Plain.
Lat. 60°15'N, Long. 128°55'W

b) Spruce and lodgepole pine on moraines.
Lat. 60°32'N, Long. 127°45'W

c) Black and white spruce along Coal River; note area with permafrost on bank near center of photo.
Lat. 60°35'N, Long. 127°30'W

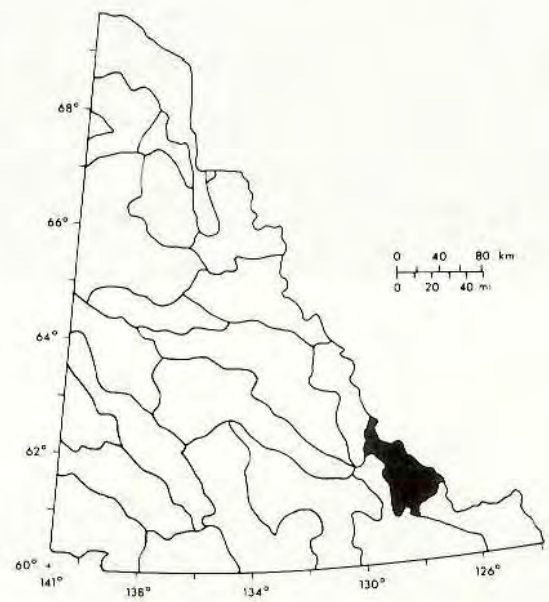
minent solifluction features are scarce, possibly due to the generally low elevation and subdued nature of the terrain and the continuous vegetative cover.

Upland slopes and plains are mostly mantled with medium-textured, often drumlinized morainal material having few rock outcrops (Plate XXIII). Colluvial material occurs on steeper upper slopes. Valley floors are often mantled with coarse-textured glaciofluvial deposits interspersed with pockets of fine-textured glaciolacustrine material. Extensive recent alluvial deposits occur along most major rivers. Volcanic ash deposits were noted only in the northern part of the ecoregion (Fig. 3).

Vegetation: The ecoregion is mostly forested with closed stands of conifers and hardwoods, which attain heights of 30 m or more on river terraces. The unit lies within the B24 and B26c forest regions of Rowe (1972), and has the highest potential for growing trees of any area in the Yukon. White and black spruce, with a moss or moss-shrub understory, form the climax vegetation on nearly all sites below subalpine. Lodgepole pine is prevalent on plateaus and hills as a result of fire, and aspen is common on south-facing slopes in either pure or mixed seral stands. Balsam poplar occurs along river terraces, and as a pioneer species on recent floodplains with willow and aspen, where it frequently persists well into the later stages of white spruce invasion. Larch is common, along with black spruce, in poorly drained situations and extends onto gentle slopes with seepage and fine-textured soil material. Paper birch is scattered amid other tree species on upland plateaus and is most common on north aspects. Alpine fir is prevalent and forms extensive open stands in the subalpine to about 1500 m a.s.l.

The understory vegetation on medium- to fine-textured soils consists of shrub and moss growth under mature conifer stands. Feathermoss is continuous and alder, soapberry, blueberry, rose and willows are common. Coarse-textured soils are frequently covered with lichens and a few forbs or shrubs. Forbs attain prominence, in numbers and species diversity, under hardwoods. Moderately well- to poorly drained areas usually have sedge or sphagnum hummocks and tussocks on which ericaceous shrubs, shrubby cinquefoil and lichens grow. Ground birch and willow occur in the subalpine and become prevalent above treeline.

3. Logan Mountains Ecoregion (area: 12 253 km^2) Plate III



Physiography: The Logan Mountains Ecoregion is characterized by rugged terrain, most of which lies above 1500 m a.s.l. The north central portion has several peaks over 2500 m high, the highest being 2571 m a.s.l. Perpetual snow fields are common at higher elevations. About 2.5% of the Yukon is contained in this unit, and it mostly lies within the Logan Mountains physiographic subdivision of Bostock (1965).

Drainage: Most of the ecoregion is drained by the Hyland River which traverses the central part. The eastern section is drained southward by Coal River, and the western portion by several tributaries to the Frances River. The extreme northern part drains through tributaries to the Pelly River. Lakes are not common in the unit.

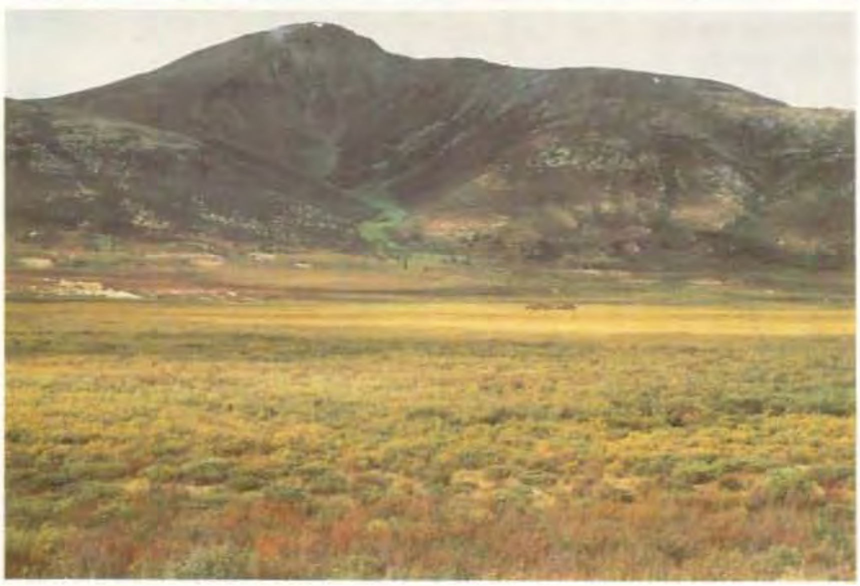
Geology: The ecoregion is generally underlain by sedimentary rocks, mostly shale, slate, conglomerate, limestone, dolomite, siltstone and sandstone which are intruded by massive bodies of granodiorite and quartz diorite.

Climate: The major part of the unit lies within

PLATE III (Logan Mtns. Ecoregion)

a) Black spruce bog-fen, white spruce on lower slopes, and alpine fir at tree line.
Lat. 60°58'N, Long. 128°30'W

b) Subalpine fir, white spruce, willow-shrub birch on terraces and lower slopes.
Lat. 62°00'N, Long. 128°17'W



c) Bog-fen on floodplain, subalpine fir and shrub birch-willow on slopes; note peat plateau.
Lat. 62°00'N, Long. 128°38'W

the 750 mm precipitation isohyet of Burns (1974). Strong topographic influences probably result in higher precipitation at higher elevations and lower precipitation at lower elevations. Tungsten, at an elevation of 1143 m, receives 605 mm average annual precipitation.

The ecoregion lies between the -6°C and -9°C isotherms of Burns (1973). Valleys are somewhat warmer than upper slopes, even with temperature inversions. Tungsten has a mean annual temperature of -6°C, with a wide range between winter and summer temperatures (Table 1).

Glaciation and surficial deposits: During the last glacial period, continental ice reached elevations of about 1500 m. Alpine ice, as indicated by strongly cirqued mountain tops, occurred above this. Ice movement was generally in a westward direction in the north, southward along the west side and southeastward and northeastward in the southern part of the ecoregion.

Valleys in the extreme northern portion were heavily scoured. Much of the material was transported to the southwest and south, where the valleys now exhibit deep mantles of medium-textured morainal and coarse-textured glaciofluvial materials (Plate XXIV, page 79). Upper elevations are frequently covered with a colluvial veneer, particularly where the bedrock is of sedimentary origin.

Terrain features: The ecoregion lies within the discontinuous widespread permafrost subzone of Brown (in press). Stone nets, with poorly developed sorted circles, are common on gentle to moderate slopes at upper elevations. Stone bordered stripes, rock rivers and scree are prevalent on steeper slopes and soils shallow to bedrock. Solifluction lobes occur where the surface mantle of mineral soil is sufficiently deep, and hummocky topography with permafrost is common on lower north-facing slopes. Valley bottoms frequently possess patterned sedge-willow fen and bog complexes, with peat mounds, hummocks, tussocky hummocks and peat plateaus being common constituents (Plate XXIV). The fens lack permafrost. Beaded streams, indicative of the melting of masses of ground ice, are common.

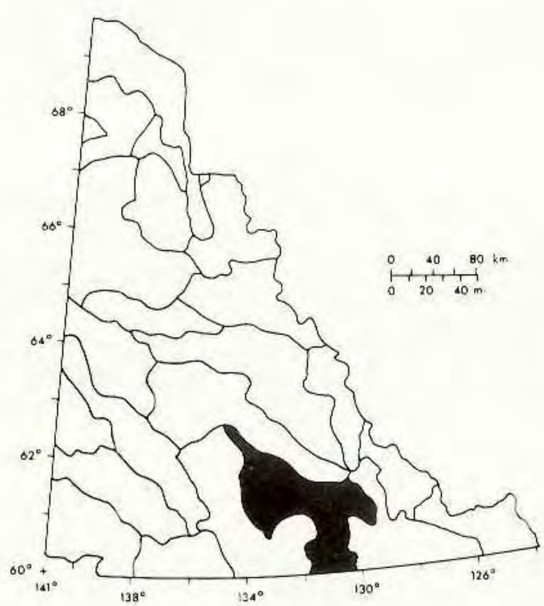
Volcanic ash was not observed during the survey, although the ecoregion lies within the area where ash could be expected (Fig. 3).

Vegetation: Most of this ecoregion lies above treeline at 1350-1500 m. Consequently, trees are confined to lower slopes and protected valleys. The higher elevation terrain lies within the tundra forest region of Rowe (1972), and lower elevation areas lie within the B26c region. Open growing black and white spruce, with a small component of paper birch, are the most widespread arboreal species. Aspen and lodgepole pine occur in seral stands on warmer aspects. Alpine fir occurs in the subalpine.

A lichen understory is prevalent on well-drained, shallow soils and hummocky tussocks, and forms the primary vegetation on rocky slopes. Sedge tussocks, with sphagnum, occur on organic soils and moderate to imperfectly drained slopes. Shrub birch and willow occur in the subalpine and extend above treeline. Forbs are seldom prevalent, but low-growing ericaceous shrubs and willows are common and become dominant, along with lichens, in alpine situations.

4. Pelly Mountains Ecoregion (area: 31 712 km^2)

Plate IV



Physiography: The Pelly Mountains Ecoregion is

PLATE IV (Pelly Mtns. Ecoregion)

a) Hummocky black spruce bog on gentle slope, lichen cover produces light tones.
Lat. 60°18′N, Long. 132°05′W

b) Spruce-willow-shrub birch, spruce/lichen and alpine fir on slope.
Lat. 61°26′N, Long. 133°37′W

c) Bog-fen in valley, spruce-alpine fir on slopes, circs on peaks.
Lat. 61°55′N, Long. 133°27′W

comprised of the Pelly and Cassiar mountains physiographic subdivisions of Bostock (1965), but also includes part of the Nisutlin Plateau. It constitutes about 6.6% of the Yukon. The terrain is of moderately high relief, generally over 1500 m, and the highest peak is 2404 m a.s.l. Relief is greater in the Pelly Mountains than in the Cassiar Mountains.

Drainage: The southern portion of the Cassiar Mountains drains southward by Swift, Smart and Morley rivers which flow into Teslin Lake, and eastward by the upper Rancheria and Meister rivers. The east central portion of the ecoregion is drained by the Liard River and the west central part by the Nisutlin, Wolf and Big Salmon rivers. The northwest part drains westerly through North Big Salmon and Magundy rivers, whereas the northern fringe of the Pelly Mountains drains northward by several tributaries of the Pelly River, the Lapie and Hoole rivers being prominent.

Lakes occur mainly in the Nisutlin Plateau, and include Nisutlin, Quiet, Big Salmon, Wolverine, Morris and Hasselberg.

Geology: The Cassiar Mountains are composed mainly of intrusive rock, consisting of biotite quartz monzonite and granodiorite, with large bodies of chert, limestone, slate, argillite and quartzite, and minor inclusions of greenstone schist. The Pelly Mountains consist largely of intrusive rocks, of which granite, granodiorite, diorite and monzonite are prominent, but also contain metamorphosed sedimentary and volcanic rocks, such as schist, gneiss quartzite and phyllite. Sedimentary rocks underlie most of the plateau portion.

Climate: Precipitation isohyet maps of Burns (1974) indicate the ecoregion receives a mean annual precipitation of between 375 and 625 mm. Precipitation is lowest in the central part (375-500 mm) and increases to 625 mm or more at higher elevations to the north and south. Temperature isotherms of -4°C to -6°C cover most of the area (Burns 1973).

Quiet Lake and Swift River, both at lower elevations, have mean annual precipitation figures of 500 and 550 mm, respectively, and have mean annual temperatures of -3°C.

Glaciation and surficial deposits: The only portion of this ecoregion not glaciated during the last ice advance was the Glenlyon Range of the Pelly Mountains in the northwest corner. The remainder was the contact area of the northerly flowing Cassiar Ice lobe and the southwesterly and westerly flowing Selwyn and Logan mountain lobes. A portion of the ice from the Selwyn and Logan mountains was deflected in a southerly and southeasterly direction and moved across the Liard Plain.

Major valley bottoms are generally deeply mantled with glaciofluvial (Plate XXV, page 80) and morainal materials and locally ponded, fine-textured lacustrine sediments. Ice contact deposits and meltwater channels (Plate XXV) often extend up slopes to mid elevations. Deep morainal and colluvial material cover much of the middle and lower slopes. Scree-covered slopes are common at the highest elevations throughout, but are most prominent where sedimentary rock occurs.

Terrain features: The ecoregion straddles the border of the discontinuous widespread and scattered permafrost subzones of Brown (in press). At lower elevations, perennially frozen peatland occurs in imperfectly drained situations. Peat plateaus are common on most large floodplains. Gently sloping to level areas that receive seepage water often support sedge tussock or hummocky tussock fields, and large peat-covered hummocks occur in some valleys. At higher elevations, perennially frozen mineral features are common and consist of stone nets, bare-center circles, solifluction lobes and stone or earth stripes. Polygonal patterns occur in upland fens, and may be relict signs of former ice wedge situations. Fens do not have permafrost.

Vegetation: Much of the ecoregion is treeless and lies within the tundra region of Rowe (1972). Treeline occurs at 1350 to 1500 m a.s.l. The lower elevation plateaus are in the B26c forest region, where open-growing black and white spruce occur in valleys and on lower slopes of the plateau area. Lodgepole pine is common following fires, and alpine fir is prevalent in the subalpine. Hardwoods are scarce, but aspen and balsam poplar are present on warmer floodplains, and paper birch is scattered in poorly drained areas.

Feathermoss, frequently with sphagnum, is common in the understory on plateaus. Ericaceous shrubs and willows occur over much of the area, but forbs are not plentiful. Shrub birch and willow are common in the subalpine, and form extensive patches in protected areas above treeline. Sedge tussocks dominate alpine wetlands. Lichens, ericaceous shrubs and willows dominate alpine tundra areas.

5. Lake Laberge Ecoregion (area: 34 176 km^2)

Plate V

Physiography: The Lake Laberge Ecoregion constitutes about 7.1% of the Yukon and covers parts of the Lewes and Nisutlin plateaus, all of the Teslin Plateau and the southern part of the Big Salmon Range physiographic subdivisions of Bostock (1965). Most of the terrain lies between 600 and 1500 m in elevation, but a few peaks are over 1800 m a.s.l., the highest being 2084 m. The topography is characterized by dissected plateaus and rolling hills.

Drainage: Drainage is provided by the northerly flowing Yukon River and its tributaries, e.g. Teslin and Nordenskiold rivers, and the Little and Big Salmon rivers which flow westward from the Pelly Mountains.

Several moderate to large lakes are present and include Teslin, Tagish, Little Atlin, Marsh, Laberge, Little Salmon, Drury and Frenchman. Smaller lakes are common throughout.

Geology: The bedrock is mostly sedimentary, comprised mainly of limestone, sandstone, siltstone and conglomerate, but it is interspersed with volcanic bodies of andesite, basalt and chert, and intruded by granite, granodiorite and diorite bodies (Mulligan 1963; Bostock and Lees 1960).

Climate: Annual precipitation increases from less than 250 mm at Carcross, Whitehorse and Carmacks (Table 1) located in the rainshadow of the Coast Mountain Range, to over 325 mm at Johnson's Crossing. The warmest mean annual temperatures occur in this ecoregion, due to the coastal influence. Whitehorse and Teslin have mean annual temperatures of about -1°C, and average temperatures in January and July are -20°C and 14°C, respectively (Table 1).

Glaciation and surficial deposits: The area was glaciated during the last advance by ice originating in the Cassiar Mountains to the southeast. A few hills in the northwest corner, lying above 1500 m a.s.l., were not glaciated. Plateau sections were covered with ice to at least 1500 m in elevation in the north and probably to about 1800 m closer to the ice source in the southeastern part of the area (Hughes et al. 1969; Mulligan 1963; Bostock and Lees 1960).

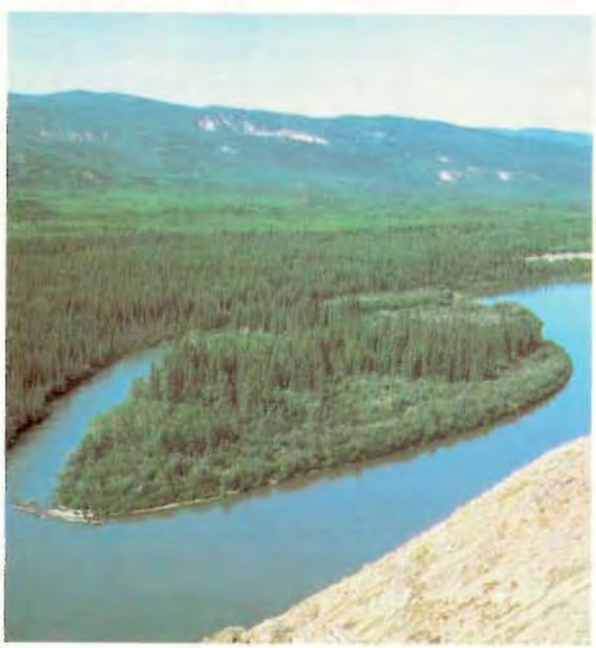
All the lower elevation terrain is overlain with extensive deposits of glacial drift, consisting of morainal and glaciofluvial material interspersed with ponded sediments deposited in numerous valleys. Large proglacial lake deposits formed during deglaciation, especially in the southern part of the unit, are particularly extensive in the Whitehorse and Takhini Valley areas. Some of the finer textured sands have been locally reworked by wind (Plate XXV, page 80). Recent fine-textured alluvium covers most of the valley floors adjacent to drainages. Upper elevations have shallow deposits of morainal and colluvial material, and bedrock outcroppings are common. Intensively scoured valleys occur above the plateaus, although, in general, the area has a fair mantle of surficial material.

Terrain features: The ecoregion lies within the discontinuous scattered permafrost subzone of Brown (in press). Perennially frozen land features are not prevalent at lower elevations, but peat plateaus, patterned fen and bog com-

PLATE V (Lake Laberge Ecoregion)

a) White spruce-lodgepole pine on Lewes Plateau, aspen common. Lat. 62°05'N, Long. 135°35'W

b) Lodgepole pine-aspen-white spruce on moraine. Lat. 60°10'N, Long. 133°25'W



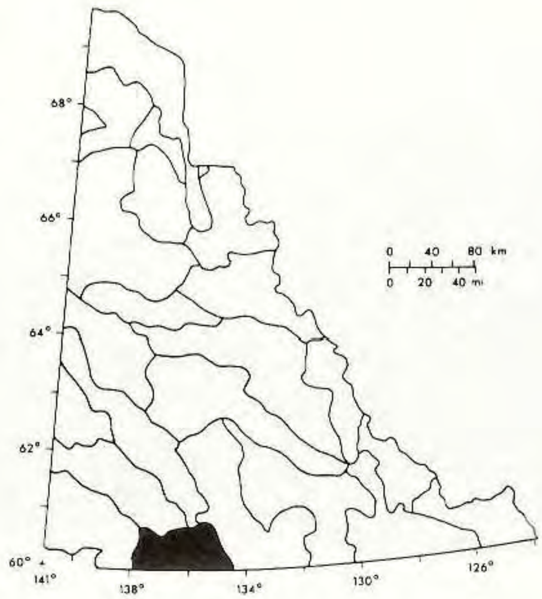
c) White spruce on floodplain, lodgepole pine-spruce-aspen on slope. Lat. 62°03'N, Long. 135°50'W plexes and beaded streams are common at middle to upper elevations, especially in the Nisutlin Plateau. Permafrost does not occur in fens. Hummocky terrain occurs on lower north-facing slopes, though development is not pronounced. At higher elevations, above treeline, poorly developed bare-center circles, stone nets and stripes are present. Steep, south aspect, morainal and colluvial slopes under grassland vegetation are prominent in the area (Plate XXVI, page 81).

Soil textures are highly variable, due to the heterogeneity of deposits. Glaciolacustrine material is silty or sandy, but sometimes interspersed with gravels. Active sand dunes occur in a few localities and sandy and gravelly glaciofluvial deposits, such as terraces and kames, are common. Morainal deposits occur throughout, though they appear deeper and more extensive in the northern half of the ecoregion.

Vegetation: The ecoregion is included in the B26b forest region of Rowe (1972). Moderately open white spruce is dominant in older stands on terraces and plateaus, and probably forms the climax species. Fires, however, have been frequent and extensive. Lodgepole pine occupies the burn areas and currently constitutes the most abundant tree species. Black spruce, either alone or with white spruce, occupies wetter sites, whereas balsam poplar is common on recent alluvium, and aspen occurs on warmer aspects. Alpine fir is found in the subalpine below 1200 to 1350 m a.s.l., but is scarce along the western portion of the unit. Paper birch is scattered, usually occupying cooler aspects.

The understory vegetation is mostly feathermoss, with or without a wide variety of shrubs and/or forbs. Sagewort grassland occurs on steep, silty river banks and on low elevation, dry slopes. Sedge meadows are not prevalent, but occur in depressional situations.

6. Coast Mountains Ecoregion (area: 13 225 km^2) Plate VI



Physiography: The Coast Mountains Ecoregion is characterized by rugged mountainous topography with several ice-covered peaks above 2400 m a.s.l.; the highest having an elevation of 2709 m. The area constitutes about 2.7% of the Yukon and includes portions of the Coast Mountains, Kluane Range, Kluane Plateau, Duke Depression and Shakwak Trench physiographic subdivisions of Bostock (1965). Only major lakes and drainage systems lie below 900 m elevation; between 900 and 1500 m, the topography consists of smooth rolling terrain dissected by U-shaped valleys.

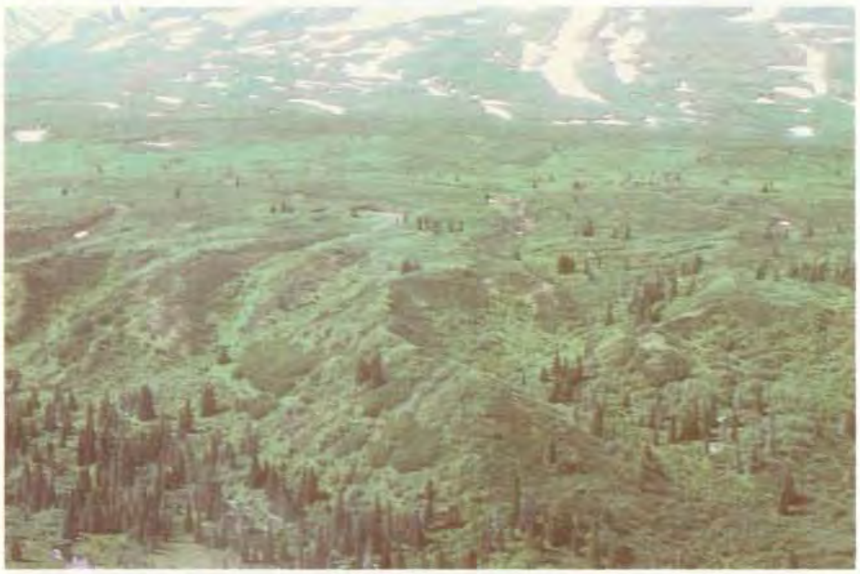
Drainage: The eastern portion drains into the Yukon River via the Wheaton and Watson rivers. The main portion of the Coast Mountains drains through the Takhini River and its tributaries, the Primrose and Ibex rivers, into the Yukon River. The west central portion drains through the Dezadeash River via several tributaries and enters the southerly flowing Alsek River which drains the remainder of the ecoregion.

Several large to moderate sized lakes occur, and include Bennett, Kusawa, Dezadeash, Primrose, Jo-Jo, Fish, Alligator, Mush and Bates.

Geology: Intrusive bedrock, comprised of granodiorite, granite, quartz monzonite and quartz diorite, is prominent, but bodies of metamorphic and volcanic rocks are present. Bedrock in the vicinity of Dezadeash Lake is mostly metamorphic, consisting of schist, gneiss, quartzite, quartz mica schist and slate. To the west of

PLATE VI (Coast Mtns. Ecoregion)

a) White spruce and aspen on valley floor.
Lat. $60^{o}03'N$, Long. $137^{o}01'W$



b) White spruce and willow-shrub birch above treeline.
Lat. $60^{o}01'N$, Long. $136^{o}51'W$

c) White spruce-shrub on valley floor; dead trees are due to spruce bark beetle (Dendroctonus rufipennis) attack from 1943 to 1948.
Lat. $60^{o}02'N$, Long. $137^{o}00'W$

Dezadeash Lake, the bedrock includes a mixture of volcanic, metamorphic and sedimentary rocks, comprised of andesite, basalt, limestone, marble, slate, quartzite, conglomerate and tuff, with large bodies of intrusive granodiorite, quartz diorite and granite (Wheeler 1961; Gilluly et al. 1959).

Climate: Limited data are available within the ecoregion, but inferences from surrounding meteorological stations indicate a coastal influence. At Mile 75 of the Haines Road, just south of the Yukon - British Columbia border, the mean annual temperature is -3°C and average annual precipitation is 761 mm (Table 1). At Haines, Alaska, located 120 km to the south, the mean annual temperature is 2°C and average annual precipitation is 1250 mm. These data can be compared with Haines Junction to the north (Table 1), which is slightly cooler in winter, warmer in summer, and has considerably less precipitation. At Canyon Creek, near the junction of Aishihik and Dezadeash rivers, the annual precipitation is 219 mm.

Glaciation and surficial deposits: The main ice body affecting this ecoregion originated in the Coast Mountains and flowed northward, covering much of the area. The northwestward flowing Cassiar ice lobe came in contact with the Coast Mountain lobe in the northeastern part of the ecoregion, and the entire mass moved in a generally northwesterly direction. All the Coast Mountains below about 2000 m a.s.l. were scoured to varying degrees (Wheeler 1961; Hughes et al. 1969).

River valleys are mantled with deep morainal and glaciofluvial material. Recent alluvium is extensive immediately adjacent to larger rivers. Middle and upper slopes are covered with morainal and colluvial deposits which become thinner at higher elevations, with frequent rock outcrops. Proglacial lakes left ponded sediments in numerous valleys as ice retreated and the lakes drained. Ice contact deposits and silty to gravelly beaches are evident on valley walls in many places.

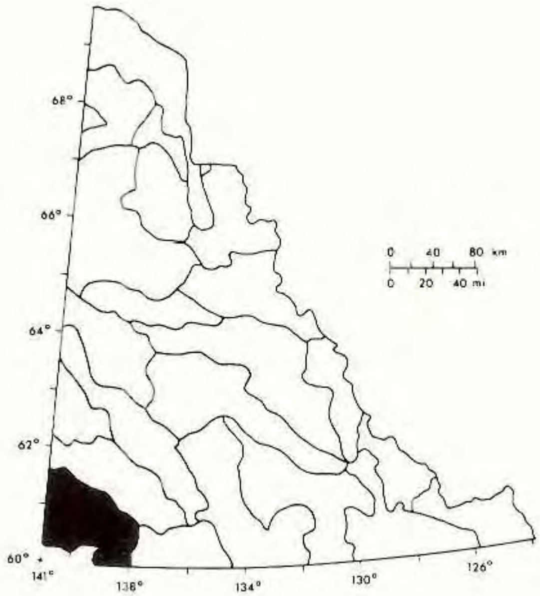
Terrain features: The ecoregion lies within the discontinuous scattered permafrost subzone of Brown (in press). Patterned fen and bog complexes, with sedge tussock fields, and peat plateaus occur in lower elevation valley bottoms with restricted drainage. At higher elevations, especially above treeline, stone nets, moderately well-sorted circles, rock rivers and block fields (felsenmeer) are common on gently sloping to level terrain. The circles are elongated into stripes on steeper slopes and are most often bordered with stones. Solifluction lobes are prevalent on most slopes that have sufficient mineral soil. Nivation hollows are evident on numerous upper slopes.

Soil textures are variable, depending on origin of parent materials. Morainal material derived from intrusive bedrock, prevalent over much of the Coast Mountains, is medium- to coarse-textured, but morainal soils in the western part are of somewhat finer texture. At higher elevations, little till is left and most of the soil mantle is of colluvial origin and is generally stony. Glaciofluvial soils in larger valleys are mostly coarse-textured. Lacustrine soils are generally fine-textured.

Vegetation: Much of the area lies above treeline (1050 to 1200 m a.s.l.) and occurs within the tundra region of Rowe (1972), but lower elevation forests are included in the B26d forest region. On most terraces and lower slopes, the primary forests consist of open-growing white spruce. Alluvial soils in valley bottoms support nearly closed stands of white spruce, often mixed with balsam poplar and willow where drainage is restricted. Aspen grows on warmer sites, but is not common except in burnt areas. Very little black spruce was observed in the unit. Some lodgepole pine and alpine fir may be present along the extreme eastern margin.

The primary shrub growth at lower elevations consists of soapberry and willows. Shrub birch and willow are prevalent in the subalpine and extend well above treeline in protected areas. Moss, herbs, graminoids and ericaceous shrubs are common throughout. Sedge dominates poorly drained sites and is frequently accompanied by sphagnum and ericaceous shrubs. Lichen, ericaceous shrubs and prostrate willows occur in alpine areas.

7. St. Elias Mountains Ecoregion (area: 20 199 km^2) Plate VII



Physiography: The St. Elias Mountains Ecoregion occupies about 4.2% of the Yukon and lies within the St. Elias Mountains, Duke Depression and Kluane Range physiographic subdivisions of Bostock (1965). It is characterized by high, rugged mountains and extensive icefields. Nearly all the unit lies above 1500 m elevation; however, some major valley drainages descend to lower elevations. Peaks over 3000 m are common, and Mt. Logan, at 6050 m, occurs here.

Drainage: Several rivers originating from glaciers drain to the north and east. The northern portion is drained by the White, Donjek, Duke and Slims rivers, all of which eventually empty into the Yukon River. The eastern portion drains through the Alsek River and its tributaries the Dusty and Kaskawulsh rivers.

No lakes occur, except for local ponding at the toe of glaciers and a few areas where drainage is impeded.

Geology: The portion encompassing a minor part of the Kluane Range, a major part of the Duke Depression and the northern slopes of the St. Elias Mountains, is composed primarily of metamorphic and volcanic rock, but large bodies of intrusive rocks occur (Muller 1967) and appear to be dominant in the St. Elias Mountains proper. Metamorphic and volcanic rocks are composed mainly of andesite, greenstone, quartzite, basalt, marble, argillite, phyllite and slate. The intrusive rock is composed mainly of granite and granodiorite.

Climate: Limited meteorological data are available from within the ecoregion (Webber, unpubl.). High peaks intercept most of the precipitation coming from the Pacific Ocean so that the southwest side of the range is very wet, but precipitation decreases rapidly towards the north and northeast of the height of land. Yakutat, Alaska, on the Pacific coast, receives 3364 mm of precipitation, while Burwash, on the northeast side of the mountain range, receives only 283 mm per year. It may be assumed the temperature is cold throughout, but the coastal influence would have a moderating effect on extreme temperatures.

Glaciation and surficial deposits: During the last major glacial advance, ice moved generally to the north and northwest from the St. Elias Mountains, and was augmented by ice formed in the Kluane and Donjek ranges (Muller 1967; Hughes et al. 1969). Intensive scouring occurred in upper valleys and deposition in lower valleys. Terminal moraines (Plate XXVI, page 81), rock drumlins, kame terraces and marginal channels are common features. Several minor glacial movements have occurred since the last major glacial period. Some glaciers, such as the Kluane, Donjek, Steele and Spring, have advanced in recent times, but most are presently stagnant and wasting away. Valleys in the north are deeply incised and morainal and glaciofluvial materials fill most valley bottoms. Cirques are common in the Donjek and Kluane ranges.

Terrain features: Most of the ecoregion lies within the discontinuous scattered permafrost subzone of Brown (in press). Higher peaks along the the extreme southwestern margin of the Yukon are designated as Cordilleran permafrost. Alpine solifluction and cryoturbated forms such as stone nets, bare-center circles, stone bordered earth stripes, felsenmeer and nivation hollows are common (Sharp 1942). Most of the terrain above 3000 m is snow and ice covered, and massive valley glaciers are prominent (Plate XXVI).

Deep deposits of coarse White River ash, or

PLATE VII (St. Elias Mtns. Ecoregion)

a) Alpine glaciers by Dusty Glacier.
Lat. 60°25'N, Long. 138°50'W

b) Valley glacier, white spruce and willow on banks.
Lat. 60°07'N, Long. 137°41'W

c) White spruce and shrub on lower slopes and valleys.
Lat. 60°43'N, Long. 137°57'W

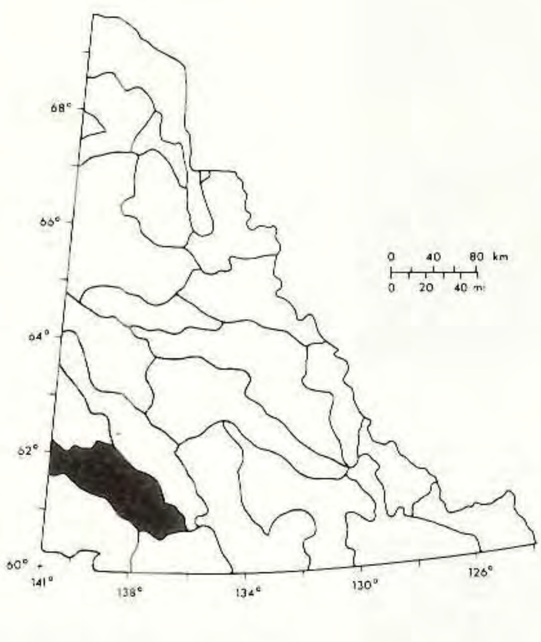
lapilli, occur in numerous localities (Plate XXVII, page 82).

Vegetation: Treeline occurs at about 1050 m elevation, and the area is included in the tundra region of Rowe (1972). Open and stunted white spruce, aspen, balsam poplar, paper birch and, rarely, lodgepole pine occur in low elevation valleys and lower slopes in the north.

Willow and shrub birch, often with soapberry, are prevalent on slopes and extend up protected valleys. Sedge tussock fields occur in valley bottoms where drainage is restricted. Grassy meadows with numerous forbs occur in protected valleys at higher elevations. The rocky slopes and ridges support lichens, prostrate willows and ericaceous shrubs.

8. Ruby Range Ecoregion (area: 21 705 km^2)

Plate VIII



Physiography: The Ruby Range Ecoregion conconstitutes about 4.5% of the Yukon, and is comprised of the Kluane, Ruby and Nisling ranges, Shakwak Valley and Kluane Plateau physiographic subdivisions of Bostock (1965). The terrain consists of rolling to undulating hills above 900 m, and the highest peak is 2304 m a.s.l.

Drainage: The northwestern portion drains to the Yukon River via Kluane, Donjek, White and Nisling rivers, and the southeastern part drains to the Alsek River via the Aishihik and Dezadeash rivers. A small portion on the northeast corner forms the headwaters of the Nordenskiold River.

Kluane Lake, with an area of 396 km^2 is the largest lake in the Yukon, and occurs in this ecoregion. Other lakes include Aishihik, Sekulmun, Canyon, Kloa, Kathleen, Toye, Moraine and Tincup.

Geology: The Ruby Range batholith, occupying a wide band in the central part, is comprised mostly of granodiorite, quartz diorite and granite (Tempelman-Kluit 1974; Muller 1967). To the north of this band, lies a belt of metamorphic rock, comprised mainly of quartzite, quartz mica schist and slate, and this is bordered in the northwest by more intrusive rock. Metamorphic rock also occurs adjacent to the north side of Kluane Lake and extends eastward. To the west of Kluane Lake, quartz chlorite schist and recrystallized limestone occur in the metamorphic complex. The Kluane Range, in the extreme southern part, is composed of volcanic rocks, mostly lava and basalt, with large intrusive bodies, composed of granodiorite and quartz diorite.

Climate: Meteorological data from Haines Junction and Burwash Landing (Table 1), and incomplete data from Kluane and Aishihik, indicate the lower elevations receive 190 to 285 mm of precipitation a year, but it increases somewhat in the central and northern parts. Mean annual temperatures are about -4°C, with a range of -3 to -5°C. Winters are cold and average January temperatures of -30°C are common, although the southeast corner is moderated slightly by the coastal influence which results in mean January temperatures of about -21°C. Mean July temperatures are about 12°C throughout. Winds are common, and frequently strong, especially in major valleys.

Glaciation and surficial deposits: The main ice sources were in the Coast and St. Elias mountains, augmented by ice from the Kluane and Donjek ranges (Muller 1967; Rampton 1969). Ice movement was in a northwesterly and northerly direction. Two periods of glaciation have occurred. The earlier advance was the

PLATE VIII (Ruby Range Ecoregion)

a) White spruce, willow-shrub birch, fens, bogs and shallow open water.
Lat. 60°54′N, Long. 137°55′W

b) Spruce-aspen-balsam poplar-willow on valley floor.
Lat. 60°47′N, Long. 136°53′W

c) White and black spruce stands intermixed with wetlands on plateau.
Lat. 61°35′N, Long. 137°35′W

most extensive and scoured surfaces up to about 2100 m a.s.l. The higher mountains and those along the northwest boundary of the ecoregion were free of ice. A more recent advance was less extensive and covered hills to about 1800 m a.s.l., and left larger portions along the northern boundary unglaciated.

Deep mantles of coarse- to medium-textured morainal and coarse-textured glaciofluvial materials were deposited in valleys; however, some were strongly eroded by subsequent fluvial action. Rock drumlins and ice contact features occur on valley walls and on lower slopes where scouring was intensive. The drift mantle thins out at higher elevations, and rock outcrops and colluvial deposits become more prevalent. Large post glacial lakes were formed in the Shakwak Trench, Kluane River, Talbot and Brooks arms of Kluane Lake and along the valleys of the Dezadeash and Takhini rivers, leaving deep deposits of silts, sands and clays (Muller 1967; Hughes et al. 1972).

The minor unglaciated area in the north is generally mantled in residual material and often capped with loess deposits. Tors are a prominent feature of this landscape.

Terrain features: The area lies within the discontinuous scattered permafrost subzone of Brown (in press). Meandering streams are common and soil drainage is frequently poor in valley bottoms. In such areas, patterned fen and bog complexes with peat plateaus and sedge tussock fields are common (Plate XXVII, page 82). Polygonal patterns are rare. Stone nets, poorly sorted circles and stripes occur in upland areas. Solifluction lobes are common, and best developed on north aspects above timberline. Upland permafrost features appear to be more pronounced in the unglaciated area to the northwest, where soils are older, deeper and often have thicker organic mantles.

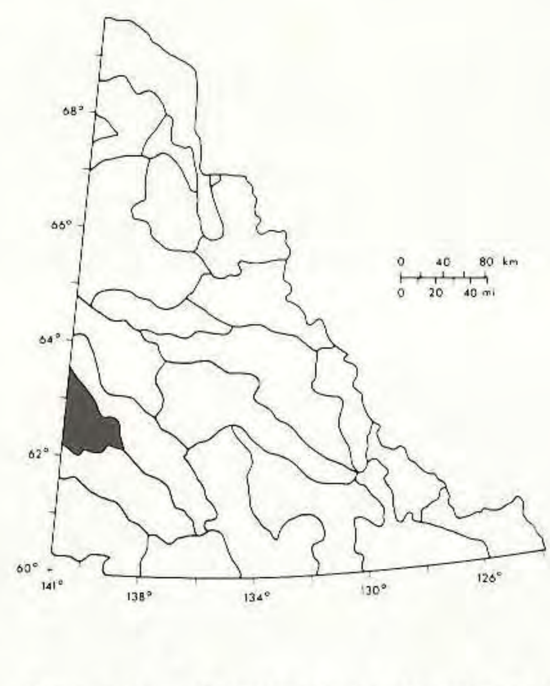
Wind affected some areas, forming parabolic dunes, particularly within the Lake Champagne deposits. Volcanic ash is evident over most of the area.

Vegetation: The higher elevation terrain lies above treeline (about 1200 m a.s.l.) and within the tundra region of Rowe (1972), and below treeline the terrain lies within the B26d forest region. White spruce is common on the better drained sites below treeline, and black spruce predominates on poorly drained sites. Paper birch is scattered throughout, usually being more common in lowlands than on uplands. Aspen and balsam poplar occur on warmer sites and often invade following fires. Lodgepole pine is very scarce except along the eastern fringe of the ecoregion.

Willow, shrub birch, soapberry, alder and ericaceous shrubs are common understory species. Shrub birch and willow communities are prevalent in the subalpine and extend into the alpine. Moss is common to abundant on many sites. Sedge tussock fields dominate poorly drained sites; sedge and grass meadows, with several forbs and ericaceous shrubs, are prevalent on gentle sloping alpine areas. Lichen, ericaceous shrub and forb alpine vegetation occurs on rocky and steep sloping terrain.

9. Wellesley Lake Ecoregion (area: 9 450 km^2)

Plate IX

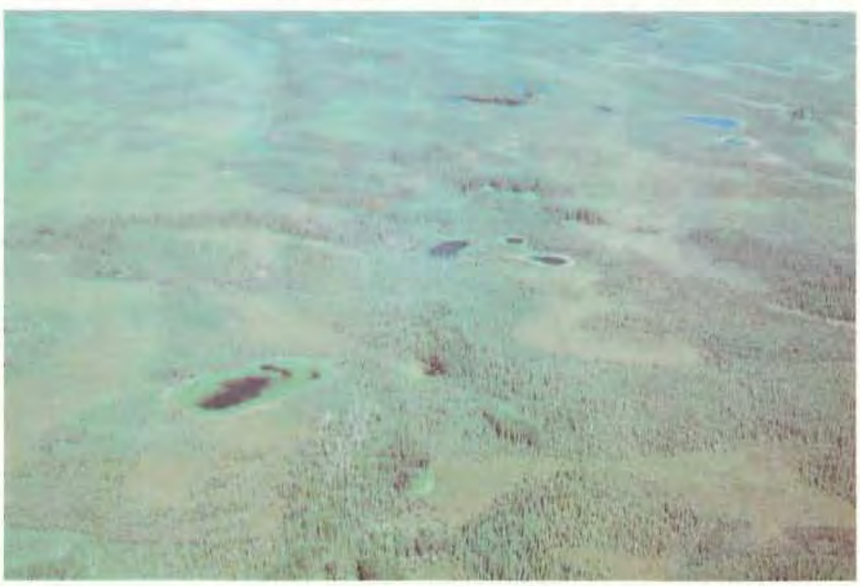


Physiography: The Wellesley Lake Ecoregion is an area of low elevation terrain constituting about 2% of the Yukon, and includes the Wellesley Basin and portions of the Kluane and Klondike plateaus physiographic subdivision of Bostock (1965). Most of the area lies between

PLATE IX (Wellesley Lake Ecoregion)

a) White and black spruce, aspen-balsam poplar and willow in basin.
Lat. 62°30'N, Long. 140°00'W

b) Hummocky, black spruce blanket bog, white spruce along drainages, "tree islands" of black spruce on slope.
Lat. 62°23'N, Long. 140°42'W



c) Bog-fen complex, black spruce, aspen, paper birch.
Lat. 62°25'N, Long. 140°40'W

600 and 900 m elevation, but has a few mountains over 1500 m, the highest peak being 1600 m a.s.l.

Drainage: The major portion drains northward to the Yukon River via Donjek and White rivers, and a portion in the northwest drains westward into Alaska.

Wellesley Lake is the largest lake in the ecoregion, but several smaller ones occur, including Fish Hole, Enger and Scottie.

Geology: Volcanic rock, consisting mainly of greenstone and tuff breccia, underlies much of the southern part. The central part is underlain by metamorphic rock, and mixtures of intrusive, volcanic and sedimentary rocks occur in the northwest and southeast (Templeman-Kluit 1974).

Climate: The mean annual temperature is approximately -7°C, and meteorological data from Beaver Creek and Snag indicate a relatively harsh continental climate, with January mean temperatures of about -34°C, and July mean temperatures of about 13°C. The coldest temperature recorded in the Yukon was at Snag, where the temperature dipped to -63°C. Mean annual precipitation is about 412 mm, more than half coming during June to August. Prevalent storms from the west or southwest are deflected by the St. Elias Mountains and precipitation increases toward the northwest near the Dawson Range. Temperature inversions during winter are common.

Glaciation and surficial deposits: The southern part was glaciated during early or pre-Wisconsin time, and a somewhat lesser portion by the late Wisconsin advance. Glacier ice moved into the area from the Coast and Cassiar mountains, augmented by ice from the St. Elias Mountains and some ice moving eastward out of Alaska (Rampton 1971a, b). The earlier advance covered elevations to about 880 m and the most recent advance to about 730 m. Glacial ice lobes extended into channels of the Donjek and White Rivers.

Moraines occur near the northern limits of the glacial advances. The Wellesley Lake basin area is covered with deep deposits of medium-textured till, large areas of coarse-textured glaciofluvial material (Plate XXVII, page 82) and some fine-textured glaciolacustrine deposits. Kettle holes, probably formed by stagnant ice, are common in the vicinity of Wellesley Lake. Hills, some with drumlinoid appearance, are present in the flat basin terrain (Rampton 1969; Hughes et al. 1969; Templeman-Kluit 1974).

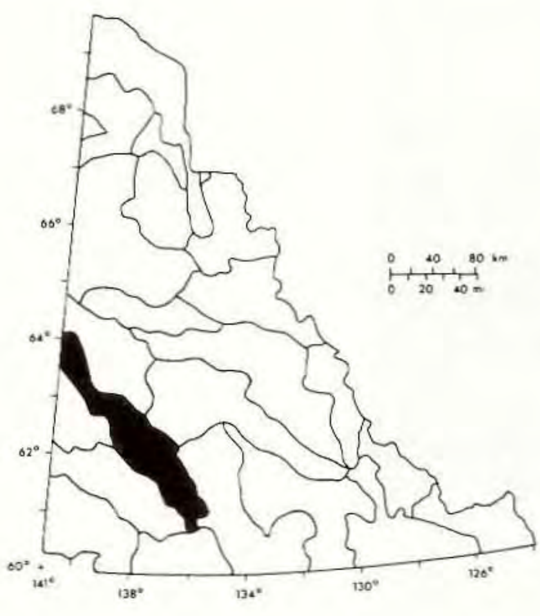
Terrain features: The ecoregion lies mainly within the discontinuous widespread permafrost subzone, with a small area along the southern border lying within the scattered permafrost subzone of Brown (in press). Many areas, except for those with glaciofluvial and recent fluvial deposits, are underlain by permafrost. Sedge tussock fields, hummocks, peat plateaus, palsas, patterned fen and bog complexes and fen polygons (Plate XXVIII, page 83) occur over low relief terrain, where drainage is restricted. Steeper north-facing lower slopes with permafrost support open black spruce hummocky or stepped terrain (Plate XXVIII). At higher elevations, mostly in the alpine but extending into the subalpine, stone nets, felsenmeer (Plate XXVIII), prominent bare-center circles, solifluction lobes and stripes and rock rivers are prevalent. Perennially frozen features appear more pronounced in this ecoregion than adjacent ones, due to the combined effect of higher precipitation, generally fine-textured soils, more subdued relief, poorer drainage, colder temperatures and fewer or less severe fires.

Much of the area is capped with loess (deposits greater than 0.6 m occur in some localities) and volcanic ash, which approach depths of 0.4 m in places (Lerbekmo and Campbell 1969; Rampton 1969). Current wind-born material derived from the floodplains of glacial fed streams, e.g. White River, is affecting local areas.

Vegetation: Nearly all the ecoregion lies within the B26d forest region of Rowe (1972); however, the higher mountains are within the tundra region. Very open stands of stunted black spruce are common on low relief terrain and, frequently, frozen cored mounds are present and support the tallest trees. White spruce, occasionally with aspen and balsam poplar, grow on better drained and warmer sites. Paper birch is scattered throughout, but attains best growth on the better drained sites. Climax vegetation includes black spruce as the sole tree species.

Willow, Labrador tea, shrub birch and alder are common on most sites, and shrubby cinquefoil or kinnikinnick are locally prevalent. Feathermoss is common on better drained sites and abundant under white spruce. Sedge tussocks, with a variety of ericaceous shrubs, willows, forbs and lichens, are the most prevalent understory types of the open black spruce. Shrub birch, willow, lingonberry and crowberry are common in the alpine, except on rocky substrates where lichens are more common.

10. Dawson Range Ecoregion (area: 26 392 km^2) Plate X



Physiography: The Dawson Range Ecoregion includes the Dawson Range and portions of the Klondike, Lewes and Kluane plateaus and Aishihik Basin physiographic subdivisions of Bostock (1965). It constitutes about 5.5% of the Yukon. The characteristic terrain features are smooth, rolling topography, with moderate to deeply incised valleys. Major drainage channels extend below 1000 m elevation. Most of the terrain lies between 1000 m and 1500 m elevation, the highest peak being 2148 m a.s.l.

Drainage: The Yukon River drains this ecoregion through many tributaries, including the Ladue and White rivers in the west, the Nisling and Klotassin rivers in the south and the Nordenskiold and Takhini rivers in the east.

Lakes are relatively small and uncommon over most of the ecoregion. Long and Stevens lakes, in the eastern part, are the largest.

Geology: Large bodies of metamorphic rocks, primarily quartzite, biotite schist, amphibolite and quartz mica schist dominate, but are intruded with igneous rocks, such as quartz diorite and granodiorite. Volcanic rocks, mostly andesite, basalt, tuff and breccias, are prevalent in the southern part. Sedimentary rock, mainly sandstone and conglomerate, occurs in widely scattered localities (Tempelmann-Kluit 1974).

Climate: Good climatic data are lacking from within the ecoregion; however, sporadic data exist from some mining operations. The climate is continental and cold, with mean annual temperatures in the vicinity of -7°C and average annual precipitation of about 330 mm. Precipitation may be somewhat higher in the northwestern portion than in the southeastern part because of the rainshadow effect of the mountain ranges to the south.

Glaciation and surficial deposits: The northwestern two-thirds of the ecoregion was not glaciated, but both early and late Wisconsin advances covered the southwestern part. Ice movement was largely to the northwest and glacial scouring occurred to an elevation of about 1800 m, exposing much bedrock along valley walls (Bostock 1966; Hughes et al. 1969).

Deep, often kettled, glaciofluvial terraces and kame material occur on sides of valleys and extend up slopes for varying distances. Much of the medium-textured till is overlain with coarser textured glaciofluvial material at lower elevations. Ponded silty sediments are often intermixed with coarser gravels in the valley bottoms. In contrast to the glaciated areas, the unglaciated portion in the northwest consists of rounded topography with residual soils dissected by numerous streams. There are few rock outcrops, except for tors (Plate XXIX, page 84) and felsenmeer. Loess and volcanic ash occur over most of the area.

Terrain features: The ecoregion straddles the

PLATE X (Dawson Range Ecoregion)

a) Willow-shrub birch, white and black spruce and aspen on gentle slopes.
Lat. 63°50'N, Long. 139°45'W

b) Open black spruce and shrub birch-willow near alpine.
Lat. 63°30'N, Long. 138°45'W

c) Spruce and willow on flood-plain, sagewort grassland on steep banks, aspen and spruce on higher areas.
Lat. 62°15'N, Long. 139°05'W

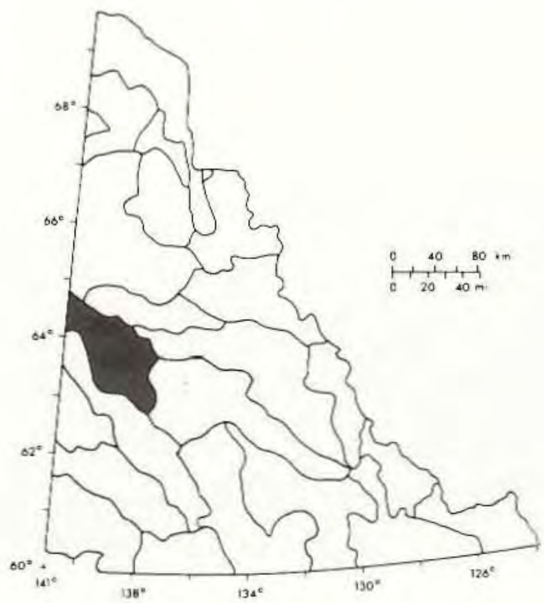
boundary between the discontinuous widespread and scattered permafrost subzones of Brown (in press). Cryoplanation terraces are fairly common in the unglaciated portion. The valley bottoms, with impeded drainage, have prominent permafrost features, such as peat plateaus, palsas, hummocky tussock fields and polygons. String bogs occur in many locations (Plate XXIX). Numerous open system pingos were identified in the unglaciated terrain by Hughes (1969). Lower slopes, especially on north aspects, are hummocky. At higher elevations, mostly above treeline, felsenmeer, stone nets or poorly developed stone polygonal patterns are common and bare-center circles and stripes are perhaps better sorted than in areas to the south and east. Solifluction lobes are prevalent and well developed, particularly on north-facing aspects. Nivation hollows occur throughout at upper elevations. Tors are prominent in the unglaciated landscapes.

Vegetation: Lower elevations are included in the B26a forest region of Rowe (1972); however, most of the terrain is above treeline at about 1200 m. Open black and white spruce stands occur in valleys and on lower slopes where black spruce prevails on wetter sites and white spruce on better drained sites. Best tree growth occurs along the White and Yukon river valleys, where white spruce, aspen, balsam poplar and paper birch are constituents of mixed stands.

Willow, shrub birch, Labrador tea, moss and lichens are principal understory species. Shrub birch and willow form extensive stands from valley bottoms to well above treeline. Sedge tussock fields, usually hummocky and supporting ericaceous shrubs, willows, lichens and sphagnum, are prevalent where drainage is impeded, a common situation on lower slopes and valley bottoms.

11. Klondike River Ecoregion (area: 20 508 km^2) Plate XI

Physiography: The Klondike River Ecoregion lies mostly within the Klondike Plateau, but includes small portions of the Tintina Valley and Ogilvie Mountains physiographic subdivisions of Bostock (1965). It comprises about 4.2% of the Yukon. Generally, the terrain consists of low relief plateaus dissected by deep, narrow, V-shaped valleys. Most of



the area lies below 1000 m in elevation and decreases to below 300 m along the western part of the Yukon River valley. A few mountains extend above 1200 m in elevation, the highest being 1482 m.

Drainage: The southwesterly flowing Stewart River crosses the eastern part, receiving several tributaries en route, and then enters the Yukon River near the south central part of the unit. Other important tributaries are the Sixty Mile, Indian, Klondike, Chandindu, Fifteenmile and Fortymile rivers.

All lakes are small, and occur primarily where drainage has been impounded in valleys.

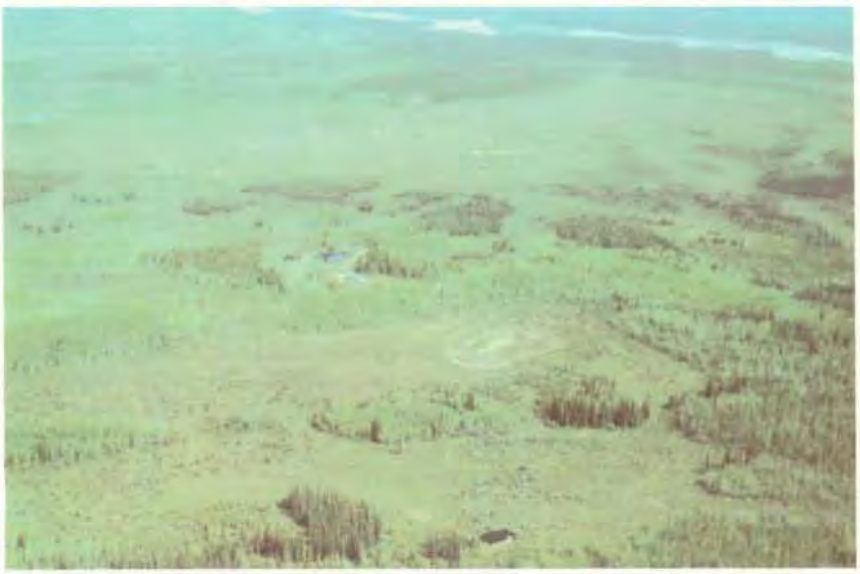
Geology: The area is underlain by metamorphic rock, with inclusions of sedimentary, volcanic and intrusive rocks. Micaceous quartzite, quartz schist, quartzite, gneiss, sandstone, shale, granodiorite, andesite and basalt are the principal types (Green 1972).

Climate: Mean annual precipitation is about 325 mm over much of the low elevation terrain, but increases slightly from east to west and with increasing elevation. Temperatures are extreme, with January means about -30^{o}C and July means near 16^{o}C. Mean annual temperatures are about -5^{o}C.

Glaciation and surficial deposits: The area has not been glaciated, except by minor valley

PLATE XI (Klondike R. Ecoregion)

a) Spruce-aspen-balsam poplar in valley complex.
Lat. 63°55'N, Long. 138°17'W



b) Spruce, paper birch, aspen and balsam poplar stands in a bog-fen complex.
Lat. 63°55'N, Long. 139°45'W

c) Spruce-aspen-balsam poplar-paper birch; darker areas on slopes have shallow active layers over permafrost; dredge tailings in river valley.
Lat. 64°01'N, Long. 139°29'W

glaciers that moved out of the Ogilvie Mountains to the north. Evidence for glaciation prior to Wisconsin time in the southeastern part of the ecoregion exists in the form of erratics and old meltwater channels (Vernon and Hughes 1966; Hughes et al. 1969).

Terrain features: The ecoregion lies within the discontinuous widespread permafrost subzone of Brown (in press). Cryoplanation terraces and tors are particularly evident in the northwestern part. At higher elevations, frost induced forms, such as stone nets or poorly defined polygons, moderately well-sorted bare-center circles (Plate XXIX, page 84), solifluction lobes, nivation hollows, stone and earth stripes and felsenmeer, are abundant. Mid and lower slopes, especially on north aspects, have hummocky terrain with perennially frozen soil. Bottom lands have sedge tussocks, hummocks, peat plateaus, patterned fen and bog complexes, string fens and thermokarst lakes. Poorly discernible polygons occur in deep peat accumulations. Pingos are scattered throughout.

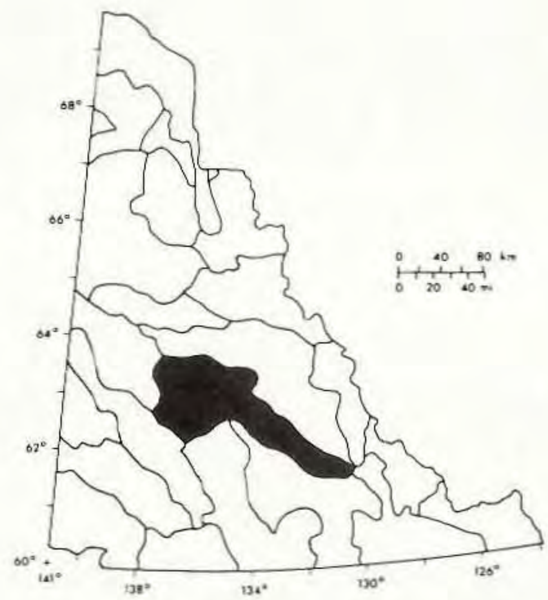
Most of the area is capped with loess, and all but the northeastern part with volcanic ash. Fairly deep accumulations of organic matter have developed on most lower slopes and in valleys. Recent alluvium has accumulated adjacent to present drainages and the Tintina Trench is deeply mantled in gravel, sand and clay materials.

Vegetation: The ecoregion lies within the B26a and c forest regions of Rowe (1972), and only a minor portion extends above the treeline at about 1050 m. Black spruce, often with paper birch and occasionally with white spruce, dominates most lower slopes. Aspen, paper birch and balsam poplar occur on slopes lacking permafrost or following fires. In valley bottoms, white spruce or deciduous trees occur on better drained sites and black spruce on poorly drained sites. Lodgepole pine and alpine fir are scarce.

Willows, shrub birch and ericaceous shrubs are common to abundant in the understory on most sites. Sedge and sphagnum tussocks are prevalent where drainage is impeded and organic material has accumulated. Most of the tussock fields are also hummocky. Feathermoss and lichens frequently thrive on the hummocks and on better drained sites. Alder is locally common along drainages. Shrub birch and willow, frequently with ericaceous shrubs, extend above treeline. Rocky alpine sites support prostrate shrubs, mostly willows and ericads, with various forbs, mosses and lichens.

12. Pelly River Ecoregion (area: 36 336 km^2)

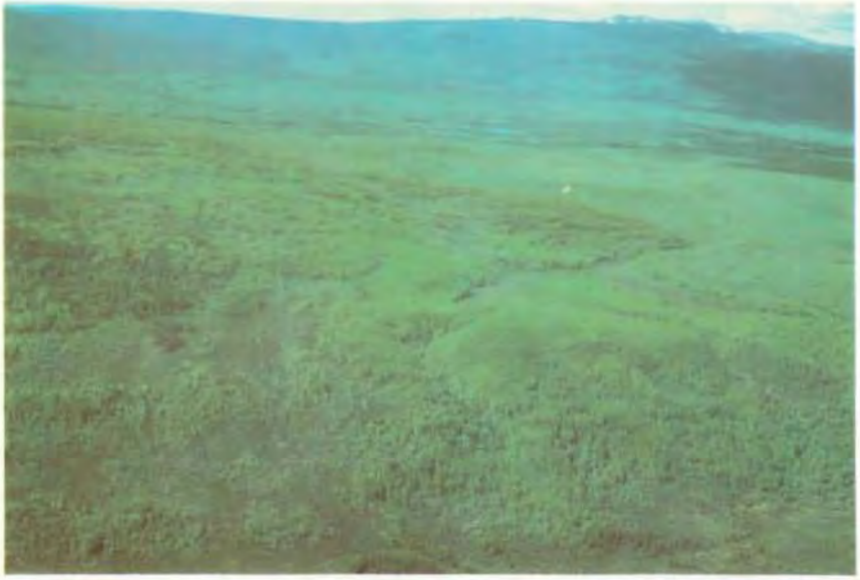
Plate XII



Physiography: The Pelly River Ecoregion is comprised of portions of the Stewart, Macmillan, Lewes and Klondike plateaus and Tintina Valley physiographic subdivisions of Bostock (1965), and constitutes about 7.5% of the Yukon. The terrain consists of several groups of rolling hills and plateaus separated by deeply cut, broad valleys. Elevations are above 1000 m, except for major river valleys which lie below 600 m in the northwest portion. Several mountains reach heights of 1500 m, but few surpass 1800 m, the highest peak being 2214 m a.s.l. The Tintina Trench, a straight valley 5 to 22 km wide, traverses the ecoregion from southeast to northwest.

Drainage: The ecoregion drains in a northwesterly direction, via the Yukon River. Major tributaries include Pelly River which nearly traverses the length of the ecoregion, the MacMillan River which flows into the Pelly River in the west

PLATE XII (Pelly R. Ecoregion)



a) Lodgepole pine, black spruce, aspen and balsam poplar on plateau.
Lat. 63°15'N, Long. 135°30'W

b) Open black spruce-shrub in subalpine.
Lat. 62°25'N, Long. 133°15'W

c) Black spruce, aspen and shrub on plateaus.
Lat. 63°00'N, Long. 135°15'W

central part, and the Stewart River which crosses the northwest corner.

Several moderate sized lakes are present and include Finlayson, Earn, Stokes, Big Kalzas, Moose, Ethel, Diamain, Tatlmain, Tadru, Ess, Janet, Reid and Swim.

Geology: The major part of the ecoregion is underlain by metamorphic rock; however, large bodies of volcanic and intrusive rocks and small bodies of sedimentary rocks occur throughout. Rock types include quartzite, slate, phyllite, conglomerate, schist, greenstone, limestone, granodiorite, quartz diorite and granite (Campbell 1967; Douglas and McLean 1963; Bostock 1973; Johnston 1936).

Climate: The ecoregion is cooler and wetter than the Lake Laberge Ecoregion to the south, but less extreme than the Klondike River Ecoregion to the northwest. Mean annual temperatures range from -4°C to -7°C, with mean January temperatures of -27°C to -35°C and mean July temperatures of 13°C to 15°C. Average annual precipitations of 250 to 300 mm are common at lower elevations, but increase to 500 mm or higher at upper elevations (Burns 1973, 1974).

Glaciation and surficial deposits: During the last glacial period, ice moved across the eastern part in a northwesterly to westerly direction and extended to heights of about 1525 m a.s.l. It probably reached higher elevations in the south than in the north, where ice lobes terminated. A large area in the northwest corner was not glaciated at this time; however, evidence of an earlier, pre-Wisconsin advance exists in the form of terminal moraines and old meltwater channels located well beyond the terminus of the most recent advance.

The area was not heavily scoured, and lower and midslopes are often deeply mantled with till, colluvium and glaciofluvial materials. Meltwater channels, formed in material adjacent to wasting ice, are common throughout the unit. Fine-textured glaciolacustrine deposits occur along the major rivers. The Pelly River is also bordered by extensive cappings of fine-textured lacustrine material (Plate XXX, page 85) (Campbell 1967; Hughes et al. 1969).

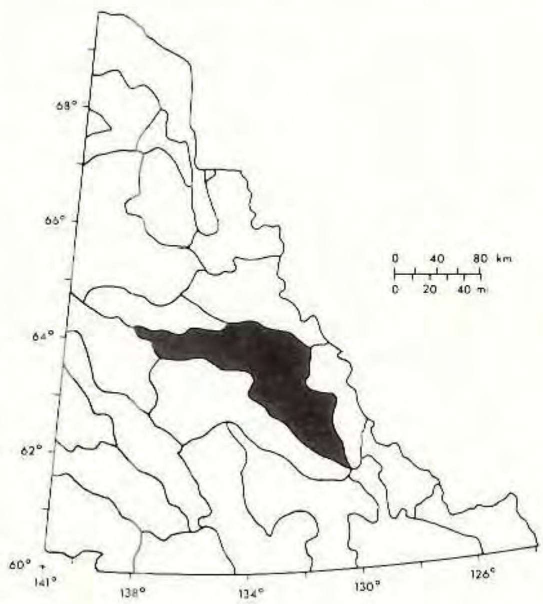
Terrain features: The ecoregion lies within the discontinuous widespread permafrost subzone of Brown (in press). Polygonal patterns occur in fen situations, but are likely relics of former ice wedges. Moist depressional areas contain peat plateaus, patterned fen and bog complexes and, occasionally, palsas. Better drained lowland areas are frequently hummocky and sometimes possess tussocks. Pingos, usually of the open system type, occur in the northwest portion not covered by recent glaciation. Above treeline, stone nets, poorly sorted bare-center circles and felsenmeer are common. Scree covered slopes are most prominent in sedimentary rock. Stone and earth stripes and solifluction lobes occur throughout, but are pronounced only in certain localities. Deep colluvium occurs on steeper mid to lower slopes. Minor loess and ash were deposited over most of the area. Steep south-facing slopes under grassland vegetation are common. These sites often have cat steps or terracettes (Fairbridge 1968) (Plate XXX).

Vegetation: The unit lies within the B26b forest region of Rowe (1972), except for mountain peaks, which are in the tundra region. White and black spruce form the most common forest types. Black spruce is usually dominant in wetter areas, white spruce in drier areas, and both occur on mesic sites. Paper birch occurs on cooler sites, and aspen and balsam poplar occupy disturbed areas. Lodgepole pine frequently invades burnt-over areas, but is often in competition with deciduous trees on moist to wet sites. Alpine fir occurs at treeline (1350 to 1500 m), but is sparse and is usually associated with white spruce and, occasionally, with paper birch.

Feathermoss dominates the understory vegetation of nearly closed coniferous stands, but as trees become less dense willows and ericaceous shrubs become prevalent. Sedge or sphagnum tussocks are common in wetlands and under black spruce. Sagewort grassland, with several forbs and sometimes aspen, occurs on steep south-facing slopes. Shrub birch and willow occur in the subalpine and extend well above treeline. Ericaceous shrubs and prostrate willows dominate the alpine vegetation, except on rocky terrain, where lichens are more prevalent.

13. Mayo Lake - Ross River Ecoregion

(area: 40 106 km^2) Plate XIII



Physiography: The Mayo Lake - Ross River Ecoregion is the largest ecoregion, comprising 8.3% of the Yukon. It lies within the Stewart, Macmillan and Pelly plateaus and southern part of the Selwyn Mountains physiographic subdivisions of Bostock (1965). The terrain consists of rolling upland plateaus and small mountain groups with nearly level tablelands dissected by deeply cut, generally broad, U-shaped valleys. An unglaciated portion in the west has deep, narrow, V-shaped valleys and rounded upland surfaces. Nearly all the terrain in the ecoregion lies above 900 m, most between 1200 and 1700 m a.s.l. Several mountains have elevations over 1800 m, the highest being 2235 m.

Drainage: Drainage occurs to the southwest through several rivers, the more prominent being Pelly, Ross, North and South Macmillan, Hess, Stewart and North and South McQuesten. Drainage from these rivers eventually enters the Yukon River.

Lakes are common; the larger ones include Fortin, Jackfish, Dragon, Tay, Sheldon, Lewis, Laforce, Fairweather, Mayo and McQuesten.

Geology: Metamorphosed sedimentary and volcanic rocks underlie most of the terrain. Granitic intrusions are infrequent. The material consists of quartzite, chert, sandstone, shale, slate, phyllite, argillite and, occasionally, dolomite and limestone. The intrusive rocks are mostly granodiorite. Some bodies of andesite, dacite and basalt occur in the southern part (Green 1971, 1972; McTaggart 1960; Douglas and MacLean 1963).

Climate: Meteorological data are sparse and incomplete, but inference from surrounding locations and data presented by Burns (1973, 1974) suggest the mean annual precipitation is about 500 mm in the southwest and about 760 mm in the mountain foothills to the northeast. The mean annual temperature is estimated to be -6°C.

Glaciation and surficial deposits: Ice from the Selwyn Lobe moved in a westerly to northwesterly direction inundating all but the northwest corner. The ice level reached about 1500 m a.s.l., however, many higher areas were subjected to alpine glaciation. Ice thinned toward the northwest, where it was confined mainly to valleys. Lateral moraines, ice contact channels and kame terrace deposits occur on a number of hills in this area.

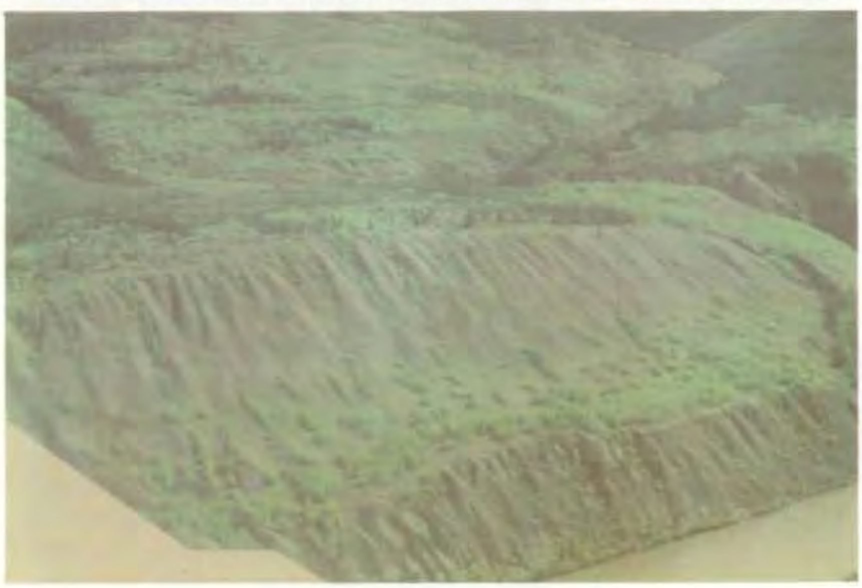
In general, glacial scouring was not intense. Mid and lower slopes are mantled with deep morainal and glaciofluvial material. Large lakes filled a number of valleys during deglaciation. The McQuesten River valley was inundated and much of the valley floor was filled with deep silty deposits. Similarly, large deposits of silts occur in the Mayo Lake area and in the Keno Ladue river valley. Small glacio-lacustrine deposits are present throughout (Vernon and Hughes 1966; Hughes et al. 1969; Bostock 1966; McTaggart 1960).

Terrain features: The ecoregion lies within the discontinuous widespread permafrost subzone of Brown (in press), and much of the area with moderate to poor drainage is underlain by perennially frozen ground. Peatlands occur in most valleys, and include string fens, peat plateaus, palsas (Plate XXX1a, b; Plate XXXIIa, page 87), sedge tussocks and hummocks. Collapse scars, remnants of plateau and palsa features, are abundant (Plate XXXII). Some polygonal patterns occur in bottoms of higher elevation valleys. Lower slopes, especially on north aspects, are hummocky. Stone nets,

PLATE XIII (Mayo L. - Ross R. Ecoregion)

a) Alpine fir and willow-shrub birch above treeline.
Lat. 63°23'N, Long. 134°50'W

b) Alpine fir/willow-shrub birch in subalpine.
Lat. 62°00'N, Long. 128°17'W



c) Aspen and sagewort grassland on river bank, aspen and spruce on slopes.
Lat. 61°59'N, Long. 132°29'W

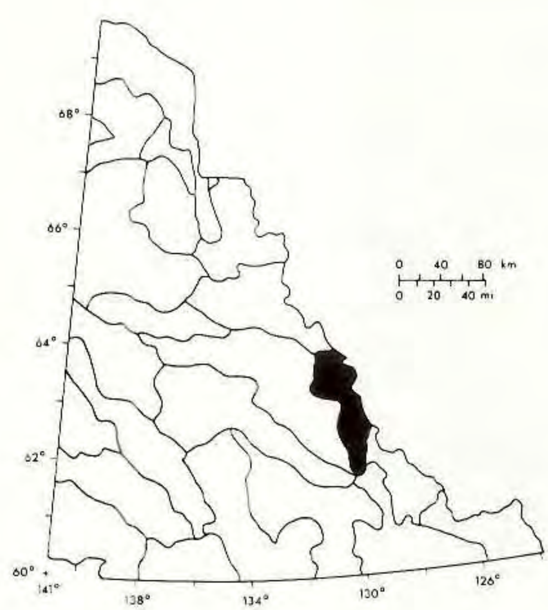
bare-center circles, stone bordered earth stripes, extensive rock rivers and solifluction lobes are common in the subalpine and alpine. Poorly defined stone nets or polygonal patterns occur in some alpine areas. Upper slopes of high elevation mountains are often covered with talus or scree material.

Vegetation: The terrain below treeline (1350 to 1500 m a.s.l.) lies within the B26c forest region (Rowe 1972), and the higher terrain lies in the tundra region. Open black spruce and, occasionally, lodgepole pine form extensive forests. White spruce, occasionally with aspen or lodgepole pine, occurs on warmer and better drained sites. Paper birch is scattered throughout. Alpine fir occurs in the subalpine. An undescribed variety of pine, similar in appearance to Pinus albicaulis, occurs near treeline.

Moss, usually with ericaceous shrubs and willows, forms the most extensive understory vegetation. Sedge tussocks, frequently with sphagnum and small shrubs, prevail in poorly drained situations and on northern aspects. Shrub birch and willow are extensive in subalpine and lower alpine sites. Lichen development is common in dry situations, including tops of hummocks, tussocks and well-drained, rocky alpine sites.

14. Itsi Range Ecoregion (area: 13 777 km^2)

Plate XIV



Physiography: About 2.9% of the Yukon lies within the Itsi Range Ecoregion. It includes portions of the Hess Mountains and Pelly Plateau physiographic subdivisions of Bostock (1965). The terrain is predominantly mountainous and lies above 1000 m a.s.l., the elevation increasing from south to north. A large portion is over 1500 m in elevation and the highest peak is 2971 m a.s.l. Most peaks over 2130 m in elevation possess icefields.

Drainage: Drainage is to the southwest, forming the headwaters of the Pelly, Ross, Macmillan, Hess and Rogue rivers, all of which are tributaries of the Yukon River. A small area in the extreme southern corner drains southward to Frances Lake and into the Liard River system.

Several small lakes occur, including McEvoy, Pelly, Otter and Itsi.

Geology: The plateau portion is underlain with sedimentary, volcanic and metamorphic rocks, but intrusive rocks are scattered throughout. The mountainous portion consists mostly of sedimentary rocks, with a small component of granitic rocks. Principal types include quartzite, conglomerate, slate, phyllite, shale, limestone, dolomite, sandstone, argillite, chert, granodiorite and quartz diorite (Douglas and MacLean 1963).

Climate: Burns (1974) indicates the largest portion lies within the 760 mm mean annual precipitation isohyet. A small portion to the southwest receives between 635 and 760 mm. Macmillan Pass, at 1409 m elevation, receives about 680 mm. Inferences from data at surrounding stations indicates the annual precipitation increases rapidly from west to east, particularly in the north, as elevations increase. Sheldon Lake, just west of the Itsi Mountains, receives about 530 mm annually. Mean annual temperatures, estimated from isotherm lines of Burns (1973), are between -6°C to -9°C, decreasing from south to north.

Glaciation and surficial deposits: The area was glaciated during the most recent ice advance, and probably during earlier glacial periods. Only mountain peaks stood above the ice masses. Ice movement was generally in a westward direction, moving down from the moun-

PLATE XIV (Itsi Range Ecoregion)

a) Bog-fen complex in valley; note peat plateaus.
Lat. 63°05'N, Long. 130°12'W

b) Black spruce-lichen on rolling hills.
Lat. 62°03'N, Long. 130°30'W

c) Subalpine white spruce-alpine fir; note scree slopes.
Lat. 63°07'N, Long. 130°15'W

tains. Scouring was more intense in the northern part than in the south, probably due to greater ice accumulation.

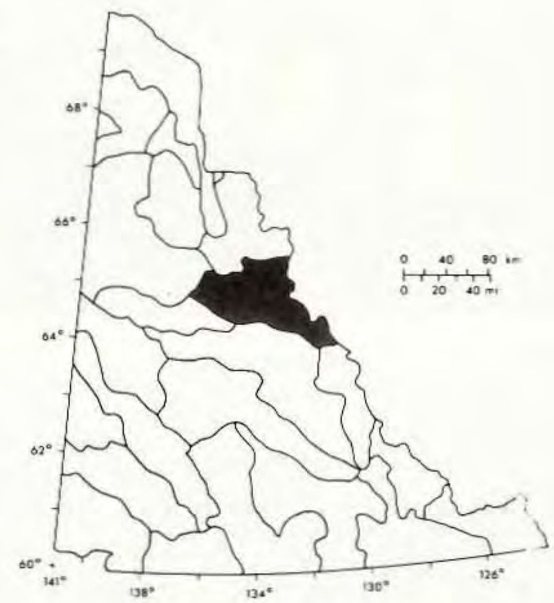
Surficial deposits mantle most of the mid and lower slopes. The deepest and most prevalent deposits occur in the Pelly Plateau physiographic subdivision to the southwest. Morainal deposits and glaciofluvial material are generally deep in valley bottoms. Upper slopes often consist of talus or scree material and bare rock. Rock glaciers (Plate XXXII, page 87) exist in many cirque basins and valleys.

Terrain features: The ecoregion lies within the discontinuous widespread permafrost subzone of Brown (in press). Polygonal surfaced peat plateaus (Plate XXXIII), palsas, collapse scars and peat hummocks are common in most valley bottoms. Under wetter conditions, patterned fens, sedge tussock fields and bare-center hummocks are prevalent. Lower slopes commonly have hummocky surfaces. At upper elevations, the more subdued terrain has well-developed stone nets, bare-center circles and felsenmeer. Solifluction activity is widespread. Steep upper slopes are often covered with talus or scree material, particularly where sedimentary rock predominates. Aufeis formations near springs and floodplains and beaded streams are common in valleys throughout the area.

Vegetation: Most terrain lies above the treeline at 1350 to 1500 m elevation and is in the tundra region (Rowe 1972); however, lower elevations are included in the B26c forest region. Open black spruce occurs where drainage is somewhat restricted or the water table is held up by permafrost. Paper birch is frequently scattered among the black spruce. White spruce occurs on well-drained, usually warmer sites. Alpine fir occurs in the subalpine.

Shrub birch and willow form prevalent communities, occurring from valley bottoms to well above treeline. Patterned fen and bog communities, mostly dominated by sedge, willow and ericaceous shrubs, are common in valleys. Sedge tussocks, usually with willows and ericaceous shrubs, dominate the understory on mid to lower slopes. Lichens frequently cap tussocks, hummocks, peat plateaus and well-drained rocky terrain. Alpine vegetation, consisting of lichens, moss, sphagnum, willows, ericaceous shrubs and some forbs, occurs on subdued alpine areas. Talus or scree slopes have little or no vegetation.

15. Wernecke Mountains Ecoregion (area: 25 218 km^2) Plate XV



Physiography: The Wernecke Mountains Ecoregion comprises about 5.2% of the Yukon, and lies within the Wernecke Mountains and Backbone Ranges subdivisions of the Selwyn and Mackenzie mountains physiographic units (Bostock 1965). Steep, rugged topography with narrow valleys prevails; however, the most rugged part lies in the central and southern portions. The major portion lies above 1000 m elevation, with about half above 1500 m. The highest peak is 2365 m a.s.l.

Drainage: The divide between the MacKenzie and Yukon river systems occurs here. The major part drains northward, forming the headwaters of the Snake, Bonnet Plume and Wind rivers, which flow into the Peel River before it enters the Mackenzie River. A narrow fringe along the southwestern border contains the headwaters of the Stewart River and its tributaries, the Beaver, Rackla and Nadaleen rivers. Stewart River is a tributary of the Yukon River.

Small lakes occur in most valleys, but no large lakes are present.

PLATE XV (Wernecke Mtns. Ecoregion)

a) Bog-fen complex with peat plateaus in valley, spruce on lower slopes.
Lat. 64°31'N, Long. 136°00'W

b) Open spruce-shrub complex along valley.
Lat. 64°56'N, Long. 134°40'W

c) Scree slopes, bare rock and fans along river bank.
Lat. 64°55'N, Long. 134°29'W

Geology: The area is predominantly underlain by metamorphic and sedimentary rocks of which phyllite, dolomite, argillite, slate, limestone, chert, sandstone and conglomerate are major constituents. Minor amounts of igneous rocks, mostly diorite and gabbro bodies, are present (Douglas and MacLean 1963; Green 1972).

Climate: No climatic data are available from within the ecoregion; however, inference from surrounding areas and information presented by Burns (1973, 1974) suggest the annual precipitation in the southern part is between 635 and 760 mm and declines to about 380 mm to the north. Mean annual temperatures at lower elevations are between -7°C and -9°C. Mid-elevation valleys, possibly higher ones also, form cold air pooling basins, and tree growth begins along sharp boundaries up-slope from the valley bottoms.

Glaciation and surficial deposits: Nearly all the valleys in the Wernecke Mountains were occupied by ice flowing in a northwesterly direction during the last two advances. During the earlier glacial advance, ice covered all the valleys and was continuous across divides; however, during the most recent advance, most mountain ranges stood above the ice masses; the ice being confined to valleys. Extensive cirque development indicates strong alpine glaciation.

Morainal deposits occur in most valleys and extend up lower and mid slopes. Glaciofluvial deposits, mostly coarse sand and gravel, mantle the morainal deposits in many valleys. Recent fluvial and fan sediments often cap the glacial deposits. Fans are particularly prominent where steep side valleys enter larger river valleys. Higher slopes are often mantled with colluvium and scree, the latter where sedimentary bedrock predominates. Mountain peaks are mostly devoid of any mantle (Vernon and Hughes 1966).

Terrain features; The ecoregion lies within the discontinuous widespread permafrost subzone of Brown (in press). Permafrost occurs in most soils, except on well-drained south aspects, deep well-drained, coarse fluvial deposits and adjacent to moving water. Peat plateaus are common, and prominent palsa and earth mound features can be seen in several valleys (Plate XXXIV, page 89). Fenlands are usually free of permafrost. Polygonal patterns occur in some localities and collapse scars are visible in several areas. Hummocky terrain, thermokarst lakes and beaded streams are common. Lower slopes, especially north aspects, are often hummocky or stepped and frequently possess parallel runnel drainage patterns. Smooth upland areas have well-developed bare-center circles, felsenmeer and stripes, which are bordered with stones on steeper topography. Solifluction lobes and rock glaciers are common. Aufeis occurs on many floodplains and is also evident near sources of spring water. A series of small push or depositional ridges were observed bordering the downstream side of an icing along the Wind River (Plate XXXIV). Continuous rock rubble or scree form prominent features on many mountain slopes.

Vegetation: All the area lies within the tundra region (Rowe 1972); however, trees occur below an elevation of about 1200 m. Black and white spruce, frequently with scattered paper birch, occur in open stands on lower slopes, occasionally in well-drained valley bottoms.

Moss and lichens, usually with ericaceous shrubs and sedge tussocks, occur as understory plants. Sedge tussock vegetation, which is usually hummocky, is prevalent over most terrain. Ericaceous shrubs, willows, forbs, mosses and lichens grow on top of hummocks. Shrub birch and willow communities are common on slopes and extend well above treeline in protected valleys. Massive scree slopes at higher elevations are essentially devoid of vegetation.

16. South Ogilvie Mountains Ecoregion

(area: 12 442 km^2) Plate XVI

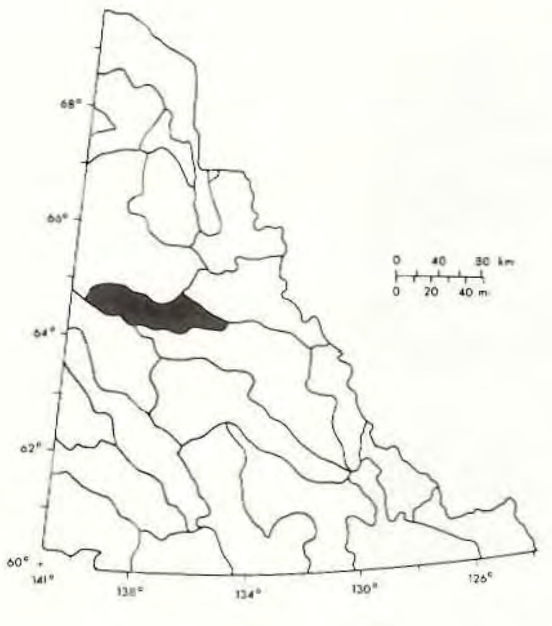
Physiography: The South Ogilvie Mountains Ecoregion lies within the southern part of the Ogilvie Mountains physiographic subdivision of Bostock (1965) and constitutes about 2.6% of the Yukon. It consists of rugged mountainous topography, with ridges connecting precipitous peaks that flank deep valleys, but becomes somewhat more subdued to the south. Nearly all the area lies above 1000 m a.s.l., and about half above 1500 m. Peaks over 2100 m are scarce, but the highest is 2362 m a.s.l.

PLATE XVI (S. Ogilvie Mtns. Ecoregion)

a) Hummocky shrub birch-willow above treeline.
Lat. 64°37'N, Long. 138°21'W

b) Hummocky tussocks on peat mounds.
Lat. 64°35'N, Long. 138°17'W

c) Shrub birch-willow on slopes; note solifluction lobes.
Lat 64°30'N, Long. 138°10'W



Drainage: Less than half the area drains southwestward through tributaries forming the headwaters of McQuesten, Klondike, Chandindy and Fifteenmile rivers, all of which enter the Yukon River. The remainder drains northeastward by the Peel River via tributaries of the Hart, Blackstone and Ogilvie rivers.

The only lakes are locally impounded water bodies in some valleys.

Geology: Sedimentary and metamorphic rocks, of which dolomite, shale, quartzite, argillite and phyllite are major constituents, underlie most of the area. Minor components of volcanic rock, mostly chert, breccia and tuff, and intrusive granodiorite rocks are present (Green 1972).

Climate: Isohyets extrapolated from Burns (1974) suggest the ecoregion receives about 380 mm of precipitation in the west and about 635 mm in the northeast. The southern Ogilvie Mountains apparently act as a barrier to air masses from the west or southwest. Precipitation increases at higher elevations, but probably not as much as in the mountains to the east. A station along the Dempster Highway at 991 m elevation records a mean annual temperature of -7°C, a mean January temperature of -28°C and a mean July temperature of 11°C (Table 1). The mean annual precipitation is 453 mm.

Glaciation and surficial deposits: Valley glaciation affected most of the area, probably during at least the last three ice advances. The glacial tongues extended short distances beyond the mountains, both to the north and south. The extreme eastern portion was affected by ice from the Selwyn Mountains, which extended into Beaver, Hart and McQuesten river valleys. Terminal moraines deposited during the last two advances are prominent, and erratic boulders beyond these moraines give evidence of at least one former advance.

Thick morainal and glaciofluvial deposits occur in valleys and form a discontinuous veneer on lower slopes. Glaciofluvial and recent alluvial deposits often overlie till in valley bottoms. Glaciolacustrine deposits occur locally. Alluvial fans are common, particularly where side valleys enter main valleys. Many upper slopes have talus or scree mantles, which extent to the toe of slopes in many instances (Plate XXXV, page 90). Cirques are common at higher elevations (Vernon and Hughes 1966).

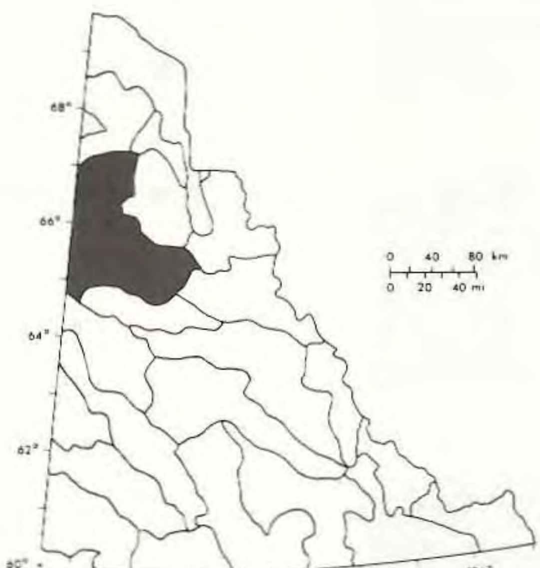
Terrain features: The ecoregion lies within the discontinuous widespread permafrost subzone of Brown (in press). Permafrost features generally occur throughout except on well-drained, south-facing slopes and adjacent to major streams. Upper valleys display peat plateaus, palsas, string bogs and fens, polygonal patterns and hummocks. Ground ice often occurs in polygonal wedge form in various deposits, and forms deep troughs where ice wedges have thawed (Plate XXXV, page 90). Aufeis accumulations are common in many valleys (Plate XXXVI, page 91). Pingos are present in some localities. Lower slopes and valleys support hummocks and tussocky hummocks (Plate XXXVIb, c). Upper slopes have solifluction lobes and stone and earth stripes, where depth of mineral soil is sufficient, or scree, when associated with bedrock, particularly of sedimentary origin. Above treeline, on more subdued topography, well-sorted bare-center circles, felsenmeer and stone nets are prevalent. Rock glaciers occur in some mountain valleys, but are not as common as in the mountains to the east.

Vegetation: The ecoregion lies within the tundra region (Rowe 1972), and trees are limited to sites below 1050 m elevation. Black and white spruce occur in open stands, usually in protected valleys. Paper birch is often present with spruce. Aspen and balsam poplar occur in well-drained warmer valleys.

Shrub birch and willow form extensive communities, especially in protected areas, from valley bottom to well above treeline. Gentle slopes support sedge tussock and hummock fields, which usually contain ericaceous shrubs, prostrate willows, forbs and moss. Sphagnum is common on the sides and between hummocks. Alpine areas have tussock fields where drainage is not rapid. Well-drained rocky, but stable, alpine slopes are dominated by prostrate ericaceous plants, willows and lichens. Loose rocky or scree slopes are frequently devoid of vegetation.

17. North Ogilvie Mountains Ecoregion

(area: 42 461 km^2) Plate XVII



Physiography: The North Ogilvie Mountains Ecoregion comprises about 8.8% of the Yukon and occupies portions of the Ogilvie and Wernecke mountains and Porcupine Plateau physiographic subdivisions of Bostock (1965). Except for a few mountains, the terrain consists of flat topped hills, which are eroded remnants of a former plain. Most elevations are between 900 and 1350 m, and the highest peak is 1803 m a.s.l. To the north, much of the area lies below 900 m and large valleys descend to below 600 m. River valleys are frequently deeply cut, especially in the mountainous areas.

Drainage: A large portion drains northward by the Hart, Blackstone and Ogilvie rivers, which flow into the Peel River. The northern portion is drained into the Porcupine River by the Miner River and its tributaries, Whitestone River, Fishing Branch and Cody Creek. The western margin drains through several tributaries to the Yukon River in Alaska.

No lakes occur in the unit, but there are ponds and thermokarst basins in the valley bottoms.

Geology: The area is underlain with sedimentary and metamorphic rocks, composed largely of dolomite, phyllite, argillite, limestone, shale, chert, sandstone and conglomerate (Douglas and MacLean 1963).

Climate: Data inferred from surrounding meteorological stations and from information presented by Burns (1973, 1974) indicate the higher mountainous areas receive an annual precipitation of about 635 mm. The precipitation declines to about 380 mm in the lower valleys. Mean annual temperatures range between -7°C and -9°C, but may be cooler in valleys due to temperature inversions.

Glaciation and surficial deposits: The only evidence of glacial activity is the presence of some terminal moraines in the southeast corner, probably deposited during pre-Wisconsin time. Some of the larger valleys contain imported glaciofluvial and glaciolacustrine sediments (Hughes 1972).

Terrain features: Pediment slopes (Plate XXI, page 72) formed by erosion of former mountains characterize the plateaus. The slopes extend from broad valleys over considerable distances to the current foothills of subdued mountains, which frequently form sharp breaks in the slope gradient. Depth of residual material is variable, but generally quite shallow. This material is frequently overlain with loess or capped with organic material. Erosional scarps in sedimentary rock form striking features in many localities (Plate XXXVII, page 92).

PLATE XVII (N. Ogilvie Mtns. Ecoregion)

a) Alpine vegetation on subdued mountains, trees are white spruce.
Lat. 65°55'N, Long. 137°40'W

b) Unglaciated terrain north of Ogilvie Mountains; note deciduous and coniferous trees on floodplains, shrubs and small trees along drainages.
Lat. 66°06'N, Long. 139°00'W

c) Hummocky black spruce bog and fen complex on lowland, black and white spruce on slopes, permafrost is prevalent.
Lat. 65°24'N, Long. 138°20'W

The south and west portions have extensive colluvial or scree material on slopes and castle-like rock groups on the crests of the more rugged mountainous areas (Plate XXXVII). Residual soils mantle most of the more subdued terrain. Rock fragments of many scree and colluvial slopes are uniform in size from toe to crest.

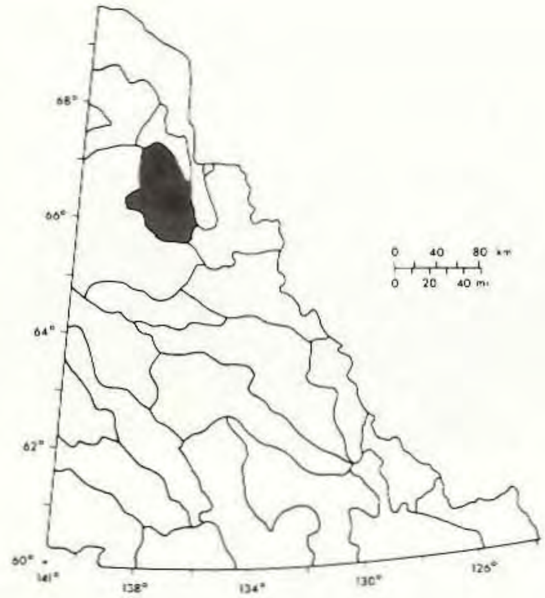
Most of the ecoregion lies within the discontinuous widespread permafrost subzone of Brown (in press); however, the northern boundary crosses into the zone of continuous permafrost. Presence of permafrost is revealed by extensive earth hummocks (Plate XXXVIIIa, b; page 93) and tussocky hummock fields which cover valley bottoms and ascend up lower slopes, sometimes covering subdued mountains. Bare-center circles are common and form elongated stripes on slopes. Peat plateaus, peat polygons and fenlands containing permafrost are common in depressions (Zoltai and Pettapiece 1973). Beaded streams, large peat hummocks and palsas occur over much of the area. Aufeis is a common feature throughout. Slopes are frequently lineated with parallel downslope drainage patterns or runnels.

Vegetation: Most of the area lies within the tundra region of Rowe (1972); however, fingers of the B33 forest region project up valleys and lower plateaus. The treeline occurs at about 900 m elevation. White spruce is found in protected areas and in well-drained river valleys. Black spruce, frequently with paper birch, occurs on low elevation wetlands. Aspen and balsam poplar occur on well-drained warmer sites and on recent floodplains.

Shrub birch and willow form extensive communities on the lower elevation terrain, and extend well above treeline, especially along valleys. Tussock tundra, which is usually hummocky and consists of sedge, ericaceous shrubs, prostrate willows and lichens, forms the most extensive vegetation type in the area. Sphagnum is frequently present on the sides of tussocks or hummocks, and the moss, Drepanocladus, is often present between tussocks under saturated conditions. Rocky alpine sites are dominated by lichens and prostrate shrubs.

18. Eagle Plain Ecoregion (area: 16 236 km^2)

Plate XVIII



Physiography: The Eagle Plain Ecoregion straddles the Arctic Circle, and comprises about 3.4% of the Yukon. It includes the Eagle Plain, Bell Basin and part of the Porcupine Plateau physiographic subdivisions of Bostock (1965). The terrain is of low relief, mostly lying between 300 m and 600 m elevation. The highest peak is 925 m a.s.l.

Drainage: The major part of the ecoregion drains northward via the Porcupine River and several tributaries, including Eagle, Whitestone and Miner rivers and Chance, Schaeffer, Pine and Johnson creeks. The southern margin drains eastward by tributaries of the Peel River.

Small lakes, many of thermokarst origin, are prevalent in drainage channels and basin areas. Whitefish Lake is the only moderate sized lake.

Geology: The ecoregion is underlain by sedimentary rock, consisting of shale, sandstone and conglomerate, with minor amounts of limestone and dolomite (Douglas and MacLean 1963).

Climate: Precipitation is light in the northern and heavy in the southern areas and ranges from 250 to 500 mm. Mean annual temperatures are between -7^{o} and -10^{o}C (Burns 1973, 1974).

PLATE XVIII (Eagle Plain Ecoregion)

a) Tundra in Eagle Plain; white spruce, balsam poplar and willow along creek.
Lat. 67°15'N, Long. 138°15'W

b) Meandering river with trees and shrubs on meander scars, older floodplains have white spruce, younger ones have willows.
Lat. 67°01'N, Long. 138°14'W

c) Hummocky black spruce-larch/sedge tussock vegetation; permafrost is near surface.
Lat. 66°08'N, Long. 137°00'W

Glaciation and surficial deposits: No glaciation occurred during the Laurentide or late Wisconsin glacial periods; however, vast amounts of water were discharged through drainages from ice fronts lying to the east and resulted in extensive deposits of glaciofluvial and lacustrine materials in the Bell Basin and adjacent upstream valleys of the Porcupine and Eagle rivers. Other large drainage valleys are mantled with deep deposits of glaciofluvial and recent fluvial material (Hughes 1972).

Terrain features: Upland terrain surfaces are generally covered with moderately deep residual materials which become shallower in the areas of more rugged relief. Pediment slopes occur, but are not as extensive as in the North Ogilvie Mountains Ecoregion.

Loess is deposited over much of the area, and imparts a silty texture to most upland soils. Organic matter accumulation is associated with most soil surfaces, except in areas of steep topography.

Most of the ecoregion lies within the discontinuous widespread permafrost subzone as described by Brown (in press); however the northern end extends into the continuous permafrost zone. The permafrost is extensive, but generally absent from coarse-textured, well-drained soils and most fenlands (Zoltai and Pettapiece 1973, Zoltai and Tarnocai 1975a, b). Fens are often patterned. Aided by the accumulated organic matter, medium- to fine-textured residual soils and loess retain a high moisture content and maintain permafrost near the surface. Cryoturbated, hummocky surfaced terrain is prevalent and extensive. Peat plateaus, some with polygonal surface patterns and palsas are common in depressional to flat lying topography, particularly when associated with underlying glacial lake sediments. Solifluction features are not conspicuous, possibly due to the subdued relief.

Vegetation: The ecoregion lies within the B33 forest region of Rowe (1972). Extensive stands of open black spruce occur on slopes below treeline at about 750 m, and larch is an associated species in poorly drained areas and on gentle slopes. White spruce and paper birch occur where drainage is not restricted. Some balsam poplar and aspen are present in warmer situations, particularly on recent alluvium of floodplains.

Ericaceous shrubs, small willows, shrub birch and lichens form the primary undergrowth of black spruce stands, at least where hummocks are prevalent. Where drainage is somewhat more restricted or the water table is held higher by permafrost, sedge tussocks become dominant, although the ericaceous shrubs, willows, shrub birch and lichens are still usually present. The tussocks are frequently associated with hummocks, so that a wide range of micro-site conditions are provided for habitation. Sphagnum is common in crevices and on the sides of hummocks, and where standing water occurs for all or most of the growing season, the moss, Drephanocladus, is abundant. Shrub birch and willows form thickets that extend well above treeline, particularly in protected valleys.

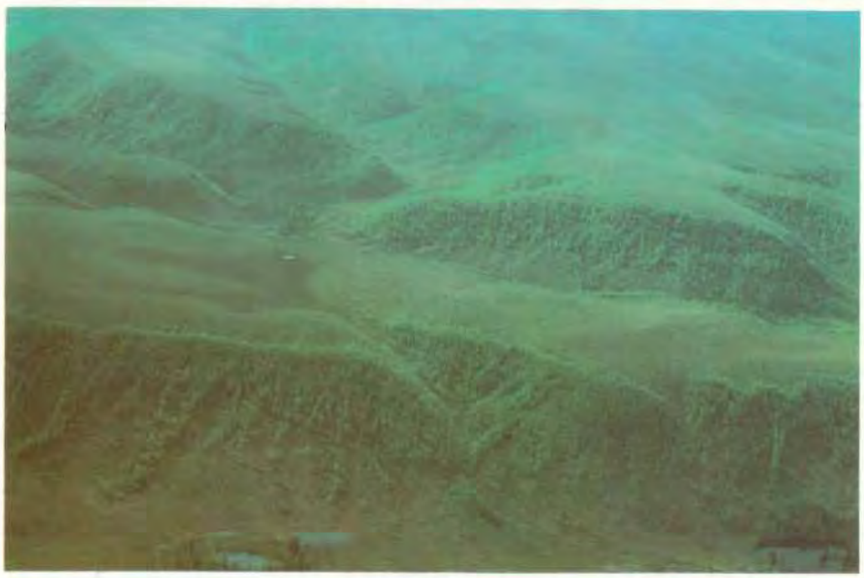
19. Peel River Ecoregion (area: 19 287 km²)

Plate XIX

Physiography: The Peel River Ecoregion includes the Peel Plateau, a portion of the Porcupine Plateau, the Bonnet Plume Basin and the lower north slopes of the Wernecke and Mackenzie mountains physiographic subdivisions of Bostock (1965). It comprises about 4% of the Yukon. The subdued terrain of undulating plateaus lies mostly below 600 m elevation, with few hills over 900 m. The highest peak

PLATE XIX (Peel River Ecoregion)

a) White and black spruce on floodplains and lower slopes.
Lat. 65°17'N, Long. 135°23'W



b) Spruce-paper birch on terrace slopes.
Lat. 65°53'N, Long. 135°25'W

c) White and black spruce and larch along Wind River.
Lat. 65°36'N, Long. 135°25'W

is 1014 m a.s.l.

Drainage: Drainage is provided by the Peel River and its tributaries, including the Snake, Bonnet Plume, Wind, Caribou, Trail and Road rivers.

Numerous small lakes, many of thermokarst origin, occur throughout, but are especially common in basin areas. Hungary Lake is the largest and there are a few others of comparable size, e.g. Chappie and Margaret lakes.

Geology: The entire ecoregion is underlain with sedimentary rock, of which shale, sandstone and conglomerate are major constituents, and coal, siltstone, dolomite and limestone are minor components (Douglas and MacLean 1963).

Climate: Based on information provided by Burns (1973, 1974), the mean annual precipitation is about 330 mm in the northeast part and increases to about 630 mm in the southern part, near the Wernecke Mountains. The ecoregion lies between the -7°C and -10°C mean annual temperature isotherms.

Glaciation and surficial deposits: The northern and western boundaries are approximately coincident with the terminus of the earliest Laurentide advance, which covered all but the extreme southwest corner.

Morainal material blankets most valleys and subdued uplands. The major river valley bottoms are deeply mantled in till and terraced glaciofluvial gravels and sands, which have been modified adjacent to the rivers by recent alluvium. Lacustrine deposits are not common, but occur sporadically. Stony colluvium blankets areas where the topography possesses enough relief for colluvium to form.

Terrain features: The ecoregion lies within the discontinuous widespread permafrost subzone of Brown (in press). Permafrost is prevalent in peatlands and in morainal material which nearly always has a high permafrost table and a hummocky surface. The upper hummock surfaces are most often capped with an organic horizon. Peat plateaus, some with polygonal surface patterns, and palsas are common in poorly drained areas. Deep coarse-textured glaciofluvial materials and fenlands are usually devoid of permafrost (Zoltai and Pettapiece 1973). Patterned and unpatterned fens are frequent (Zoltai and Tarnocai 1975a, b).

Sloping mineral terrain has the characteristic runnel or fine featherlike, parallel drainage pattern common in high latitude frozen soils. Terracing, solifluction and earth stripes are common on moderate slopes of upper elevations. On gently sloping upland surfaces, sorted circles and poorly formed stone nets (polygons) are present.

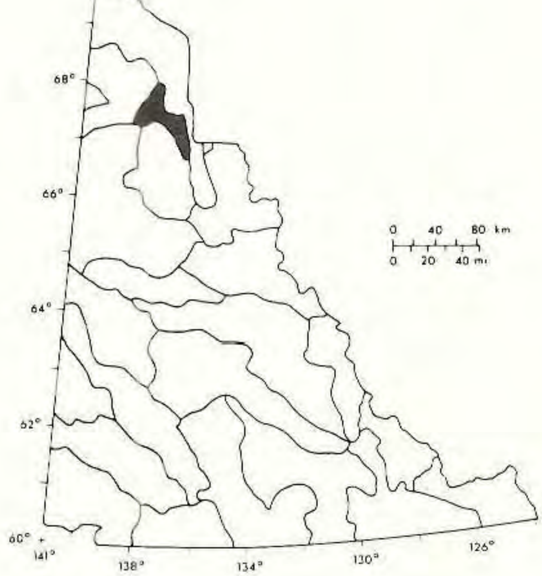
Vegetation: The B33 and B23b forest regions of Rowe (1972) comprise most of the ecoregion, but elevations above 600 to 750 m are treeless and are included in the tundra region. Open growing black spruce dominates the forested areas. Larch is common with black spruce on poorly drained areas, including slopes with permafrost. White spruce and paper birch are present on better drained sites, with aspen and balsam poplar occurring on the warmer exposures.

Shrub birch and willow communities occur on warmer, usually protected sites, even though the drainage is sometimes restricted. These communities often extend above treeline. Hummocky sedge tussocks form extensive fields under black spruce and on treeless areas. Ericaceous shrubs, low to prostrate willows, shrub birch, lichens and mosses occupy various sites provided by tussocks and hummocks.

20. Berry Creek Ecoregion (area: 4 802 km^2)

Physiography: The Berry Creek Ecoregion is characterized by generally flat to gently rolling terrain lying within the Porcupine Plain, Bell Basin and Arctic Plateau physiographic subdivisions of Bostock (1965). It constitutes about 1% of the Yukon. Most elevations are below 600 m, with valleys below 300 m. The highest hill is 884 m a.s.l.

Drainage: The westerly flowing Rock and Bell rivers drain the southeastern part and flow into the Eagle River, which empties into the Porcupine River. Berry Creek and Driftwood River drain the northwestern part and flow southwesterly to enter the Porcupine River.



Numerous small lakes, many of thermokarst origin, occur throughout.

Geology: Sedimentary rock, of which shale, limestone, sandstone and conglomerate are major constituents, underlies the area.

Climate: The mean annual precipitation gradient ranges from about 250 mm in the northwest to about 400 mm near the Richardson Mountains (Burns 1974). Mean annual temperatures of -9°C to -10°C can be expected (Burns 1973).

Glaciation and surficial deposits: No evidence of glaciation occurs; however, glacial meltwater has effected large areas. Extensive glaciofluvial and minor amounts of lacustrine sediments mantle the Bell, Rock, Driftwood and Porcupine river valleys (Hughes 1972).

Terrain features: Upland surfaces are the result of erosion forming extensive pediment slopes. These slopes are most conspicuous in the western part, east of the Driftwood River. The residual material is variable in depth, and has been capped with loess. Recent alluvium has been deposited adjacent to most drainages.

Nearly all of the area lies within the zone of continuous permafrost (Brown, in press); however, the southeastern tip extends into the discontinuous widespread permafrost subzone. Permafrost is near the surface in most mineral and organic soils, but does not usually occur in the fenlands (Zoltai and Pettapiece 1973). Cryoturbation is extensive.

Organic deposits are thin to non-existent on upland slopes, but are common in lowlands, particularly overlying lacustrine deposits and low-lying glaciofluvial materials. Peat plateaus, with polygonal surface features, and peat polygons are prevalent in these low-lying areas. Pingos probably occur; however, their abundance, type and distribution are not known. Mineral soils of upland areas are usually hummocky, and the hummock tops are frequently bare. Stripes and terraces are common on steeper slopes. Solifluction lobes are not common, or at least not prominent, due perhaps to the gentle sloping topography. The steeper slopes are often covered with a thin veneer of colluvium, and few bedrock outcrops occur. Intricate runnel or featherlike drainage patterns are prominent. Ridgetops often have well-developed stone polygonal or net patterns and usually possess sorted circles.

Vegetation: The lower elevation terrain lies within the B33 forest region (Rowe 1972), and the terrain above 450 m elevation is in the tundra region. Open black spruce is the most common forest type, but white spruce occurs with or without black spruce on warmer, well-drained sites. Larch is sometimes present with black spruce on some bog or poorly drained sites. Paper birch, balsam poplar and aspen are minor components of forests on well-drained soils, mainly on floodplains (Hettinger, Janz and Wein 1973).

Shrub birch, willow and, occasionally, alder form extensive ground cover. Sedge and cottongrass, usually in tussocks, are prevalent under forest and shrub communities or in open fields. Ericaceous shrubs, low willows, few forbs, mosses and lichens are usually associated with the tussocks. Lichens are prevalent on drier sites, including the tops of hummocks. Sphagnum is abundant in poorly drained sites and feather mosses are prominent on mesic sites.

21. Old Crow Basin Ecoregion (area: 15 080 km²) Plate XX

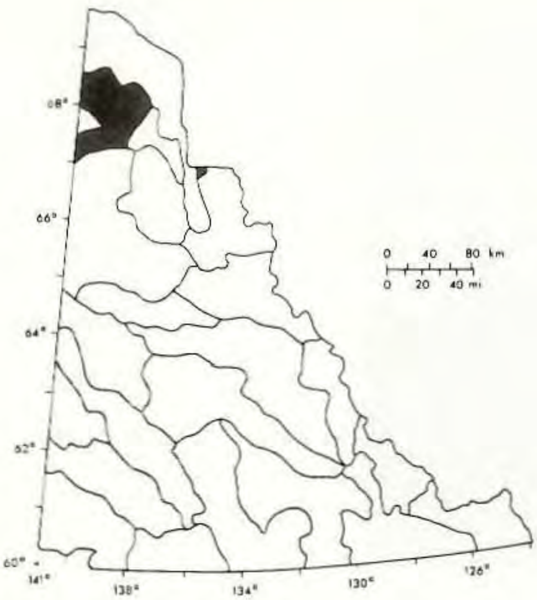
Physiography: The Old Crow Basin Ecoregion includes the northern part of the Porcupine

PLATE XX (Old Crow Basin Ecoregion)

a) Oriented lakes in Old Crow Basin.
Lat. 67°50'N, Long. 140°00'W

b) Runnel drainage on Old Crow Flats, hummocky tussock vegetation.
Lat. 67°20'N, Long. 139°20'W

c) Old Crow on Porcupine River; spruce, balsam poplar, paper birch and willow.
Lat. 67°34'N, Long. 139°51'W



Plain, adjacent portions of the Porcupine and Arctic plateaus and the plateau portion of the British Mountains physiographic subdivisions of Bostock (1965). A small area on the east side of the Richardson Mountains consisting of the upper Vittrekwa River drainage is included because of its ecological similarity (Zoltai and Pettapiece 1973). The main body of the ecoregion constitutes about 3.1% or 14 826 km^2 of the Yukon, and the upper Vittrekwa River portion adds 254 km^2. The topography is nearly flat, with only minor elevational differences. The Old Crow Basin lies below 300 m a.s.l. and the surrounding uplands are mostly between 300 and 600 m elevation. The plateaus adjacent to the British Mountains rise to just over 900 m a.s.l.

Drainage: The major portion is drained via the Old Crow River, which is a tributary of the Porcupine River. The southwestern part drains into the Porcupine River through several creeks and the Bluefish River. The portion on the east side of the Richardson Mountains drains northward through the Vittrekwa River to join the Peel River.

Lakes are abundant in the basin portions. Most lakes are of thermokarst origin, being shallow and oriented in a northwest-southeast direction.

Geology: The terrain is underlain by sedimentary rocks, mostly limestone, dolomite, sandstone, shale and conglomerate (Douglas and MacLean 1963). Unconsolidated deposits of sands, silts, gravels and peat form particularly thick mantles over much of the Old Crow Basin and along the Porcupine River. Deposits over 58 m deep have been measured (Hughes 1972).

Climate: Average annual precipitation varies from about 170 to 250 mm and the mean annual temperature is from -9°C to -12°C over most of the ecoregion. Old Crow village, at 274 m elevation, receives an average annual precipitation of 192 mm and has a mean annual temperature of -10°C.

Glaciation and surficial deposits: The only portion that was glaciated lies on the east side of the Richardson Mountains and is largely mantled with morainal material. Meltwater, along with damming, has left large deposits of deep glaciofluvial and lacustrine materials, particularly in Old Crow and Bluefish basins. Large fan deposits are common around the edge of both basins (Hughes 1972).

Terrain features: The ecoregion lies within the zone of continuous permafrost (Brown, in press) and is coincident with Land Region 1 of Zoltai and Pettapiece (1973). The most outstanding feature is the vast number of oriented lakes occurring in basins, especially the Old Crow Basin. These lakes are more or less square to rectangular and oriented in a northwest to southeast direction. Several theories have been proposed for their development (Walker 1973) and include waves resulting from winds oriented parallel to the long axis, waves resulting from winds oriented perpendicular to the long axis, structural control, angle of solar radiation and sediment distribution. The lakes are of thermokarst origin and are shallow, seldom over 3 m deep. The thermokarst process is ongoing.

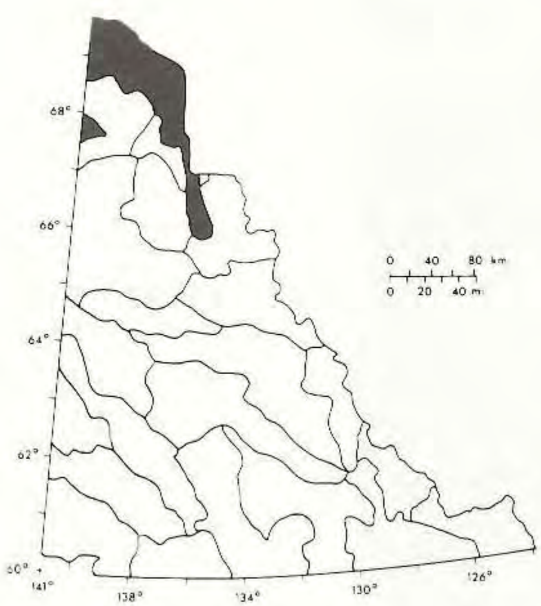
Organic deposits are most common in lowlands, generally overlying lacustrine deposits, and peat plateaus with polygonal surfaces and peat polygons (Plate XXXVIII, page 93) are prevalent. Most fenlands appear to be underlain by permafrost, though the permafrost table may be quite deep in some instances. Patterned fens with frozen ridges occur, as well as unfrozen seepage fens (Zoltai and Pettapiece 1973; Zoltai and Tarnocai 1975a, b).

Pediment slopes, developed through erosion, dominate the uplands. Bare-center hummocks frequently occur on upland surfaces. Solifluction lobes or stripes are not prominent, probably due to the subdued nature of the landscape, although hummocks or terraces occur on some slopes.

Vegetation: The portion below about 450 m elevation lies within the B33 forest region of Rowe (1972) and the remainder lies in the Tundra region. Open black and white spruce occur at lower elevations, the white spruce occurring mostly on better drained sites. Paper birch, balsam poplar and aspen are frequently present, but are abundant only in early successional stands following disturbances, primarily fire.

Shrub birch, willow and sometimes alder form extensive thickets in openings and under trees, and extend above treeline. Sedge and cottongrass tussocks are prevalent under most other vegetation types, as well as in open communities. The tussocks are usually hummocky, which provides habitat for a variety of other species. Ericaceous shrubs, dwarf willows, forbs and lichens are prevalent, at times dominant, on tops of hummocks. Sphagnum often grows on the sides or between hummocks and is most prevalent on older hummocks that are degrading.

22. Northern Mountains and Coastal Plain Ecoregion (area: 29 689 km^2) Plate XXI



Physiography: This is a heterogeneous unit composed of rugged mountains over 1500 m in elevation, plateaus between the mountain ranges and plains dipping into the Arctic Ocean. It is combined into a single ecoregion because of vegetation similarities, and it is coincident with Land Region 0 of Zoltai and Pettapiece (1973). The British and Richardson mountains, a major portion of the Arctic Plateau and the entire Arctic Coastal Plain physiographic subdivisions (Bostock 1965) form a continuous mass constituting about 6.1% or 28 157 km^2 of the Yukon. The Mackenzie Delta crosses the extreme northeast corner of the ecoregion. The Old Crow Range portion constitutes less than 1% or 1532 km^2 of the Yukon.

Drainage: The eastern slopes of the Richardson Mountains drain eastward by several tributaries to the Peel River and Mackenzie Delta. The western slopes of these mountains drain into the Porcupine River, the Bell River being a major channel. The north slopes of the Richardson and British mountains, the Arctic Plateau and Coastal Plain drain northward to Beaufort Sea, principally by Big Fish, Blow, Babbage, Trail, Tulugaq, Firth and Malcolm rivers. The southern fringe of the British Mountains and the northern part of the Old Crow Range drain into the Porcupine River, largely through the Old Crow Basin.

Lakes, many of thermokarst origin, occur on plateaus, are common on the Coastal Plain and are of small to moderate size. They may be remnants of lakes formed during deglaciation.

Geology: The major part is underlain by sedimentary rocks, of which sandstone, shale, conglomerate, limestone and dolomite are primary constituents. The British Mountains contain a high proportion of metamorphic rock, most of which is phyllite. Intrusive rocks, mainly granite and granitic porphyry, are dominant in the Old Crow Range (Douglas and MacLean 1963).

Climate: Climatic data presented by Burns (1973, 1974) and from meteorological stations along the Arctic Coast (Table 1) indicate the mean annual precipitation is about 500 mm in the Richardson Mountains, between 250 and 380 mm in the Arctic Plateau and British Mountains, and about 125 mm along the Arctic Coast.

PLATE XXI (Northern Mtns. and Coastal Plain Ecoregion)

a) Arctic tundra in British Mountains along Firth River.
Lat. 68°43'N, Long. 140°15'W

b) Coastal Plain at Beaufort Sea.
Lat. 69°02'N, Long. 137°44'W

c) White spruce, balsam poplar and willow in tundra along Firth River.
Lat. 69°15'N, Long. 139°45'W

Mean annual temperatures are about -9°C in the Richardson Mountains and about -11°C along the Arctic Coast. Mean annual temperatures between -10°C and -11°C probably prevail. The coastal influence tends to moderate the temperature so that the magnitude between highs and lows is not as great as farther inland.

Glaciation and surficial deposits: The Richardson Mountains formed an effective barrier to the westerly moving Laurentide ice. Consequently, only the eastern slopes, to an elevation of about 1100 m, and the coastal plain were glaciated during early Wisconsin and, to a lesser extent during late Wisconsin time.

Deep, medium-textured morainal material is extensive along the Arctic Coast, extending inland on the coastal plain and along the eastern slopes of the Richardson Mountains (Hughes 1972). Extensive deposits of fluvial material bound by steep sided erosional scarps occur on the Coastal Plain. Large channel features, possibly of meltwater origin, are common near the coast. Deltaic forms occur along the coast, but are most prominent in the unglaciated portion of the Coastal Plain near the Yukon-Alaska border. Marine estuarine deposits are present.

Terrain features: Pediment or gently inclined erosion surfaces extend outward from many river valleys in the central unglaciated area. Fluvial deposits are not extensive, although narrow strips of recent alluvium in meandering stream channels (Plate XXI) occur along most rivers. Floodplains are better developed near the coast. Slopes of subdued mountains are mantled with deep colluvium and the steeper slopes of more rugged mountains are covered with scree at upper elevations and shallow colluvium at lower elevations. The unglaciated terrain consists of moderately deep residual soils. Loess deposits are common.

Except for the southern tip of the Richardson Mountains, the ecoregion lies within the zone of continuous permafrost (Brown, in press), which occurs near the surface. Organic terrain is uncommon in this ecoregion and deposits are generally shallow. Many of the lowland areas in which peat plateaus are common have polygonal surfaces (Zoltai and Tarnocai 1975a, b). Fenlands are not common, but do contain permafrost. Nearly all mineral land surfaces are hummocky and hummock tops are often devoid of vegetation. On steeper slopes, the hummocks are elongated into stripes. Stoney soils have a relatively high degree of sorting in which stone nets and sorted circles are characteristic, particularly on flattened ridge tops. Pingos, of the open system type, are present. Intricate feather-like drainage patterns typify most sloping landscapes in which parallel lineations or runnels occur at regular intervals.

Vegetation: Most of the terrain is devoid of trees and, consequently, lies within the tundra region (Rowe 1972). Open stands of black and white spruce and balsam poplar occur in protected valleys, particularly along the Firth River (Drew and Shanks 1965).

The most prevalent vegetation type is sedge and cottongrass tussocks. This is nearly always hummocky, and supports shrub birch, willow and alder in warmer situations and ericaceous shrubs, prostrate willows, forbs and moss in cooler areas (Hettinger, Janz and Wein 1973). Lichens are prevalent on drier microsites, such as tops of tussocks and hummocks.

TERRAIN INTERRELATIONSHIPS

Vegetation: Climate - On a broad scale, the most easily noted relationship between vegetation and climate is the distribution and stature of various species. Their occurrence and distribution not only changes with latitude, but also with elevation. The greatest variety of species, the tallest and the most continuous canopy of trees occurs in the Liard River Ecoregion, where all the terrain below about 1500 m is forested. To the east, in the Beaver River Ecoregion, the variety of trees is much the same, but usually they are not as large and generally do not occur above 1350 m elevation. Larch generally does not occur north and west of the Liard River Ecoregion, but is present in the Eagle Plain and Peel River ecoregions. Alpine fir reaches its general limit in the Yukon in the Lake Laberge and Mayo Lake-Ross River ecoregions, but occurs sporadically in the Klondike River Ecoregion. Lodgepole pine occurs only in scattered localities west of the Lake Laberge Ecoregion and does not occur north of the Mayo Lake-Ross River Ecoregion. The other species, namely white and black spruce, aspen, balsam poplar and paper birch, occur in nearly all ecoregions but, in the north, stands are more open and limited to lower elevations. Also, trees do not grow as fast or as large, and their distribution on the landscape changes in respect to the Liard River Ecoregion. Aspen, for example, occurs only on warmer sites in the northern and western ecoregions; all species become restricted to protected valleys in the far northern ecoregions.

A similar situation exists for some ground cover species. Various shrubs were observed to be more abundant in some ecoregions than in others. Shrub birch and various species of willow form communities in all ecoregions; however, they are generally confined to narrow bands in the subalpine of southeastern Yukon, but form extensive coverage in west-central and northern areas. Alder is common in the most southern ecoregions, except for the Coast Mountain Ecoregion, where soapberry predominates. Silverberry formed extensive patches in river valleys in the Ruby Range Ecoregion, although Hultén (1968) indicates scattered occurrences to the northeast. Tundra vegetation constitutes a greater proportion of the vegetative cover in northern than in southern ecoregions, and generally occurs at progressively lower elevations with increasing latitude.

The development of climax forest stands is related, at least in part to the regional climate, although other environmental factors may influence succession. In the western and north-central parts of the Yukon the development of climax stands appears to follow a pattern similar to that described by Viereck (1970). Following a disturbance, such as fire, or the formation of new habitat, such as recent alluvial deposits, the initial tree invaders may include willows, balsam poplar, aspen, black spruce or white spruce depending on the condition of the original forest, the severity of the disturbance or the seed availability. The deciduous species (willows, balsam poplar and aspen) generally invade and grow faster than either species of spruce, and tend to dominate during early successional stages. If no permafrost is present, at least within the upper 90 cm of mineral soil, white spruce tends to replace the deciduous species. Black spruce may become established during any successional stage, but is the most prevalent invader after the organic mat becomes sufficiently thick to provide the insulation required for the development of permafrost. White spruce is intolerant of permafrost and the deciduous species are intolerant of thick organic blankets, which allow black spruce to become dominant. The eventual outcome is an open stand of black spruce with a sphagnum and ericaceous shrub understory.

In the south-central and southeastern areas, lodgepole pine is a prominent constituent of successional stages, and is often the sole invader following fires. Aspen, sometimes with tall shrubs, may become established following disturbances, but is usually restricted to warm, south-facing slopes. White and black spruce become established at some point in the successional sequence, probably related to seed availability. On upland sites with coarse-textured soils, especially where fires were extensive, the establishment of white and black spruce is relatively slow. Stands of lodgepole pine more than 100 years old with only a few scattered spruce are frequent. On these coarse-textured upland sites, as well as on fine-textured upland sites where succession is usually somewhat faster, spruce eventually gains dominance, often with the assistance of alder, which aids in curtailing lodgepole pine regeneration. As the vegetative cover thickens on fine-textured sites, the seasonal frost becomes persistent for most of the year, and permafrost develops. Whether white spruce is ever totally eliminated from the coarse-textured upland sites is questionable. The climax vegetation on the upland sites, therefore, consists of black spruce, some white spruce, and an understory of alder and/or moss.

On recent alluvial sites in the south and east, willows and balsam poplar are initial invaders. White spruce seed is usually abundant in snow-melt waters (Viereck 1970) and is deposited along banks as floods recede. Establishment of white spruce usually occurs as soon as flooding becomes infrequent, say at about five-year intervals, and the development of stands proceeds relatively rapidly.

Vegetation: Permafrost - The presence of permafrost near the surface results in conditions that affect the distribution and growth of vegetation. Black spruce and, to a limited extent, paper birch and larch are the only tree species that can tolerate permafrost within about 40 cm of the surface. The vegetation develops a characteristic appearance when growing over shallow permafrost on north-facing slopes. In general, it has a dark colored appearance in relation to slopes lacking permafrost, and is composed of open, scrubby black spruce with an understory of moss, frequently dominated by sphagnum and ericaceous shrubs. In other situations, permafrost in hummocks and peat plateaus creates very dry surface conditions and lichens dominate the vegetation, forming a distinctive appearance.

In general, permafrost supports a high water table and, in situations that would otherwise be dry, it causes the substrate above the frozen layer to be wet throughout much or all of the growing season. This allows wetland plants to grow on portions of the landscape at the expense of plants that cannot tolerate wet conditions. Black spruce is more common on upland terrain because of this situation. Sphagnum, sedges and willows are considerably more common on upland slopes than is the case where permafrost is absent.

Terrain factors: Permafrost - Terrain factors which influence the development of permafrost include relief, topographic position, hydrology, vegetation, soil and rock type, snow cover and fire history. These factors are interrelated; therefore, discussion of any one factor must consider the others (Brown 1967, 1973, 1974).

Landform, which includes relief, exposure and topographic position, influences the amount of solar radiation received by the ground surface and the accumulation of snow. The configuration and gradient of a particular landform can determine whether the dominant mass-wasting process is landsliding, frost creep or solulifluction (Washburn 1973). In the discontinuous permafrost zone, permafrost may be prevalent on north aspects and almost totally absent on south aspects. In the continuous zone, permafrost is thicker and the active layer is thinner on north-facing slopes than on south-facing slopes.

Water influences permafrost by affecting its distribution and the thermal regime. The amount of moisture in the soil immediately before it freezes in the autumn determines the ice content and the depth of thaw the following summer. Infiltration of atmospheric water and the moisture content of the soil surface have strong bearings on the heat transfer to the frozen soil during thaw periods (Brown 1974). Under permanent water bodies, depending on whether or not they freeze to the bottom, there is almost always a layer of ground that never completely freezes. Moving water tends to thaw and erode perennially frozen ground.

Soil and rock types have a considerable influence on permafrost, especially in the continuous permafrost zone. Variations in soil texture, which affects the soil moisture regime, alters the thermal properties of landforms. The color of the soil and rock also influences the thermal regime. These factors in turn affect the rate of permafrost accumulation and thickness of the active layer. Soils with organic matter additions, either from cryoturbation or from incorporation through decomposition, tend to absorb and hold more water than soils of the same texture lacking such additions, and are prone to further modification by frost action.

Snow cover influences the heat transfer between air and ground, and hence effects the distribution of permafrost. Timing and depth of snowfall, and duration of snow cover, are critical factors. A heavy snowfall in late autumn inhibits frost penetration, and a deep snow cover extending into late spring delays thawing of the ground. In the southern part of the discontinuous scattered permafrost subzone, the snow regime can be critical to the formation and existence of permafrost, as well as the extent and duration of seasonal frost.

Vegetation, and the resulting organic mat, have profound effects on permafrost, mostly through shielding the ground surface from solar radiation and insulating against thermal exchange between soil and air. Though trees are effective in shading and snow interception, the main insulating layer is the moss and peat cover. Removal of vegetation, particularly the moss cover, and organic matter, causes degradation of the underlying permafrost.

Fire and other disturbances disrupt the balance between vegetation, land and permafrost developed during stable conditions. The destruction of the stable vegetation and organic mat may cause ground subsidence through lowering of the permafrost table and deepening of the active layer. This in turn will result in ponding or downslope flow, creating conditions that are not suitable for the growth of stable vegetation, and a new group of plant species is likely to colonize the area. The return to original conditions is a very slow process.

Vegetation: Landform - Similar landforms may occur in several ecoregions, although the vegetation on them differs from one ecoregion to another. Often, however, it is the stature and growth rates, rather than the species, that vary among ecoregions.

Recent alluvial sites that are flooded periodically or have a relatively high water table, but are well-drained, tend to lack permafrost and support the best growth of vegetation, including woody plants, within a particular ecoregion. Moisture is rarely wanting, yet the roots are not in a perpetually saturated environment and thus are able to obtain oxygen. White spruce, balsam poplar and aspen are the primary tree species on these sites, and are present in protected sites almost to the Arctic Ocean. Older floodplains that are not flooded periodically often experience drought and tree growth is reduced.

Landforms composed of coarse-textured upland soils are usually well-drained and permafrost is generally absent, but the vegetation associated with these soils, at least in the south, must endure periods of drought during most summers. In the northern ecoregions, where permafrost is prominent, the vegetative growth may be better on drier sites because they warm up faster. These coarse-textured upland soils support moderate stands of lodgepole pine, white spruce, black spruce and aspen in southern Yukon. Tree growth and density declines as the magnitude of the moisture deficit, altitude and latitude increases. Shrub communities, primarily shrub birch and willow, occupy many of these sites above treeline and in northern latitudes.

Landforms composed of fine-textured material are frequently wet and have a high incidence of permafrost, consequently, growth of vegetation is restricted. Black spruce is the most extensive tree species, but larch, willow, paper birch and aspen may be common in some areas. The understory vegetation is usually lush and is composed of ericaceous shrubs, willows, graminoids, forbs, mosses and lichens. Decomposition is slow; therefore, litter and fermentation layers are frequently thick.

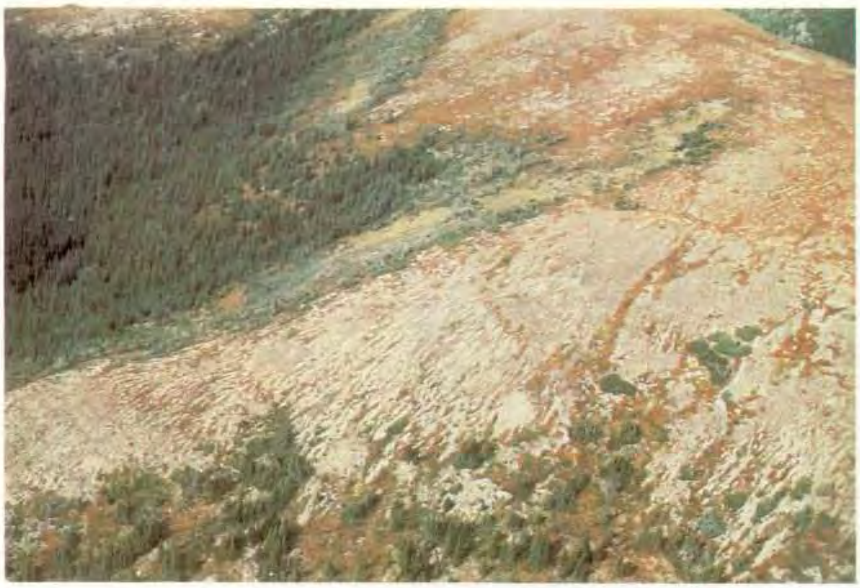
Organic landforms almost always contain permafrost and have shallow active layers, except in fenlands. Black spruce, sometimes with larch or paper birch, form the primary tree species of these sites, but the productivity is low, even in the south. Bog terrain is frequently hummocky, and forms microsite conditions for several understory species. Sedge or cottongrass tussocks are common, and ericaceous shrubs and dwarf willows often dominate the sides and tops of hummocks. Sphagnum is frequently abundant, and lichens may be abundant on dry tops of hummocks. Fenlands usually lack trees, but support shrubs, graminoids and moss, which often occur in stands or clusters within a water saturated matrix.

Upper slopes are usually composed of shallow, coarse-textured colluvial soils, are rapidly drained and have deep thaw layers. Trees are sparse to absent, depending on altitude; however, medium to tall shrubs may form dense growths in protected areas. Low shrubs, forbs, graminoids and moss occur on exposed slopes. Slopes of talus or scree may be devoid of any vegetation or, if stable, may support lichens. On some active talus or scree slopes, patches of vegetation that have slid part way down may be present or the talus material may cover vegetated slopes, leaving islands of plant growth.

Tops of mountains are composed primarily of rock, either consolidated bedrock or felsenmeer. Prostrate shrubs, forbs and lichens constitute the most common vegetation. Wet depressions frequently support sedge or cottongrass tussocks and may be hummocky.

No discernible difference was detected in the vegetation of glaciated and nonglaciated areas on the reconnaissance level of analysis used in this study. The soils of nonglaciated areas tended to be more deeply weathered, and more detailed or specific vegetational analysis may reveal differences. Unglaciated areas probably served as refugia for plants during glacial periods and conceivably some variance in vegetation may be associated with this. However, the species that survived on various refugia are not known.

PLATE XXII

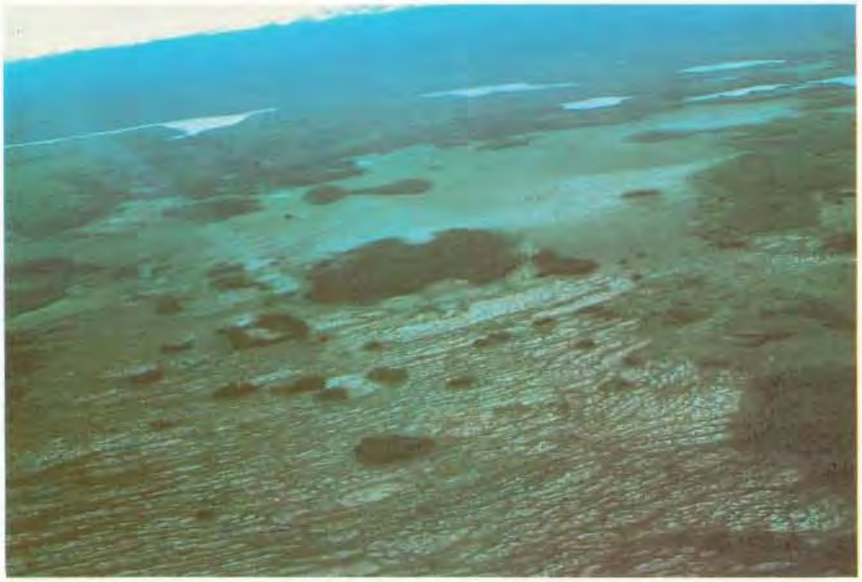


a) Earth stripes, nonsorted on steeper slopes, bare center circles on subdued crest in medium-textured, deep, morainal material.
Lat. 60°40'N, Long. 125°10'W

b) Blanket bog in alpine. Slope: 5-7°. Peat 1.5+m thick. Depth of thaw 54 cm. Surface tussocky to small hummocky. Small thaw ponds.
Lat. 60°32'N, Long. 124°53'W

c) Nonsorted circle, 1.0 to 1.25 m in diameter. Fine-textured, clay material with few stones; adjacent to blanket bog in photo above.
Lat. 60°32'N, Long. 124°53'W

PLATE XXIII



a) String fen or net-like patterned fen with peat plateau and evidence of plateau collapse.
Lat. 60°15'N, Long. 127°30'W

b) Collapsing palsa 6 m high by 30 m across in treeless fen. Open water where section of palsa has recently collapsed. Peat to 75 cm overlying frozen marl layer.
Lat. 60°25'N, Long. 127°04'W

c) Drumlinzed landscape.
Lat. 60°48'N, Long. 130°12'W

PLATE XXIV

a) Coarse-textured glaciofluvial deposits along Hyland River.
Lat. 60°59'N, Long. 128°28'W

b) Sorting and frost shattering of stream bed materials; note angularity of rock material and gradation in size by shovel point.
Lat. 61°52'N, Long. 128°22'W

c) Peat mounds (hummocks) 1 m high by 1.5 m across. Frozen peat at 70 cm. Large number of hummocks occur bordering a fen.
Lat. 61°52'N, Long. 128°22'W

PLATE XXV

a) Pitted glaciofluvial deposits recently burned.
Lat. 61°05'N, Long. 131°17'W

b) Lateral meltwater channels and minor fluvial (ice contact) deposits.
Lat. 61°18'N, Long. 130°30'W

c) Active sand dunes in vicinity of Carcross encroaching on vegetation.
60°07'N and Long. 134°45'W

PLATE XXVI

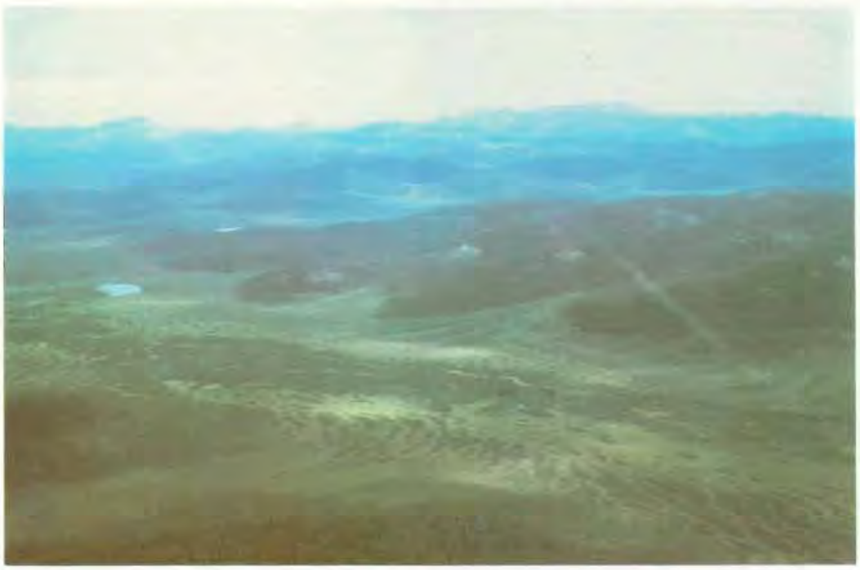
a) South aspect grassland on gullied, medium-textured colluvial veneer and deep morainal material. Frequent bedrock outcroppings and accumulation of ash at base of slope.
Lat. 61°36'N, Long. 135°50'W

b) Hummocky, kettled morainal material. Fluvial material in background.
Lat. 60°46'N, Long. 138°35'W

c) Junction of Kaskawulsh (in background) and South Arm glaciers (in foreground). Movement of ice is to the right. Medial moraines evident in background are further supplemented by material contained in lateral moraine of South Arm glacier in center of photo.
Lat. 60°40'N, Long. 138°46'W

PLATE XXVII

a) Deep lapilli (coarse ash) deposits near source. Some of the material has been eroded and redeposited by water and to some extent by wind.
Lat. 61°37'N, Long. 140°52'W



b) Sedge-willow bog-fen complex. Transitional stage from fen to bog. Permafrost in willow islands.
Lat. 61°35'N, Long. 137°50'W

c) Glaciofluvial terrace; deep gravels capped with somewhat finer textured material.
Lat. 61°21'N, Long. 139°11'W

PLATE XXVIII

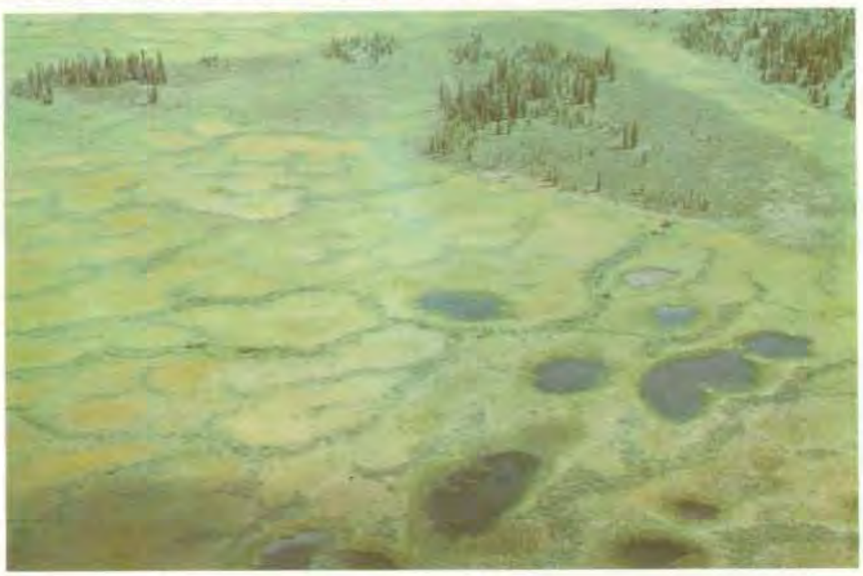
a) Polygonal pattern in peat deposits. Centers of polygons supporting a growth of ericaceous shrubs.
Lat. 62°25'N, Long. 139°27'W

b) North aspect slope permafrost. Areas nearly devoid of trees are most often hummocky, the hummocks being covered with sphagnum. Black spruce, paper birch, alder generally growing along drainages where permafrost is deeper.
Lat. 62°20'N, Long. 140°53'W

c) Continuous felsenmeer or stone field, in background, vague polygonal or net-like patterns visible in frost heaved blocks in foreground.
Lat. 62°46'N, Long. 140°25'W

PLATE XXIX

a) Tor in unglaciated landscape.
Lat. 62°06'N, Long 137°30'W

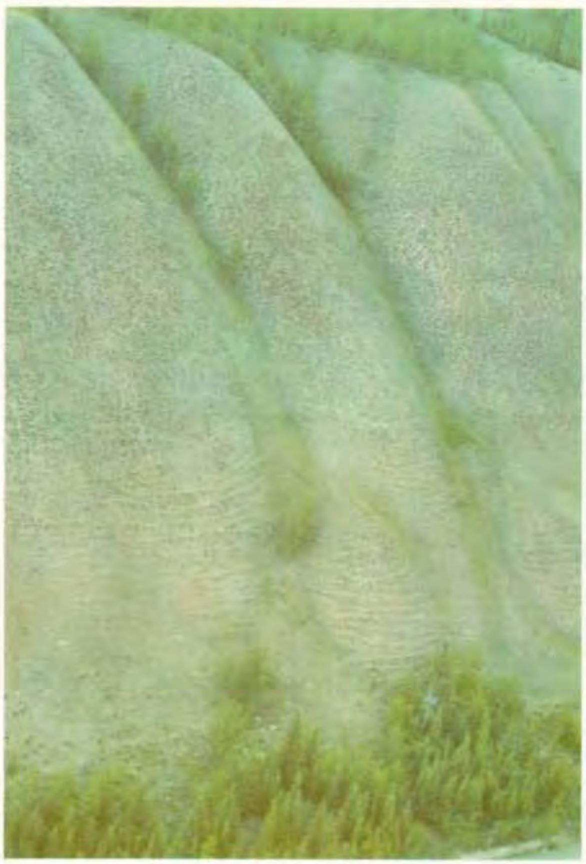


b) Patterned fen. Vegetated ridges form a netlike pattern. Similar to string fen. The area between ridges is water saturated to the point of forming small open ponds.
Lat. 62°02'N, Long. 137°58'W

c) Poorly sorted circles in alpine. The central part of these circles consisted of gravelly material largely free of fines.
Lat. 64°10'N, Long. 140°38'W

PLATE XXX

a) Deep, fine-textured, silty material, in places capping coarse-textured ice contact deposits and glaciofluvial material. Grassland vegetation on steep south-facing slopes with aspen confined to gullies.
Lat. 61°59'N, Long. 132°25'W



b) Very steep, south-facing slopes exhibiting cat steps or terracettes on lower part of slope.
Lat. 61°54'N, Long. 132°38'W

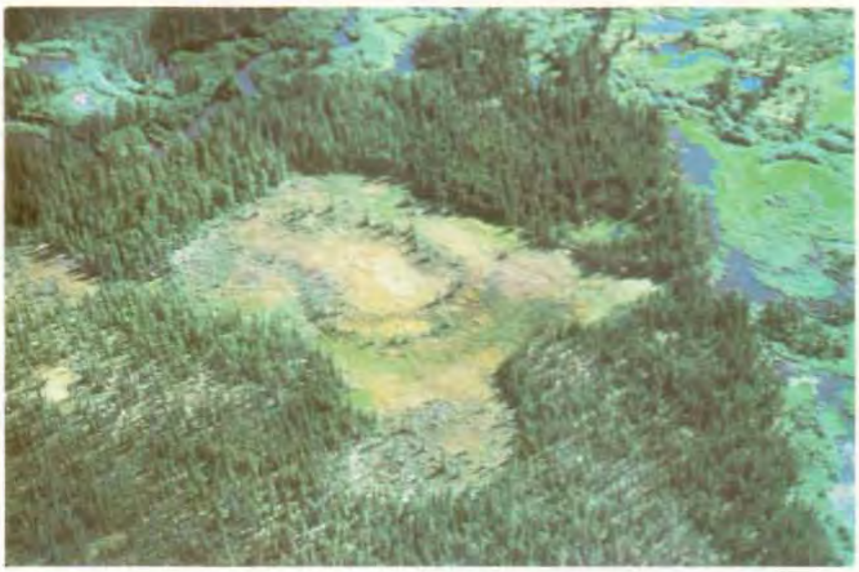
PLATE XXXI

a) Palsa, approximately 7m high by 24 to 30 metres across, collapsing into surrounding fen. Two more palsas are evident in upper left center with peat plateau in upper right. Leaning trees (drunken forest) evidence of thawing ground ice.
Lat. 64°35'N, Long. 135°47'W

b) Collapsing face of palsa. 2.5 m of peat (frozen at .5 m) overlying fine-textured frozen silts.
Lat. 64°35'N, Long. 135°47'W

PLATE XXXII

a) High ice content of permanently frozen mineral soil core in palsa. Knife is at approximate contact between organic and mineral soil.
Lat. 64°35'N, Long. 135°47'W



b) Collapse scar. Remains of former peat plateau.
Lat. 64°54'N, Long. 134°10'W

c) Rock glacier, exhibiting successive lobate ridges. Solifluction terraces on moderately sloping terrain in lower center. Peat plateau in fen at lower center.
Lat. 63°15'N, Long. 130°05'W

PLATE XXXIII

a) Peat plateau in upper elevation valley fen. Lichen covered plateau in center of photo showing advanced signs of collapse.
Lat. 63°11'N, Long. 130°07'W

b) Polygons (4.5-6 m across) intrenched in peat surface of plateau. Bare peat surface likely caused by surface fire. Depth of peat over marl 1.5-2 m. Palsa about 7.5 m high x 60 m across.
Lat. 63°05'N, Long. 130°13'W

c) Miniature polygons (<1 m across) within larger polygonal structures in photo above.
Lat. 63°05'N, Long. 130°13'W

XXXIV

a) Profile of thaw layer in large earth mound (mineral soil), 4.5m-5m high by 15-18m across with very shallow organic capping<10 cm). Frozen at 82 cm. Knife resting in frozen layer.
Lat. 64°28'N, Long. 134°19'W

b) Aufeis or icing on floodplain. Concentric ridges 4-7 cm high along downstream margin of ice.
Lat. 64°35'N, Long. 134°27'W

PLATE XXXV

a) Continuous scree slopes in sedimentary bedrock. Talus cones at base of slopes in right center. Moraine blocking side valley and impounded lake behind moraine in center of photo.
Lat. 64°40'N, Long. 140°05'W

b) Polygonal trench in deep peat deposit (1-1.5 m) over mineral soil.
Lat. 64°57'N, Long. 138°57'W

PLATE XXXVI

a) Aufeis formation in drainage channel. Ice formation both from groundwater below causing lifting of material and by surface flooding.
Lat. 64°40'N, Long. 138°22'W

b) Hummocky tussocks. Organic horizon generally shallow over mineral soil.
Lat. 64°40'N, Long. 138°22'W

c) Tussocky hummocks on imperfectly drained alluvium. Prior to being burned, the area supported moss covered earth hummocks and open grown black spruce. Removal of the insulating moss layer caused ice degradation and collapse of hummocks.
Lat. 64°30'N, Long. 139°50'W

PLATE XXXVII

a) Erosional scarp on gently tilted sedimentary rock.
Lat. 66°30'N, Long. 139°35'W

b) Castle-like erosional remnants on mountain crests in sedimentary rock. Talus or scree slopes partially vegetated.
Lat. 65°20'N, Long. 138°20'W

PLATE XXXVIII

a) Cross section of earth hummock. Permafrost at 72 cm. Active layer frozen at 37 cm. Lat. 64°53′N, Long. 138°25′W

b) Cross section of north-facing slope hummock, 25-30 cm of organic (sphagnum) capping on fine-textured, high ice content mineral soil.
Lat. 65°15′N, Long. 128°20′W

c) Polygonal pattern in former lake basins. Abandoned shorelines in upper center of photo. Lat. 67°55′N, Long. 139°50′W

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APPENDIX A

Partial List of Plant Species

The Flora of Alaska and Neighboring Territories by Hultén (1968) was followed for most vascular plants, but in some cases Anderson's work (Welsh 1974) was sought for species not included by Hultén and Porsild's (1951, 1966) community descriptions were useful. The works of Argus (1973) for willows and Lawton (1971), Grout (1928 - 1939) and Schofield (1969) for mosses were often used. The sphagna and lichens were mostly identified through personnal communications with Dr. Kojima. Voucher specimens are kept at the Pacific Forest Research Centre and a second set will be deposited with the Yukon Lands and Forest Service.

Trees - Coniferous	
Alpine fir	Abies lasiocarpa (Hook.) Nutt.
Black spruce	Picea mariana (Nill.) Britt., Sterns & Pogg
Larch	Larix laricina (Du Roi) K. Koch var alaskensis (Wright) Raup
Lodgepole pine	Pinus contorta Dougl ex Loud.
White spruce	Picea glauca (Moench) Voss
- Broadleaf	
Aspen	Populus tremuloides Michx.
Balsam poplar	Populus balsamifera L.
Paper (white) birch	Betula papyrifera Marsh. subsp. humilis (Regel) Hult.
Willow	Salix spp. (e.g. alaxensis (Anderss.) Cov., depressa L. subsp. rostrata (Anderss.) Hiitonen, scouleriana Barratt, arbusculoides Anderss. and lasiandra Benth.)
Plants common in mesic to dry forests	
Kinnikinnick	Arctostaphylos uva-ursi (L.) Spring.
Fescue grass	Festuca altaica Trin.
Bluejoint	Calamagrostis canadensis (Michx.) Beauv.
White Camass	Zygadenus elegans Purah
Comandra	Geocaulon lividum (Richards.) Fern.
Service-berry	Amelanchier alnifolia (Nutt.) Nutt.
Rose	Rosa acicularis Lindl.
Lupine	Lupinus arcticus S. Wats.
Bunchberry	Cornus canadensis L.
Bluebell	Mertensia paniculata (Ait.) G. Don
Twinflower	Linnaea borealis L.
Moss	Dicranum spp.
Moss	Hylocomium splendens (Hedw.) B.S.G.
Moss	Pleurozium schreberi (Brid.) Mitt.
Moss	Polytrichum juniperinum Hedw.
Lichen	Cladonia spp.
Lichen	Peltigera spp.

Plants common in wet forests and heath

Crowberry	Empetrum nigrum L.
Labrador Tea	Ledum palustre L.
Lingonberry	Vaccinium vitis-idaea L.
Alpine Blueberry	Vaccinium uliginosum L.
Polar grass	Arctagrostis latifolia (R.Br.) Griseb.
Willow	Salix glauca L.
Willow	Salix pulchra Cham.
Shrub birch	Betula glandulosa Michx.
Mountain Alder	Alnus crispa (Ait.) Pursh
Chickweed	Stellaria crassifolia Ehrh.
Anemone	Anemone parviflora Michx.
Cloudberry	Rubus chamaemorus L.
Shrubby Cinquefoil	Potentilla fruticosa L.
Yarrow	Achillea borealis Bong.
Saussura	Saussurea viscida Hult.
Moss	Aulacomnium palustre (Hedw.) Schwaegr.
Moss	Tomenthypnum nitens (Hedw.) Loeske
Moss	Bryum spp.
Moss	Pohlia spp.
Sphagnum	Sphagnum spp.
Lichen	Cladonia spp.
Lichen	Cladina spp.
Lichen	Cetraria spp.
Lichen	Peltigera spp.

Plants common on dry slopes

Kinnikinnick	Arctostaphylos uva-ursi (L.) Spreng.
Mountain Juniper	Juniperus communis L.
Bent grass	Agrostis scabra Willd.
Bluejoint	Calamagrostis spp.
Pasqueflower	Pulsatilla patens (L.) Mill.
Comandra	Geocaulon lividum (Richards) Fern.
Prickly Saxifrage	Saxifraga tricuspidata Rottb.
Lupine	Lupinus arcticus S. Wats.
Beardtongue	Pentstemon procerus Dougl.
Beardtongue	Pentstemon gormani Greene
Sagewort	Artemesia frigida Willd.
Arnica	Arnica frigida C.A. Mey
Moss	Polytrichum piliferum Hedw.
Moss	Rhacomitrium canescens (Hedw.) Brid.

Plants common in bogs and tundra

Crowberry	Empetrum nigrum L.
Labrador Tea	Ledum palustre L.
Bog Rosemary	Andromeda polifolia L.
Lingonberry	Vaccinium vitis-idaea L.
Alpine blueberry	Vaccinium uliginosum L.
Cranberry	Oxycoccus microcarpus Tuccy.
Cottongrass	Eriophorum angustifolium Honck.
Cottongrass	Eriophorum brachyantherum Troutw. & Mey.

Sedge	*Carex bigelowii* Torr.
Sedge	*Carex saxatilis* L.
Shrub birch	*Betula glandulosa* Michx.
Cloudberry	*Rubus chamaemorus* L.
Butterwort	*Pinguicula villosa* L.
Coltsfoot	*Petasites frigidus* (L.) Franch.
Moss	*Aulacomnium palustre* (Hedw.) Schwaegr.
Moss	*Tomenthypnum nitens* (Hedw.) Loeske
Moss	*Drepanocladus uncinatus* (Hedw.) Warnst.
Sphagnum	*Sphagnum* spp.

Plants common in Alpine and dry tundra

Lapland Rosebay	*Rhododendron lapponicum* (L.) Wahlenb.
Alpine Azalea	*Loiseleuria procumbens* (L.) Desv.
Mountain Heather	*Phylladoce empetriformis* (Sm.) D. Don
Lapland Cassiope	*Cassiope tetragona* (L.) D. Don
Alpine Bearberry	*Arctostaphylos rubra* (Rehd. & Wilson) Fern.
Diapensia	*Diapensia lapponica* L.
Grass	*Trisetum specatum* (L.) Richter
Grass	*Poa alpina* L.
Grass	*Poa arctica* R. Br.
Kobresia	*Kobresia myrosuroides* (Vill.) Fiori & Paol.
Willow	*Salix reticulata* L.
Willow	*Salix arctica* Pall.
Anemone	*Anemone parviflora* Michx.
Roseroot	*Sedum rosea* (L.) Scop.
Mountain Avens	*Dryas octopetala* L.
Lousewort	*Pedicularis labradorica* Wirsing
Lousewort	*Pedicularis suedetica* Willd.
Lousewort	*Pedicularis capitata* Adams
Lousewort	*Pedicularis kanei* Durand
Bellflower	*Campanula lasiocarpa* Cham.
Arnica	*Arnica alpina* (L.) Olin
Lichens	*Cladina* spp.
Lichens	*Cladonia* spp.
Lichens	*Cetraria* spp.
Lichens	*Peltigera* spp.

APPENDIX B

Glossary of Terms

Definitions are taken from American Geological Institute (1962), Fairbridge (1968), Brown and Kupsch (1974), Washburn (1973) and Canada Soil Survey Committee (1976).

Active layer: The layer of ground above the permafrost table that thaws each summer and refreezes each fall.

Aeolian (Eolian): Materials transported and deposited by wind action. Generally consist of medium to fine sand and coarse silt.

Alluvium: Material of any particle size that has been deposited by moving water.

Aufeis: A sheet-like mass of ice on the ground surface or on the surface of river ice.

Beaded stream: A drainage pattern of individual streams in which pools or small lakes are connected by short stream reaches. The pools are caused by the melting of ground ice.

Bog: Peat-covered areas or peat-filled depressions with a high water table, strongly acid peat and a surface layer of mosses.

Brunisol: A type of soil with weak development; it is often light brown in color with good drainage and of a loam or coarser texture. It is Eutric if the pH is 5.5 or higher and the base saturation is 100%; it is Dystric if the pH is less than 5.5 and the base saturation is less than 100%.

Cat steps (Terracettes): Narrow ledges of earth on steep hill sides. In instance cited, likely due to landslip aided by freeze-thaw action.

Chernozem: A type of soil with a dark brown to black surface horizon 9 cm or more thick; the surface horizon contains up to 30% organic matter. These soils usually develop under grassland.

Circle, nonsorted: Patterned ground feature, occurring in groups, whose mesh (interior surfaces) is dominantly circular and lacks a border of stones.

Circle, sorted: Patterned ground features occurring in groups, whose mesh is dominantly circular and which has a sorted appearance commonly due to a border of stones surrounding finer material.

Cirque: A bowl shaped,hollow recess in a mountain resulting from ice erosion.

Collapse scar: A circular, wet depression several meters across, adjacent to the slumping edge of a peat plateau or palsa, caused by the thawing of ice-rich permafrost.

Colluvium: Materials of any particle size that have reached their present position by direct gravity induced movement.

Cryosol: A soil formed in mineral or organic material that has permafrost within one meter of the surface, or within two meters and marked cryoturbation, and a mean annual temperature below $0^{o}C$.

Cryoturbation: A collective term to describe all soil movements due to frost action. Encompasses frost heaving and all differential and mass movement including expansion and contraction due to temperature changes.

Deglaciation: Uncovering of the land surface brought about by the melting of glacier ice.

Drumlin: A smooth,streamlined,cigar shaped hill formed beneath moving glacial ice.

Drunken forest: A group of trees leaning in a random orientation usually associated with thermokarst topography.

Ecoregion: An area of land where the vegetation, soils and permafrost reflect the regional climate.

Ericaceous plants: A collective term for members of the Ericaceae family; shrubby plants with usually thick leathery leaves.

Felsenmeer: A chaotic assemblage of fractured, often upheaved, rocks resulting from intensive frost shattering of jointed bedrock.

Fen: A peatland with slowly moving water above or below the surface, acid to neutral and commonly supporting graminoid vegetation.

Fibric Organic Cryosol: A cryosol in organic soil material that is dominantly fibric below 40 cm depth. Fibers are readily identifiable as to botanical origin.

Forbs: A general term used to refer to non-woody plants other than graminoids, mosses and lichens.

Formation: Of vegetation, a world vegetation type dominated throughout by plants of the same life-form.

Frost cracking: Fracturing of the ground by thermal contraction at temperatures below 0^oC.

Frost table: Any frozen surface within the active layer above the permafrost table or a frozen surface in seasonally frozen ground in a non-permafrost environment.

Frozen ground: Soil or rock having a temperature below 0^oC.

Glaciofluvial: Materials deposited by moving water either directly in front of, or in contact with, glacier ice.

Glaciolacustrine: Materials originating from glacier ice and deposited in standing water.

Graminoid vegetation: A collective term for grasses, sedges, cottongrass, bulrushes, reeds, etc.

Hummock: Special nonsorted form of net, characterized by a knob-like shape and vegetation cover. Earth hummock - hummocks having a core of mineral soil. Turf hummock - hummocks consisting of vegetation with or without a core of mineral soil or stone.

Ice contact: Material dropped in holes, ice walled trenches, etc. and remains on the land surface when the glacier melts. (In report used to symbolize kame materials).

Ice, ground: Ice in pores, cavities, voids or other openings in soil or rock, including massive ice.

Ice, segregated: Ice formed by the migration of pore water to the freezing plane where it forms into discrete lenses, layers, or seams ranging in thickness from hairline to greater than 10 m.

Ice lens: A dominantly horizontal lens-shaped body of ice of any dimension. Commonly used for layers of segregated ice that are parallel to the ground surface. The lenses may range in thickness from a hairline to as much as about 10 m.

Ice wedge: A massive, generally wedge-shaped body with its apex pointing downward, composed of foliated or layered, vertically oriented, commonly white ice; from less than 10 cm to 3 m or more wide at the top, tapering to a feather edge at the apex at a depth of 1 to 10 m or more. Some ice wedges may extend downward as far as 25 m and may have shapes dissimilar from wedges.

Icing: A sheet-like mass of ice either on the ground surface or on the surface of river ice. See also aufeis.

Kame: Mounds of poorly sorted, water laid sand and gravel formed within holes or fissures in the glacier or between the glacier and the land surface. (Can contain other material i.e. till as well).

Lapilli: Coarse ash, volcanic ejecta ranging in size from 4 mm to 32 mm.

Loess: A generally homogeneous, unstratified predominantly silty material, deposited by wind. (Can alternate with layers of fossil soil, solifluction material, sands or gravels).

Luvisol: A type of soil that has clay leached from the surface horizon to the B horizon; they usually develop on non-acidic parent materials under deciduous or mixed deciduous and coniferous trees.

Marl: Fine-textured (silts and clays) highly calcareous unconsolidated material containing shells.

Mesic: The mid range of the moisture scale from dry to wet; used to refer to vegetation growing in this moisture range.

Mesic Organic Cryosol: A Cryosol in organic soil material that is dominantly mesic below 40 cm depth. Fibers have been altered both physically and biochemically.

Moraine: Rock debris ranging from clay to large block size, that has been transported beneath, beside, on, within and in front of moving ice and deposited on the land surface during both growth and recession of the ice and not modified by any intermediate agent. Lateral moraine - elongate accumulation of rock and soil debris lying on the surface of a glacier in a valley at or near the lateral margin of the glacier. Medial moraine - elongate accumulation of rock and soil debris formed by the joining of adjacent lateral moraines below the juncture of two valley glaciers.

Nivation hollows: Bowl shaped depressions caused by frost action and mass wasting beneath lingering or perennial snow drifts.

Oriented lake: One of a number of lakes having a parallel alignment and commonly elliptical or rectangular in plan.

Palsa: A round or elongated hillock or mound, maximum height of about 10 m, composed of a peat layer overlying mineral soil. It has a perennially frozen core which extends from within the covering peat layer downward into or toward the underlying mineral soil.

Patterned ground: A general term for any ground surface or surficial soil material exhibiting a discernible, more or less ordered and symmetrical, micro-physiographic pattern.

Peat: Unconsolidated, compressible material consisting of partially decomposed, semi-carbonized remains of plants such as mosses, sedges and trees, some animal residues, and commonly some mineral soil.

Peat mound: A mound or hillock in a peatland composed mainly of peat overlying mineral soil.

Peat plateau: A low, generally flat-topped expanse of peat, rising one or more meters above the general surface of a peatland. A layer of permafrost exists in the peat plateau, which may extent into the peat below the general peatland surface and even into the underlying mineral soil.

Peatland: Any terrain covered by a layer of peat.

Permafrost: The thermal condition in soil or rock of having temperatures below 0^oC persist over at least two consecutive winters and the intervening summer. Permafrost, continuous - Permafrost occurring everywhere beneath the exposed land surface throughout a geographic regional zone with the exception of widely scattered sites. Permafrost, discontinuous - Permafrost occurring in some areas beneath the ground surface throughout a geographic regional zone where other areas are free of permafrost. Permafrost, widespread - Permafrost that is widely distributed but not continuous beneath the land surface.

Permafrost table: The upper boundary of permafrost.

Permafrost thickness: The vertical distance between the permafrost table and the permafrost base.

Pingo: A conical, commonly more or less asymmetrical mound or hill, with a circular or oval base and commonly fissured summit, which has a core of massive ground ice covered with soil and vegetation, and which exists for at least two winters.

Pingo, closed system: A genetic term for a pingo, in flat, poorly drained terrain of the continuous permafrost zone, that originates where a water-bearing, unfrozen layer of soil, generally in a thaw basin underlying a lake, becomes enclosed by permafrost aggradation (as when a previously existing lake, which provided insulation, shallows or drains completely) causing the expulsion of pore water. The water may dome up the overlying permafrost and inject water that freezes into that layer to form the ice-cored pingo, or the overlying permafrost may be domed up by the segregation of ice.

Pingo, open system: A genetic term for a pingo in areas of marked relief mainly in the discontinuous permafrost zone. An open system pingo originates where the hydrostatic pressure of water circulating from higher ground to beneath a frozen layer causes injection of water which freezes into a weakened part of the overlying layer to form the ice-cored pingo.

Podzol: A type of soil with moderate to strong development whereby organic matter, iron and aluminum are leached from the surface horizon (Ae) and accumulate in the B horizon. These soils usually develop under coniferous trees and on acid parent materials.

Polygon: A type of patterned ground consisting of a closed, roughly equidimensional figure bounded by several sides, commonly more or less straight but some, or all, of which may be irregularly curved. Polygon, high centre - A polygon having a center that is higher than its margins. Polygon, low centre - A polygon having a center that is lower than its margins. Polygon, nonsorted - Patterned ground whose mesh is dominantly polygonal and lacks a border of stones.

Proglacial: Material carried beyond the glacier margins.

Regosol: A type of soil with virtually no development or movement of materials within the soil.

Rock glacier: A glacier-like tongue of angular rock waste usually heading in cirques or other steep walled hollows.

Scree: A sheet of coarse debris mantling a mountain slope. A frost riven rubble sheet consisting of angular rocks with few fines, resulting from freeze-thaw action and downslope creep.

Seral: Any stage in the succession of plants from pioneers following disturbances to the climax vegetation.

Solifluction: The process of slow, gravitational, downslope movement of saturated, unfrozen earth material behaving apparently as a viscous mass over a surface of frozen material. Solifluction features - physiographic features of varying scale produced by the process of solifluction which include: lobe, stripe, sheet, terrace.

Static Cryosol: Primarily mineral soils that are not, or are weakly, cryoturbated, most commonly associated with coarse-textured materials; permafrost usually within one meter of the surface.

Step: Patterned ground features occurring in groups displaying a step-like form and downslope border of vegetation or stones embanking an area of relatively bare ground up-slope.

Stone net: A type of patterned ground characterized by a textural differentiation caused by frost action between fine-grained soils in the center and coarse-grained, stony materials forming the rims of an irregular network of features intermediate between sorted circles and sorted polygons.

String bog (fen): Boggy area marked by serpentine ridges of peat and vegetation interspersed with depressions many of which contain shallow ponds.

Stripe, nonsorted: Patterned ground with a striped pattern and a nonsorted appearance owing to parallel lines of vegetation-covered ground and intervening strips of relatively bare ground oriented down the steepest slope.

Stripe, sorted: Patterned ground feature occurring in groups displaying a striped pattern and a sorted appearance due to parallel lines of stones and intervening strips of finer material oriented down the steepest available slope.

Thermokarst (topography): The irregular topography resulting from the process of differential thaw settlement or caving of the ground because of the melting of ground ice.

Tor: Isolated masses of rock protruding above the surrounding landscape and consisting of either a single or numerous joint blocks displaying varying degrees of angularity and roundness. As used in report - a protruding rock body in unglaciated terrain probably more resistant to weathering than the surrounding terrain.

Tundra: A treeless, generally level to undulating, region of lichens, mosses, sedges, grasses, and some low shrubs, including dwarf willows and birches, which is characteristics of both the Arctic and higher alpine regions outside of the Arctic.

Turbic Cryosol: Mineral soils having marked evidence of cryoturbation. They generally occur on patterned ground and have permafrost within 2 m of the surface.

APPENDIX C

Soil Analyses

The soil samples were air dried and crushed to pass through a 2 mm sieve. Analyses of the sieved fraction were conducted using the standard methods presented by McKeague (1976); texture by the hydrometer method, pH with a glass electrode using a 0.01 M $CaCl_2$ mixture, carbon by Leco induction furnace, iron and aluminum by the pyrophosphate method, phosphorus by the medium - strength Bray extract and exchangeable cations by ammonium acetate extraction, except for those with a high calcium content which were extracted with sodium acetate, and atomic absorption. The moist color and dry color were determined according to Munsell color charts.

Loess Texture

Location: Wellesley Lake Ecoregion, 62° 17'N; 140° 17'W

Texture of Bm Horizon: Sand 19%, Silt 60%, Clay 21%

Ash Texture

Location: Lake Laberge Ecoregion, 62° 11'N; 135° 50'W

Texture of Ash Layer 6 cm thick: Sand 36%, Silt 50%, Clay 14%

Pyrophosphate Iron and Aluminum in Ash Rich Horizon

Location: Pelly Mountains Ecoregion, 61° 35'N; 133° 00'W

Iron .42 Aluminum 1.18

PROFILE NO. 1

TENTATIVE CLASSIFICATION: Eutric Brunisol
LOCATION: Lake Laberge Ecoregion, 62° 11'N; 135° 50'W — ELEVATION: 701 m
GENERAL AREA: Frenchman Lake near Carmacks
DRAINAGE: Well Drained — SLOPE & ASPECT: S 5%
LANDFORM: Glaciofluvial — ACTIVE LAYER: No frost to 110 cm+

HORIZON	DEPTH (cm)	TEXTURE	DRY COLOR	MOIST COLOR	pH 0.01M$CaCl_2$	% CARBON
L-H	4 - 0	Organic	10 YR 2.5/1	10 YR 2.5/1	6.0	32.32
Upper Ash	0 - 6	Loam	10 YR 7/1	10 YR 5/2	5.5	1.90
Lower Ash	6 - 12	Sandy Loam	10 YR 7/1	10 YR 5/2	6.0	0.97
Bm1	12 - 17	Sandy Loam	7.5 YR 5/4	5 YR 3/3	6.8	1.17
Bm2	17 - 24	Loam	5 YR 4/6	5 YR 3/4	7.0	0.82
Bm3	24 - 30	Loam	10 YR 5/4	7.5 YR 4/4	6.9	0.58
Bm4	30 - 37	Sandy Loam	10 YR 5/6	10 YR 4/4	7.1	0.29
BCI	37 - 67	Sandy Loam	2.5 Y 5/6	2.5 Y 4/4	7.0	0.48
BC2	67 - 78	Sandy Loam	2.5 Y 5/4	5 Y 4/3	7.4	0.39
(Lens)	78 - 95	Loamy Sand	5 Y 5/3	2.5 Y 4/2	7.5	0.46
BC3	95 - 110	Loam	5 Y 6/3	5 Y 4/3	7.4	0.24
Cca	110+	Loam	2.5 Y 6/2	2.5 Y 4/2	7.8	1.16

		EXCHANGEABLE CATIONS - (M.E./100 gms)						PHOSPHOROUS	PYROPHOSPHATE	
HORIZON	DEPTH (cm)	Ca	Mg	Na	K	H	C.E.C.	(ppm)	Fe	Al
L-H	4 - 0	55.08	13.89	0.20	1.36	30.50	101.03	17.95	--	--
Upper Ash	0 - 6	2.40	0.44	0.09	0.23	9.00	12.16	38.55	--	--
Lower Ash	6 - 12	2.00	0.31	0.04	0.20	4.50	7.05	54.95	--	--
Bm1	12 - 17	6.84	1.88	0.06	0.26	3.83	12.87	13.09	0.06	0.06
Bm2	17 - 24	7.88	1.92	0.08	0.27	3.88	14.03	22.54	0.07	0.08
Bm3	24 - 30	5.49	2.21	0.05	0.21	3.00	10.96	9.66	0.03	0.02
Bm4	30 - 37	6.80	2.72	0.07	0.14	2.00	11.73	8.75	0.03	0.02
BC1	37 - 67	3.99	1.64	0.08	0.06	0.25	6.02	4.34	--	--
BC2	67 - 78	4.62	1.56	0.08	0.06	0.50	6.82	2.59	--	--
(Lens)	78 - 95	4.59	1.10	0.08	0.06	0.50	6.33	0.49	--	--
BC3	95 - 110	6.59	1.73	0.09	0.08	1.53	10.02	1.40	--	--
Cca	110+	8.13	3.13	0.34	0.06	0.00	11.66	0.35	--	--

PROFILE NO. 2

TENTATIVE CLASSIFICATION: Humo-Ferric Podzol
LOCATION: Dawson Range Ecoregion, 62° 05'N; 137° 26'W
GENERAL AREA: Mt. Nansen west of Carmacks
DRAINAGE: Imperfect - Mod. Well Drained
LANDFORM: Residual Soil on Granitic Bedrock

ELEVATION: 1550 m
SLOPE & ASPECT: Apex 10%
ACTIVE LAYER: No frost to 30 cm+

HORIZON	DEPTH (cm)	TEXTURE	DRY COLOR	MOIST COLOR	pH 0.01M $CaCl_2$	% CARBON
L-H Ash	2 - 0 0 - 5	Organic	10 YR 5/3	10 YR 3/3	4.6	5.14
Bf	5 - 10	Loam	10 YR 5/4	10 YR 3/3	5.3	1.01
Bm	10 - 20	Loam	10 YR 5/6	7.5 YR 4/4	5.0	1.41
BC	20 - 30	Loam	2.5 Y 6/4	2.5 Y 4/4	4.5	0.29
C	30+	-	-	-	-	-

HORIZON	DEPTH (cm)	EXCHANGEABLE CATIONS - (M.E./100 gms)						PHOSPHOROUS	PYROPHOSPHATE	
		Ca	Mg	Na	K	H	C.E.C.	(ppm)	Fe	Al
L-H Ash	2 - 0 0 - 5	2.52	1.04	0.09	0.16	20.50	24.31	25.55	--	--
Bf	5 - 10	2.74	1.07	0.07	0.26	7.33	11.47	31.15	0.30	0.32
Bm	10 - 20	1.93	0.79	0.09	0.28	12.50	15.59	2.45	0.16	0.32
BC	20 - 30	1.07	0.39	0.09	0.23	11.83	13.61	2.59	0.06	0.27
C	30+	--	--	--	--	--	--	--	--	--

PROFILE NO. 3

TENTATIVE CLASSIFICATION: (Alpine) Dystric Brunisol
LOCATION: Pelly River Ecoregion, 63° 35'N; 134° 25'W — ELEVATION: 1510 m
GENERAL AREA: Lonely Dome near Mayo
DRAINAGE: Well Drained — SLOPE & ASPECT: N 5%
LANDFORM: Morainal Veneer — ACTIVE LAYER: No frost to 45 cm+

HORIZON	DEPTH (cm)	TEXTURE	DRY COLOR	MOIST COLOR	pH 0.01M $CaCl_2$	% CARBON
L-H	5 - 0	Organic	10 YR 3/2	10 YR 2.5/2	3.5	20.79
Ahe	0 - 8	Loam	10 YR 5/3	7.5 YR 4/2	4.2	5.44
Bm1	8 - 17	Loam	2.5 Y 6/4	2.5 Y 4/4	4.7	1.15
Bm2	17 - 28	Loam	5 Y 6/3	5 Y 5/3	5.0	0.29
BC	28 - 45	Loam	5 Y 6/3	5 Y 5/3	4.9	0.15
C	45+	Stony Loam	5 Y 7/3	5 Y 5/3	4.5	0.38

HORIZON	DEPTH (cm)	EXCHANGEABLE CATIONS - (M.E./100 gms)						PHOSPHOROUS	PYROPHOSPHATE	
		Ca	Mg	Na	K	H	C.E.C.	(ppm)	Fe	Al
L-H	5 - 0	1.12	0.64	0.22	0.92	39.00	41.90	19.74	--	--
Ahe	0 - 8	0.16	0.10	0.06	0.10	27.17	27.59	0.84	--	--
Bm1	8 - 17	0.08	0.01	0.05	0.05	15.00	15.18	1.40	0.37	0.20
Bm2	17 - 28	0.09	0.01	0.05	0.03	7.00	7.18	5.60	0.14	0.12
BC	28 - 45	0.09	0.07	0.05	0.02	5.50	5.73	7.70	--	--
C	45+	0.06	0.05	0.03	0.02	6.50	6.66	13.51	--	--

PROFILE NO. 4

TENTATIVE CLASSIFICATION: Humo-Ferric Podzol
LOCATION: Mayo Lake - Ross River Ecoregion, 64° 13'N; 134° 20'W
ELEVATION: 1524 m
GENERAL AREA: Alpine area near Kathleen Lake
DRAINAGE: Mod. Well Drained
SLOPE & ASPECT: Apex
LANDFORM: Morainal Veneer
ACTIVE LAYER: No frost to 42 cm+

HORIZON	DEPTH (cm)	TEXTURE	DRY COLOR	MOIST COLOR	pH 0.01M $CaCl_2$	% CARBON
L-H	6 - 0	Organic (Lichens, grass)	-	-	-	-
Bf1	0 - 12	Silt Loam	2.5 Y 6/4	2.5 Y 4/2	4.5	2.88
Bf2	12 - 24	Gravelly Silt Loam	2.5 Y 6/4	2.5 Y 4/4	5.2	1.49
BC	24 - 42	Gravelly Silt Loam	2.5 Y 6/4	2.5 Y 4/4	4.8	0.47
C	42+		-	-	-	-

HORIZON	DEPTH (cm)	EXCHANGEABLE CATIONS - (M.E./100 gms)						PHOSPHOROUS	PYROPHOSPHATE	
		Ca	Mg	Na	K	H	C.E.C.	(ppm)	Fe	Al
L-H	6 - 0	-	-	-	-	-	-	-	--	--
Bf1	0 - 12	0.11	0.04	0.03	0.03	24.83	25.04	4.34	0.50	0.54
Bf2	12 - 24	0.16	0.01	0.06	0.04	15.17	15.44	7.98	0.35	0.45
BC	24 - 42	0.26	0.04	0.06	0.02	10.50	10.88	17.64	--	--
C	42+	-	-	-	-	-	-	-	--	--

PROFILE NO. 5

TENTATIVE CLASSIFICATION: Regosolic Static Cryosol
LOCATION: Mayo Lake - Ross River Ecoregion, 64° 23'N; 135° 15'N
ELEVATION: 914 m
GENERAL AREA: Beaver River near Mayo
DRAINAGE: Mod. Well - Well Drained
SLOPE & ASPECT: Level
LANDFORM: Alluvial terrace
ACTIVE LAYER: Ice lenses at 50 cm

HORIZON	DEPTH (cm)	TEXTURE	DRY COLOR	MOIST COLOR	pH 0.01M $CaCl_2$	% CARBON
L-H	10 - 0	Organic	10 YR 4/2	10 YR 2.5/2	6.3	10.12
C_1	0 - 10	Silt Loam	5 Y 5/1	5 Y 4/1	7.9	6.21
C_2	10 - 20	Silt Loam	5 Y 5/2	5 Y 3/2	7.1	4.63
C_3	20 - 35	Silt Loam	5 Y 5/3	5 Y 3/2	7.2	2.16
C_4	35 - 50	Loam	5 Y 5/2	5 Y 3/2	-	1.08
C_Z	50+	Loam	5 Y 5/2	5 Y 4/1	7.1	0.48

HORIZON	DEPTH (cm)	EXCHANGEABLE CATIONS - (M.E./100 gms) Ca	Mg	Na	K	H	C.E.C.	PHOSPHOROUS (ppm)	PYROPHOSPHATE Fe	Al
L-H	10 - 0	36.72	10.76	0.13	0.53	10.75	58.89	7.84	–	–
C_1	0 - 10	20.56	5.92	0.03	0.15	6.33	32.99	1.89	--	–
C_2	10 - 20	15.47	3.90	0.06	0.07	3.83	23.33	1.40	0.14	0.05
C_3	20 - 35	10.38	1.66	0.10	0.06	2.33	14.53	1.12	0.12	0.03
C_4	35 - 50	7.19	1.01	0.04	0.06	1.75	10.05	0.35	–	--
C_Z	50+	6.59	0.64	0.09	0.05	0.63	8.00	1.19	--	--

Pyrophosphate extractable Iron and Aluminum and Percent Carbon of B Horizons from Various Locations in the Yukon.

LATITUDE	LONGITUDE	ELEV. (m)	HORIZON	DEPTH (cm)	TEXTURE	PYROPHOSPHATE Fe	PYROPHOSPHATE Al	% CARBON	ECOREGION NO.
60°12'N	129°07'W	732	Bm	0 - 15	Loam	0.18	0.03	1.48	2
60°18'N	129°33'W	732	Bm	15+	Sandy Loam	0.15	0.06	0.63	2
61°12'N	128°20'W	853	Bm	3 - 5	Silt Loam	0.22	0.25	1.20	3
60°23'N	133°38'W	1372	Bf	2 - 10	Sandy Loam	0.26	0.65	1.52	5
60°24'N	133°27'W	1158	Bf	5 - 20	Silt Loam	0.33	0.33	0.77	5
60°33'N	133°03'W	1219	Bf	5 - 9	Sandy Loam	0.22	0.43	1.10	5
60°50'N	132°17'W	1067	Bm	8 - 25	Loam	0.17	0.25	0.77	5
61°35'N	133°00'W	1524	Bf	2+	Sandy Loam	0.42	1.18	2.78	5
62°11'N	135°50'W	701	Bm	12 - 17	Sandy Loam-Loam	0.06	0.06	1.17	5
61°08'N	138°03'W	1067	Bm	4+	Clay Loam	0.27	0.11	2.02	8
61°33'N	137°40'W	1585	Bm	2+	Sandy Loam	0.08	0.19	0.47	8
62°16'N	140°17'W	640	Bm	0 - 15	Silt Loam	0.07	0.06	1.29	9
62°17'N	140°17'W	640	Bm	0 - 5+	Silty Loam	0.16	0.10	2.11	9
62°23'N	140°37'W	632	Bmg	2 - 23	Silt Loam	0.28	0.11	1.82	9
62°44'N	140°56'W	1103	Bf	6 - 21	Silt Loam-Loam	0.50	0.63	2.75	9
62°47'N	140°53'W	762	Bm	5+	Loam	0.13	0.16	0.53	9
61°55'N	137°42'W	914	Bm	5+	Sandy Loam	0.10	0.08	0.58	10
62°05'N	136°56'W	1067	Bm	12 - 30	Loamy Sand	0.13	0.24	0.28	10
62°05'N	137°26'W	1550	Bf	5 - 10	Loam	0.30	0.32	1.01	10
64°03'N	139°23'W	1082	Bm	5 - 16	Silt Loam	0.11	0.18	0.85	11
62°12'N	131°45'W	914	Bm	13 - 21	Clay Loam	0.23	0.15	0.93	12
63°35'N	134°25'W	1510	Bm	8 - 17	Loam	0.37	0.20	1.15	12
62°27'N	131°24'W	914	Bm	10 - 22	Loam	0.14	0.08	1.47	13
63°44'N	136°56'W	1402	Bf	4 - 14	Silt Loam-Loam	0.55	0.53	2.59	13
63°55'N	134°37'W	762	Bm	0 - 10	Silt Loam	0.27	0.23	1.19	13
64°13'N	134°20'W	1524	Bf	5 - 12	Silt Loam	0.50	0.54	2.88	13

APPENDIX D

Forest Statistics*

Assembled according to ecoregion based on Gairns (1968). The figures may not add due to rounding.

Table 1 -- area summary determined from an assessment based on using the Universal Transverse Mercator Grid.

Table 2 -- volume summary of merchantable timber.

* Provided by Dr. Y. J. Lee and D. Hunt
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TABLE 1. YUKON FOREST RESOURCES AREA SUMMARY

	COVER TYPES (THOUSANDS OF HECTARES)							
EOREGION	SOFTWD ALLUV	SOFTWD UPLAND	HARD WOOD	PROD AREA	BURN	WATER	OTHER	TOTAL
1 - BEAVER RIVER	46.7	618.8	12.3	677.7	114.2	2.3	796.3	1590.5
2 - LIARD RIVER	53.9	1292.2	5.5	1351.6	150.6	34.9	635.4	2172.5
3 - LOGAN MTS.	2.9	106.9	0.1	110.0	12.4	1.2	1101.7	1225.3
4 - PELLY MTS.	16.2	293.0	0.0	309.2	73.0	17.0	2772.0	3171.2
5 - LAKE LABERGE	20.7	902.4	5.1	928.1	510.0	102.5	1877.0	3417.6
6 - COAST MTS.	6.0	29.5	0.0	35.5	11.3	40.2	1235.6	1322.5
7 - ST. ELIAS MTS.	0.0	0.0	0.0	0.0	0.0	1.4	2018.6	2019.9
8 - RUBY RANGE	0.3	69.9	0.0	70.2	16.2	26.9	2057.3	2170.5
9 - WELLESLEY LAKE	5.2	26.0	0.0	31.2	38.7	1.7	873.4	945.0
10 - DAWSON RANGE	11.6	30.7	0.0	42.3	329.3	16.7	2250.9	2639.2
11 - KLONDIKE RIVER	32.5	71.3	1.2	105.1	148.3	40.0	1757.5	2050.8
12 - PELLY RIVER	50.5	542.5	18.7	611.8	255.5	45.4	2720.9	3633.6
13 - MAYO LAKE - ROSS RIVER	38.5	506.3	2.3	547.1	122.7	38.2	3302.7	4010.6
14 - ITSI RANGE	7.3	102.3	1.0	110.7	1.5	8.1	1257.4	1377.7
15 - WERNECKE MTS.	0.0	0.0	0.0	0.0	0.0	7.0	2514.9	2521.8
16 - S. OGILVIE MTS.	1.5	1.3	0.0	2.8	4.1	1.8	1235.6	1244.2
17 - N. OGILVIE MTS.	0.0	0.0	0.0	0.0	6.8	1.7	4237.7	4246.1
18 - EAGLE PLAIN	0.0	0.0	0.0	0.0	0.0	24.4	1599.2	1623.6
19 - PEEL RIVER	0.0	0.0	0.0	0.0	0.0	48.1	1880.6	1928.7
20 - BERRY CREEK	0.0	0.0	0.0	0.0	0.0	6.7	473.5	480.2
21 - OLD CROW BASIN	0.0	0.0	0.0	0.0	0.0	136.7	1371.3	1508.0
22 - N. MTS. & COASTAL PL.	0.0	0.0	0.0	0.0	0.0	30.9	2938.0	2968.9
TOTAL	293.8	4593.1	46.3	4933.2	1794.3	633.3	40907.3	48268.1

TABLE 2. YUKON FOREST RESOURCES VOLUME SUMMARY

ECOREGION		COVER TYPES (THOUSANDS OF CUBIC METRES) SOFTWOOD ALLUVIAL	SOFTWOOD UPLAND	HARDWOOD	SUB TOTAL	TOTAL
1 - BEAVER	(SOFTWD)	7747.7	32352.4	238.6	40338.6	
RIVER	(HARDWD)	1295.8	2309.1	1240.5	4845.4	45184.0
2 - LIARD	(SOFTWD)	8955.9	67563.3	106.9	76626.1	
RIVER	(HARDWD)	1497.9	4822.1	556.1	6876.1	83502.3
3 - LOGAN	(SOFTWD)	485.8	5590.8	2.4	6079.0	
MTS.	(HARDWD)	81.2	399.0	12.6	492.9	6571.8
4 - PELLY	(SOFTWD)	2132.6	10058.5	0.0	12191.1	
MTS.	(HARDWD)	220.5	1101.9	0.0	1322.4	13513.5
5 - LAKE	(SOFTWD)	2609.1	26058.0	4.2	28671.3	
LABERGE	(HARDWD)	268.4	2178.7	103.6	2550.7	31222.0
6 - COAST	(SOFTWD)	1005.2	835.8	0.0	1841.1	
MTS.	(HARDWD)	67.4	68.0	0.0	135.4	1976.5
8 - RUBY	(SOFTWD)	31.5	1964.2	0.0	1995.7	
RANGE	(HARDWD)	10.0	448.2	0.0	458.2	2453.9
9 - WELLESLEY	(SOFTWD)	543.8	666.7	0.0	1210.5	
LAKE	(HARDWD)	172.5	393.9	0.0	566.4	1776.9
10 - DAWSON	(SOFTWD)	1242.3	822.4	0.0	2064.7	
RANGE	(HARDWD)	387.5	236.6	0.0	624.1	2688.8
11 - KLONDIKE	(SOFTWD)	3420.2	1818.6	0.0	5238.9	
RIVER	(HARDWD)	1084.8	1045.5	0.0	2130.3	7369.2
12 - PELLY	(SOFTWD)	5791.5	12902.3	19.2	18713.0	
RIVER	(HARDWD)	1775.9	6747.7	409.4	8933.0	27646.0
13 - MAYO LAKE -	(SOFTWD)	4425.6	11820.0	2.7	16248.3	
ROSS RIVER	(HARDWD)	1375.8	6796.5	52.3	8224.7	24473.0
14 - ITSI	(SOFTWD)	855.3	2395.1	1.2	3251.6	
RANGE	(HARDWD)	250.7	1347.8	23.0	1621.5	4873.1
16 - S. OGILVIE	(SOFTWD)	154.9	32.7	0.0	187.6	
MTS.	(HARDWD)	49.1	19.3	0.0	68.5	256.1
TOTAL	(SOFTWD)	39401.5	174880.9	375.2	214657.6	
	(HARDWD)	8537.6	27914.4	2397.5	38849.4	253507.0

Back cover photographs

a. Dredge tailings near Dawson City.

b. Subalpine meadow along the South Macmillan River. Lat. 62°56'N, Long. 130°30'W.

c. Black spruce - larch/sedge tussock field. Lat. 66°17'N, Long. 136°40'W

d. Anemone parviflora, common in meadows and on slopes.

e. <u>Pedicularis</u> <u>Kanei</u>, common in tundra.

f. Ogilvie Mountains and Ogilvie River. Lat. 65°35'N, Long. 138°08'W

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ORIGINAL MOSAIC SUPPLIED BY THE SURVEYS AND MAPPING BRANCH, DEPARTMENT OF ENERGY, MINES AND RESOURCES

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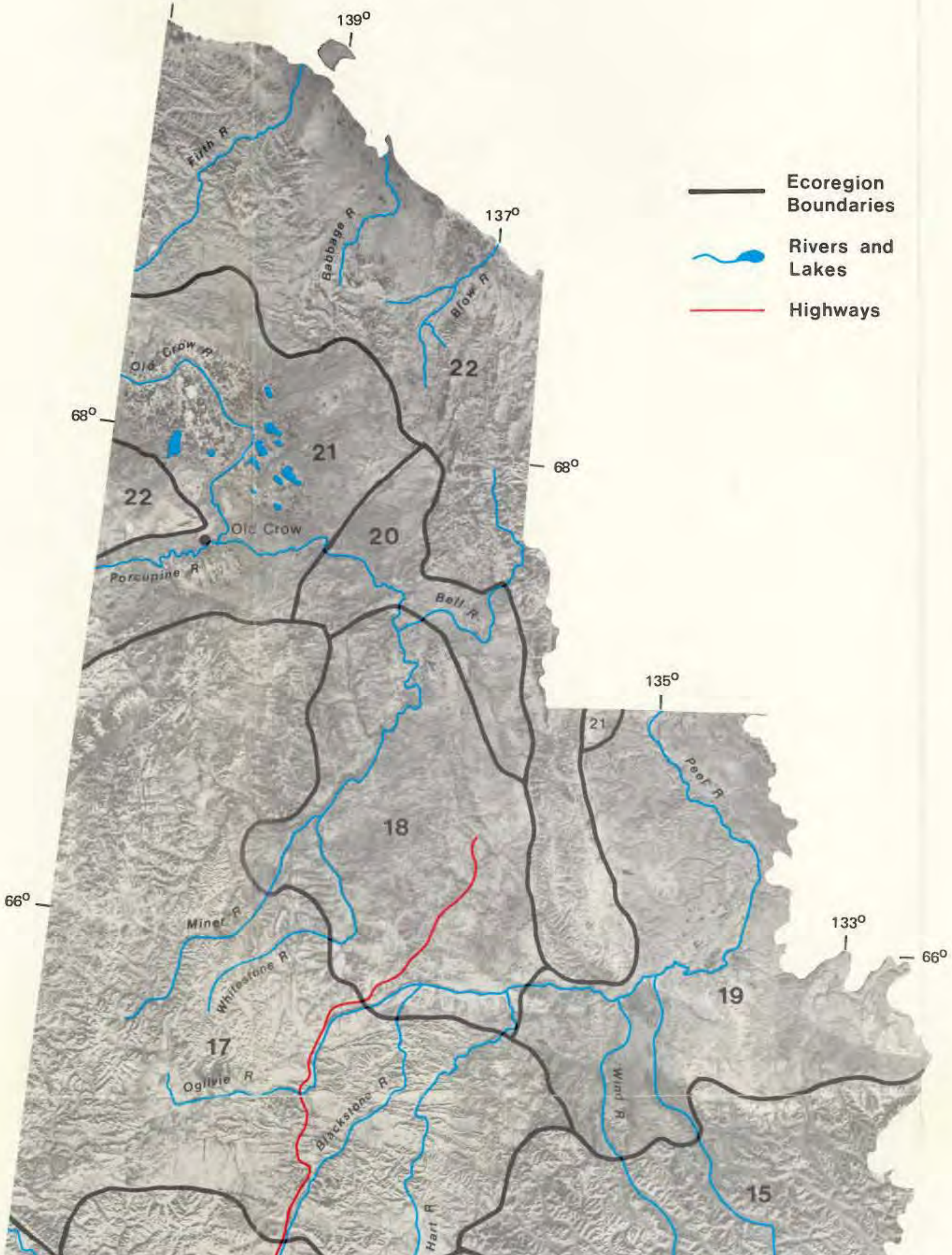


ECOREGIONS OF YUKON TERRITORY

Environment Canada / Environnement Canada
Canadian Forestry Service / Service canadien des forêts

SCALE 1:2 500 000

1. **Beaver River:** (15 905 km²) Mostly forested with open black and white spruce and lodgepole pine; lichens prominent on well-drained sites, moss on wet sites, black spruce and larch in bogs, alpine fir and shrub birch-willow-lichen near treeline; treeline at 1200-1350 m; pptn and temp moderate.

2. **Liard River:** (21 725 km²) Forested with closed and nearly closed stands of black and white spruce and lodgepole pine; understory mostly moss with or without shrubs and forbs, black spruce and larch in bogs, aspen on dry sites, white spruce and balsam poplar on flood plains, alpine fir in subalpine; treeline at 1500 m; pptn and temp moderate.

3. **Logan Mountains:** (12 253 km²) Mostly alpine treeless tundra of shrub birch-willow-sedge; open black and white spruce/lichen in valleys and lower slopes, aspen and lodgepole pine on warmer sites, alpine fir and shrub birch-willow in subalpine; treeline at 1350-1500 m; pptn high, temp moderate.

4. **Pelly Mountains:** (31 712 km²) High elevation treeless tundra common; white and black spruce/moss at lower elevations, white spruce and lodgepole pine on warmer sites, alpine fir and shrub birch-willow in subalpine, sedge tussock in alpine wetlands; treeline at 1350-1500 m; pptn moderately high, temp moderate.

5. **Lake Laberge:** (34 176 km²) Open white spruce and lodgepole pine with moss understory common; black and white spruce on cool sites, aspen or sagewort-grassland on drier sites, alpine fir present, larch absent; treeline at 1200-1350 m; pptn low, temp moderately warm.

6. **Coast Mountains:** (13 225 km²) Alpine tundra prominent; white spruce/soapberry-moss at lower elevations, white spruce-aspen on warmer sites, shrub birch-willow in subalpine, alpine fir and lodgepole pine absent, black spruce scarce; treeline at 1050-1200 m; pptn high, temp moderate.

7. **St. Elias Mountains:** (20 199 km²) High elevation ice and snow fields; white spruce/moss at lower elevations, black spruce bog and shrub birch-willow on cooler sites, aspen and white spruce on warmer sites; treeline at 1050 m; pptn high, temp cold.

8. **Ruby Range:** (21 705 km²) Open white and black spruce/moss common; black spruce bogs or paper birch/alder on cooler sites, white spruce-aspen/moss-forb on warmer sites, lodgepole pine rare; treeline at 1200 m; pptn low, temp moderately cold.

9. **Wellesley Lake:** (9 450 km²) Low elevation open black spruce/sphagnum bog common; black spruce bog and bog-fen complex on cool, moist sites, white spruce-paper birch-aspen/moss-alder on warm, dry sites; treeline at 1050 m; pptn low, temp moderately cold.

10. **Dawson Range:** (26 392 km²) Mostly treeless; shrub birch-willow common, white spruce on warm, dry sites, very open white and black spruce/willow-shrub birch at lower elevations, sedge tussock (black spruce) on cool, moist sites; treeline at 1200 m; pptn moderately low, temp moderately cold.

11. **Klondike River:** (20 508 km²) Black spruce and paper birch/Ledum-sphagnum common; aspen and white spruce on drier sites, balsam poplar on flood plains, lodgepole pine scarce; treeline at 1050 m; pptn moderate, temp moderately cold.

12. **Pelly River:** (36 336 km²) White and black spruce/shrub-moss common; black spruce bog in moist, cool lowlands, aspen (white spruce) or sagewort-grassland on warm, dry sites, lodgepole pine common, alpine fir sparse; treeline at 1350-1500 m; pptn low, temp moderately cold.

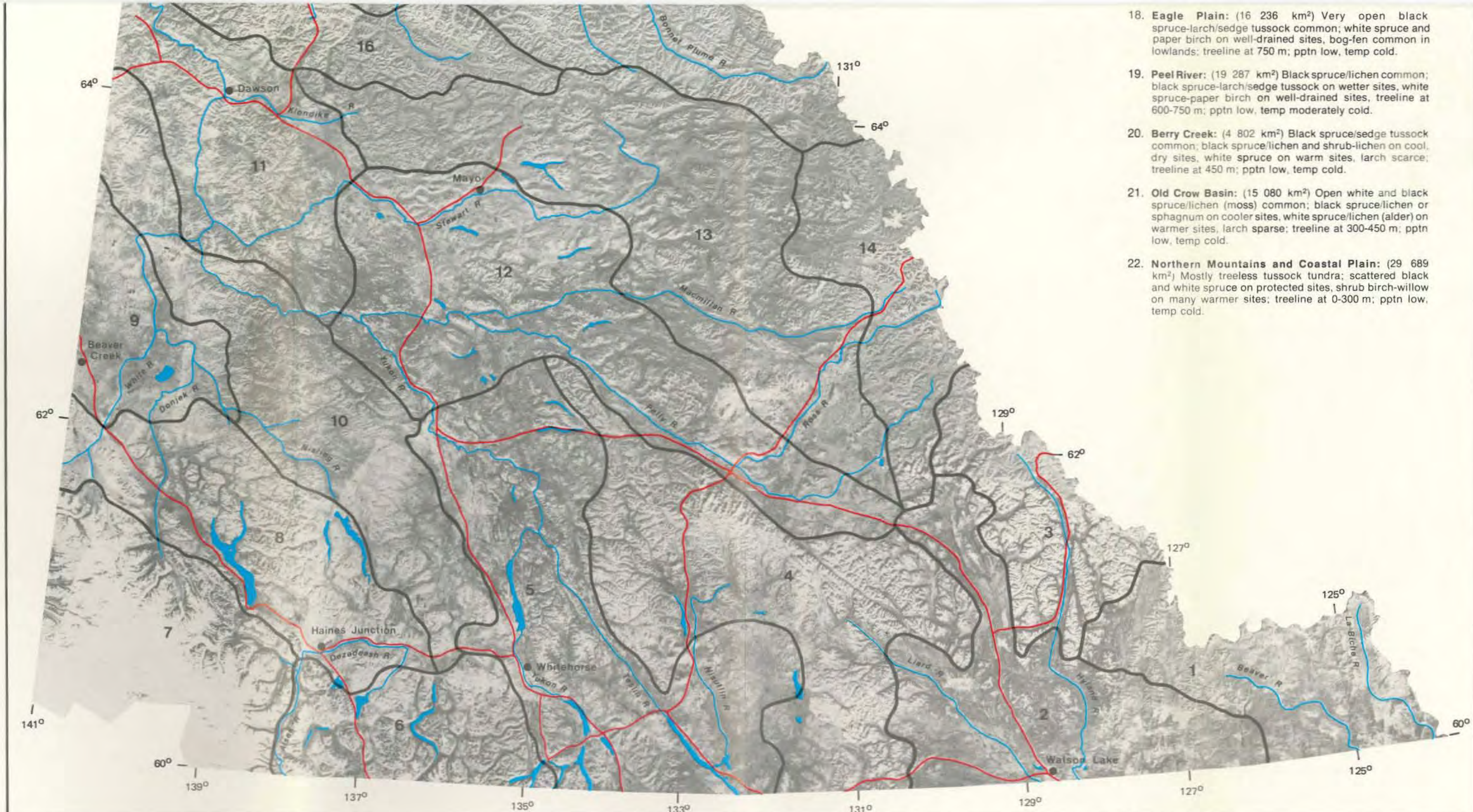
13. **Mayo Lake-Ross River:** (40 106 km²) Open black spruce/moss (lichen) common; white spruce on warm, dry sites, black spruce bog-fen in lowlands, aspen, paper birch and lodgepole pine sparse, larch absent, alpine fir in subalpine; treeline at 1350-1500 m; pptn moderate, temp moderately cold.

14. **Itsi Range:** (13 777 km²) High elevation tundra; open black and white spruce/lichen on lower slopes, shrub birch-willow common, bog-fen in valleys, alpine fir in subalpine but sparse; treeline at 1350-1500 m; pptn high, temp moderately cold.

15. **Wernecke Mountains:** (25 218 km²) High elevation tundra; black and white spruce/moss (lichen) on protected, warmer sites, shrub birch-willow common, bog-fen complexes and sedge tussock fields common; treeline at 1200 m; pptn high, temp moderately cold.

16. **South Ogilvie Mountains:** (12 442 km²) High elevation treeless tundra; sedge tussock bogs in valleys, shrub birch-willow on slopes, open black and white spruce on protected warm sites; treeline at 1050 m; pptn moderate, temp moderately cold.

17. **North Ogilvie Mountains:** (42 461 km²) Moderate elevation treeless tundra with sedge tussock or shrub birch-willow; white spruce on protected sites, scattered black spruce in low elevation bogs; treeline at 900 m; pptn moderate, temp. cold.



18. **Eagle Plain:** (16 236 km²) Very open black spruce-larch/sedge tussock common; white spruce and paper birch on well-drained sites, bog-fen common in lowlands; treeline at 750 m; pptn low, temp cold.

19. **Peel River:** (19 287 km²) Black spruce/lichen common; black spruce-larch/sedge tussock on wetter sites, white spruce-paper birch on well-drained sites, treeline at 600-750 m; pptn low, temp moderately cold.

20. **Berry Creek:** (4 802 km²) Black spruce/sedge tussock common; black spruce/lichen and shrub-lichen on cool, dry sites, white spruce on warm sites, larch scarce; treeline at 450 m; pptn low, temp cold.

21. **Old Crow Basin:** (15 080 km²) Open white and black spruce/lichen (moss) common; black spruce/lichen or sphagnum on cooler sites, white spruce/lichen (alder) on warmer sites, larch sparse; treeline at 300-450 m; pptn low, temp cold.

22. **Northern Mountains and Coastal Plain:** (29 689 km²) Mostly treeless tussock tundra; scattered black and white spruce on protected sites, shrub birch-willow on many warmer sites; treeline at 0-300 m; pptn low, temp cold.