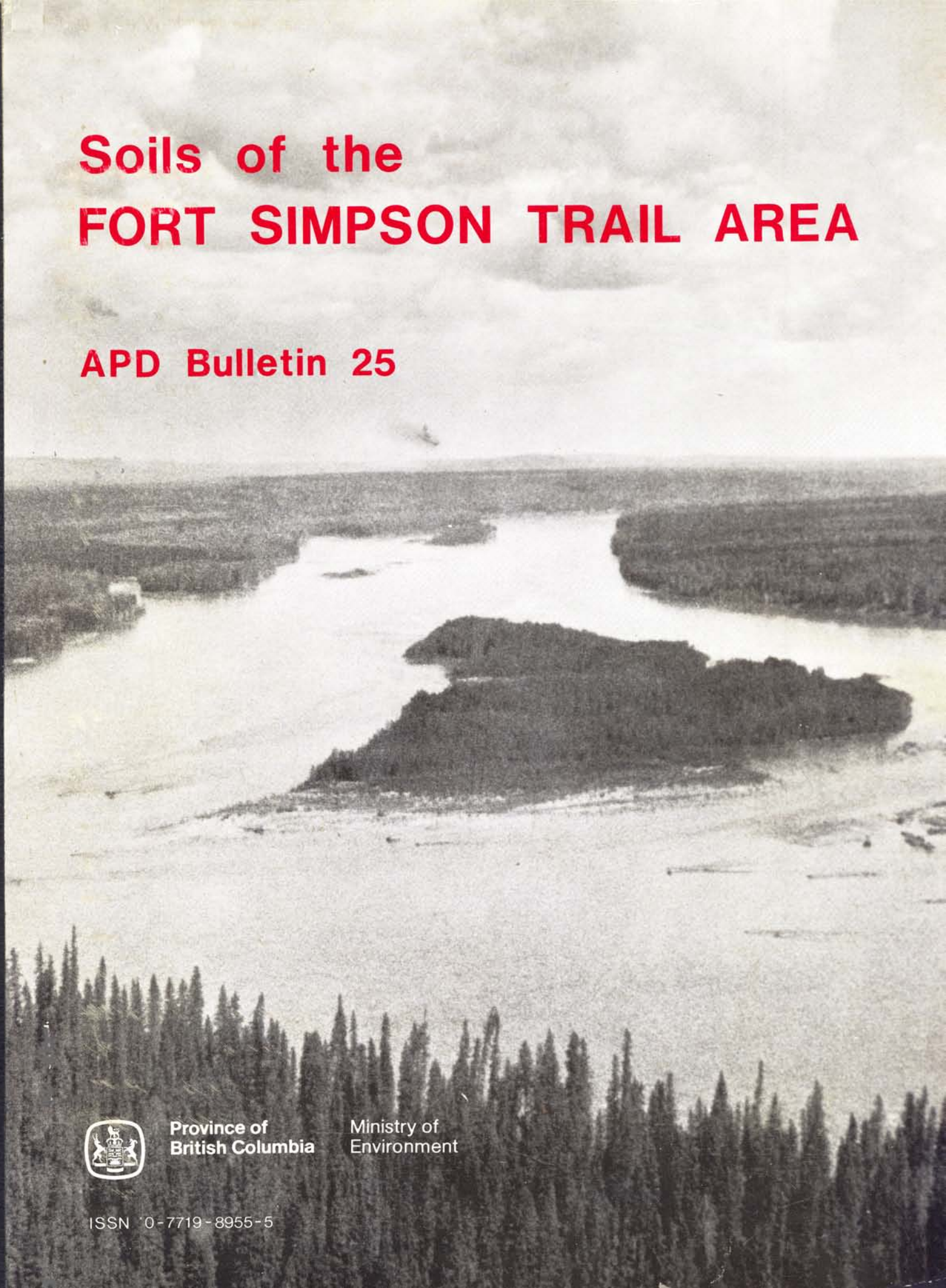
Soils of the FORT SIMPSON TRAIL AREA

APD Bulletin 25



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SOILS OF THE FORT SIMPSON TRAIL AREA

Report No. 58
British Columbia Soil Survey

R.C. Kowall
TERRESTRIAL STUDIES BRANCH

Kelowna, B.C.
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COVER PHOTO: The junction of the Fort Nelson and Liard Rivers.

ABSTRACT

The purpose of the survey was to map the soils, to evaluate their potential for agriculture and forestry and to describe the vegetation. Travel throughout the area was by truck on limited road access and by helicopter. A total of 61 soil and 51 vegetation sites were described and 8 soil profiles sampled. The soils were classified according to the Canadian System of Soil Classification and the vegetation survey followed the Terrestrial Studies Branch procedure.

The first section of the report describes the report area, located north and west of Fort Nelson and encompassing 837,500 ha. The terrain, which is generally a flat and rolling lowland, is entrenched by streams and rivers. To the southwest, a gently rolling upland cuesta occurs with an escarpment leading down to the lowland. The report area occurs in the Boreal White Spruce Zone of the Boreal Region.

The second section of the report briefly describes the 18 soils, 5 soil phases and 1 land type mapped and classified in the report area. The soils generally are developed in clay loam morainal, clay glaciolacustrine or sandy eolian deposits. On the steep escarpments, the soils have developed in clay loam colluvial deposits and along the stream channels, sandy fluvial sediments.

The final section of the report provides the soil capability ratings for agriculture and forestry. The methodology followed is that employed by the Canada Land Inventory.

The agriculture capability of the fluvial and eolian sediments is generally Class 3. The morainal and glaciolacustrine deposits are Class 4 at the lower elevations and Class 5 at the higher elevations. The colluvial deposits are Class 7. The forestry capability of all the drier, better drained soils is generally Class 3. Some of the upper fluvial terraces are Class 2, and the higher elevation morainal and upper slope colluvial deposits and the lower terrace fluvial sediments are Class 4. Where excess moisture or shallow soils overlying bedrock exist, the agriculture and forestry capability decreases appreciably.

Three 1:100 000 scale soil maps are included with the report and show the distribution and extent of the map units. These maps are direct reductions of the 1:50 000 manuscript maps. Although not included with the report, manuscript soil maps and soil capability for agriculture and forestry maps at the 1:50 000 scale are available.

PREFACE

The soil and vegetation survey of the Fort Simpson Trail Area is part of a continuing program to map, at a reconnaissance level, the soil and vegetation resources in the Province of British Columbia. The purpose of these surveys is to provide land planners and land managers with a reconnaissance inventory of the physical features found in the map area.

The Fort Simpson Trail Area survey was conducted by the Terrestrial Studies Branch at the joint request of the Ministry of Lands, Parks and Housing and the Ministry of Agriculture and Food.

ACKNOWLEDGEMENT

Sincere gratitude is extended to Dr. K. Valentine of the Pedology Unit, Canada Department of Agriculture for his participation as editor in the preparation of this report.

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PART 1

1. GENERAL DESCRIPTION OF THE AREA

Location

The report area is located north and west of Fort Nelson in northeastern British Columbia (Figure 1). The area mapped includes all of 94 O/1 to 8 and 94 J/14 and portions of 94 J/11 to 13, 1:50 000 National Topographic Series maps and covers an area of about 8375 km^2.

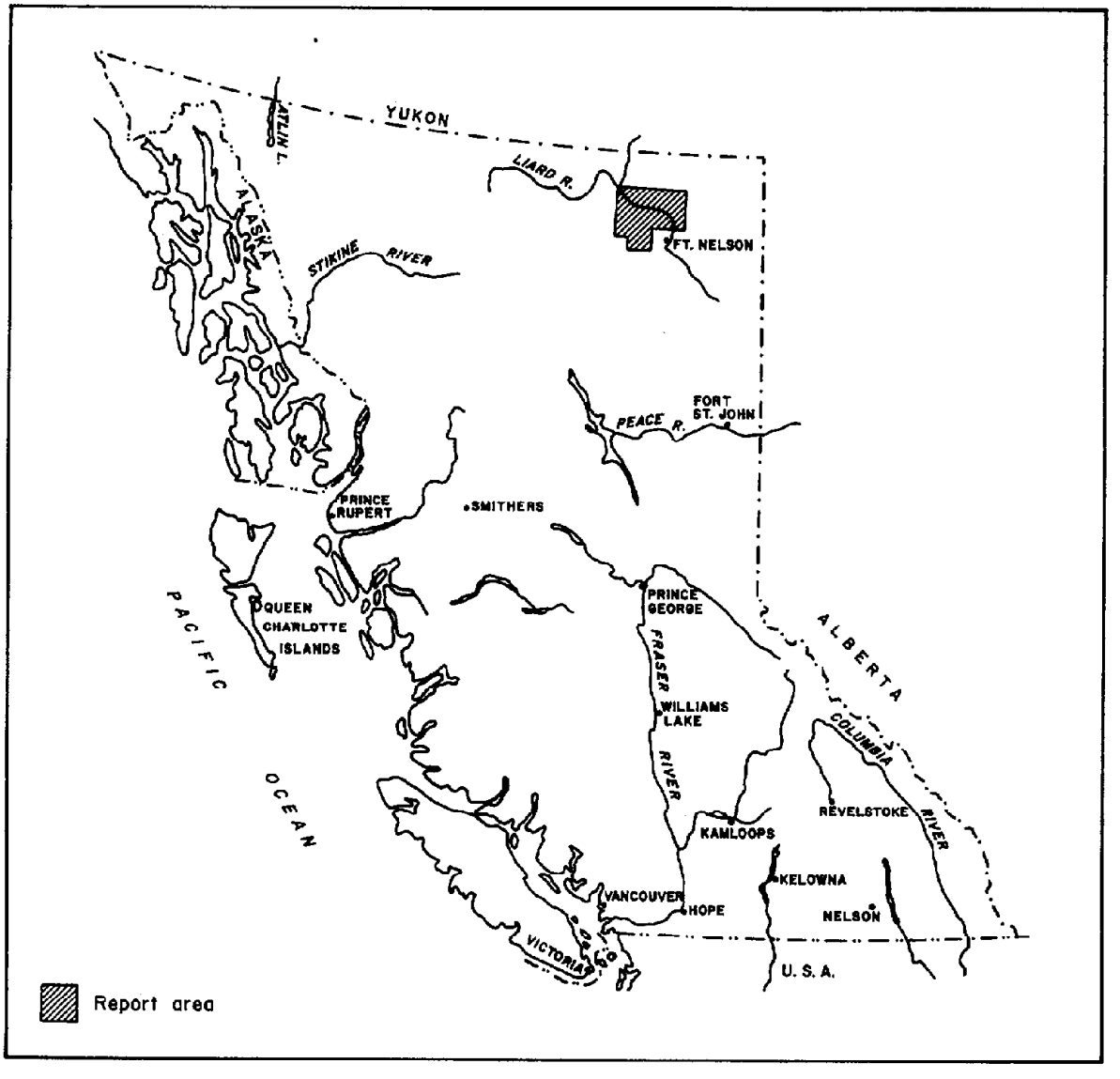

Figure 1. Outline map of British Columbia showing the location of the Fort Simpson Trail Area.

Physiography

The physiography (Holland, 1964) of the study area is characterized by flat and gently rolling plateaux having poorly organized drainage. There are large areas of muskeg, and streams meander across the landscape eventually to join one of the trunk streams: Sahtaneh, Kiwigana, Muskwa and Fort Nelson Rivers.

The study area is composed of parts of two physiographic regions. The first is part of the Fort Nelson Lowland, a subdivision of the Alberta Plateau, which is an area of low relief, being in places flat and in places gently rolling, that lies below an elevation of 610 m. It is entrenched by streams and rivers; with the Muskwa River some 60 to 75 m and the Fort Nelson River 75 to 120 m below the plateau level. The lowland is for the most part underlain by flat or gently dipping Buckinghorse shales and Sikanni sandstones of Cretaceous age (Taylor and Stott, 1968a, 1968b), but exposures of bedrock are rare. The topography, for the most part, reflects the flat lying orientation of the underlying rocks. The second part consists of a portion of the Alberta Plateau, and is located on the west and south sides of the study area and is named the Tsoo Tablelands. It is an area of flat and gently rolling upland ranging in elevation from 610 to 1125 m. It generally has a distinctive cuesta topography upheld by the more weather resistant Dunvegan conglomerates and Sikanni sandstones and is underlain by the Sully and Buckinghorse shales. The Maxhamish Escarpment and Etsho Plateau, which are considered as outliers of the Alberta Plateau, are topped by Dunvegan conglomerates and are isolated remnants attaining elevations of 750 m. Table 1, abbreviated from Taylor and Stott (1968a), shows the order, depth and lithology of the geologic formations.

The plateau was glaciated during the Pleistocene Epoch. Continental ice from the Keewatin centre of accumulation west of Hudson Bay moved westward and southwestward across the plateau, transporting boulders and drift from Precambrian areas far to the east. After the maximum expansion of the Keewatin ice and its retreat, piedmont and valley glaciers flowing eastward from the Rocky Mountains moved out onto the plateau leaving morainal deposits. Remnants of these moraines are observed on the Etsho Plateau, at the foot of

the Etsho Escarpment and north of Sahtaneh River. Ice movement is noted from the glacial fluting in the ground moraine, notably around Capot-Blanc Creek. As the ice waned, channels discharged glacial meltwater leaving misfit streams. These meltwater channels are quite evident on the north side of the Fort Nelson River. In instances, the glacial meltwater was ponded and glacial lakes formed and perhaps, the deposits bordering the Muskwa River and Stanolind and Tsimeh Creeks south of Fort Nelson River are glaciolacustrine sediments. Post-Pleistocene erosion has incised the rivers to their present elevations and alluvial sediments have been deposited on their floodplains. Eolian deposits are found along embankments of the Fort Nelson River. Some dunes occur between Stanolind and Tsimeh Creeks. An extensively duned area is located south of Nelson Crossing, west of the Fort Nelson River.

Table 1. Geologic Formations and Lithology for the Study Area

Era	Period or Epoch	Group	Formation and Thickness	Lithology
Mesozoic	Upper Cretaceous	-	Kotaneelee 180m+	Dark grey, marine shale; minor amounts of sandstone
		UNCONFORMITY		
		-	Dunvegan 175m	Massive conglomerate; fine- to coarse-grained sandstone and carbonaceous shale
	Lower Cretaceous	Fort St. John Group 610-1310m	Sully 90-120m	Dark grey marine shale
			Sikanni 0-305m	Fine-grained, well sorted to silty sandstone; interbedded shale
			Bucking-horse 455 - 610m	Dark grey marine shale; siltstone; sideritic concretions

Climate

The area has a boreal climate with short, cool summers, severe winters, a wide annual range of temperature, and modest total annual precipitation, most of which falls in the summer. The climate is dominated by continental polar air masses that centre over the Northwest Territories. Cyclonic storms from the Pacific Ocean intrude only rarely in winter. Their occurrence is more frequent in summer, but they are weak after crossing the Coast and Rocky Mountains.

There are no climate stations in the report area; the nearest continuing, long-term meteorological station is at the Fort Nelson airport. The long-term station which was located at the Smith River airport about 240 km to the northwest of the report area, is used as a reference, as are the short-term meteorological stations at Sierra about 65 km east, and Prophet River some 90 km south. Meteorological data for these four stations are given in Table 2. The data for the Fort Nelson and Smith River stations were obtained from Canada, Environment Canada (1941-1970) and those for the Sierra and Prophet River stations from Canada, Fisheries and Environment (1974-1976, 1977-1979).

Vegetation

The vegetation survey was conducted by M. Rafiq of the Vegetation Unit, Terrestrial Studies Branch and followed the methodology developed by the Terrestrial Studies Branch and outlined by Walmsley and van Barneveld (1977). The survey was conducted as a team effort, and as a result, the description and sampling sites for both soils and vegetation are the same. A total of 51 vegetation sites were described and recorded.

With the completion of the field work, the vegetation data was evaluated and 23 tentative units, which are subjectively grouped sample plots based on similarities in apparent composition of the plant communities, were defined for four broad landscape positions (Table 3). Three vegetation units were differentiated for organic areas, 4 for gleysolic areas, 10 for moist upland and floodplain areas and 6 vegetation units for dry upland areas. The Appendix lists the species used in describing the vegetation units. The

trees, shrubs and herbs are named after Taylor and MacBryde (1977), the mosses after Crum et. al. (1973) and the lichens after Hale (1969).

The vegetation zonation was determined after the data had been evaluated. The entire report area was considered to be part of the Boreal White Spruce Zone of the Boreal Forest Region (Walmsley and van Barneveld, 1977). The Boreal White Spruce Zone is the lowest zone in elevation of the Boreal Forest Region. It has a potential of maturing into regnerating white spruce forests after disturbances on well drained sites. However, on poorly drained sites, black spruce is the dominant regenerating species.

Table 2. Meteorological Data

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Fort Nelson Airport (30 year data)	Latitude 58° 50' N					Longitude 122° 35' W				Elevation 375 m ASL			
Mean Daily Temperature (°C)	-23.2	-17.0	-9.2	1.2	9.7	14.5	16.7	14.8	8.8	1.2	-12.3	-20.7	-1.3
Mean Daily Maximum Temperature (°C)	-18.8	-11.7	-2.7	7.3	16.1	20.9	23.0	21.2	14.6	6.1	-8.3	-16.9	4.2
Mean Daily Minimum Temperature (°C)	-27.6	-22.4	-15.7	-5.0	3.2	8.1	10.4	8.4	3.0	-3.8	-16.3	-24.6	-6.8
Number of Days with Frost	31	28	31	26	8	*	0	1	7	26	30	31	219
Mean Rainfall (mm)	T	0.3	0.8	5.1	31.8	64.0	74.7	55.6	33.3	7.4	0.8	T	273.6
Mean Snowfall (cm)	30.2	26.2	27.4	19.3	5.8	T	0.0	T	5.3	19.0	29.5	28.7	191.5
Mean Total Precipitation (mm)	26.4	24.4	24.9	21.6	37.6	64.3	74.7	55.6	38.6	25.6	26.7	25.9	446.3
Greatest Rainfall in 24 Hours (mm)	1.5	5.1	4.1	20.3	34.5	52.1	47.5	80.5	28.4	18.5	5.1	0.8	80.5
Smith River Airport (26 year data)	Latitude 59° 54' N					Longitude 126° 26' W				Elevation 673 m ASL			
Mean Daily Temperature (°C)	-24.5	-17.6	-9.9	-0.9	6.9	12.0	14.1	12.2	7.0	-0.7	-13.2	-21.5	-3.0
Mean Daily Maximum Temperature (°C)	-19.1	-11.3	-2.7	5.5	13.9	19.0	20.9	19.0	13.0	4.2	-8.5	-16.6	3.1
Mean Daily Minimum Temperature (°C)	-29.8	-23.7	-17.2	-7.2	0.0	5.0	7.3	5.4	0.9	-5.6	-17.9	-26.4	-9.1
Number of Days with Frost	31	28	31	29	18	3	1	3	14	28	30	31	247
Mean Rainfall (mm)	0.8	0.3	0.8	4.6	21.6	54.9	68.1	49.0	37.1	17.3	3.3	0.5	258.1
Mean Snowfall (cm)	37.3	29.5	25.1	16.8	5.8	5.1	0.0	T	3.3	20.3	35.3	37.6	211.6
Mean Total Precipitation (mm)	37.6	29.2	24.9	20.8	27.4	55.6	68.1	49.0	40.4	37.1	37.8	37.3	465.3
Greatest Rainfall in 24 Hours (mm)	9.4	2.5	10.4	10.2	24.9	37.1	42.7	67.6	22.6	14.5	11.9	7.6	67.6
Sierra (approx. 5 years data)	Latitude 58° 50' N					Longitude 121° 50' W				Elevation 566 m ASL			
Mean Daily Temperature (°C)	-18.4	-16.2	-11.2	2.2	8.0	13.0	14.5	11.8	8.0	1.6	-10.4	-18.4	-1.3
Mean Daily Maximum Temperature (°C)	-13.6	-10.6	-4.8	8.0	14.7	19.5	20.7	17.6	14.0	7.0	-5.8	-13.4	4.4
Mean Daily Minimum Temperature (°C)	-23.3	-22.7	-17.5	-4.9	1.3	6.5	8.1	6.1	2.2	-4.0	-15.1	-23.3	-7.2
Number of Days with Frost	31	28	31	23	12	1	0	1	7	27	30	31	222

Table 2 (Continued)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Sierra (approx. 5 years data)	Latitude 58° 50' N					Longitude 121° 50' W				Elevation 566 m ASL			
Mean Rainfall (mm)	0.0	0.0	0.0	2.1	26.9	85.0	67.5	73.7	22.1	7.6	0.4	0.0	285.3
Mean Snowfall (cm)	25.8	12.8	13.5	4.9	4.8	0.0	0.0	0.0	1.7	1.4	29.4	11.2	106.5
Mean Total Precipitation (mm)	25.8	12.8	13.5	7.0	31.7	85.0	67.5	73.7	23.8	9.0	29.8	11.2	290.2
Greatest Rainfall in 24 Hours (mm)	11.4	2.5	6.4	11.0	24.1	41.9	36.6	25.0	12.0	5.3	8.9	8.9	41.9
Prophet River (approx. 2 years data)	Latitude 58° 13' N					Longitude 122° 47' W				Elevation 457 m ASL			
Mean Daily Temperature (°C)	-17.2	-10.8	-8.1	4.0	9.3	13.2	15.8	14.3	10.8	1.6	-8.7	-15.6	0.7
Mean Daily Maximum Temperature (°C)	-12.2	-3.8	-0.8	12.2	16.6	20.2	22.4	19.7	19.4	6.8	-3.1	-10.6	7.2
Mean Daily Minimum Temperature (°C)	-23.4	-20.2	-15.3	-4.3	2.1	6.2	9.2	7.7	2.3	-3.7	-14.3	-22.6	-6.4
Number of Days with Frost	31	28	31	25	8	0	0	0	7	30	30	31	221
Mean Rainfall (mm)	0.0	0.0	0.0	0.7	46.7	140.7	116.4	123.6	23.7	3.8	0.0	0.0	455.6
Mean Snowfall (cm)	24.2	24.7	22.1	4.0	0.0	0.0	0.0	0.0	0.0	20.7	14.2	21.2	131.1
Mean Total Precipitation (mm)	24.2	24.7	22.1	4.7	46.7	140.7	116.4	123.6	23.7	24.5	14.2	21.2	586.7
Greatest Rainfall in 24 Hours (mm)	10.2	3.6	7.6	3.0	27.2	25.4	33.0	27.2	14.7	30.5	7.6	15.2	33.0

Table 3. Generalized Relationship between Vegetation and Soils

Vegetation Units	Comments	Soils	Soil Drainage	Landscape Position
Organic Areas 1. Black spruce - cloudberry - black crowberry - peat mosses 2. Black spruce - tamarack - common Labrador tea - peat mosses 3. Leather leaf - common Labrador tea - cotton grass - peat mosses	Characterized by very poor tree growth, a dense shrub layer, a moderately dense herb layer and a thick continuous moss layer. Maturing edaphic climax vegetation presently occupies most of the organic wetlands.	Klua McConachie Odayin Parker	very poor	organic wetlands occupying flat to water collecting depressional areas
Gleysolic Areas 1. American green alder - Bebb's willow - common Labrador tea - wood horsetail 2. Black spruce - tamarack - bog blueberry - mountain cranberry - common moss 3. Black spruce - alpine fir - common Labrador tea - mountain cranberry - layered moss 4. Black spruce - white spruce - common Labrador tea - layered moss	Characterized by moderate to dense tree and shrub layers, an open herbaceous layer and a dense moss layer. Climax species are black spruce and white spruce with commonly associated species being tamarack and alpine fir.	Klowee Simpson Tsinhia Utahn	poor to very poor	gleysolic wetlands occupying flat to gently sloping seepage areas
Moist Upland and Floodplain Areas 1. Trembling aspen - white spruce - high bush cranberry 2. Trembling aspen - common Labrador tea - ground cedar - layered moss 3. Trembling aspen - soopolallie - layered moss 4. White spruce - Canadian bunchberry - northern twinflower - layered moss 5. Alpine fir - black spruce - common Labrador tea - layered moss 6. Lodgepole pine - white spruce - velvet leaved blueberry - fruiticose lichens	Characterized by a moderately dense to dense tree layer, usually a dense shrub layer, a somewhat sparse herb layer and usually a thick moss layer. On the alluvial floodplains (periodically flooded) seemingly untouched by fire, balsam poplar is the dominant species with white spruce the climax species. On upland soils trembling aspen is the dominant species with white and black spruce the climax species.	Chischa Donaldson Fort Nelson Prophet Sikanni Snake	moderately well to imperfect	moist upland and floodplain terrace areas

Table 3 (Continued)

Vegetation Units	Comments	Soils	Soil Drainage	Landscape Position
Moist Upland and Floodplain Areas 7. Alpine fir - black blueberry - black crowberry - common moss 8. Black spruce - black blueberry - layered moss - feather moss 9. Balsam poplar - white spruce - common red osier dogwood - meadow horsetail 10. White spruce - black spruce - common red osier dogwood - common moss	Characterized by a moderately dense to dense tree layer, usually a dense shrub layer, a somewhat sparse herb layer and usually a thick moss layer. On the alluvial floodplains (periodically flooded) seemingly untouched by fire, balsam poplar is the dominant species with white spruce the climax species. On upland soils trembling aspen is the dominant species with white and black spruce the climax species.	Chischa Donaldson Fort Nelson Prophet Sikanni Snake	moderately well to imperfect	moist upland and floodplain terrace areas
Dry Upland Areas 1. Lodgepole pine - Alaska paper birch - mountain cranberry - common moss 2. Trembling aspen - high bush cranberry - northern twinflower - pink pyrola 3. Trembling aspen - soopolallie - pink pyrola - layered moss 4. White spruce - black spruce - Canadian bunchberry - feather moss 5. Jack pine - white spruce - common Labrador tea - layered moss 6. Trembling aspen - white spruce - jack pine - layered moss	Characterized by dense tree, shrub and moss layers and usually a sparse herb layer. These sites are inhabited by a greater number of drier habitat species. Jack pine occurs on some of the high alluvial terraces along the Fort Nelson River on gravelly sand soils.	Kiwigana Klenteh Trail	moderately well to well	steeply sloping shedding areas, gravelly terraces and dry upland areas

PART 2

2. METHODS

Field Methods

Prior to the commencement of the field work, preliminary assessment of the landscape and access was undertaken on 1:50 000 scale aerial photographs exposed in 1978 and on 1:50 000 and 1:250 000 NTS maps. The landscape was separated into segments by stereoscopically examining the aerial photographs and delineating the inferred organic soils and a variety of mineral soils. These delineations were refined on the bases of inferred soil texture, parent material, soil genesis and slope. The bedrock geology (Taylor and Stott, 1968a, 1968b) was used to aid in estimating some of the soil characteristics such as texture, soil reaction, carbonate content and soil development. The physiographic map of Holland (1964) was used to divide the report area into its respective physiographic regions.

The field survey was conducted during 15 days in August, 1979. A survey intensity level 4 (MSWG, 1979) was applied with about 8375 km^2 being field checked. Field work consisted of traversing all passable roads by truck and spot checking inaccessible areas by helicopter. Figure 2 shows the helicopter traverses, road access and the locations of most of the 61 described soil and vegetation sites and 8 sampled soil profiles. The actual map units identified in the field were checked against those pretyped, and mapping lines and symbols were adjusted as necessary. Initially, many stops were made to check the soils and vegetation but as familiarity with the terrain characteristics increased, the number of examinations or spot checks was reduced. The information from the spot checks was put directly on the photograph in the form of a terrain symbol, texture, soil classification or other identifying characteristics. Checks, in which the site was described in more detail, were recorded on site and soil description forms and were identified by a number on the photograph and subsequently on the map. At 37 truck and 24 helicopter check points, site and soil description forms were completed according to the Manual for Describing Ecosystems in the Field (RAB, 1980) with parent material, soil horizons, depth, drainage, slope, elevation, rockiness, aspect and other characteristics described and noted. Many of the terms used are defined in the Glossary of Terms in Soil Science (Canada Department of

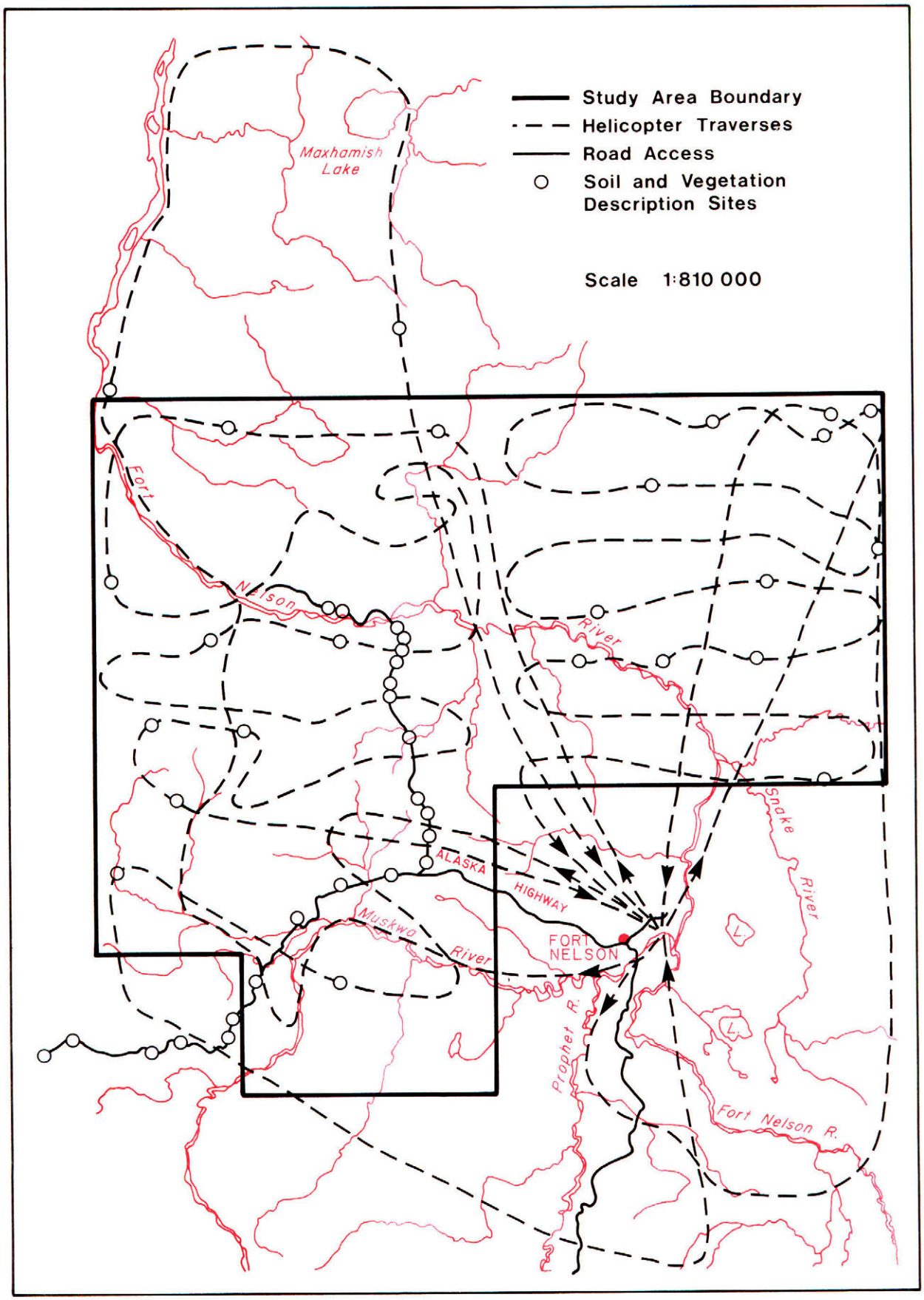

Figure 2. Road access and helicopter traverses.

Agriculture, 1976). The soil profiles were described and classified according to The Canadian System of Soil Classification (Canada Soil Survey Committee, Subcommittee on Soil Classification, 1978). Forest capability plots were measured where suitable forest stands were available, to determine the potential productivity of the soils to produce wood fibre. Each soil was also assessed to determine its agricultural capability.

Generally, representative sampled soil profiles should be scattered throughout the report area and chosen to show the relationship between soil and terrain in as many physiographic regions and forest zones as possible. Because of the limited access and time constraints associated with the Fort Simpson Trail report area, only 8 representative soil profiles were sampled and described in detail. Some of the classified soils are described by Valentine (1971). The morphological and landscape characteristics for each soil were described according to RAB (1980) and the Canada Soil Information System (1978). For each soil profile, laboratory analyses were performed on all sampled soil horizons to determine their chemical characteristics. The water holding capacity of the soil profile was assessed by determining the field capacity and wilting point of representative horizons of the soil profile. For the parent material (subsoil), a particle size analysis was performed on the fraction less than 76 mm. The Atterberg limits were also determined. The chemical and physical soil data, as well as the descriptive information on the soil and landscape, are stored in the British Columbia Soil Information System.

Mapping Methods

Upon completion of pretyping the aerial photographs, field checking, sampling and laboratory analyses, and adjusting the pretyped lines where necessary, the soil maps were developed. The map unit boundaries from the aerial photographs were transferred to map bases, and the polygons (map delineations) were symbolled according to the soil legend. About 8% of the map delineations had at least one ground field check, although many others were observed from the air by helicopter, especially in the organic soil areas. Although all map delineations were determined by air photo interpretation and extrapolation, the relative distinctness of the organic, escarpment, river and

stream embankment and floodplain photo images and the homogeneity of the terrain allowed for an estimated mapping reliability of about 70% through the report area.

Many of the soils and map units identified by Valentine (1971) also occur in the Fort Simpson Trail report area. Eighteen separate soils were identified in the report area. They are differentiated on the basis of differences in soil parent material lithology and texture, drainage, depth and taxonomy and are listed in Table 4.

The distribution of the soils is shown on the map by symbols. Single map symbols identify map areas in which one soil predominates. Where two soil symbols occur in a map delineation, both soils are present in substantial areal extent with the first named soil dominant in the map delineation. Where a slight variation from the established soil occurs, a soil phase is used to indicate the kind of variation. The variations in this report area include slope, stones or shallow soils overlying bedrock.

Using the Sikanni soil as an example, a single map symbol SK indicates that the Sikanni soils predominantly occur in the delineation. A compound map unit SK-MC indicates that the Sikanni soils predominantly occur in the delineation but there are significant inclusions of the McConachie (MC) soils. The areal extent of the predominant and included soil is expressed by a percentage. The use of compound map units was necessary in the report area because of the broad scale of mapping. The map symbol SKb indicates that the Sikanni-slope phase soils predominantly occur in the delineation and that it differs from the Sikanni soils by occurring on strongly to very strongly sloping embankments.

Climate Capability for Agriculture

The agricultural climatic limitation is assessed using the meteorological data from the Atmospheric Environment Service stations at Prophet River, Sierra and Fort Nelson and Smith River airports. All of these stations are located outside the study area, but are the only representatives available. Table 5 lists some of the important meteorological data.

Using the meteorological data, the B.C. Ministry of Environment, Air Studies Branch (G. Cheesman, personal communication) has developed regression formulas relating growing degree days and freeze free period to elevational range. The formulas are (1) $y = 1750 - 1.294x$ where y = growing degree days and x = elevation and (2) $y = 172 - 0.053x$ where y = freeze free period and x = elevation.

Table 4. The Soils of the Fort Simpson Trail Area

Name	Symbol	Texture	Drainage	Soil Classification
Soils associated with calcareous, moderately fine- to fine-textured morainal materials				
Sikanni	SK	silt loam overlying clay loam	imperfectly	Gleyed Gray Luvisol
Klowee	KL	humic organic overlying clay loam	poorly	Rego Humic Gleysol
McConachie	MC	fibric organic overlying clay loam	very poorly	Terric Mesic Fibrisol, Terric Fibric Organic Cryosol
Pouce	PO	silt loam overlying very gravelly loam	well	Cumulic Regosol
Soils associated with calcareous, fine-textured glaciolacustrine materials				
Fort Nelson	FN	silt loam overlying clay	moderately well	Orthic Gray Luvisol
Simpson	SP	humic organic overlying clay	poorly	Orthic Humic Gleysol
Parker	PK	mesic organic overlying clay	very poorly	Terric Fibric Mesisol, Terric Fibric Organic Cryosol
Klua	KU	mesic organic	very poorly	Typic Mesisol, Mesic Organic Cryosol
Soils associated with calcareous, sandy eolian materials				
Trail	TR	sand, sandy loam or silt loam overlying sand or sandy loam	well	Eluviated Dystric Brunisol
Utahn	UT	humic organic overlying sand or sandy loam	poorly	Rego Gleysol
Donaldson	DD	sand, sandy loam or silt loam overlying sand or sandy loam	well	Orthic Gray Luvisol
Soils associated with calcareous, silty, sandy or gravelly fluvial materials				
Kiwigana	KA	sand overlying very gravelly sand	rapidly	Eluviated Dystric Brunisol
Prophet	PR	silt loam overlying loam	moderately well	Cumulic Regosol
Snake	SN	loam or silt loam overlying sand	moderately well	Cumulic Regosol
Recent Bars	b	sand and gravel	well	Orthic Regosol
Soils associated with non-calcareous, moderately fine- to fine-textured morainal and colluvial materials				
Chischa	CS	silt loam overlying clay loam	moderately well	Brunisolic Gray Luvisol
Tsinhia	TS	humic organic overlying clay loam	poorly	Rego Humic Gleysol
Odayin	OD	fibric organic overlying clay loam	very poorly	Terric Mesic Fibrisol, Terric Fibric Organic Cryosol
Klenteh	KH	loam overlying clay loam	moderately well	Brunisolic Gray Luvisol

Table 5. Climate Data for Selected Stations

Station	Elevation (m)	Growing Degree Days (°C)	Freeze Free Period (days)	May-Sept PET* (mm)	May-Sept PPT* (mm)	May-Sept Deficit (mm)
Fort Nelson A	375	1275	104	295	271	24
Prophet River	457	1140	94	-	-	-
Sierra	566	975	75	-	-	-
Smith River A	673	890	52	294	241	53

*PET - Potential Evapotranspiration

*PPT - Precipitation

Using the above regressions and the definitions of the Climate Capability for Agriculture classes, Table 6 was developed. Again, it must be stressed, that because of the lack of climate stations in the study area, the elevational range for each Climate Capability for Agriculture class is only approximate. The analyses of the data generated by the regression formulas indicate that the lack of growing degree days is the main limitation for determining the Climate for Capability for Agriculture classes.

Table 6. Climate Capability for Agriculture Classes Related to Elevation Ranges

Climatic Capability for Agriculture Classes	Elevation Range (metres)
Class 1	under 340
Class 2	340 - 450
Classes 3&4	450 - 555
Class 5	555 - 740
Classes 6&7	over 740

PART 3

3. SOIL DESCRIPTIONS

1. Soils associated with calcareous, moderately fine- to fine-textured morainal materials

These soils occur on the rolling, undulating and occasionally flat relief of the Fort Nelson Lowlands (Holland, 1964) and in the Boreal White Spruce Zone of the Boreal Forest Region (Walmsley and van Barneveld, 1977). Elevations generally range between 400 to 610 m above sea level except for the Etsho Plateau which has an upper elevation of 730 m. The basal till, from or over which the soils have developed, was deposited by glaciers that moved westward and south westward across the lowland. It has been predominantly derived from and laid on the Buckinghorse, Sully and Kotaneelee marine shales, Sikanni sandstones and Dunvegan conglomerates (Taylor and Stott, 1968a, 1968b). It is calcareous, contains from 2 to 10% gravel to stone size rocks (by volume) and has a clay loam or silty clay texture.

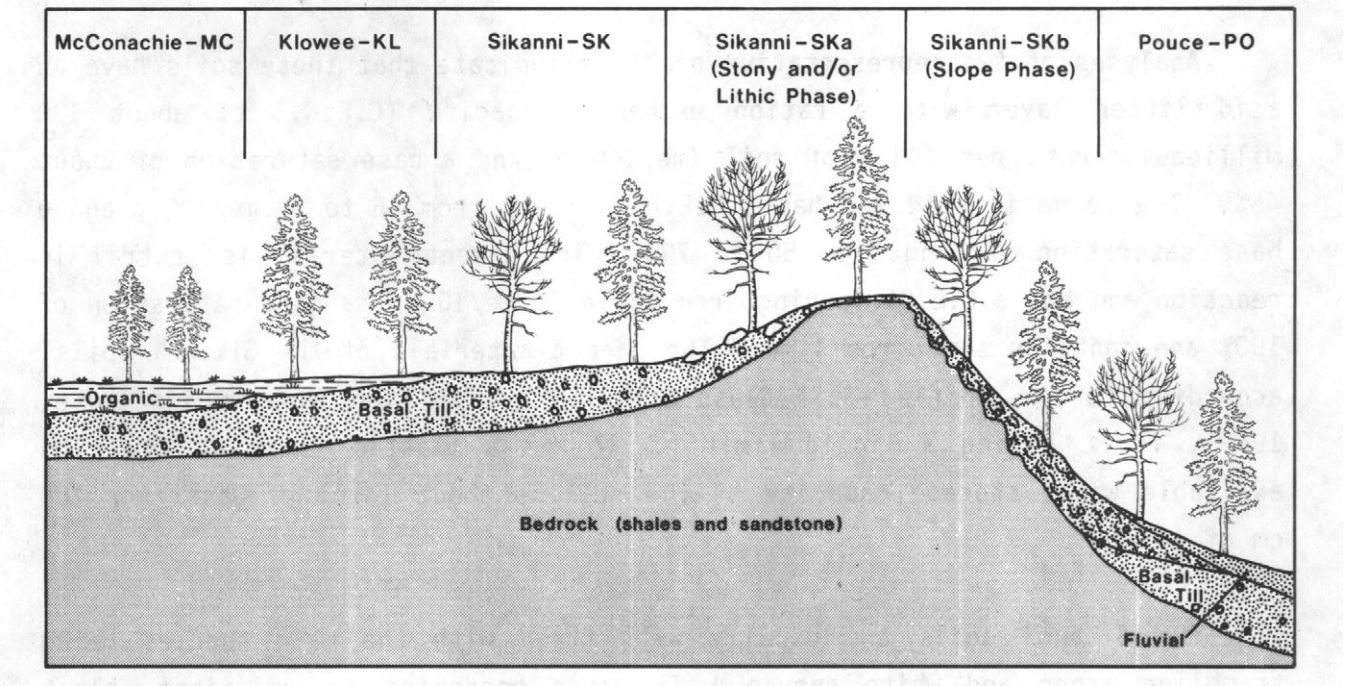

Figure 3. Soils associated with calcareous, moderately fine- to fine-textured morainal materials.

The soils found in this grouping are the well drained Pouce, the imperfectly drained Sikanni, the poorly drained Klowee and the very poorly drained McConachie soils. The relationship between these soils is depicted in Figure 3.

Sikanni Soils (SK)

The Sikanni soils occur on very gently and moderately sloping land. The solum, which varies from 38 to 78 cm in thickness, generally consists of a 5 to 18 cm thick litter layer and a 13 to 27 cm thick silt loam surface horizon underlain by a 20 to 33 cm thick silty clay horizon which overlies a clay loam or silty clay parent material. The soils are mostly imperfectly drained (the water remains perched above the clay enriched, illuvial Bt horizon for some parts of the year causing gleying in the lower portion of the light colored, eluvial Ae horizon) and are classified as Gleyed Gray Luvisols. In a few drier areas where the water perches for shorter periods, the soils are moderately well drained and are classified as Orthic Gray Luvisols.

Analyses of two representative profiles indicate that these soils have an acid litter layer with a cation exchange capacity (C.E.C.) of about 130 milliequivalents per 100 q of soil (me/100 q) and a base saturation of about 45%. The solum is acid and has a C.E.C. varying from 15 to 30 me/100 q and a base saturation varying from 50 to 70%. The parent material is neutral in reaction and has a C.E.C. varying from 13 to 20 me/100 q, a base saturation of 100% and contains some free lime. The parent materials of the Sikanni soils, according to the Unified Soil Classification System (The Asphalt Institute, 1969), is ML having a liquid limit of 37 and a plastic limit of 25. The available water storage capacity of the soil is about 17 cm of water per 100 cm of soil.

The Sikanni soils are usually well treed with the main species being trembling aspen and white spruce. In areas bordering on wet sites, black spruce may be found. Some areas also occur in which willow and Alaska paper birch form the main canopy.

Sikanni soils, delineated as single map units (SK), may include minor areas of poorly drained Klowee soils. Compound map units, dominantly containing Sikanni soils, include significant areas of very poorly drained, organic McConachie soils (SK-MC) or poorly drained Klowee soils (SK-KL) on gently sloping, flat or depressional topography or stony and/or lithic phase of the Sikanni soils (SK-SKa) on ridged or irregular topography.

The stony and/or lithic phase of the Sikanni soils is generally moderately well drained and classified as Orthic Gray Luvisols-stony and lithic phase. The stony phase occurs in an area along the road to the Fort Nelson River ferry and is difficult to identify from aerial photographs without ground inspection. The soils of this phase are moderately stony having large erratic stones up to 4 m in diameter scattered throughout the landscape. The lithic phase occurs on ridges where the Sikanni soils occur as a veneer (less than 1 m thick) overlying bedrock. Sikanni-stony and/or lithic phase soils occur as single map units (SKa).

A slope phase of the Sikanni soils is delineated along entrenched streams and escarpments. These soils are generally moderately well to well drained and are classified as Orthic Gray Luvisols-slope phase. In these areas, the topography is strongly to very strongly sloping. These areas are unstable and subject to slumping.

The Sikanni-slope phase soils occur as single map units (SKb). Compound map units, dominantly containing Sikanni-slope phase soils, include significant areas of very poorly drained, organic McConachie soils (SKb-MC) or fluvial Snake soils (SKb-SN) on gully topography in flat, fluvial bottomlands.

Klowee Soils (KL)

The Klowee soils occur on nearly level to very gently sloping land. The surface horizons consist of a 17 to 45 cm thick organic layer overlying a clay loam parent material. These soils are predominantly poorly drained and are classified as Rego Humic Gleysols.

The Klowee soils were not sampled but chemically and physically are expected to have an organic surface layer similar to that of the McConachie soils and a parent material similar to the Sikanni soils.

The Klowee soils are usually well treed with the main species being black spruce. Tamarack and alpine fir also occur in lesser numbers with the black spruce. Some areas, in which American green alder and Bebb's willow form the main canopy, are also found.

The Klowee soils occur as a single map unit (KL).

McConachie Soils (MC)

The McConachie soils occur on level to nearly level lands. The surface consists of a 10 to 42 cm thick fibric organic layer overlying a 28 cm plus mesic organic layer overlying a clay loam mineral soil. These soils are very poorly drained and are generally classified as Terric Mesic Fibrisols or Terric Humic Fibrisols.

Although frozen lenses were found in the organic material, they are not continuous. During the August field work frozen lenses, where present, occurred at about 50 cm below the surface. Usually the thick frozen lenses, which entered the mineral soil, were located under deeper accumulations of peat moss and thinned out to less than 5 cm thick where the peat moss accumulations were thin or absent. Laterally, the distance between the thick frozen lenses and very thin lenses or no frozen ground is as close as 1 to 2 m. Where there was a significant amount of frozen ground the soils are classified as Terric Fibric Organic Cryosols or Terric Mesic Organic Cryosols.

Analyses of two representative profiles indicate that these soils have an acid organic layer with a C.E.C. varying from 185 to 230 me/100 g and a base saturation varying from 10 to 50%.

The McConachie soils generally support relatively dense to quite open stands of stunted black spruce and tamarack. Some treeless areas also occur which are covered with shrubs such as leather leaf and common Labrador tea.

McConachie soils, delineated as a single map unit (MC), may include minor areas of poorly drained Klowee soils. Compound map units, dominantly containing McConachie soils, include significant areas of Sikanni soils (MC-SK) on gently hummocky or undulating topography or poorly drained Klowee soils (MC-KL) at the transition between the organic and mineral soils.

Pounce Soils (PO)

The Pouce soils occur on the fluvial fans at the foot of the Sikanni escarpment west of Fort Nelson and are of very limited extent. They occur on gently sloping land and have a silt loam surface horizon overlying a series of coarse-textured horizons containing varying amounts of shale and sandstone fragments. They are well drained and are classified as Orthic Regosols.

The Pouce soils were not sampled but some chemical data are available (Valentine, 1971).

The Pouce soils are well treed with the main species being trembling aspen and white spruce.

The Pouce soils occur as a single map unit (PO).

2. Soils associated with calcareous, fine-textured glaciolacustrine materials

These soils occur on the gently inclined, relatively flat relief of the Fort Nelson Lowlands in the Boreal White Spruce Zone of the Boreal Forest Region. Elevations generally range between 320 and 410 m. These soils have developed in or over what apparently are glaciolacustrine sediments. Compared to the surrounding basal till, these sediments have finer textures, lack stones or gravels, and occur on flatter, lower elevational areas. The glaciolacustrine sediments have been deposited mainly on the Buckinghorse marine shales and are predominantly calcareous and have a clay texture.

The soils found in this grouping are the moderately well and occasionally imperfectly drained Fort Nelson, the poorly drained Simpson and the very poorly drained Parker and Klua soils. The relationship between the soils is depicted in Figure 4.

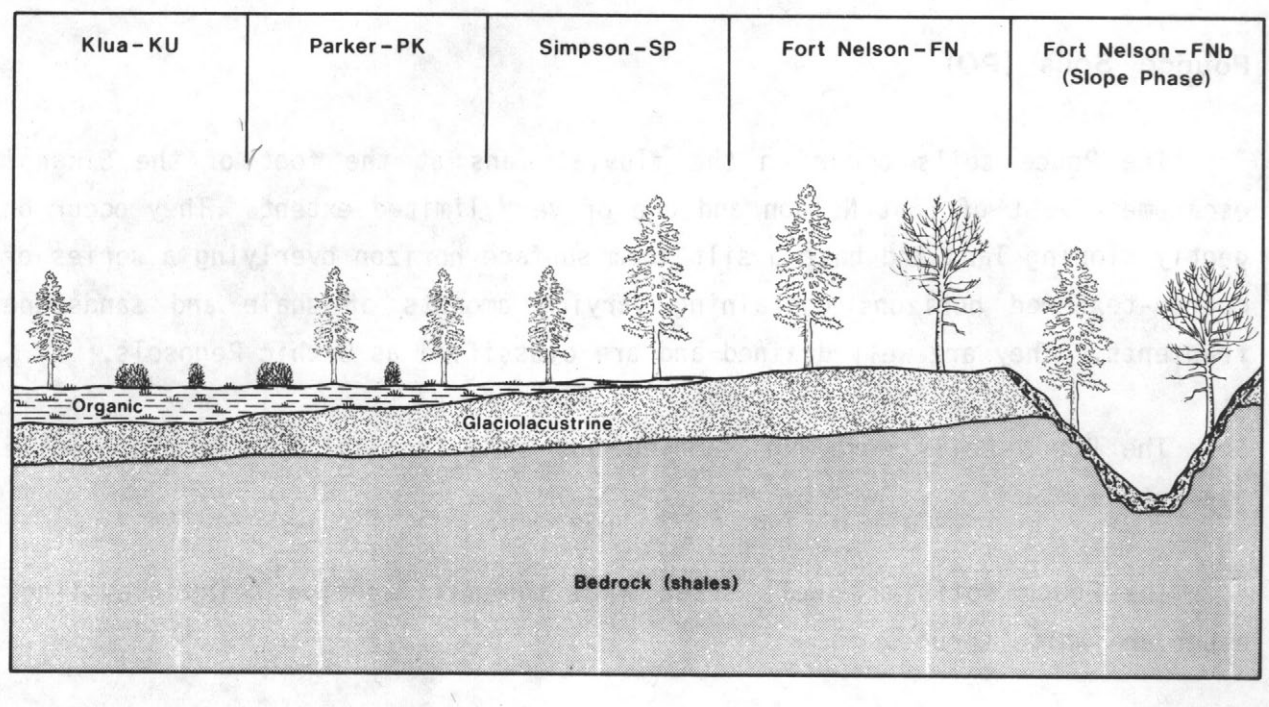

Figure 4. Soils associated with calcareous, fine-textured glaciolacustrine materials.

Fort Nelson Soils (FN)

The Fort Nelson soils occur on very gently sloping land. The solum, which varies from 45 to 90 cm in thickness, generally consists of a 10 to 17 cm thick litter layer and a 12 to 20 cm thick silt loam surface horizon underlain by a 33 to 53 cm thick clay horizon which overlies a clay parent material. These soils are predominantly moderately well drained but the soil water remains perched above the clay enriched, illuvial Bt horizon for some parts of the year causing weak gleying in the lower portion of the light coloured, eluvial Ae horizon. They are classified as Orthic Gray Luvisols. Some soils that are located in depressional areas, are imperfectly drained and classified as Gleyed Gray Luvisols.

Analyses of two representative profiles indicate that these soils have an acid litter layer with a C.E.C. of about 135 me/100 g and a base saturation of about 40%. The solum is acid with a C.E.C. varying from 8 to 40 me/100 g and a base saturation varying from 40 to 70%. The parent material has a neutral reaction, a C.E.C. of about 30 me/100 g, a base saturation of 100% and contains some free lime. The parent material of the Fort Nelson soil, according to the Unified Soil Classification System, is CH having a liquid limit of 66 and a plastic limit of 32. The available water storage capacity of the soil is about 16 cm of water per 100 cm of soil.

The Fort Nelson soils are usually well treed with the main species being trembling aspen and white spruce. In areas, bordering on wet sites, black spruce may be found.

Fort Nelson soils, delineated as a single map unit (FN), may include minor areas of the poorly drained Simpson soils.

A slope phase of the Fort Nelson soils was mapped in areas of stream entrenchment. These soils are generally moderately well to well drained and are classified as Orthic Gray Luvisol-slope phase. In these areas, the topography consists of strong to very strong slopes. These areas are unstable and subject to slumping. The Fort Nelson-slope phase soils occur as a single map unit (FNb).

Simpson Soils (SP)

The Simpson soils occur on nearly level to very gently sloping land. The surface horizons consist of a 20 to 45 cm thick organic layer overlying a clay parent material. These soils are predominantly poorly drained and are classified as Orthic Humic Gleysols.

The Simpson soils were not sampled but chemically and physically are expected to have organic surface layer similar to that of the Parker soils and a parent material similar to the Fort Nelson soils.

The Simpson soils are usually well treed with the main species being black spruce. Tamarack and alpine fir also occur in lesser numbers with the black spruce. Some areas are found in which American green alder and Bebb's willow form the main canopy.

The Simpson soils occur as a single map unit (SP).

Parker Soils (PK)

The Parker soils occur on level to nearly level lands. The surface consists of a 10 to 40 cm thick fibric organic layer overlying a 30 cm plus mesic organic layer overlying a clay mineral soil. These soils are very poorly drained and are predominantly classified as Terric Fibric Mesisols. As with the McConachie soils, there is a great variation in the thickness, extent and duration of the frozen lenses in the profile. Where permanently frozen lenses occur, these soils are classified as Terric Fibric Organic Cryosols or Terric Mesic Organic Cryosols.

Analyses of two representative profiles indicate that these soils have an acidic organic layer with a C.E.C. varying from 115 to 210 me/100 g and a base saturation varying from 5 to 25%.

The Parker soils generally support relatively dense or quite open stands of stunted black spruce and tamarack. Some treeless areas also occur which are covered with shrubs such as leather leaf and common Labrador tea.

Parker soils, delineated as a single map unit (PK), may include minor areas of the poorly drained Simpson soils. Compound map units, dominantly containing Parker soils, include significant areas of the mineral Fort Nelson soils (PK-FN) on gently undulating topography, the poorly drained Simpson soils (PK-SP) at the transition between the organic and mineral soils or the eolian Trail soils (PK-TR) on hummocky topography.

Klua Soils (KU)

The Klua soils occur on level to nearly level lands. These soils consist of deep organic accumulations over 160 cm thick and are very poorly drained.

As with the McConachie soils, there is a great variation in the degree of decomposition of the organic matter and in the thickness and extent of the frozen lenses in the profile. The Klua soils have been classified as Typic Mesisols, Fibric Organic Cryosols or Mesic Organic Cryosols.

The Klua soils were not sampled but chemically are expected to be similar to the Parker soils. Some chemical data is available (Valentine, 1971).

The Klua soils sometimes support quite open stands of black spruce and tamarack, but are more often treeless and covered with shrubs, mosses and herbs.

The Klua soils occur as a single map unit (KU). Compound map units, dominantly containing Klua soils, include significant areas of fluvial Snake soils (KU-SN) on the Fort Nelson River floodplain or poorly drained Utahn soils (KU-UT) in the transition area between the organic and mineral soils.

3. Soils associated with calcareous, sandy eolian materials

These soils occur on the rolling, undulating and flat relief of the Fort Nelson Lowlands and Alberta Plateau in the Boreal White Spruce Zone of the Boreal Forest Region. Elevations range from a low of 275 m on the Fort Nelson River and 380 m on the uplands bordering the Fort Nelson River to about 520 m on the Tsoo Tablelands. These soils have developed in what apparently are eolian sediments. They are sandy and occur on the embankments and on the uplands bordering the Fort Nelson River where there is some evidence of sand dunes. Generally the eolian deposits are the deepest on the lip of the embankment and become thinner away from the embankment. On the embankments themselves, which vary from about 75 to over 200 m in height above the rivers, the eolian deposits are variable in depth due to slumping and soil creep and are often intermixed with the deposits beneath them. The parent material is usually calcareous and has a sand texture.

The soils found in this grouping are the well drained Trail and Donaldson and the poorly drained Utahn soils. The relationship between the soils is depicted in Figure 5.

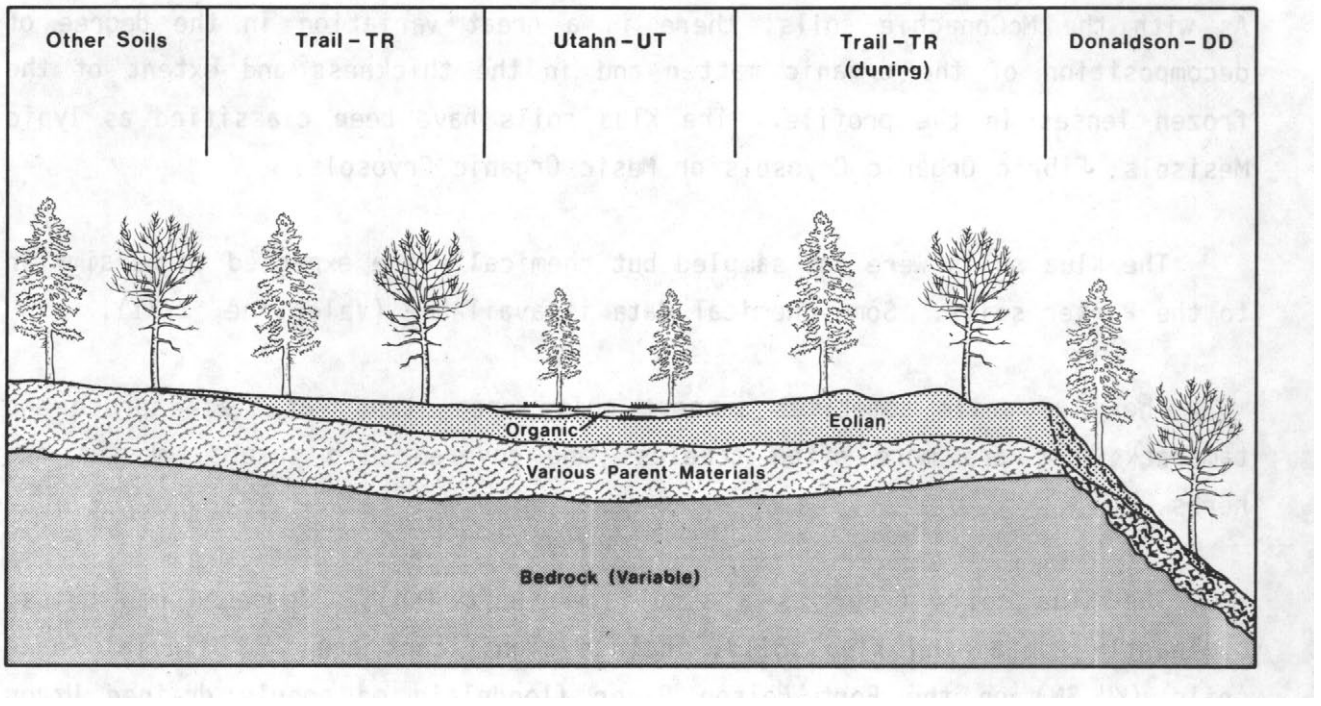

Figure 5. Soils associated with calcareous, sandy eolian materials.

Trail Soils (TR)

The Trail soils generally occur on very gently sloping land and, in places, where the wind has produced sand dunes with complex slopes, the topography is irregular. The solum, which varies from 53 to 77 cm in thickness, generally consists of a 6 to 15 cm thick litter layer and a 47 to 62 cm thick sand, sandy loam or silt loam surface horizon overlying a sand or sandy loam parent material. These soils are predominantly well drained and are classified as Eluviated Dystric Brunisols or Brunisolic Gray Luvisols on the finer textures.

Analyses of three representative profiles indicate that these soils have an acid litter layer with a C.E.C. of about 130 me/100 g and a base saturation of about 40%. The solum is acid with a C.E.C. varying from 3 to 10 me/100 g and a base saturation of about 65%. The parent material has a neutral reaction, a C.E.C. generally less than 10 me/100 g, a base saturation of usually 100% and contains some free lime. No physical analyses were done on these soils.

The Trail soils are usually well treed with the main species being trembling aspen and white spruce. In areas, bordering on wet sites, black spruce may be found.

Trail soils, delineated as a single map unit (TR), may include minor areas of poorly drained Utahn soils. One map delineation, just north of the Sahtaneh River, includes a fluvioglacial esker ridge. Compound map units, dominantly containing Trail soils, include significant areas of the organic McConachie soils (TR-MC) or the poorly drained Utahn soils (TR-UT) on gently undulating or flat topography.

Utahn Soils (UT)

The Utahn soils occur on nearly level to very gently sloping land. The surface horizons consist of a 5 to 25 cm thick organic layer overlying a sandy loam or sand parent material. These soils are predominantly poorly drained Rego Gleysols.

The Utahn soils were not sampled but chemically are expected to have an organic layer similar to that of the McConachie soils and a parent material similar to the Trail soils.

The Utahn soils are usually well treed with the main species being black spruce. Tamarack and alpine fir occur in lesser numbers with the black spruce. There are also minor areas in which American green alder and Bebb's willow form the main canopy.

The Utahn soils occur as a single map unit (UT).

Donaldson Soils (DD)

The Donaldson soils occur on moderately to very strongly sloping embankments flanking the Fort Nelson and Muskwa Rivers. Near the tops of the embankments, where the eolian deposits are deep and relatively stable, the solum generally consists of sand, sandy loam or silt loam surface horizons overlying a sand or sandy loam parent material. A textural variant of the

Donaldson soils occurs where the embankment slopes are unstable and soil creep and slumping occurs. In this situation, the underlying clay parent material of the Fort Nelson soils is mixed and churned into the solum. Also, along the base of the slopes the clay soils may completely dominate the profile and little or no sand is found. The Donaldson soils are predominantly well to moderately well drained and are classified as Orthic Gray Luvisols.

The Donaldson soils were not sampled but chemically are expected to have a solum and parent material similar to that of the Trail soils in sandy areas and Fort Nelson soils in clay areas.

The Donaldson soils are usually well treed with the main species being trembling aspen and white spruce.

The Donaldson soils occur as a single map unit (DD), except for one small portion of the Fort Nelson River embankment where there is one delineation of a compound map unit (DD-UT) which allows for an inclusion of a significant area of poorly drained Utahn soils.

4. Soils associated with calcareous, silty, sandy or gravelly fluvial materials

These soils occur in the valleys of the major rivers and creeks and have developed in the fluvial deposits of the Fort Nelson, Muskwa, Kiwigana and Sahtaneh Rivers and Kledo, Capot-Blanc, Akue and Steamboat Creeks. They occur in the Boreal White Spruce Zone of the Boreal Forest Region. Elevations range from a low of 255 m on the Fort Nelson River to a high of 625 m on Kledo Creek. The parent material is calcareous and has a silt loam or loam texture unless there are coarse fragments and then the texture is sandy.

The soils found in this grouping are the Kiwigana, Prophet and Snake soils and the Recent Bars land type. The relationship between the soils is depicted in the cross-section shown in Figure 6.

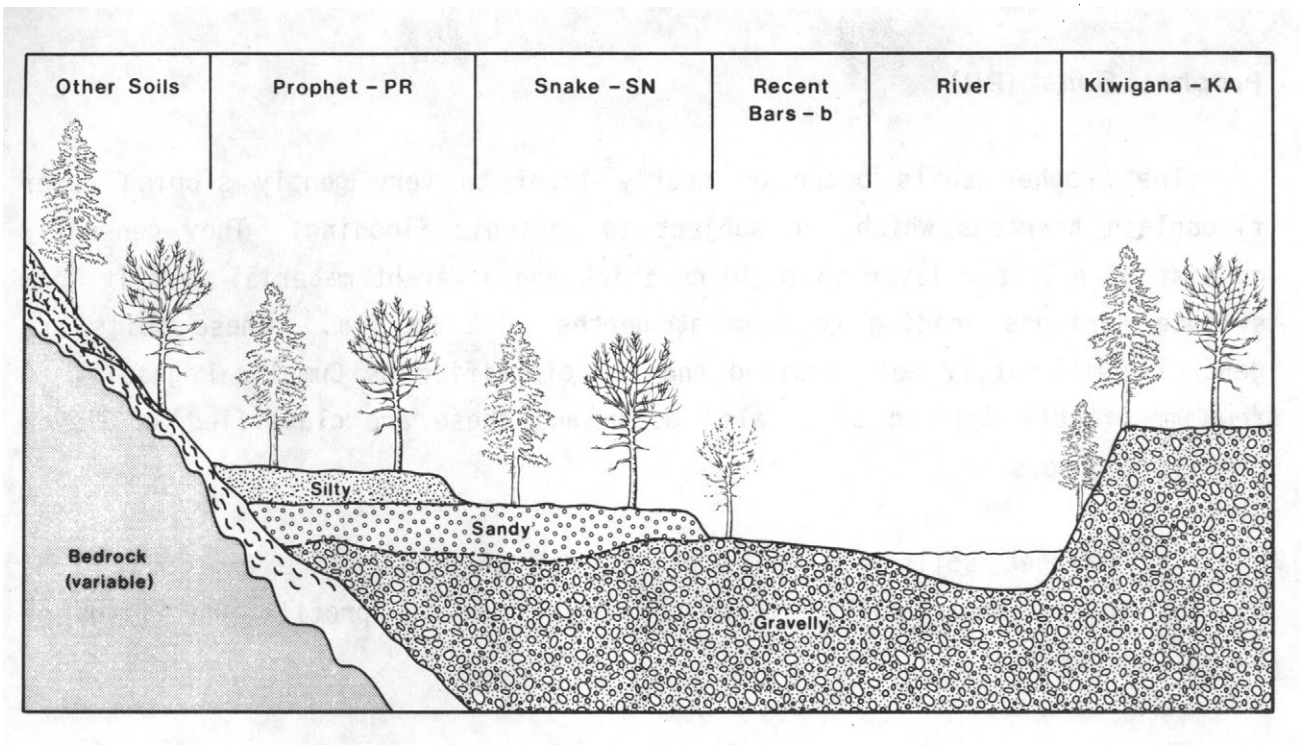

Figure 6. Soils associated with calcareous, silty, sandy or gravelly fluvial materials.

Kiwigana Soils (KA)

The Kiwigana soils occur on nearly level to very gently sloping fluvial terrace remnants and strongly sloping terrace embankments along the Fort Nelson River. They are located about 15 to 20 m above the river, are free from periodic flooding and are the only source of gravels in the report area. The solum generally consists of very gravelly loamy sand surface horizons overlying a very gravelly sand parent material. The solum may also consist of a sandy veneer overlying the very gravelly sand parent material. These soils are predominantly rapidly drained and are classified as Eluviated Dystric Brunisols.

The Kiwigana soils were not sampled but chemically are expected to be similar to the Trail soils.

The Kiwigana soils are usually well treed with the main species being jack pine, white spruce and trembling aspen.

The Kiwigana soils occur as a single map unit (KA).

Prophet Soils (PR)

The Prophet soils occur on nearly level to very gently sloping upper floodplain terraces which are subject to periodic flooding. They generally consist of a litter layer up to 10 cm thick and a parent material of silt loam surface horizons grading to loam at depths of 2 to 3 m. These soils are generally moderately well drained and are classified as Cumulic Regosols. A few imperfectly drained areas also occur and these are classified as Gleyed Cumulic Regosols.

The Prophet soils were not sampled but chemically are expected to be similar to the Snake soils. Chemical data from one profile are listed by Valentine (1971).

The Prophet soils are usually well treed with the main species being balsam poplar and white spruce.

The Prophet soils occur as a single map unit (PR) and as a compound map unit (PR-SN) which allows for inclusions of significant areas of the lower floodplain terrace Snake soils.

Snake Soils (SN)

The Snake soils occur on nearly level to very gently sloping lower floodplain terraces. The terraces have developed by successive depositions of stream sediments during the frequent flooding periods. These soils generally consist of a 1 to 10 cm thick litter layer and a parent material of coarse sandy loam to silt loam surface horizons grading to sands and occasionally gravels at depths greater than 5 m. These soils are generally moderately well drained and are classified as Cumulic Regosols.

Analyses of two representative profiles indicate that these soils have a neutral litter layer with a C.E.C. of about 130 me/100 g and a base saturation of about 45%. The parent material has a neutral reaction, a C.E.C. of about 9 to 13 me/100 g, a base saturation of 100% and contains some free lime. The parent material of the Snake soil, according to the Unified Soil

Classification System, is ML-SM and is non-plastic. The available water storage capacity of the soil is about 19 cm of water per 100 cm of soil.

The Snake soils are usually well treed with the main species being balsam poplar and white spruce.

The Snake soils occur as a single map unit (SN) and as compound map units (SN-PR and SN-SKb) which allows for inclusions of significant areas of the Prophet soils on the higher floodplain terraces and the Sikanni slope phase soils on the stream embankments.

Recent Bars (b)

Recent Bars are composed of the sand and gravel most recently deposited by the rivers and creeks and are subject to annual flooding. At their highest points they merge with lower floodplain terraces in which the Snake soils have developed. For the most part they are unvegetated. Only at their upper levels is vegetation established, usually scattered balsam poplar and willow.

This land type occurs as a single map unit (b).

5. Soils associated with non-calcareous, moderately fine- to fine-textured morainal and colluvial materials

These soils occur on the rolling and undulating relief of the Alberta Plateau and the steep escarpments leading from the Alberta Plateau to the Fort Nelson Lowlands. They are in the upper elevational range of the Boreal White Spruce Zone of the Boreal Forest Region. Elevations generally range between 490 to 1040 m on the Alberta Plateau, but extend down to 380 m at the base of the escarpment. The soils of the Plateau area have developed from basal till derived predominantly from the Kotaneelee and Sully marine shales, Sikanni sandstones and Dunvegan conglomerates. The soils of the escarpment have developed from colluvium of the same bedrock types. All the parent materials are non-calcareous in the upper 2 m, contain a variable amount of gravel to stone size rocks and have a silty clay or clay loam texture.

The soils found in this grouping are the moderately well drained Chischa, poorly drained Tsinhia, very poorly drained Odayin and well to moderately well drained Klenteh soils. The relationship between the soils is depicted in Figure 7.

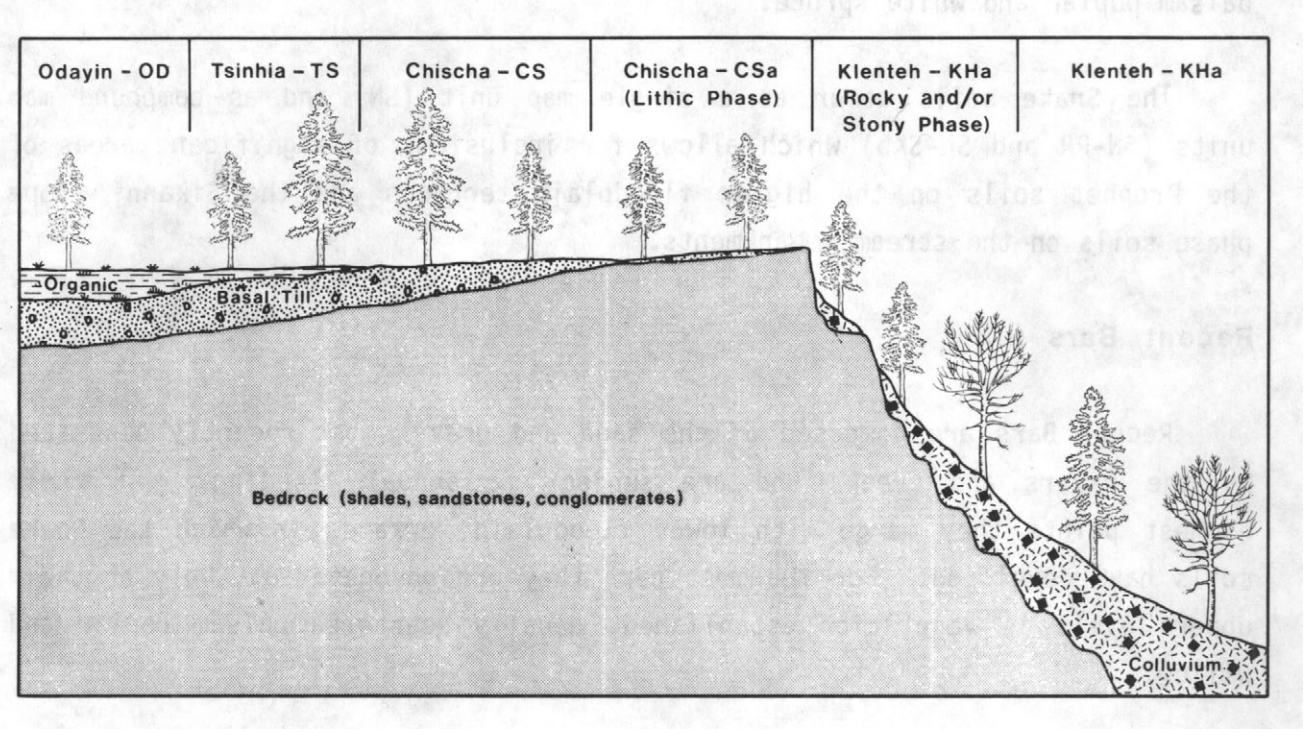

Figure 7. Soils associated with non-calcareous, moderately fine- to fine-textured morainal and colluvial materials.

Chischa Soils (CS)

The Chischa soils occur on very gently to moderately sloping land. The solum, which varies from 33 to 67 cm in thickness, generally consists of a 5 to 18 cm thick litter layer and a 13 to 24 cm thick silt loam surface horizon underlain by a 15 to 25 cm thick clay loam horizon which overlies a clay loam parent material in areas where the soil is deep. These soils are predominantly moderately well drained and are classified as Brunisolic Gray Luvisols.

Analyses of two representative profiles indicate that these soils have a acid litter layer with a C.E.C. of about 60 me/100 g and a base saturation of

about 25%. The solum is acid and has a C.E.C. varying from 11 to 25 me/100 g and a base saturation of about 6%. The acid parent material has a C.E.C. of about 14 me/100 g and a base saturation of about 6%. No physical analyses were done on these soils except for the available water storage capacity, which is about 14 cm of water per 100 cm of soil.

The Chischa soils are usually well treed with the main species being lodgepole pine, alpine fir and white spruce.

Chischa soils, delineated as a single map unit (CS), may include minor areas of poorly drained Tsinhia soils. Compound map units, dominantly containing Chischa soils, include significant areas of Chischa-lithic phase soils (CS-CSa) near the escarpments or very poorly drained, organic Odayin soils (CS-OD) on flatter or depressional topography.

The lithic phase of the Chischa soils is located near the escarpments and occurs as a veneer over bedrock. These soils have a solum which is usually composed of clay loam, silt loam or loam windblown deposits. The parent material is generally clay loam, loam or sandy loam depending on the type of bedrock from which it was derived, (shales, sandstones or conglomerate). These soils are well to moderately well drained and are classified as Brunisolic Gray Luvisols-lithic phase.

The Chischa-lithic phase soils occur as a single map unit (CSa) and as a compound map unit (CSa-CS) which allows for inclusion of significant areas of the Chischa soils.

Tsinhia Soils (TS)

The Tsinhia soils occur on nearly level to gently sloping land. The surface horizons consist of a 17 to 45 cm thick organic layer overlying a clay loam parent material. These soils are predominantly poorly drained and are classified as Rego Humic Gleysols.

The Tsinhia soils were not sampled but chemically are expected to have an organic layer similar to the McConachie soils and a parent material similar to the Chischa soils.

The Tsinhia soils are usually well treed with the main species being black spruce. Tamarack and alpine fir also occur in lesser numbers with the black spruce. These soils may occasionally be treeless and covered with shrubs.

The Tsinhia soils occur as a single map unit (TS).

Odayin Soils (OD)

The Odayin soils occur on level to nearly level lands. The surface consists of a 10 to 40 cm thick fibric organic layer overlying a 30 cm plus mesic organic layer overlying a clay loam mineral soil. These soils are very poorly drained and are classified as Terric Mesic Fibrisols or Terric Humic Fibrisols. As with the McConachie soils, there is a great variation in the thickness, extent and duration of the frozen lenses in the profile. Where the permanently frozen lenses occur, these soils are classified as Terric Fibric Organic Cryosols or Terric Mesic Organic Cryosols.

The Odayin soils were not sampled but chemically are expected to be similar to the McConachie soils.

The Odayin soils may be covered with relatively dense or quite open stands of stunted black spruce and tamarack trees. These soils may also be treeless and covered with shrubs.

Odayin soils, when delineated as a single map unit (OD), may include minor areas of the poorly drained Tsinhia soils. Compound map units, dominantly containing Odayin soils, include significant areas of the mineral Chischa soils (OD-CS) on the flatter plateau areas or the Klenteh soils (OD-KH) on the benches within the escarpment.

Klenteh Soils (KH)

The Klenteh soils occur on strongly to steeply sloping escarpments. At the top of the escarpment there is usually an exposed bedrock cliff. Immediately below the cliff, are rubbly materials that have fallen from above.

At the base of the escarpment the materials are usually either colluvial or fluvial. The solum, which varies from 45 to 109 cm in thickness, generally consists of a 2 to 24 cm thick litter layer and a 18 to 45 cm thick loam surface horizon underlain by a 25 to 40 cm thick silty clay loam horizon which overlies a silty clay loam or clay loam colluvial parent material containing between 10 to 20% gravel to stone size rocks (by volume). The Klenteh soils developed in fluvial fan materials generally have a loam solum and parent material with up to 60% coarse fragments. These soils are predominantly moderately well drained and are classified as Brunisolic Gray Luvisols in stable areas and Orthic Gray Luvisols in unstable areas.

Analyses of two representative profiles indicate that these soils have an acid litter layer with a C.E.C. of about 110 to 120 me/100 g and a base saturation of about 20 to 40%. The solum is acid and has a C.E.C. varying from 11 to 30 me/100 g and a base saturation varying from 5 to 55%. The parent material is acid and has a C.E.C. varying from 13 to 28 me/100 g and a base saturation varying from 16 to 55%. The parent material of the Klenteh soil, according to the Unified Soil Classification System, varies from ML to ML-CL having a liquid limit varying between 25 and 37 and a plastic limit varying between 19 and 25. The available water storage capacity of the soil is about 9 cm of water per 100 cm of soil.

The Klenteh soils are usually well treed with the main species being white spruce and trembling aspen. In areas, bordering on wet sites, black spruce may be found.

The Klenteh soils occur as a single map unit (KH). They also occur as compound map units which allow for inclusions of significant areas of the Klenteh-rocky and/or stony phase soils (KH-KHa) on the steeply sloping, upper portion of the escarpment; the organic Odayin soils (KH-OD) on the benches within the escarpment; or the fluvial Snake soils (KH-SN) in areas of stream entrenchment.

A rocky and/or stony phase of the Klenteh soils is found immediately below the bedrock cliffs and is very to exceedingly stony having large blocks of rock covering the landscape. These soils are unstable and subject to

slumping. They are generally well drained and are classified as Orthic Gray Luvisol-rocky or stony phase or Orthic Dystric Brunisol-rocky or stony phase. They are usually treed with lodgepole pine and white spruce.

The Klenteh-rocky and/or stony phase soils occur as a single map unit (KHa) or as a compound map unit (KHa-CSa) which allows for inclusions of significant areas of the Chischa-lithic phase soils along the ridge tops and steeply sloping hillsides.

PART 4

4. SOIL INTERPRETATIONS FOR AGRICULTURE AND FORESTRY

Soils and Agriculture Capability

The soils of the report area are rated according to their capability to produce cultivated field or forage crops. The method used for determing the soil capability for agriculture is outlined by Runka (1973), The Canada Land Inventory (1965) and British Columbia, Climatology Division (1978). In the soil capability for agriculture classification, the mineral and organic soils are grouped into seven classes. The organic soils are differentiated from the mineral soils by placing an "O" before the class numeral. The soil capability for agriculture Class 1, 2 and 3 are considered capable of sustained use for field crops. Whereas class 4 is marginal for sustained arable agriculture, Class 5 is capable of use only for permanent pasture and hay and Class 6 is capable of use only for native pasture. Class 7 is not capable of supporting any form of agriculture.

Land requiring improvements that can be made by the individual farmer is classified according to its continuing limitations after the improvements have been made. Forested lands are rated as if cleared. Flat lying, poorly drained areas, where it would not be feasible for an individual farmer to drain the land effectively, are rated in their present condition. The study area, which is located in the Boreal White Spruce Forest Zone, is generally considered incapable of sustaining native grazing. Therefore, areas that may have been classified as Class 6 are now mapped as Class 7. A feature of the study area, which the present climate capability for agriculture classified does not consider, is the response of crops to the longer hours of daylight during the growing season or the types of crops best suited to this phenomenon. There are also lowlying areas where cold air tends to pool, resulting in shorter freeze free periods and possibly lower climate capabilities for agriculture. Due to the lack of climate data, it is not possible to delineate these areas.

The distance to markets, presence of roads, location, size of farms, type of ownership, cultural patterns and the skill or resources of individual operators are not criteria used in this classification.

The soil capability for agriculture ratings for each soil are listed in Table 7. Soils, which occur in only one climate capability for agriculture class, have the soil capability for agriculture rating listed under only that climate class. Soils, which extend beyond one climate class, have the soil capability ratings for that soil listed in each climate class. For example, the Chischa soil, which ranges from 380 to 1100 m, has a soil capability rating of 4DT in the climate Class 2, 5D in climate Classes 3 and 4 and 7TC in climate Classes 5 and 7.

Soils and Forestry Capability

The study area covers parts of the Fort Nelson, Liard and Kotcho Public Sustained Yield Units. The land capability for forestry classification identifies the productivity of an individual soil to produce wood fibre. The classes were determined on forest plots and by use of the British Columbia Ministry of Forests inventory data and forest cover maps. The methodology of locating and measuring productivity plots, and assessing the capability of the soils is described by Thibodeau (1973) and Kowall (1971). The mapping of the Land Capability for Forestry follows the Canada Land Inventory procedure outlined by McCormack (1970a, 1970b).

Each soil is rated in one of seven classes according to its inherent ability to grow trees. Capability class limits are based on a mean annual increment range expressed in cubic metres per hectare per year. Also indicated are the physical limitations (capability subclasses) of the soil which affect tree growth and the tree species suitable for growing on the soil. The forest capability ratings for each soil are shown in Table 8.

White spruce is the species of highest present and potential commercial value in the area. However, in terms of present areal extent, trembling aspen is by far the most abundant species on these soils. Forest fires have been relatively common in the past and the scarcity of white spruce is probably due to faster regeneration of trembling aspen after these fires. It is noticeable that fires have occurred on the Donaldson soils of the valley slopes, but appear not to have reached the alluvial Prophet or Snake soils of the floodplains. White spruce occurs consistently only on the Prophet soils.

Table 7. Soil Capability for Agriculture Ratings by Soils and Climate Classes

Soil	Symbol	Climate Capability for Agriculture Classes (elevation in metres)				
		Class 1 (<340)	Class 2 (340-450)	Classes 3&4 (450-555)	Class 5 (555-740)	Classes 6&7 (>740)
Recent Bars	b	7I				
Snake	SN	4MI	5IW,5IM	5IM,5IW		
Prophet	PR	3MI				
Kiwigana	KA	3M,4MP				
Donaldson	DD	7TE	7TE			
Trail	TR		3M,4M			
Utahn	UT		7W,5W	7W	7W	
Fort Nelson	FN		4D			
Fort Nelson-slope phase	FNb		7TE			
Simpson	SP		5WD,7W			
Parker	PK		07W			
Klua	KU	07W	07W			
Sikanni	SK		4D	5D,5TD	5D,5DT,5C	
Sikanni-stony/lithic phase	SKa			7TR	7TR,7TC	
Sikanni-slope phase	SKb		7TE	7TE	7TE	
Klowie	KL		5WD,7W	7W,5WD	7W	
McConachie	MC		07W	07W	07W	
Pouce	PO		5M			
Klenteh	KH		7TE	7TP,5T	7TP,5C	7TP
Klenteh-stony phase	KHa		7TR	7TR	7TR,7R	7R,7TR
Chischa	CS		4DT	5D	7TC	7TC
Chischa-lithic phase	CSa				7TR	7TR
Tsinhia	TS		7W	7W	7W	7W
Odayin	OD			07W	07W	07W

Subclasses:
- C adverse climate
- D undesirable soil structure and/or low permeability
- E erosion
- I inundation by streams
- M moisture limitation
- P stoniness
- R consolidated bedrock
- T topography
- W excess water

Forest management practices should be concentrated on those soils with ratings of Class 1 to Class 4. These moderately well and imperfectly drained soils are productive enough to warrant continued intensive management, such as planting and scarifying after logging to ensure the regeneration of white spruce. To further enhance the production of white spruce, fire protection should continue to be applied to the area as a whole.

The level or gently undulating land of much of the area lends itself to mechanical harvesting methods. The problems of trafficability on the wet, silty and clayey soils can be overcome by harvesting during the winter months when the ground is frozen.

Table 8. Land Capability for Forestry Ratings by Soils

Soil	Capability Class	Capability Subclass	Tree Species Indicators
Chischa	4,3	D	white spruce, lodgepole pine
Chischa, lithic phase	5	R,M	lodgepole pine, white spruce
Donaldson	3,4	D,M	white spruce, trembling aspen
Fort Nelson	3	D	white spruce, trembling aspen
Fort Nelson, slope phase	4,5	D,E	white spruce, trembling aspen
Kiwigana	3,4,5	S,M	white spruce, trembling aspen, jack pine
Klenteh	3	D	white spruce, trembling aspen
Klenteh, stony phase	4,5	P,E	white spruce, trembling aspen
Klenteh, rocky phase	6,5	R,M	lodgepole pine, white spruce
Klowee	7,6,5	W,H	black spruce, white spruce
Klua	7	W,H	black spruce
McConachie	7	W,H	black spruce
Odayin	7	W,H	black spruce
Parker	7	W,H	black spruce
Pouce	5	M	white spruce, trembling aspen
Prophet	3,2	I,M	white spruce, balsam poplar
Sikanni	3,4	D	white spruce, trembling aspen
Sikanni, slope phase	4,5	D,E	white spruce, trembling aspen
Sikanni, lithic phase	5	R,M	white spruce, trembling aspen
Snake	3,4,5	I,M,W	white spruce, balsam poplar
Simpson	7,5	W,H	black spruce, white spruce
Trail	3,4	S,M	white spruce, trembling aspen
Tsinhia	7,5	W,H	black spruce, white spruce
Utahn	7,5	W,H	black spruce, white spruce

Capability Classes

Class	Cubic metres per hectare per year
1	7.8 - 9.1
2	6.4 - 7.7
3	5.0 - 6.3
4	3.6 - 4.9
5	2.2 - 3.5
6	0.8 - 2.1
7	0.0 - 0.7

Capability Subclasses (Limitations)

- D - rooting depth restricted by dense or compacted soil
- E - actively eroding and slumping embankments
- H - cold soil temperature - temporary permafrost
- I - periodic inundation by streams
- M - soil moisture deficiency
- P - stoniness which affects forest density or growth
- R - rooting depth restricted by bedrock
- S - combination of soil factors, none of which by themselves are significantly limiting
- W - soil moisture excess

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APPENDIX

APPENDIX: LIST OF SPECIES USED IN CHARACTERIZING THE VEGETATION UNITS

	Common Name	Botanical Name
Trees	Alaska paper birch	Betula neoalaskana
	alpine fir	Abies lasiocarpa
	balsam poplar	Populus balsamifera
	black spruce	Picea mariana
	jack pine	Pinus banksiana
	lodgepole pine	Pinus contorta
	tamarack	Larix laricina
	trembling aspen	Populus tremuloides
	white spruce	Picea glauca
Shrubs	American green alder	Alnus viridis
	Bebb's willow	Salix bebbiana
	black blueberry	Vaccinium membranaceum
	bog blueberry	Vaccinium uliginosum
	common Labrador tea	Ledum groenlandicum
	common red osier dogwood	Cornus sericea
	high bush cranberry	Viburnum edule
	leather leaf	Chamaedaphne calyculata
	soopolallie	Shepherdia canadensis
	velvet leaved blueberry	Vaccinium myrtilloides
Herbs	black crowberry	Empetrum nigrum
	Canadian bunchberry	Cornus canadensis
	cloudberry	Rubus chamaemorus
	cotton grass	Eriophorum spp.
	ground cedar	Lycopodium complanatum
	meadow horsetail	Equisetum pratense
	mountain cranberry	Vaccinium vitis-idaea
	northern twinflower	Linnaea borealis
	pink pyrola	Pyrola asarifolia
	wood horsetail	Equisetum sylvaticum
Mosses	common moss	Pleurozium schreberi
	feather moss	Ptillium crista-castrensis
	layered moss	Hylocomium splendens
	peat mosses	Sphagnum spp.
Lichens	fruiticose lichens	Cladonia spp.