GEOLOGICAL SURVEY OF CANADA

OPEN FILE 1614

Digital Compilation of Vegetation Types of the Mackenzie Valley Transportation Corridor

J.F. Wright, C. Duchesne and M.M. Côté

2003

Available from
Geological Survey of Canada
601 Booth Street
Ottawa, Ontario K1A 0E8

J.F. Wright, C. Duchesne and M.M. Côté
2003: Digital compilation of vegetation types of the Mackenzie Valley Transportation Corridor; Geological Survey of Canada, Open File 1614, 1 CD-ROM.

Open files are products that have not gone through the GSC formal publication process.

ABSTRACT

The vegetation maps were originally prepared by the Forest Management Institute of the Canadian Forestry Service for the Environmental-Social Program of the Task Force on Northern Oil Development. They were subsequently digitized by Natural Resources Canada (Geological Survey of Canada) for use in a ground thermal modeling project. Secondary benefit of digitizing the 1974 paper maps was data preservation to a digital format easily accessible in a Geographic Information System. The data represent a broad classification of the vegetation in the Mackenzie Valley Transportation Corridor, which stretches along the Mackenzie River, Northwest Territories, from the Alberta border to the Beaufort Sea (10° of latitude). Included in the dataset are information on species composition, and canopy height and density of the forest cover. Landform modifiers are also included for areas of tundra vegetation. The vegetation was interpreted from black and white panchromatic aerial photographs taken between 1970 and 1972. Additional infrared colour photography was taken in 1971 and 1972 to cover a small portion of the area. Field checks of the maps took place at 314 sites in 1971 and 1972.

Table of Contents

List of Figures, Tables and Appendices

1 INTRODUCTION

This CD contains digital vegetation data for the Mackenzie Valley Transportation Corridor, compiled from thirty-one maps at a scale of 1:125,000 originally prepared by the Forest Management Institute of the Canadian Forestry Service for the Environmental Social Program of the Task Force on Northern Oil Development (Fig. 1.1).

The Geological Survey of Canada, with funding from the Climate Change Action Fund (CCAF), and the Panel on Energy Review and Development (PERD), digitized and verified these maps to: 1) preserve the data on these hardcopy maps which are subject to degradation and which are becoming difficult to access and 2) make the data available for use within a Geographic Information System (GIS). The maps were digitized from paper copies, as original mylar maps were unavailable.

The broad classification of vegetation in the Mackenzie corridor was developed from interpretation of small-scale, primarily black and white, aerial photographs taken between 1970 and 1972 (W.L. Wallace, Project Leader). Field verification at 314 sites took place in summer 1971 and 1972. Relevant excerpts from the descriptive report that accompanied the maps (ESP, 1974) are included with this report. Figure 1.2 presents a snapshot of the primary vegetation types of the entire corridor.

Chapters 2 and 3 of this report present excerpts from the descriptive report that accompanied the maps (ESP, 1974). Chapter 2 discusses the method of study and map production, and the development of the vegetation classification including a description of the vegetation types, while Chapter 3 identifies limitations in the interpretation and use of the dataset. The digital database format for each data layer is outlined in Chapter 4.

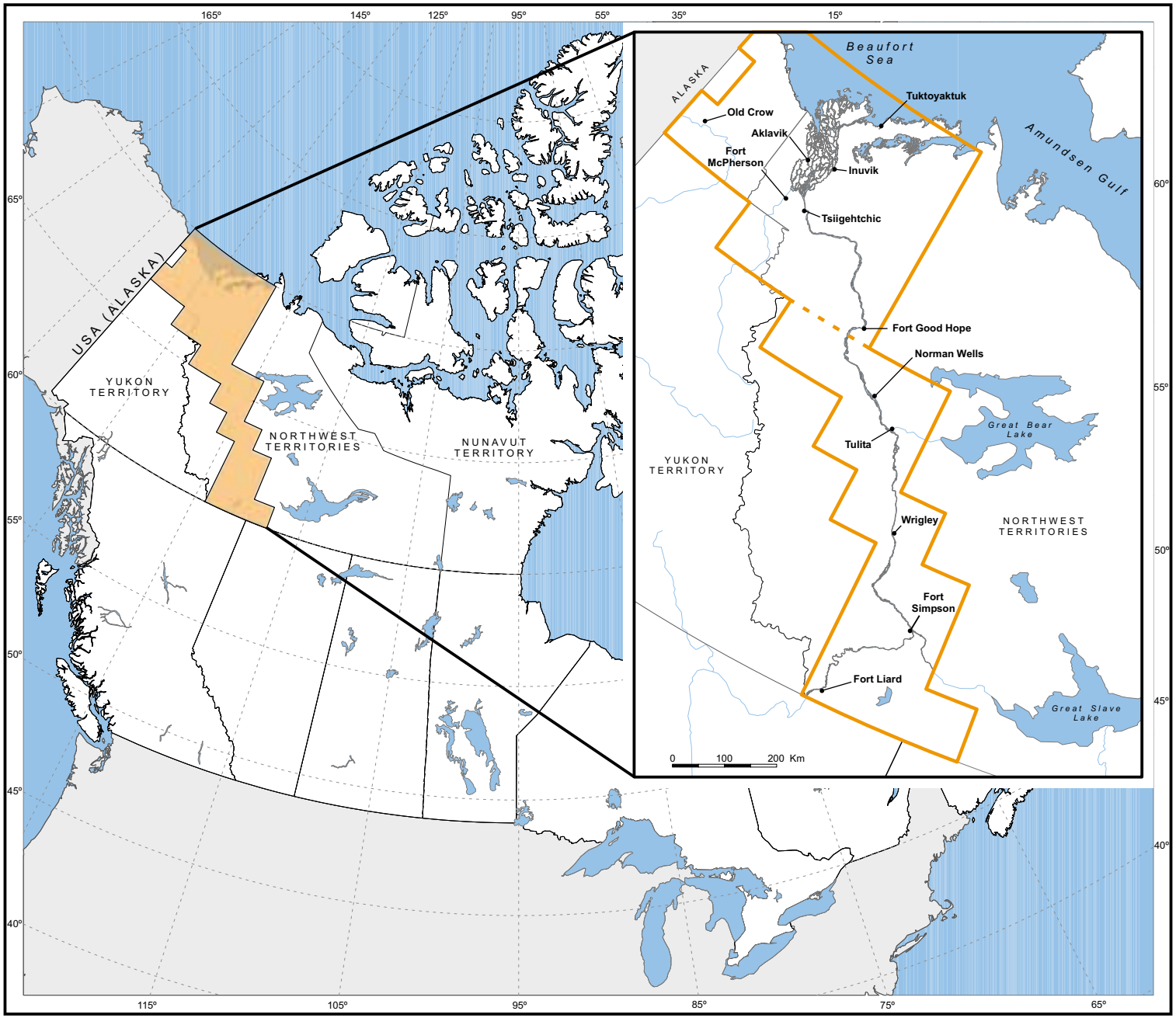

FIGURE 1.1 Location of Mackenzie Valley Transportation Corridor. Inset map indicates the location of major communities. The latitudinal division between the north and south portion of the corridor is defined by a dashed-line. This division was arbitrarily generated to minimize the data file size and to facilitate the use of the data.

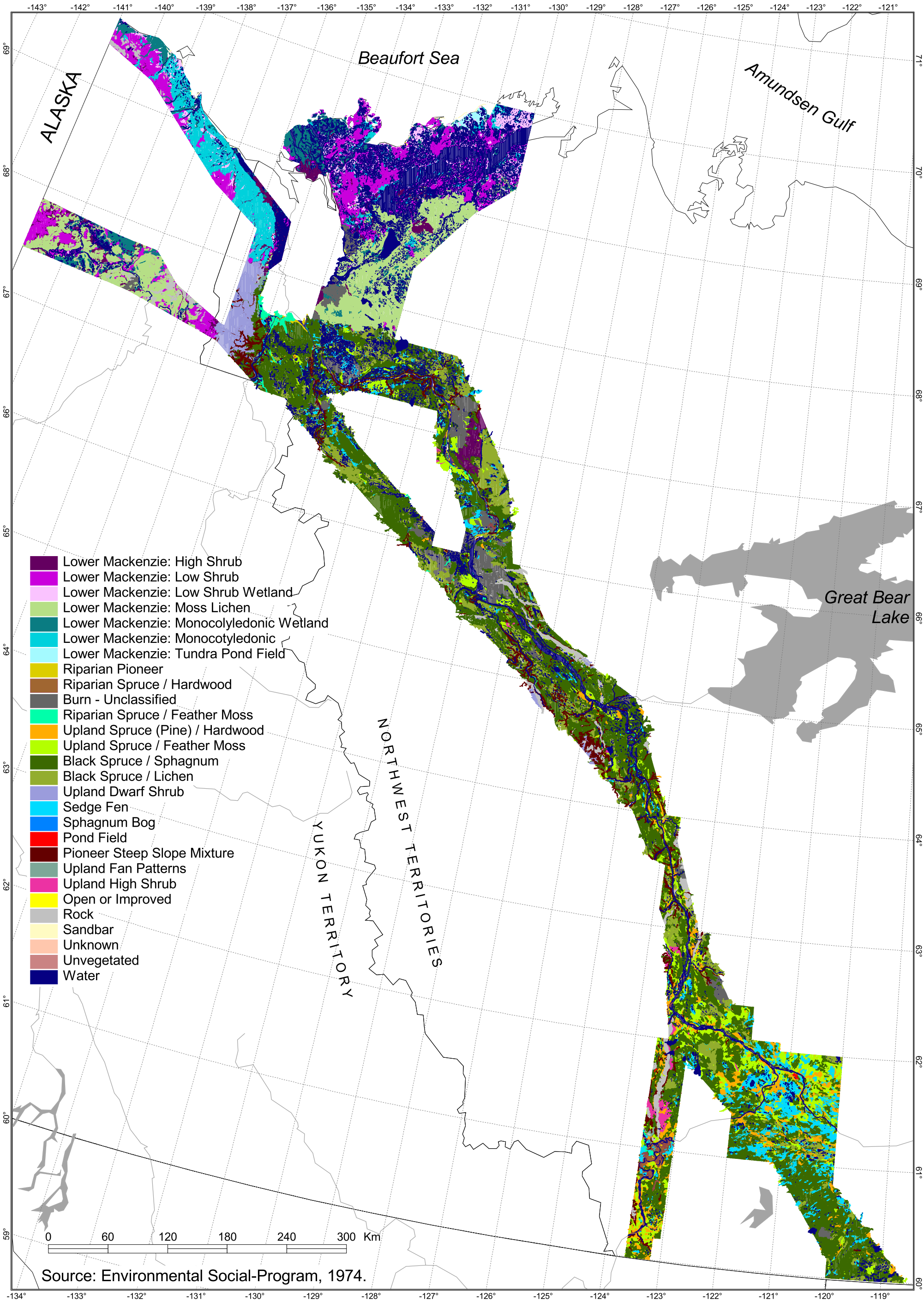

FIGURE 1.2 Primary vegetation types of the Mackenzie Valley Transporation Corridor.

2 METHODOLOGY

2.1 Methods of Study and Source of Data

The entire project relied heavily upon the interpretation of aerial photographs. Photo interpretation began at the Forest Management Institute in 1971, several months before fieldwork and well before the final vegetation classification had been developed. Photo interpreters started by delineating vegetation strata, which they could distinguish, even though they had little information on the significance of the differences observed. Later, as the classification system was developed and refined they were increasingly guided by stereograms and experience gained in the field.

2.1.1 Interpretation of Aerial Photographs

The aerial photographs used were all of small scales. For Sections I to VI black and white panchromatic photographs were available at scales ranging from 1:50,000 to 1:70,000 taken during 1970, 1971, and 1972. For Sections I to III a single line of excellent colour infrared photography (1971, 1:50,000) was also available. The only recent photography for Sections VII and VIII were 1970, 1:100,000 black and white panchromatic photographs and colour infrared photographs, of poor quality and at a scale of 1:127,000.

Field checks by crews, which include the aerial-photo interpreters, began in 1971. One crew initially concentrated on checking the forested stands along the river in the Fort Simpson area, while another crew concentrated on helicopter survey in the area of Norman Wells and Fort Norman[1]. During 1972, reconnaissance surveys were completed for the remainder of the Corridor sections. Generally Sections I, II, and III were subject to the most detailed ground checks, Sections IV and VII were somewhat intermediated, while Sections V, VI, and VIII received very limited sampling (Table 2.1). In some sections, particularly in Section VI and in the Mackenzie Delta, past forest inventories completed by the Forest Management Institute were of significant assistance in providing data on forest stands.

TABLE 2.1 Number of samples for ground checks by map section and vegetation type

Corridor Section	Vegetation Type															
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Burn	Total
I	-	1	-	45	18	12	2	-	4	-	-	-	-	2	1	85
II	-	6	3	31	37	14	4	1	-	1	-	-	-	-	1	98
III	-	4	2	6	12	19	4	-	1	-	-	7	-	-	5	60
IV	-	-	-	3	9	12	5	1	-	-	-	-	1	-	1	32
V	-	1	-	-	-	1	-	-	-	-	-	-	-	-	1	3
VI	-	1	-	-	-	1	-	-	-	-	-	-	-	2	-	4
VII	2	3	1	-	7	9	-	2	1	-	-	1	-	1	1	28
VIII	1	-	-	-	-	-	-	2	-	-	-	1	-	-	-	4
Totals	3	16	6	85	83	68	15	6	6	1	-	9	1	5	10	314

[1] Fort Norman was renamed “Tulita”, January 1, 1996

During the early weeks of fieldwork the crews concentrated on describing vegetation and site (topographic location, soil, drainage). During the later stages of 1972 fieldwork, as the vegetation classification system was defined and accepted, fieldwork emphasized the confirmation or correction of classifications made from aerial photographs.

Whenever a crew, usually transported by helicopter, reached a sample site a Stand Description Form was completed. In the forest stand, relascope samples were also taken to determine basal area, and measurements of diameter, height and age. Plants in all vegetation strata were listed and botanical specimens were collected for later verification.

All permafrost measurements were made between June 25 and August 15 with a Wisconsin soil sampler to a maximum depth of three feet. This depth was considered sufficient to provide a reasonable indication of the active layer, which the root systems of vegetation could utilize. All conclusions regarding permafrost in this report relate solely to this upper 3-foot layer. Seasonal variation and detailed study of correlations with microtopography were beyond the scope of this survey.

2.1.2 Map Production

Information collected during fieldwork was used to correct the preliminary interpretation and mapping of the vegetation types. The revised vegetation types were drafted on 1:125,000 cronaflex base maps that were produced by enlarging available 1:250,000 National Topographic maps. Topographic detail was subdued to half-tone before addition of vegetation types.

Additional information on species composition, average stand height and crown-canopy density was mapped for all forest stands. The height and crown-canopy density classes recognized and the abbreviations and codes used are given in Table 2-2. In recording species composition the rule was to first show the symbol of the most frequent species or species group. This was followed by the symbol of the second most frequent species or species group, provided it accounted for at least 20% of the crown canopy.

TABLE 2.2 Key to symbols used in mapping forest cover

Symbol	Height (feet)	Symbol	Species	Symbol	Canopy Density (%)
1	1 to 20	P	Jack pine	1	1 to 20
3	21 to 40	bS	Black spruce	3	21 to 40
5	41 to 60	S	White spruce or undifferentiated spruce	5	41 to 60
7	61 to 80	L	Larch	7	61 to 80
9	81 +	H	All hardwoods	9	81 +

2.2 Development of Vegetation Classification – South of ~66.5°N

A classification system that recognized 13 major vegetation types, three non-vegetated land types, and two categories of "water" was developed. These types are listed in Table 2-3 together with the associated symbols used in mapping and in the text. A description of the individual types follows in section 2.3, and additional material is given in the appendices to this report, e.g. some details of floristic composition appear in Appendix 1. A schematic presentation of the types is given in Figure 2-1.

The vegetation types are discrete but very broad categories, as they had to be for mapping at a scale 1:125,000. The criteria for defining types are primarily vegetation characteristics. However, there is often a very close correlation between vegetation and site, particularly between vegetation, soil and physiography. For example, vigorous lowland spruce stands always occur on alluvial soils and for practical purposes the presence of alluvial deposits has become an additional essential characteristic of this vegetation type. But the type also has its own, unique vegetation characteristics.

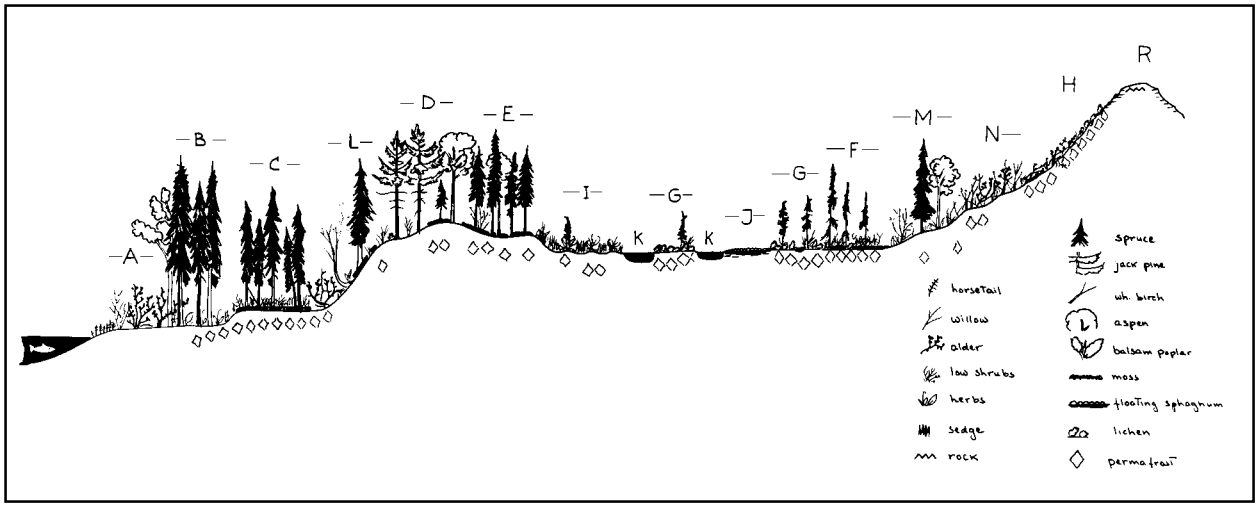

FIGURE 2.1 Schematic presentation of the vegetation types mapped and discussed in text.

TABLE 2.3 Vegetation types and associated symbols used in mapping and in the text

Symbol	Type	Associated in complexes with
	CLOSED FOREST	
B	Riparian spruce – hardwoods	C
C	Riparian spruce – feather moss	B,F
D	Upland spruce (pine) – hardwoods	E,F,G,I,J,K,L,M
E	Upland spruce – feather moss	D,F,G,I,J.K,L,M
	OPEN, DISCONTINUOUS TRANSITION FOREST	
F	Black spruce – sphagnum	C,E,G,H,I,J,K,L,M
G	Black spruce – lichen	D,E,F,H,I,J,K
L	Pioneer steep slope mixtures	D,E,F,H,M
M	Upland fan patterns	D,E,F,H,J,L
N	Upland high shrub	
	NON-FORESTED LAND	
A	Riparian pioneer	B,C
H	Upland dwarf shrub	F,G,I,J,K,L,M
I	Wet dwarf shrub	D,E,F,G,H,J,K
J	Wet – sphagnum	D,E,F,G,H,I,K,M
^^^	Rock	
⏀	Burn – unclassified	
Φ	Open or improved land	
	WATER	
K	Pond fields	D,E,F,G,H,I,J
	Other, larger bodies of water are identified separately	

2.3 Description of Vegetation Types – South of ~66.5°N

Photographs of each vegetation type are not reproduced in this report, but can be viewed in the original document (ESP, 1974).

2.3.1 Type A – Riparian Pioneer

Three alluvial types (A, B and C) are recognized. Type A includes vegetation on recently deposited alluvium, which is still subject to frequent flooding.

Vegetation

There are no trees. The dominant vegetation is high shrubs, mostly alder and willow. Horsetails (*Equisetum* sp.) and sedges are most common among ground vegetation.

Identifying characteristics

This type is identified on aerial photographs by its dense layer of high shrubs, which displays a smooth texture and medium tone on panchromatic aerial photographs. The location is always adjacent to rivers and streams and evidence of recent flooding, which may be apparent on the photographs, is readily confirmed on the ground.

Site characteristics

The area is flooded annually, which results in new deposits of silts and sands and gravels. The fine sands and silts are moist and quite fertile.

Permafrost: The annual flooding and proximity to flowing water make these sites free of permafrost within three feet of the surface.

Importance

Type A occupies a very small portion of the total Corridor area. It represents a very early stage of ecological succession. It is also a very uniform type with little variation over the entire length of the Corridor.

2.3.2 Type B – Riparian Spruce/Hardwoods

This type includes the most productive forests on recent alluvial soils.

Tree cover

Vigorously growing white spruce and balsam poplar and/or aspen in pure or mixed stands are characteristic of the southern half of the Corridor (Sections I, II and VI). Here spruce may reach heights of up to 120 feet. In the northern half of the Corridor, forest cover is white and black spruce with white birch the common minor component in stands. Tree growth is much slower in the northern part; in the Mackenzie Delta white spruce seldom exceeds 70 feet. Typical statistical data on forest cover are given in Tables 2-4, 2-5, 2-6.

TABLE 2.4 Typical forest stand characteristics – Coniferous stands*

Vegetation Type	Height Class	Basal area/acre (ft^2)	Dbh (in)	Height (ft)	Age (yrs)	Site index	Cunits per acre
B	5	90-140	8	50	70	60-70	8-14
	7	100-150	11	70	110		14-30
	9	100-150	13	85	160		25-40
C	5	80-130	7	50	110	40-50	3-14
D	5	100-150 jP	6	50	60	60-70	
		wS	8	50	80		8-14
	7+	100-150 jP	8	65	80		
		wS	10	70	120		14-25
E	5	80-130	8	50	80	55-65	8-14
	7+	100-150	10	70	120		14-25
F	All	10-60	3	20	80	20-30	–
G	All	10-30	2	15	80	15-25	–

*In vegetation types
- B, C, and E; white spruce
- D; jack pine and white spruce
- F and G; black spruce

TABLE 2.5 Typical forest stand characteristics – Mixedwood stands*

Vegetation Type	Height Class	Basal area/acre (ft^2)	Dbh (in)	Height (ft)	Age (yrs)	Site index	Cunits per acre
B	5	80-130	7	50	70	65-75	5-10
	7	90-140	10	70	100		9-25
	9	100-150	13	85	150		20-35
D	5	80-130	7	50	60	60-70	5-13
	7	100-150	10	70	110		10-30
E	5	80-130	7	50	70	60-70	5-10
	7	100-150	11	70	110		10-25

*Mixedwood stands may be very variable depending on the percentage composition of softwoods and hardwoods. A stand having a high proportion of either will have characteristics similar to those illustrated in the corresponding table.

TABLE 2.6 Typical forest stand characteristics – Hardwood stands

Vegetation Type	Height class	Basal area/acre (ft^2)	Dbh (in)	Height (ft)	Age (yrs)	Cunits per acre
B	5	80-130	6	50	60	2-10
	7	90-140	9	70	90	10-25
D	5	90-140	6	50	60	2-7
	7	100-150	8	65	90	7-20

Other vegetation

A moderately dense layer of high shrubs consisting largely of alder and willow and low shrubs (roses and *Viburnum*) are characteristic. Herbs are more abundant in this type than in any other; they are most abundant in the southern portion of the Corridor. The most common herbaceous species belong to the genera *Equisetum* and *Pyrola*.

Identifying characteristics

The species composition as well as consistent occurrence on recent alluvial soils provide identifying characteristics for the photo interpreter. Type B can be separated from older alluvial sites by the distinct scrolls and oxbows typical of recent alluvial sites along rivers and meandering streams.

Site characteristics

These flood plains are subject to periodic flooding and are generally fresh with fertility decreasing from alluvial silts and sands to gravels. The upper soil horizons are usually inter-banded mixtures of mineral soil and organic matter.

Permafrost: Permafrost in the rooting zone is usually absent in the southern half of the Corridor but often can be found within one or two feet of the surface in the Mackenzie Delta.

Importance

Type B occupies a small percentage of the total area but it is potentially of high significance because it contains the best forest sites and stands.

2.3.3 Type C – Riparian Spruce/Feather Moss

Type C describes forests on the older alluvial soils.

Tree cover

Black and white spruce, either in pure stands or in mixtures, are characteristic. White birch and poplars may form a minor component. Tree growth is slow with a maximum tree height of 90 feet typical in the south and 60 feet in the northern part of the Corridor. Typical data on tree sizes, age and site index are given in Table 2-4.

Other vegetation

These sites have been under a dense tree cover for a sufficient period to allow a dense layer of mosses and ericaceous shrubs to form. Feather mosses and sphagnum are the most important mosses; roses, Labrador tea and species of *Vaccinium* are among the shrubs.

Identifying characteristics

The type is identified by the main tree species and, on aerial photographs, is identified by the patterns of soil deposition. It is separated from type B by its higher elevation and by the less distinct channel scars. The retarded or stagnating condition of the forest stands and the almost complete cover of mosses are the main distinguishing features in the field.

Site characteristics

These sites have a largely undecomposed organic mat 6 to 12 inches deep; the shallow (9 to 18 inches) active layer results in slow tree growth.

Importance

The present forest cover has commercial value, but it would be difficult to establish a new forest on such sites. These sites can therefore hardly be considered as productive forest land with significant potential. Since permafrost is close to the surface, the terrain would also be highly susceptible to disturbance.

2.3.4 Type D – Upland Spruce (Pine)/Hardwoods

This type is vigorous forest almost invariably found on well-drained upland sites. It is most common in Sections I, II and VI.

Tree cover

Characteristically this type supports vigorous forest stands that are usually of fire origin. The cover type varies from the southern to northern extremities of the Corridor. Jack pine occurs only south of Fort Norman where it grows as pure stands or in association with aspen, spruce and white birch. North of Fort Norman the main tree species are white and black spruce, and white birch; aspen may occur on frost-free sites. Tables 2-4, 2-5 and 2-6 give typical values for tree size, volume and site.

Other vegetation

High shrubs, defined as shrubs over three feet in height, are usually absent in younger stands. But a sparse to moderate growth of alders, willows and *Viburnum* is characteristic of older stands. Sparse to moderate quantities of low shrubs are usual; the most common are *Rosa acicularis, Linnaea borealis* and various species of *Vaccinium*. *Ledum* sp. becomes more frequent as one proceeds northward. The cover of mosses varies greatly from one stand to another. Mosses are usually absent in pure hardwood stands but increase with the coniferous content. Feather mosses such as *Pleurozium schreberi* and broom mosses such as *Dicranum* sp. are most prevalent, the latter mainly

in jack pine stands. Lichens (*Cladonia* sp. and *Peltigera* sp.) are often present in jack pine stands, but seldom elsewhere. A more detailed listing of lower vegetation is presented in Appendix 1.

Identifying characteristics

On aerial photographs the identifying characteristics are first the tree species composition, mentioned above. The more vigorous growth of stands, as expressed by tree size and crown dimensions, can also be inferred and serve to distinguish this type from type E. Also, as previously mentioned, spruce was never the dominating species in the southern portions of the Corridor. The boundaries of old forest fires can also be seen on photographs, and type D is usually of fire origin, this information is a great help in identification. These same identifying features were used during fieldwork, except that it was usually possible to make more reliable statements about vigour of growth.

Site characteristics

This type is characteristic of moderately- to excessively-drained sites and would typically occur on eskers, aeolian sands and glacial flutings. Soils range from dry to fresh and usually have a sandy texture. The undecomposed organic layer is very shallow, always less than two inches thick, and consists mainly of litter such as aspen leaves and pine needles. The decomposed organic layer is also very shallow and may even be completely absent.

Permafrost: Usually permafrost does not occur within three feet of the surface in Sections I, II and VI (south of Norman Wells). Further north, permafrost can be expected occasionally in stands with a significant spruce component and it may even be encountered under pure white birch stands. But generally permafrost is not encountered within two feet of the surface anywhere in type D.

Importance

This type contains a large proportion of the merchantable timber in the Corridor. It should also be the easiest for road or pipeline construction, because drainage is good and the active layer is deep.

2.3.5 Type E – Upland Spruce/Feather Moss

This is an upland forest type, characterized by white spruce.

Tree cover

The predominant species is white spruce, in pure stands or in association with black spruce, aspen, balsam poplar and white birch. The proportion of aspen decreases north of Norman Wells, while that of white birch increases. Stands may reach 80 feet in the south but rarely exceed 60 feet in the northern half of the Corridor. Diameters of 15 inches or more are common for white spruce, but other species usually do not exceed 10 inches. Other typical statistics are given in Tables 2-4, 2-5.

Other vegetation

High shrubs, most frequently willows, alders and dwarf birch, are present in sparse to moderate quantities. Low shrubs are also sparse to moderate; *Rosa acicularis* is the most prominent species in the southern half of the Corridor. As one moves northward this species, although still present, is gradually surpassed by *Vaccinium* sp. and *Ledum* sp. *Arctostaphylos* also becomes more frequent. *Equisetum* sp. and *Pyrola* sp. are the most frequent among the generally sparse herbaceous layer. *Cornus canadensis* is common. Grasses and sedges are absent or rare, but mosses are usually present and in many places blanket the ground completely. Feather mosses, *e.g. Hylocomium splendens*, are by far the most abundant. Lichens are absent or sparse.

Identifying characteristics

The species composition, the predominance of spruce, is one of the key characteristics. Topographic location is another. Also, on aerial photographs, fire boundaries are less distinct than for type D. On the ground, the dense cover of feather moss is an additional identifying characteristic and permafrost is usually present within three feet of the surface.

Site characteristics

Soil supporting type E vegetation are generally moderately- to imperfectly-drained glacial tills or lacustrine deposits. Drumlin fields or rolling till plains would be typical sites. Soils are mainly clays, which may have a coarser sandy component. They are generally fresh and wet at the frost line. The decomposed organic layer is less than six inches thick and the undecomposed layer is shallow.

Permafrost: Permafrost is frequently but not always present. The active layer is usually between two and three feet deep. The occurrence of permafrost is closely related to the occurrence of white and black spruce in the stand: the higher the proportion of spruce the more likely the presence of permafrost. Conversely, in stands with a significant aspen component permafrost is at a greater depth or entirely absent. However, north of latitude 66°30'N, stands with a high proportion of white birch may have permafrost at shallow depth.

Importance

Much good timber, especially spruce, occurs on this type. Generally, this vegetation type is a good indicator of relatively stable soil conditions.

2.3.6 Type F – Black Spruce/Sphagnum

This is a type in the transition from forest to tundra. It usually occurs on upland sites but may be found on ancient alluvial flood plains.

Tree cover

When tree cover is present black spruce and larch are the only significant species that occur; white spruce and white birch form minor components in some areas. Larch

usually comprises less than 20 percent of the crown cover and therefore is not included as a forest-cover symbol. The few stands in which it is the main species are identified on the map. Trees have slow growth and narrow crowns; this has made the estimation of tree height on small-scale aerial photographs very difficult. Tree height, however, generally does not exceed 50 feet in this type (see Table 2-4).

Other vegetation

Dwarf birch, alder and willow form a sparse layer of high shrubs. Labrador tea and species of *Vaccinium* are the major, and *Potentilla fruticosa, Rubus chamaemorus* and roses the minor species in the dense, low shrub layer. The herbaceous layer is usually insignificant, but sphagnum and feather mosses cover 75 to 100 percent of the ground. Lichen is present in small patches on flat areas but forms a significant part of the ground cover on some slopes.

Identifying characteristics

On aerial photographs the main distinguishing feature of this type is the dark tone of black spruce and of the dense ericaceous shrub cover. There may also be a linear pattern on slopes where vegetation changes coincide with drainage channels. During fieldwork type F is most readily recognized by the presence of small-crowned, stunted spruce and a deep and continuous moss layer.

Site characteristics

This type is found on slopes and peat plateaux. Vegetation is usually rooted in the poorly drained organic layer whose depth varies greatly between sections. The deepest organic mat is in Section I where mineral soil was rarely reached in the active layer. In the sections to the north, mineral soil was frequently encountered above the frost line; in Section IV the samples average was an active layer of 15 inches with four inches of organic material and 11 inches of mineral soil.

Importance

Type F accounts for 40 percent of the Corridor area and may pose many problems during pipeline or road construction, particularly on slopes.

2.3.7 Type G – Spruce/Lichen

This is another type in the transition from forest to tundra.

Tree cover

Stunted black spruce and minor amounts of larch grow in open stands. Trees rarely reach 30 feet in height and never form dense stands. Any tree cover is generally similar to that of type F (Table 2-4).

Other vegetation

The high shrub layer is very sparse but small clumps of alder and dwarf birch may be present. There usually are prominent patches of low shrubs and Labrador tea, various

Vacciniums, and *Rubus chamaemorus* as the main species. Herbs, grasses and sedges are either absent or very rare. Mosses, predominantly sphagnum, grow in association with low shrubs on elevated, frozen plateaux and in association with sedges in wet collapsed areas. Between 50 and 100 percent of the ground cover is formed by lichens, chiefly species of *Cladonia* and *Cetraria*.

Identifying characteristics

This is the easiest type to identify on aerial photographs; the key characteristic is the white tone of the lichen cover and its occurrence on relatively-flat upland areas. Lichen is also the main identifying feature on the ground.

Site characteristics

Type G is usually found on palsas and peat plateaux south of latitude 65°N but further north occurs on a variety of sites. Field samples indicate that the soils in the active layer are organic in Sections I, II and III but in Section IV the mineral soil accounts for 2/3 the depth of the active layer.

Permafrost: Permafrost is variable within this type and may range from eight inches under the lichen cover to three feet or more in the thawed depressions. The average sampled depths of the active layer on this type for Sections I to IV are 17, 11, 10 and 22 inches respectively.

Importance

This type occurs throughout the entire length of the Corridor with the proportion increasing northwards. Special precautions will be required to maintain the insulating effect of the deep organic layer during road or pipeline construction; otherwise severe subsidence could occur.

2.3.8 Type H – Upland Dwarf Shrub

This is a non-forest type found on exposed slopes.

Vegetation

Some of the species found as high shrubs on other types are here found in prostrate form as part of the low shrub layer. The species in the low shrub layer, in the usual order of dominance, are: dwarf birch, *Vaccinium*, Labrador tea, willow, *Empetrum nigrum, Shepherdia canadensis, Arctostaphyla* sp. and mosses. There is only sparse growth of herbs and tussocks of *Eriophorum* are commonly found, particularly in northern areas. The lichen layer is significant and typically covers 25 percent of the area; *Cladonia* and *Cetraria* are the main species.

Identifying characteristics

Topographic location (exposed slopes) and the smooth texture and light grey tone are the main features for identification on aerial photographs. The wind-whipped prostrate shrubs and the lichen cover are key features used in field identification.

Site characteristics

The soils can be quite variable but are usually coarse-textured and in some cases consist of rock rubble.

Permafrost: Permafrost is usually present near the surface except in areas of recent local erosion, which occur within this type.

Importance

This type is rare in the Corridor and was more frequently encountered at the outer limits of the mapped area. The fact that it is located on exposed slopes will present difficulties and require precautions during construction to prevent erosion.

2.3.9 Type I – Sedge Fens

This is a non-forested type that varies considerably in character from the northern to southern limits of the Corridor.

Vegetation

Sometimes the fens are "patterned", i.e. there is a characteristic difference in vegetation on the slightly raised ridges and on the flat fens and areas between ridges. The predominant vegetation on ridges is dwarf birch, willow, *Vaccinium*, sphagnum, sedges and occasionally larch. Between the ridges there are combinations of grass and sedges with species composition varying considerably with moisture content. Dwarf birch and willow are usually scattered over the better drained sites. North of 67°N this type is usually frozen and may show a frost-polygon pattern, with the primary vegetation being dwarf birch, *Vaccinium* and sedges. There was little opportunity for field sampling in this northern type. When mapping is extended to the northern portion of the Corridor, further investigations should be undertaken to establish whether or not it should be recognized as a separate vegetation type.

Identifying characteristics

Type I is recognized on aerial photographs by its flat grey-toned appearance and also by string bogs and the polygon patterns already mentioned. In the field it is best recognized by its flat "meadow-like" appearance.

Site characteristics

The terrain is usually flat. Moisture content can vary considerably but most areas are probably water covered in the spring.

Permafrost: Permafrost is usually absent to a depth of more than three feet south of 67°N, but north of this latitude the active layer becomes progressively shallower.

Importance

This deep organic type occupies a significant portion of Section I. It will pose difficulties for road construction but may be suited for a buried pipeline.

2.3.10 Type J – Sphagnum Bogs

This is a non-forest type, usually a thermokarst feature that occurs in association with types F, G, and K.

Vegetation

Floating sphagnum is the only significant vegetation. Grasses and sedges, although usually present, form a very minor component.

Identifying characteristics

On aerial photographs this type is identified by its whitish tone and by the circular patches in which it occurs. It is usually associated with frozen F and G types. Often it occurs as a proportion of these types that is too small to be mapped or to be noted in the classification. In areas that are very likely to be subjected to construction, maps at a larger scale would give more precise indications of the occurrence of this type.

Site conditions and importance

The type is a bog formed by the thawing and collapse of permafrost. It is a unique type, with floating frost-free sphagnum areas in sharp contrast to the surrounding frozen ground. Although type J occupies only a small portion of the total area it will need special consideration during construction and it will require different construction techniques than the immediately surrounding ground.

2.3.11 Type K – Pond Fields

Type K describes small open ponds, which are too small to be mapped individually at a scale of 1:125,000. The ponds are a thermokarst feature associated with permafrost disintegration. The ponds occur in “pond fields”, often in association with vegetation type I and sometimes with types F, G, and J. Type K is always associated with some other type. Although strictly speaking not a vegetation type, these small ponds have a significant effect on associated vegetation types.

2.3.12 Type L – Pioneer Steep Slope Mixtures

This transition type is found on unstable soil conditions on riverbanks, eroded slopes and gullies.

Tree cover

When present, trees are usually vigorous. The main species are white spruce, black spruce, aspen and white birch found in pure stands or mixtures. White spruce is usually the dominant softwood and white birch the dominant hardwood.

Other vegetation

As in the forest cover, other vegetation is quite varied. In the majority of sampled areas alder was the main species in the moderately dense high shrub layer. Roses, junipers, and in the southern portions of the Corridor, *Cornus stolonifera* and twinflower were found in the low shrub layer; the most common herbaceous plant was *Pyrola*; patches of feather moss were usually present.

Identifying characteristics

The key features are steep, bare, eroded slopes and riverbanks with vegetation characteristically occurring in strips separated by erosion channels. On the ground, erosion or solifluction features and their effects on vegetation were the identifying characteristics.

Site characteristics

Permafrost was seldom present in recently eroded areas but was often found in the more stable patches between erosion channels.

Importance

This type, because of its unstable soils and steep slopes, is probably the most sensitive to disturbance. Some area of type L will undoubtedly have to be crossed by the pipeline, because the type occurs throughout the Corridor area.

2.3.13 Type M – Upland Fan Patterns

This type is found on stabilized upland alluvial fans and colluvial deposits.

Tree cover

Trees are not always present on these areas, but when present any of the usual northern species (white and black spruce, balsam poplar, aspen, white birch, jack pine) may exist as pure stands or as mixtures. Jack pine and aspen occur mainly in Sections I, II, III, and VI (i.e. south of 66°N). Tree heights up to 70 feet can be found when these areas occur at low altitudes in the southern parts of the Corridor.

Other vegetation

In the northern part, at high altitudes and on fairly recently-stabilized areas, shrubs form the predominant vegetation cover. The densities of the shrub layers are very variable, from one location to the next, and may vary from almost nil to quite dense. High shrubs, when present, are mainly willows and alders. The low shrub layer can also be quite varied in species composition but willows seem to be again frequently present.

Identifying characteristics

Both the aforementioned fans and colluvial deposits are readily identifiable on aerial photographs. On the ground these well-drained slopes of coarse-textured material are also easily recognized.

Site characteristics

This type occurs mainly on well- to excessively-drained, coarse-textured, sandy or gravelly material. On the colluvial deposits, stoniness is also common. Because of the coarse soils, the moisture content is usually fairly low.

Permafrost: Permafrost is usually present at higher altitudes and/or at the more northerly latitudes, but varies with soil texture.

Importance

Some of these areas may be useful as sources of sand and gravel.

General

From a purely vegetational standpoint, these sites are very variable and a typical vegetation type is difficult to define for them. Further sampling and study of this type may suggest its elimination as a distinct vegetation type. Consequently, each of these areas would be reclassified into the most appropriate one of the other types.

2.3.14 Type N – Upland High Shrub

Type N describes areas that have not regenerated to forest because of unstable soils, or unfavourable microclimatic conditions.

Vegetation

Trees, where present, are scattered. The main vegetation consists of very dense high shrubs: dwarf birch, alder and willow. The low shrubs found are *Ledum* sp., *Empetrum nigrum, Arctostaphylos*, and *Potentilla fruticosa*. There are few herbs, mosses and lichen, but grasses and sedges may be present, although they do not occupy more than 50 percent of the area.

Identifying characteristics

This type was difficult to identify on small-scale aerial photographs because the dense shrub cover tends to camouflage evidence of the unstable soil conditions. It often occurs between forested stands and during the preliminary interpretation it was often included with these stands because it could not be separated due to its similar topographic position. However, the type is easily recognized during helicopter reconnaissance and most areas have been correctly identified on the final maps.

Site conditions

The organic layer is usually thin. Depth to permafrost is quite variable in relation to soil texture and exposure; limited sampling precludes firm conclusions.

Importance

Type N will probably prove unstable during construction but it covers only a small proportion of the total Corridor area.

2.3.15 Burn (unclassified)

This comprises areas on which the vegetation has been recently burned off wholly or partially. In areas of the most recent burns, little or no vegetation has re-established itself. On slightly older burns, where some vegetation has come in since the fire, it often is of a pioneer type that may or may not be characteristic of the site as it was before the fire. Since it often is not, it was felt that further classification, from a vegetation standpoint, of recently burned-over areas would be of limited use for site evaluation.

Burned-over areas are significant as fire is probably the most influential factor in altering the vegetation cover. When the burn is intense it will remove the insulating mat from frozen areas and expose the soils to the sun and rains, thus lowering the permafrost and returning the site, usually, to a more productive one from a vegetative standpoint.

2.3.16 Rock

Areas of rock outcrops, mountain tops, etc. which, for the most part, are void of vegetation were simply mapped as rock (∧∧∧) with no accompanying vegetation symbol. Those rocky slopes or mountain tops that do have a tree cover and a very shallow soil layer were also designated as rock, but with the appropriate symbol for cover-type combination.

The trees in these areas are usually of low density and seldom exceed 50 feet in height. White spruce is the most common species; black spruce and white birch are also present but much less common. South of the 65th parallel, jack pine may also occur.

2.3.17 Water

This classification includes all bodies of open water which were large enough to be shown at a scale of 1:250,000 on the National Topographic Series maps that were enlarged to 1:125,000 for this project.

2.4 Vegetation Complexes

The individual vegetation types are clearly defined and discrete. However when mapping at 1:125,000 areas will be encountered that are too small to be mapped individually and thus must be shown as a mixture with adjacent types. For example, when areas of the black spruce/sphagnum type (F) were interspersed with open patches of wet sphagnum (type J), the type was identified as the Complex “F-J”. The map symbol in such cases also shows the proportion (in tenths) of each component of the complex type. All subsequent compilations such as area summaries, consider these proportions. Since multiple complexing procedures would destroy the initial advantages of a discrete and well-defined vegetation-classification system, the rule that no vegetation complex should ever include more than two types was adopted and proved quite feasible. Table 2-1 shows the combinations that were recognized and mapped. Some vegetation types could be defined clearly and without any ambiguity. However there were also combinations of types where distinction was difficult and had to be accompanied by personal judgement and occasionally doubt. For example, the transition from upland spruce/feather moss type (E) to the black spruce/sphagnum type (F) is gradual and there were intermediate conditions, which were difficult to classify.

2.5 Description of Vegetation Types – North of ~66.5°N

In the northern Mackenzie Valley, a number identifies each vegetation unit and the landform modifier is identified by a lower-case letter (Table 2.7). Additional vegetation information associated with each landform type is also indicated in the legend.

TABLE 2.7 Legend for area north of ~66.5°N in Mackenzie Valley ESP vegetation map

1)	HIGH SHRUB	
	a) Recent alluvial.....	high shrub
	b) Upland.....	high shrub
	c) Eroded.....	high shrub
	d) Upland fans.....	high shrub, grass, sedge
2)	LOW SHRUB	
	a) Ancient alluvial.....	low shrub
	b) Upland.....	low shrub
	c) Upland.....	low shrub, grass, sedge
	d) Variable (polygon).....	dryas, lichen, low shrub
	e) High elevation.....	dwarf shrub, lichen, grass
3)	LOW SHRUB WETLANDS	
	a) Flat.....	low shrub, moss
	b) Flat (polygon).....	low shrub, moss, lichen
4)	MOSS LICHEN	
	a) Variable terrain.....	moss
	b) Variable terrain.....	lichen
	c) Variable (polygon).....	grass, lichen (low shrub)
5)	MONOCOTYLEDONIC WETLANDS	
	a) Flat or alluvial fan.....	sedge, grass, low shrub
	b) Flat (polygon).....	sedge, grass, low shrub
	c) Flat.....	sedge moss
6)	MONOCOTYLEDONIC	
	a) Variable terrain.....	grass, sedge
	b) High elevation.....	grass, dwarf shrub, moss
7)	TUNDRA POND FIELDS	
	a) Variable terrain.....	grass, sedge, low shrub, moss

3 USING THE DATASET

The use that can be made of vegetation or ecosystem mapping depends largely upon scale. The present vegetation types and type aggregates are applicable for general planning and assessment of alternate route locations at scales of 1:125,000, and 1:500,000 respectively. They are not suitable for the evaluation of localized problem areas where scales of 1:50,000 and larger are required. The vegetation types and type aggregates mapped serve as a simple guide in identifying the associated ecosystems and the ecosystem components.

3.1 Reliability of Results

In using the maps produced and in making any analysis of other data presented one should consider the strengths and limitations of this study. The following remarks are accordingly provided:

3.1.1 The Classification of Vegetation Types

The system was developed and modified during the two field seasons of this project chiefly by personnel with over ten-years experience in photo-interpretation, mapping and field checking of forest and wildland conditions in Yukon and Northwest Territories. The system was found to be eminently practical for operational mapping; cases where vegetation conditions did not fit the system well were rare.

3.1.2 Aerial Photography

Most of the interpretation and mapping of vegetation was undertaken from existing small–scale photography whose specifications were not oriented toward such a use. Since the quality of the photography was generally uniform, differences in interpretation between various segments of the Corridor are probably not of practical significance.

The limited infrared colour photography available at several scales for portions of the area permitted a much more precise definition and mapping of the vegetation types.

3.1.3 The Vegetation Maps

The maps were prepared by experienced photo interpreters who were also involved in fieldwork to check photo interpretation. Generally a high standard of photo interpretation can be expected.

Since the two map scales are small and the vegetation types and type aggregates are quite broad, there are the usual limitations on precision: small pockets of one type, scattered through a larger type may not be recognized in mapping and any specific point may therefore be misclassified. The maps are not intended for detailed work in critical areas; a larger map scale and additional field checks would be required for such areas.

4 DIGITAL DATABASE FORMAT

4.1 Vegetation

4.1.1 File Description and Map Projection

File format (entity type):	Shapefile (polygon)
Filename:	Espveg
File title:	Vegetation Types of the Mackenzie Valley Transportation Corridor
File description:	Complete coverage of vegetation classification
File size:	150 Mb

File format (entity type):	Shapefile (polygon)
Filename:	Espveg_n
File title:	Vegetation Types of the Mackenzie Valley Transportation Corridor – Northern Section
File description:	Coverage of vegetation classification for the area north of 66°N
File size:	95 Mb

File format (entity type):	Shapefile (polygon)
Filename:	Espveg_s
File title:	Vegetation Types of the Mackenzie Valley Transportation Corridor – Southern Section
File description:	Coverage of vegetation classification for the area south of 66°N
File size:	55 Mb

Projection:	Lambert Conformal Conic
Ellipsoid:	GRS 80
Central Meridian	115°W
Reference Latitude	0°N
1st Standard Parallel	60°N
2nd Standard Parallel	66°N
False Easting	0 m
False Northing	0 m

4.1.2 Attribute Field Names

Shape	Identifies shape type in ArcView. Field is required by the software
Prim_vg	Dominant vegetation class within the polygon
Height_p	Tree height - primary vegetation class
Spcies_p	Most frequent species or species group - primary vegetation class
Dnsity_p	Crown-canopy density - primary vegetation class
Coverage	Coverage of pure types in mapped complex
Sec_vg	Second most frequent vegetation class within the polygon. Only present when it accounted for at least 20% of the crown canopy.
Height_s	Tree height - secondary vegetation class
Spcies_s	Most frequent species or species group - secondary vegetation class
Dnsity_s	Crown-canopy density - secondary vegetation class
Lndfrm_p*	Landform and cover type - primary vegetation class
Lndfrm_s*	Landform and cover type - secondary vegetation class
Area	Area (m^2) of the polygon as calculated by ArcView
Perimetr	Perimeter (m) of the polygon as calculated by ArcView

* Found only in the Mackenzie Delta area.

4.2. Communities in Corridor

4.2.1 File Description and Map Projection

File format (entity type):	Shapefile (point)
Filename:	Towns
File title:	Communities within the Mackenzie Valley Transportation Corridor
File description:	Communities within the Mackenzie Valley Transportation Corridor
File size:	<1 Mb
Projection:	Lambert Conformal Conic
Ellipsoid:	GRS 80
Central Meridian	115°W
Reference Latitude	0°N
1st Standard Parallel	60°N
2nd Standard Parallel	66°N
False Easting	0 m
False Northing	0 m

4.2.2 Attribute Field Names

Shape	Identifies shape type in ArcView. Field is required by the software
Community	Name of community

4.3 Corridor

4.3.1 File Description and Map Projection

File format:	Shapefile (polygon)
Filename (entity type):	Corridor
File title:	Boundary of the Mackenzie Valley Transportation Corridor
File description:	Boundary of the Mackenzie Valley Transportation Corridor
File size:	<1 Mb

Projection:	Lambert Conformal Conic
Ellipsoid:	GRS 80
Central Meridian	115°W
Reference Latitude	0°N
1st Standard Parallel	60°N
2nd Standard Parallel	66°N
False Easting	0 m
False Northing	0 m

4.3.2 Attribute Field Names

Shape	Identifies shape type in ArcView. Field is required by the software
Mapsheet	NTS map sheet number
Map_name	NTS map sheet name
Section	Corridor section as defined in ESP report (ESP, 1974)
Sec_name	Corridor section name as defined in ESP report (ESP, 1974)

4.4 Legends

A legend file is included for each theme as follows:

Espveg.avl	Legend for Espveg
Espveg_n.avl	Legend for Espveg_n
Espveg_s.avl	Legend for Espveg_s
Corridor.avl	Legend for Corridor
Towns.avl	Legend for Towns

5 ACKNOWLEDMENTS

Eric Roberts contributed significantly to the quality control of this dataset. Technical expertise on georeferencing and final production of the Open File were provided by Louis Robertson. Dan Riseborough provided helpful comments during the review process.

6 REFERENCE

Environmental Social Program, (1974). Vegetation Types of the Mackenzie Corridor. *Task Force on Northern Oil Development*, Report No. 73-46, 85 pages.

Appendix 1
Listings of the Most Common Plants by Vegetation Types

Within each category, the species likely to be encountered
most frequently are listed first

Vegetation Type A – Riparian Pioneer

	Canopy density
Tree Layer	absent
High shrub layer	50 - 100%
– *Salix* sp. – *Alnus* sp.	
Low shrub layer	10 - 50%
– *Salix* sp. – *Alnus* sp. – *Cornus stolonifera*	
Herb layer	5 - 100%
– *Equisetum* sp. – *Vicia americana*	
Grass and sedge layer	0 - 100%
Moss layer	absent
Lichen layer	absent

Vegetation Type B – Riparian Spruce/Hardwoods

	Canopy density
Tree layer	30 - 70%
– *Picea glauca* – *Populus balsamifera tremuloides* – *Picea mariana*	
High shrub layer	10 - 50%
– *Alnus* sp. – *Salix* sp. – *Cornus stolonifera*	
Low shrub layer	10 - 50%
– *Rosa acicularis* – *Cornus canadensis* – *Arctostaphylos* sp. – *Shepherdia canadensis* – *Ribes* sp.	
Herb layer	5 - 50%
– *Equisetum* sp. – *Linnea borealis* – *Pyrola* sp. – *Fragaria virginiana*	
Grass and sedge layer	sparse
Moss layer	5 - 100%
– Feather mosses	
Lichen layer	absent

Vegetation Type C – Riparian Spruce/Feather Moss

	Canopy density
Tree layer	10 - 50%
– *Picea glauca* *mariana* – *Larix laricina* – *Betula papyrifera* – *Populus tremuloides*	
High shrub layer	25 - 50%
– *Alnus* sp. – *Salix* sp.	
Low shrub layer	5 - 50%
– *Rosa acicularis* – *Ledum* sp. – *Vaccinium* sp. – *Arctostaphylos* sp. – *Viburnum* sp. – *Juniperus* sp. – *Linnaea borealis*	
Herb layer	5 - 25%
– *Equisetum* sp. – *Pyrola* sp.	
Grass and sedge layer	sparse
Moss layer	50 - 100%
– Feather mosses – *Sphagnum* sp.	
Lichen layer	absent

Vegetation Type D – Upland Spruce (Pine)/Hardwoods

	Canopy density
Tree layer	30 - 100%
– *Populus tremuloides*; infrequent north of 66°N – *balsamifera* – *Betula papyrifera* – *Picea glauca* – *Pinus divaricata*; not present north of 65°N – *contorta*; present south of 62°N only	
High shrub layer	25 - 50%
– *Alnus* sp. – *Salix* sp. – *Viburnum* sp. – *Cornus stolonifera*	
Low shrub layer	10 - 50%
– *Rosa acicularis* – *Vaccinum* sp. – *Ledum* sp. – *Linnaea borealis* – *Viburnum* sp.	
Herb layer	sparse
– *Equisetum* sp. – *Pyrola* sp. – *Cornus canadensis*	
Grass and sedge layer	sparse
Moss layer	
– Feather mosses – *Dicranum* sp.	
Lichen layer – usually associated only with pine stands	0 - 50%
– *Cladonia* sp. – *Peltigera aphthosa*	

Vegetation Type E – Upland Spruce/Feather Moss

	Canopy density
Tree layer	30 - 70%
– *Picea glauca* – *Populus tremuloides*; infrequent north of 66°N – *balsamifera* – *Betula papyrifera* – *Picea mariana*	
High shrub layer	5 - 50%
– *Alnus* sp. – *Salix* sp. – *Betula glandulosa*	
Low Shrub layer	5 - 50%
– *Vaccinium* sp. – *Rosa acicularis* – *Ledum* sp. – *Arctostaphylos* sp. – *Potentilla fruticosa* – *Shepherdia canadensis* – *Lycopodium* sp.	
Herb layer	5 - 25%
– *Equisetum* sp. – *Pyrola* sp. – *Cornus canadensis*	
Grass and sedge layer	sparse
Moss layer	50 - 100%
– Feather mosses – *Sphagnum* sp.	
Lichen layer	0 - 25%
– *Cladonia* sp. – *Peltigera aphthosa*	

Vegetation Type F – Black Spruce/Sphagnum

	Canopy density
Tree Layer	10 - 30%
– *Picea mariana* – *Larix laricina*	
High shrub layer	10 - 50%
– *Salix* sp. – *Betula glandulosa* – *Alnus* sp.	
Low shrub layer	10 - 50%
– *Ledum* sp. – *Vaccinium* sp. – *Arctostaphylos* sp. – *Rosa acicularis* – *Potentilla fruticosa* – *Betula glandulosa* – *Rubus chamaemorus* – *Empetrum nigrum*	
Herb layer	sparse
– *Equisetum* sp. – *Pyrola* sp.	
Grass and sedge layer	sparse - 25%
Moss layer	50 - 100%
– Feather mosses – *Sphagnum* sp.	
Lichen layer	5 - 25%
– *Cladonia* sp. – *Cetraria* sp.	

Vegetation Type G – Black Spruce/Lichen

	Canopy density
Tree Layer	10 - 30%
– *Picea mariana* – *Larix laricina*	
High shrub layer	sparse
– *Betula glandulosa* – *Salix* sp. – *Alnus* sp.	
Low shrub layer	25 - 50%
– *Ledum* sp. – *Vaccinium* sp. – *Rubus chamaemorus* – *Betula glandulosa* – *Arctostaphylos* sp. – *Empetrum nigrum*	
Herb layer	sparse
– *Equisetum* sp.	
Grass and sedge layer	sparse
Moss layer	25 - 50%
– *Sphagnum* sp. – Feather mosses	
Lichen layer	50 - 100%
– *Cladonia* sp. – *Cetraria* sp.	

Vegetation Type H – Upland Dwarf Shrub

	Canopy density
Tree Layer	absent
High shrub layer	absent - sparse
Low shrub layer	5 - 75%
– *Betula glandulosa* – *Vaccinium* sp. – *Salix* sp. – *Ledum* sp. – *Empetrum nigrum* – *Arctostaphylos* sp. – *Shepherdia canadensis*	
Herb layer	sparse - 25%
– *Lupinus* sp. – *Equisetum* sp.	
Grass and sedge layer	sparse - 25%
Moss layer	sparse - 50%
– *Dicranum* sp.	
Lichen layer	5 - 75%
– *Cladonia* sp. – *Cetraria* sp.	

Vegetation Type I – Sedge Fens

	Canopy density
Tree Layer	absent
High shrub layer	sparse - 75%
– *Betula glandulosa* – *Salix* sp.	
Low shrub layer	25 - 100%
– *Vaccinium* sp. – *Betula glandulosa* – *Ledum* sp. – *Potentilla fruticosa*	
Herb layer	sparse
– *Equisetum* sp.	
Grass and sedge layer	25 - 75%
Moss layer	0 - 50%
– *Sphagnum* sp. – Feather mosses	
Lichen layer	absent

Vegetation Type J – Sphagnum Bogs

	Canopy density
Tree Layer	absent
High shrub layer	absent
Low shrub layer	0 - 10%
– *Rubus chamaemorus* – *Chamaedaphne calyculata*	
Herb layer	0 - 5%
– *Liliaceae* sp.	
Grass and sedge layer	5 - 25%
Moss layer	100%
– *Sphagnum* sp.	
Lichen layer	absent

Vegetation Type N – Upland High Shrub

	Canopy density
Tree Layer	absent
High shrub layer – *Betula glandulosa* – *Salix* sp. – *Alnus* sp.	25 - 100%
Low shrub layer – *Betula glandulosa* – *Vaccinium* sp. – *Ledum* sp. – *Arctostaphylos* sp. – *Alnus* sp. – *Empetrum nigrum*	25 - 100%
Herb layer	sparse
Grass and sedge layer	sparse - 25%
Moss layer – Feather mosses	sparse
Lichen layer	absent or sparse

Appendix 2
Latin and English Names of Plants Mentioned in Text

Trees

Betula papyrifera	white birch
Larix laricina	larch
Picea glauca	white spruce
mariana	black spruce
Pinus divaricata	jack pine
contorta	lodgepole pine
Populus balsamifera	balsam poplar
tremuloides	trembling aspen

High shrubs

Alnus crispa	green alder
incana	speckled alder
Betula glandulosa	dwarf birch
Cornus stolonifera	red-osier dogwood
Salix sp.	willows
Viburnum edule	squashberry

Low shrubs

Andromeda polifolia	bog-rosemary
Arctostaphylos alpina	alpine bearberry
rubra	red bearberry
uva-ursi	bearberry
Betula glandulosa	dwarf birch
Chamaedaphne calyculata	leather leaf
Linnaea borealis	bunchberry
Cornus stolonifera	red-osier dogwood
Empetrum nigrum	black crowberry
Juniperus horizontalis	creeping juniper
Ledum groelandicum	Labrador tea
Lycopodium sp.	clubmosses
Myrica gale	sweet gale
Potentilla fruticosa	shrubby cinquefoil
Ribes oxyacanthoides	northern gooseberry
triste	bitter currant
Rosa acicularis	prickly rose
Rubus chamaemorus	cloudberry
Shepherdia canadensis	buffalo-berry
Spiraea sp.	spiraea
Vaccinium uliginosum	bilberry
vitis-idaea	cowberry
Viburnum edule	squashberry

Herbs

Epilobium angustifolium	fireweed
Equisetum arvense	field horsetail
scirpoides	dwarf scouring-rush
silvaticum	woodland horsetail
Fragaria virginiana	wild strawberry

Liliaceae sp.	lily family
Cornus canadensis	twinflower
Lupinus sp.	lupine
Petasites sp.	sweet coltsfoot
Pyrola rotundifolia	roundleaf pyrola
secunda	one-sided pyrola
Vicia americana	American vetch

Grasses and sedges

Cyperaceae	sedge family
Carex sp.	sedge genus
Eriophorum sp.	cotton grass
Gramineae	grass family

Mosses

Aulacomnium sp.	bog moss	
Dicranum sp.	broom mosses	
Hylocomium splendens	hylocomium	feather mosses
Hypnum crista-castrensis	plume moss	
Pleurozium schreberi	Schreber's moss	
Sphagnum sp.	sphagnum	

Lichens

Cetraria sp.	Iceland moss
Cladonia sp. often *C. alpestris* and *C. rangiferina*	reindeer mosses