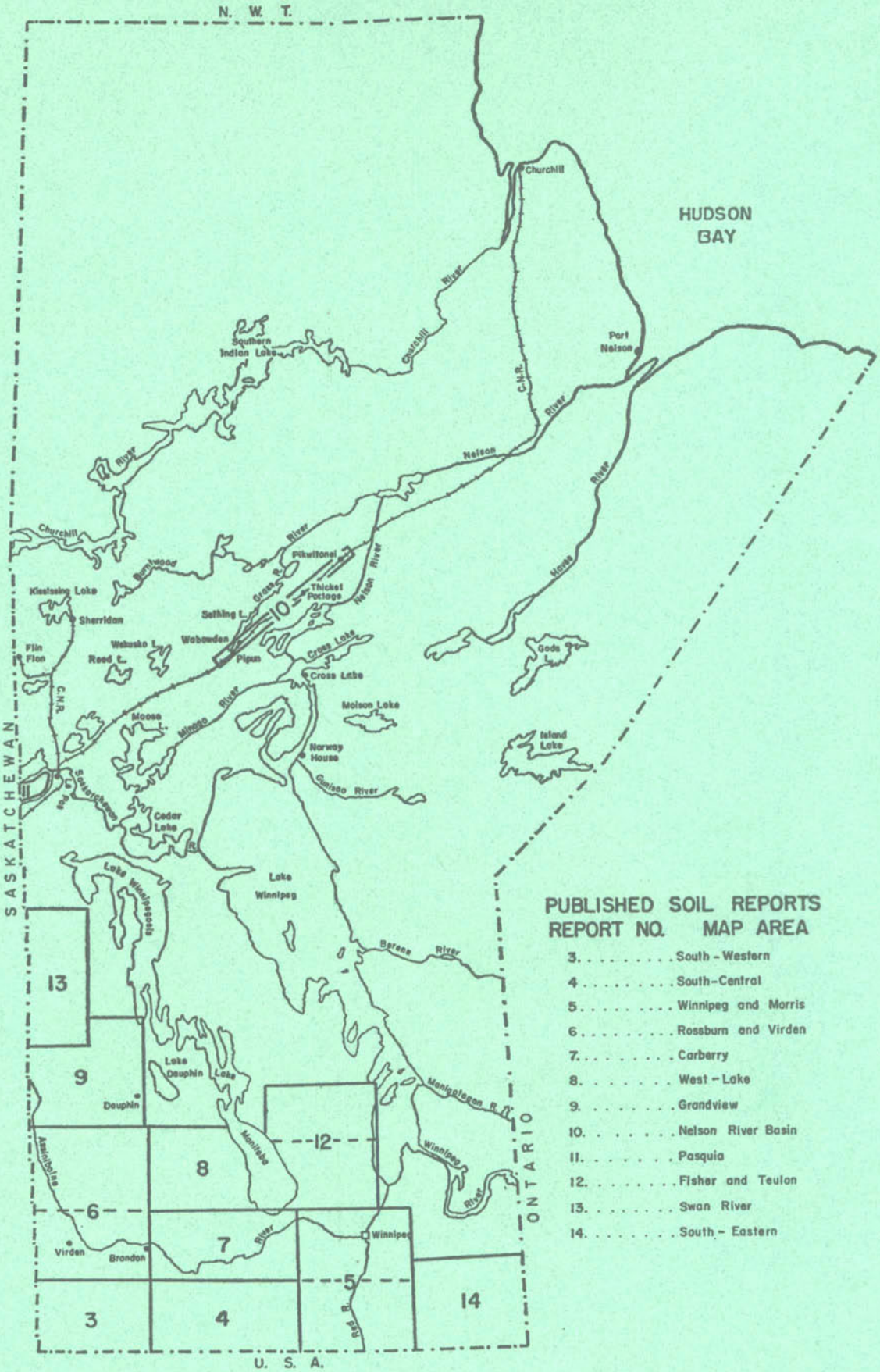
SOIL SURVEY

of the

SOUTH-EASTERN MAP SHEET AREA

SOILS REPORT No. 14

1964



PUBLISHED SOIL REPORTS

REPORT NO.	MAP AREA
3.	South - Western
4.	South-Central
5.	Winnipeg and Morris
6.	Rossburn and Virden
7.	Carberry
8.	West - Lake
9.	Grandview
10.	Nelson River Basin
11.	Pasquia
12.	Fisher and Teulon
13.	Swan River
14.	South - Eastern

FIGURE 1

Report of the
SOIL SURVEY
of the
SOUTH-EASTERN MAP SHEET AREA

by

R. E. SMITH and W. A. EHRLICH

with a Section on Forestry

by

J. S. JAMESON and J. H. CAYFORD
Department of Forestry of Canada

With a Soil Map covering Townships 1 to 9 and Ranges 9E to 17E exclusive of the Whiteshell Forest Reserve in Township 9, Ranges 14E to 17E.

MANITOBA SOIL SURVEY

CANADA DEPARTMENT *of* AGRICULTURE
MANITOBA DEPARTMENT *of* AGRICULTURE AND CONSERVATION
LANDS BRANCH, MANITOBA DEPARTMENT *of* MINES AND NATURAL RESOURCES,
AND
DEPARTMENT OF SOIL SCIENCE, THE UNIVERSITY OF MANITOBA.

Report published by the Manitoba Department of Agriculture and Conservation.
Map published by Canada Department of Agriculture.

Preface

THE REPORT OF THE SOIL SURVEY of the South-Eastern Map Area is the fourteenth of a series of reports devoted to the description of the soils of Manitoba as determined through the work of the Manitoba Soil Survey. The object of the survey was to obtain the facts about the soils of the area—their kind, distribution, agricultural and forestry features. The publication consists of two parts; a coloured map and a report.

In the survey of the South-Eastern area, various kinds of soil separations were made in different portions of the area. Soil series and phases of series were mapped wherever the scale of mapping permitted. These were used mainly within the flat, smooth lacustrine basins with soils that are uniform over relatively large areas. However, in most of the map area various soil series occurred in intricate pattern and in such small areas that they could not be shown separately on the map. Here the map units are mostly complexes of two or more series that occur within the outlined area. Soil associations which have been the common mapping unit in previously surveyed areas in Manitoba are used in the micro-duned areas surrounding the sandy Bedford Hills.

The soil map indicates the distribution and area of the soil series, phases and complexes. It is published at the scale of one inch equals two miles. Township and Range numbers are shown along the margin of the map. Soil series, phases and complexes are identified by colour and letter designations. Complexes are coloured the same as one of the included series, usually the dominant member. A key to colour and letter designation appears in the descriptive legend along the side of the map.

The report presents descriptions and data on the cultural and physical features of the map area and the formation, character, capabilities and limitations of the soils. The report is divided into five parts. Part I describes the location and extent of the area, the population distribution and the transportation facilities. Part II describes the physical features, including relief, drainage, geology, climate and vegetation. Part III presents a key to the soils of the area, describes the general soil areas and gives a detailed description of the physical, morphological and agronomic features of each series. Part IV presents a grouping of soils into agricultural land-use capability classes, sub-classes and units, a table indicating the suitability of each soil for regional crops and outlines the history of settlement and present agricultural land use. Part V, prepared by the Department of Forestry of Canada, deals with the forestry features of the different soils. This portion of the report provides the reader with a general knowledge of forest conditions and history, as well as estimated productivity and reproduction practices for the soils in the South-Eastern Map Area. A grouping of soils into forest land-use capability classes, sub-classes and units is also presented.

Acknowledgements

THE REPORT OF THE SOIL SURVEY of the South-Eastern Map Area was conducted as a joint project of the Canada Department of Agriculture; The Manitoba Department of Agriculture and Conservation; the Lands Branch, Manitoba Department of Mines and Natural Resources; and the Department of Soil Science, The University of Manitoba.

Acknowledgement is made to Dr. A. Leahey, Canada Department of Agriculture, and Dr. R. A. Hedlin, Department of Soil Science, The University of Manitoba, for their critical review of the report.

The soils were mapped by L. E. Pratt, J. A. Barr, R. E. Smith, G. S. Emmond, W. E. Janke, and H. Smallwood under the direction of Dr. W. A. Ehrlich. Those assisting in the field work were: D. Ashton, G. F. Mills, J. Manns, J. Lovering and G. Raymer. Miss S. Cunningham and Mrs. H. Gallagher assisted in the recording of the field and laboratory data and in the preparation of the report.

Grateful acknowledgement is also made to C. C. Thomson, District Forest Officer, J. S. Jameson and J. H. Cayford, Research Officers, Department of Forestry of Canada, Winnipeg, for the preparation of the section on forestry.

The final drafting and printing of the map was undertaken by the Research Branch, Canada Department of Agriculture, and the printing of the report was undertaken by the Manitoba Department of Agriculture and Conservation.

Summary

THE REPORT OF THE SOIL SURVEY of the South-Eastern Map Area covers approximately 2,926 square miles (1,872,597 acres) in the south-eastern corner of Manitoba. This district comprises the portion of the Manitoba Lowlands which lies between the Red River Plain and the Lake of the Woods and is known locally as the South-Eastern Lowlands. This area is dominated by a sandy upland which rises to 1,300 feet above sea level. This water and wind modified glacial drift plain or plateau slopes abruptly to the west, east and south. North-east of the plateau a broad, flat, peat-covered area slopes gently from 1,100 to 900 feet above sea level at the northern margin of the map area; an average drop of 5.5 feet per mile. The huge swampy area gives way in the north-eastern part of the map area to the rugged, rocky terrain of the Precambrian Shield. This part of the Shield has a local relief of 50 to 150 feet and a general elevation of 1,000 to 1,150 feet above sea level. The climate is subhumid with a definite summer maximum of precipitation (mean annual precipitation ranges from 20 to 22 inches). Surface and internal soil drainage is rapid in the sandy uplands and very slow in the swampy, peat-covered lowlands. Forest growth forms the dominant vegetative cover of the area, and consists largely of black spruce, aspen, jack pine, tamarack with minor amounts of cedar, white spruce, balsam poplar, balsam fir, white birch, red pine, white pine, ash and elm. (Table 46).

The mapped area can be divided into a number of regions on the basis of physical features and agricultural value. The most extensive region is the vast tract of Organic Soils in the lowlands that surround the Bedford Hills-Whitemouth Lake Plateau. These soils are very poorly drained and are only marginally suitable for tree growth. A second region is the sandy morainic upland called the Bedford Hills. Here the sandy soils, consisting of Podzol and Grey Wooded types, are tree covered and are neither suited to arable culture nor naturally suited for pasture land. A third region is the rocky, lake terrain of the Precambrian Shield. This region consists of 75 percent or more of rock outcrop associated with small areas of Podzolic, Gleysolic and Organic soils and its best use is for wildlife, recreation and forestry. Approximately 10 percent of the map area, mainly in the vicinity of St. Labre, Whitemouth Lake, Sirko, South Junction and Sprague districts, is comprised of a relatively smooth, variably stony, water-worked till that is well suited for forage crops but marginal for other cultivated types. Here the Grey Wooded soils are thin, have variable surface textures and are not naturally fertile. The remainder of the map area consists of smooth, lacustrine and alluvial soils, ranging in texture from loamy sand to clay, and are suitable for a range of regionally adapted crops. The soils in this region, located mainly along rivers and streams, are imperfectly to poorly drained, moderately fertile, Dark Grey and Humic Gleysol soils.

Eighty-five percent of the South-Eastern map area is Crown land best suited for forestry, wildlife and recreation; the remainder is alienated land, mainly used for agriculture. Less than one percent of the map area is cultivated or improved land. Most of this cultivated land occurs in narrow bands along the Whitemouth, Birch, Boggy and Sprague rivers and Pine Creek. These lands are utilized mainly for the production of grass and legume forage. The grain grown in the scattered areas of cultivated land is principally oats for livestock feed. While farmers depend mainly on livestock, dairying and poultry production for their livelihood most herds and flocks are small. The carrying capacity of livestock on pasture in the wooded land is low and very little pasture improvement has been attempted.

Contents

Contents—Continued

Table No.

List of Tables

Page

List of Illustrations

List of Illustrations—Continued

Report of the

SOIL SURVEY

of the

SOUTH-EASTERN MAP SHEET AREA

PART I

GENERAL DESCRIPTION OF AREA

A. LOCATION AND EXTENT

The South-Eastern map area lies in the forested south-eastern portion of the Manitoba Lowlands between the Red River Valley and the Lake of the Woods. The location of the area with respect to other published soil map areas is shown in Figure 1. The South-Eastern map includes Townships 1 to 9 in Ranges 9 to 17 east of the Principal Meridian and covers approximately 2,926 square miles (1,872,597 acres). The map includes: the Local Government Districts of Piney and Reynolds; a portion of the Local Government District of Stuartburn; and Unorganized Territory (see Figure 2).

B. POPULATION

According to the 1961 Canada census, the total population of the South-Eastern map area was 4,641. This represents a population density of about 1.6 persons per square mile. Approximately 40 percent of these people live in the unincorporated towns and villages of Sandilands, Woodridge, Vassar, Sundown, Piney, Wampum, Sadlow, South Junction, Sprague and Middlebro and about 12 percent in the hamlets and settlements of Hadashville, Medika, Prawda, East Braintree, Waugh, St. Labre, Carrick, Badger, McMunn, Sirko and Menisino (see Table 1). The average density of rural population is less than one person per square mile. However, the density varies greatly in different portions of the map area (see Figure 2). The rural population is concentrated in river lot settlements along the Whitemouth and Birch rivers, in settlements along the Dawson Road in T. 8, R. 9E and in small agricultural settlements in the St. Labre, Sundown, Sirko, Piney, South Junction and Sprague districts.

TABLE 1

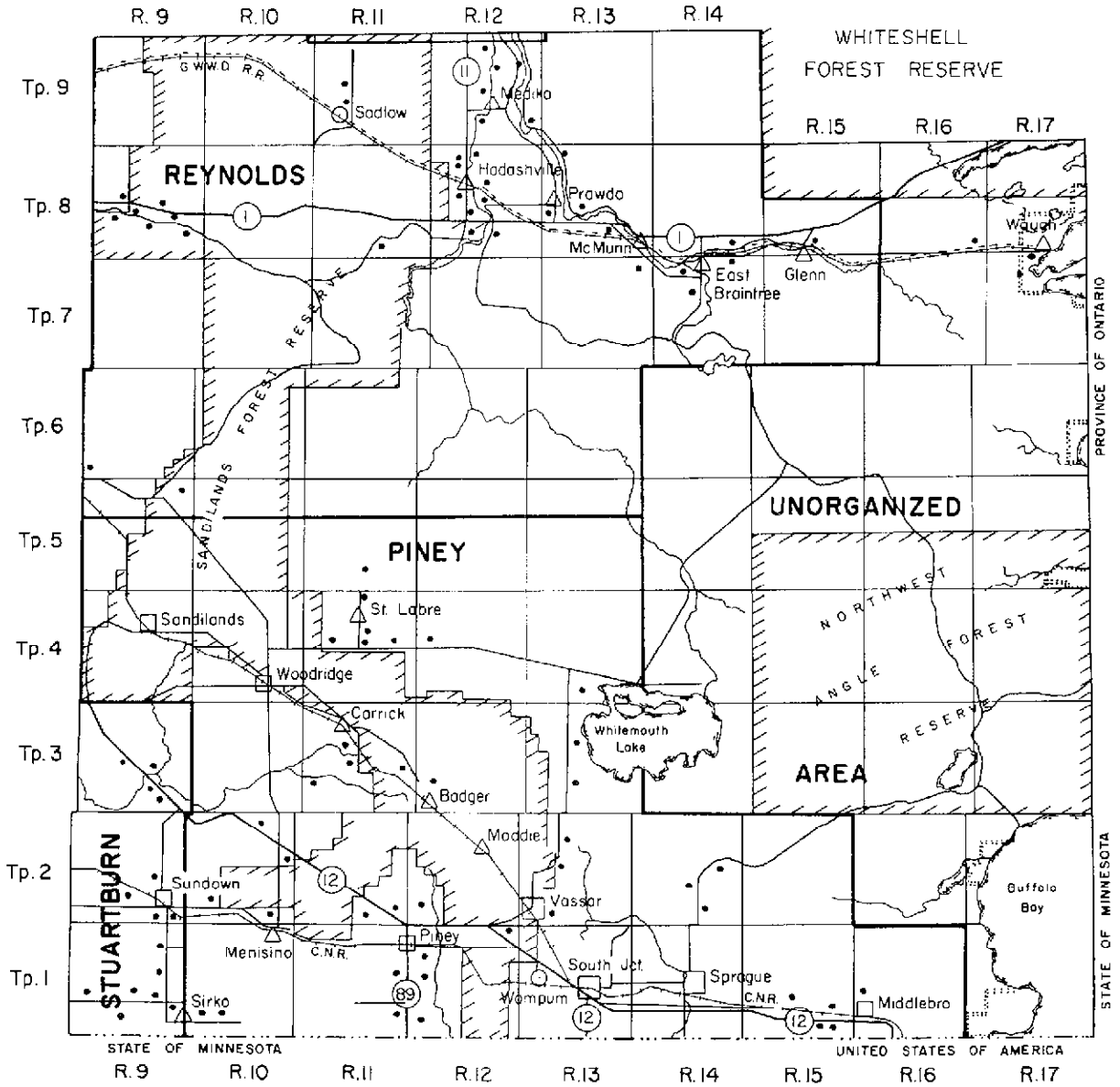
Population of Unincorporated Villages and Settlements
(1961 D.B.S. data)

Sprague	364	Badger	less than 50
Woodridge	289	Carrick	less than 50
Vassar	243	East Braintree	less than 50
South Junction	233	Hadashville	less than 50
Piney	197	McMunn	less than 50
Sundown	196	Medika	less than 50
Middlebro	147	Menisino	less than 50
Sandilands	133	Prawda	less than 50
Sadlow	55	St. Labre	less than 50
Wampum	50	Sirko	less than 50
		Waugh	less than 50

C. TRANSPORTATION AND MARKETS

The more densely populated agricultural districts which occur as a fringe on the northern and southern sides of the forested section of the South-Eastern map area are well provided with road and rail facilities (Figure 2). The railways and most highways, which radiate from either Winnipeg or Emerson and traverse the area in an east-west direction, serve most of the agricultural districts with ready access to the Winnipeg market. The central forested section of the map area is covered with vast expanses of open and treed muskeg and consequently has limited transportation facilities. A system of forestry access and fireguard roads presently is being constructed by the Renewable Resources Branch, Manitoba Department of Mines and Natural Resources, to overcome this deficiency.

Agricultural produce is transported to markets outside of the map area. Local villages provide a small outlet for eggs, vegetables and blueberries. The principal agricultural market and processing facilities are located at Winnipeg. Most of the forestry products of the area are transported to markets in the United States and Ontario. Small sawmills and flakeboard processing plants in Sprague and Winnipeg provide a small market for sawlogs and aspen cordwood.



LEGEND

RURAL
- ● 25 People
- △ Hamlet Site

UNINCORPORATED TOWNS AND VILLAGES
- ○ 50 - 100
- □ 100 - 200
- □ Over 200

- Provincial trunk highway
- Secondary and Forestry access roads
- Railways
- Forest Reserves
- Local Goverment Districts
- Indian Reserves

FIGURE 2
Local Government Districts, Distribution of Population and Main Transportation Routes in the South-Eastern Map Area.

PART II

PHYSIOGRAPHIC FACTORS AFFECTING SOIL FORMATION

The principal factors affecting soil formation are climate, vegetation, parent material, relief and drainage. The type of soil formed at any one place is dependent upon the interaction of these factors, the length of time they have been operative and the modifications resulting from the work of man.

A. RELIEF AND DRAINAGE

The principal relief and drainage systems of the South-Eastern map area are shown in Figure 3.

The most striking topographical feature of the map area is an upland known locally as the Bedford Hills occurring above the 1,050-foot contour and rising to a height of 1,300 feet above sea level (a.s.l.) in T. 5, R. 9E. From the uplands, the terrain slopes rather abruptly to the west, south and east in the form of broad, smooth, gently sloping, water modified ground moraine. North-east of the upland a broad, flat, peat covered area slopes gently from 1,100-foot contour to the 900-foot contour at the northern margin of the map area, an average of 5.5 feet per mile. This flat swampy area gives way to the rugged rock and lake terrain of the Precambrian Shield in the north-eastern portion of the map area. This rocky area has a local relief of 50 to 150 feet and a general elevation of 1,000 to 1,150 feet a.s.l.

The lowest part of the map area is the Brokenhead River Basin, in the north-west corner where the river has an altitude of 900 feet a.s.l. The maximum relief of the whole area is, therefore, approximately 400 feet.

Throughout most of the area the surface drainage is poorly developed and large swampy tracts, relatively unaffected by stream erosion, are prevalent. These vast swampy expanses are due to low relief, having an average fall of slightly more than 5 feet per mile. In many places too, low sand and gravel beaches, spits and bars of glacial Lake Agassiz act as dams and prevent more rapid development of natural drainage.[1] Also, the area is geologically youthful and sufficient time has not elapsed for significant development of stream valleys.

Three distinct drainage basins occur within the region (Figure 3). The most extensive of these, that is part of the Winnipeg River basin, consists of the Whitemouth, Birch, Boggy, Powawassan and Reed Rivers and St. Labre, Harrison, Poplar and Stony creeks. All of these begin in the swampy lowlands north-east and east of the Bedford Hills in poorly-defined valleys. However, north from Township 8 the main branch of the Whitemouth, Birch and Boggy Rivers flow in well-defined valleys with banks 10 to 40 feet high.[2] The Sprague and Rat Rivers and the Pine Creek are in the Red River basin. All of these begin in the upland area and have well-defined valleys with depths to 40 feet throughout their course in the upland tract; in the lowland areas the valleys are poorly-defined and their banks, in places, are subject to overflow.[3] The Brokenhead River basin occurs in the north-west corner of the map area. Hazel Creek, whose headwaters have been captured by the Whitemouth River, also forms part of the Basin. Both the Hazel Creek and the Brokenhead Rivers meander through poorly-defined channels in swampy depressions between strongly water-worked ridges of calcareous glacial till.

The South-Eastern map area has only a few lakes which is in strong contrast to the numerous lakes in the Precambrian Shield to the north and east. Whitemouth Lake, the largest, Moose Lake, Sprague Lake and Birch Lake are remnants of glacial Lake Agassiz which covered this part of the country about 8,000 to 10,000 years ago. These lakes are held in place by beach and outwash deposits through which outlet streams have cut narrow channels. Whitemouth Lake has a maximum depth of about 20 feet but its average depth, like the other lakes in the area, is assumed to be less than 10 feet.[4]

B. GEOLOGY AND SOIL PARENT MATERIAL

A surface mantle of unconsolidated rock materials covers the bedrock formations throughout most of the South-Eastern map area. These unconsolidated materials are composed of rock fragments derived from bedrock formations through the action of continental glacier ice and melt-water. The continental ice sheets, which completely covered Manitoba in recent geological time, picked up and transported huge quantities of materials from bedrock formations over which they passed. When the ice sheets melted the rock materials were deposited as glacial drift in various forms. These drift deposits, along with small areas of

1. Johnston, W. A., Winnipegosis and Upper Whitemouth River Areas, Manitoba Pleistocene and Recent Deposits. Canada Department of Mines, Geological Survey, Memoir 128, Ottawa, 1921. p. 24.

2. *Ibid.* 3. *Ibid.*

4. *Ibid.*

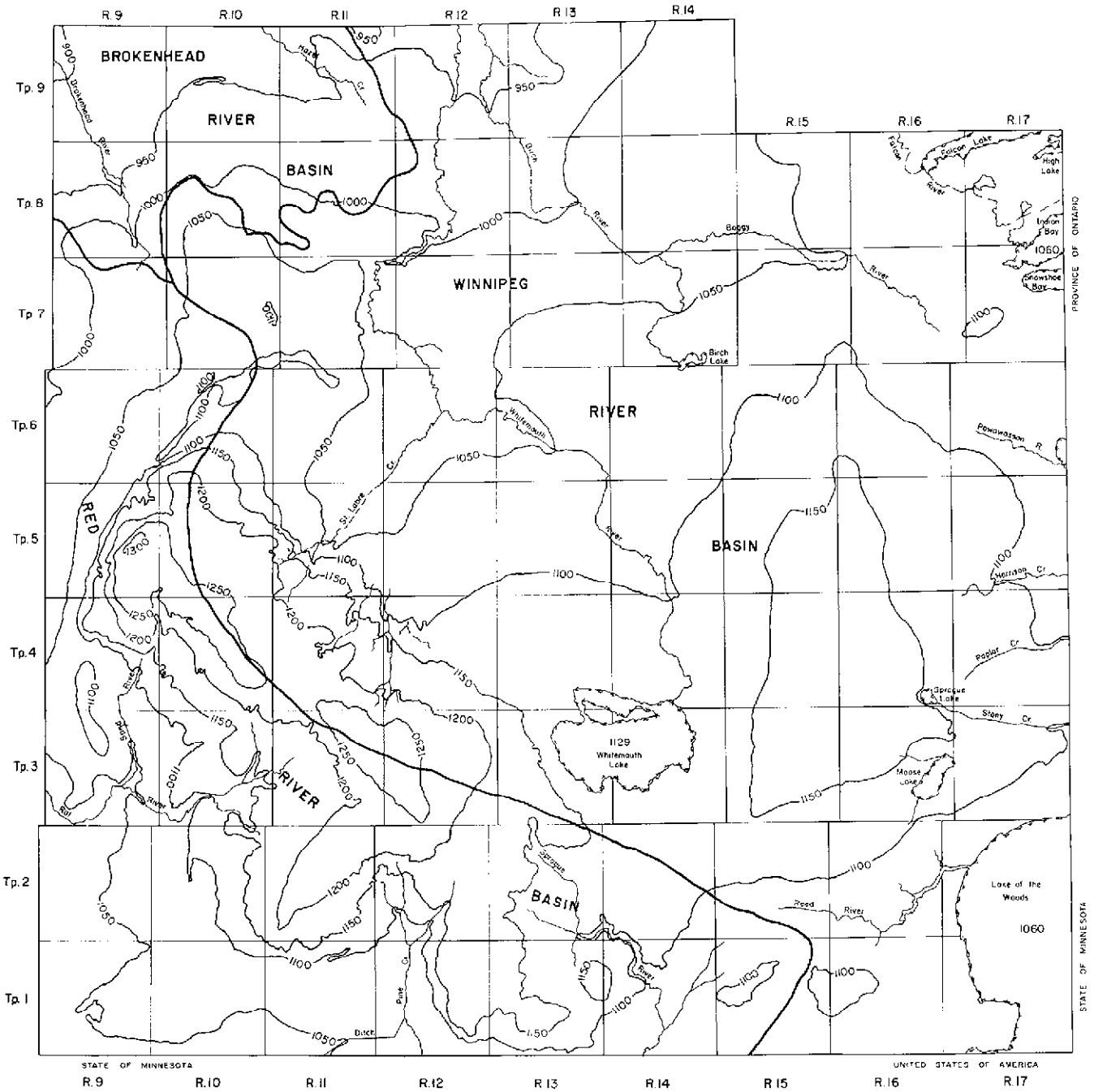
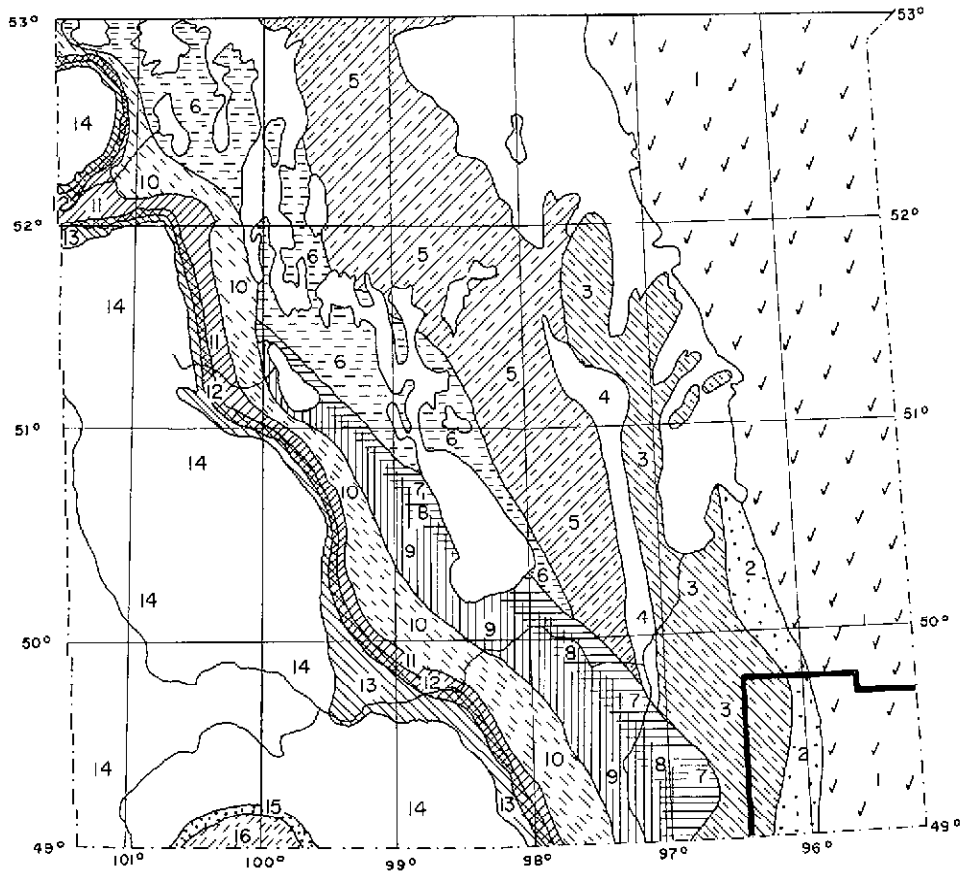


FIGURE 3
Contour Map and Drainage Systems of the South-Eastern Map Area.



KEY TO ROCK FORMATIONS

CENOZOIC

TERTIARY

16 TURTLE MTN. FORMATION: Mottled shales and lignite beds

MESOZOIC

CRETACEOUS OR TERTIARY

15 BOISSEVAIN FORMATION: Sandstone

UPPER CRETACEOUS

14 RIDING MTN. FORMATION: Light grey hard shale and soft greenish shale

13 VERMILLION RIVER FORMATION: Acid and calcareous shales, some bentonite

12 FAVEL FORMATION: Grey shale, some limestone and bentonite

LOWER AND UPPER CRETACEOUS

11 ASHVILLE FORMATION: Dark grey shale with lime and sandy beds

LOWER CRETACEOUS AND EARLIER

10 SWAN RIVER GROUP: Sandstone, shale and low grade coal

JURASSIC AND EARLIER

9 SUNDANCE FORMATION: Glauconitic sandstone, shale, limestone and gypsum

8 GYPSUM SPRINGS FORMATION: Red shale and gypsum

7 SPEARFISH FORMATION: Red to brown shales and red argillaceous sandstone

PALAEOZIC

DEVONIAN

6 UNAMED DEVONIAN: Limestone and dolostone

SILURIAN

5 INTERLAKE GROUP: Dolostone

ORDOVICIAN

4 STONY MTN. FORMATION: Limestone and dolostone, red shale

3 RED RIVER FORMATION: Limestone and dolostone

2 WINNIPEG FORMATION: Sandstone, minor shale

ARCHEAN OR PROTEROZIC

1 Chiefly acidic intrusive rocks

FIGURE 4
Location of the South-Eastern Map Area with respect to the surface contacts of the Rock Formations of Southern Manitoba.

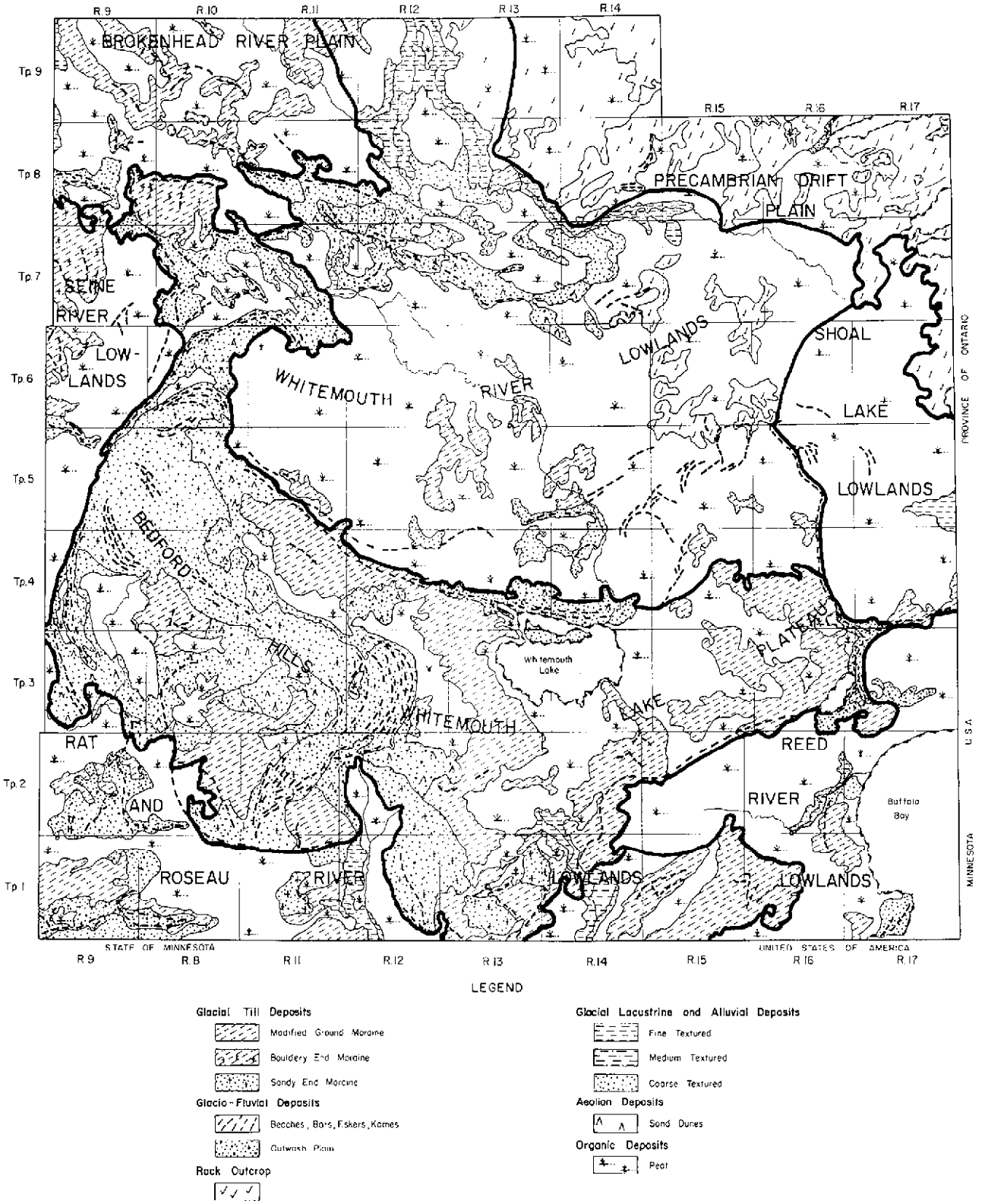


FIGURE 5
Physiographic Areas and Surface Deposits in the South-Eastern Map Area.

recent alluvial deposits of the present streams, wind-blown sand and organic deposits constitute the parent materials from which the soils have been developed.

(i) Geology of the Underlying Rocks

The bedrock formations of southern Manitoba and the location of the South-Eastern map area with respect to the surface contact of these formations are shown in Figure 4. The South-Eastern map area is underlain by limestone, dolomite, shale and sandstone of the Ordovician period in the western section of the area and by granitoid rocks of the Precambrian era in the eastern section. The line of contact between the Precambrian and the Palaeozoic rocks is concealed by thick drift deposits and cannot be readily demarcated by the few available well borings to bedrock.[5] Other rock formations which overlie these formations and reach the surface to the north-west of the map area are shales, limestones, gypsum and sandstones of the Cretaceous, Jurassic, Devonian and Silurian periods. As continental ice sheets advanced from the north these rock formations have all contributed materials to the surface deposits of the South-Eastern area as glacial drift in various forms.

(ii) Surface Deposits and Physiographic Areas

The principal types of surface geological deposits occurring in the South-Eastern map area are defined in Table 2. The table draws attention to the origin of the deposits or to the method of their deposition. The specific nature of the deposit as parent material of a particular soil series is described under the respective soil series. The distribution of these deposits and the division of the area into local landscape or physiographic units are shown in Figure 5.

The terrain within the South-Eastern map area lies in a transitional position between the flat lacustrine plain of the first prairie level of the Interior Continental Plain of Canada to the west and the rugged rock and lake terrain of the Canadian Shield to the east. It forms a part of the Manitoba Lowlands known as the South-Eastern Glacial Lake Terrace Landscape area. However, this description does not include important local topographical features or landscape units which occur in complex patterns in the area.

The most striking physiographic feature of the area is a roughly semi-circular upland area, herein referred to as the Bedford Hills-Whitemouth Lake Plateau occurring above the 1,050-foot contour and rising to a height of 1,300 feet a.s.l. This upland, which is surrounded in part by the strandlines of the Campbell stage of glacial Lake Agassiz, appears as a sandy, wind and water modified end moraine or drift plateau. A considerable part of this sandy highland area is characterized by numerous, irregularly shaped hills with intervening undrained basins. Wave cut terraces, north of Sandilands and Menisino and east of Badger, occur along the abruptly sloping faces of the upland. The drift deposits in the uplands, which are over 285 feet thick in places, consist of an upper till sheet with an abundance of limestone boulders and a lower till (Patrician till) sheet with little or no limestone.[6] These till sheets are separated by a thick stratum of sand and gravel which is the source of artesian

TABLE 2

Description of Surface Deposits Occurring in the South-Eastern Map Area

Deposit	Description
GLACIAL TILL	
Modified Ground Moraine	Generally an unsorted mixture of rocks, boulders, sand, silt and clay, deposited by glacial ice and resorted to some extent by wave-action of glacial meltwaters. The topography is characterized by a succession of low ridges and depressions. Textures are loams to clay loams.
End Moraine	Often modified or resorted, rough to hilly terminal ice deposits. Textures range from coarse sand to clay loam. Frequently stonier than ground moraine.
GLACIO-FLUVIAL	
Outwash Plain	Glacial outwash sand and gravel deposits frequently occurring in a nearly level plain. Stone-free to excessively stony.
Kame	Short hill of outwash and gravel—may contain resorted till. Contains some stones and boulders.
Esker	Winding ridge of irregularly stratified sand, gravel and cobbles laid down under the ice by a rapidly flowing stream.
GLACIAL LACUSTRINE AND ALLUVIUM	
	Glacial lake and alluvial sands, silts and clays; also includes thin lacustrine deposits overlying till. Topography is usually level to gently sloping. Stone-free to slightly stony.
Aeolian	Fine sands reworked and deposited locally by the wind to form dunes. Stone-free.
RECENT ALLUVIUM	
	Post-glacial deposits of sand, silts and clays along streams during periods of flooding and organic deposits of peats and mucks in ponds and depressions. Topography is nearly level to depressional. Usually stone-free.

5. *Ibid.* p. 25.

6. *Ibid.* p. 27.

water found along the base of the highland area. This upper till sheet is thinly covered by sand and gravel outwash deposits. Deposits of wind blown sand occur in the upland near Sandilands and are not extensive. Wind modified outwash occurs chiefly below the 1,100-foot contour and surrounds the uplands. Most of the upland is rapidly to well drained.

Level to irregular gently sloping, clay loam textured, modified till forms the surface in parts of this upland plateau. In places the even surface is due partly to erosion by wave action and partly to deposition of lacustrine and outwash material from melting ice. In areas immediately north of the plateau the surface of the till is extremely stony because of the removal of fine textured material by wave action and the consequent concentration of boulders at the surface.

Most of the area that surrounds the uplands is a vast, peat covered, swampy expanse broken occasionally by small islands of very stony, water-worked till and by numerous wave-built sand and gravel bars and beaches marking the ancient shore-lines of glacial Lake Agassiz. These beaches and bars are relatively long, narrow ridges 6 to 10 feet high and 100 to 500 feet wide which act as dams and prevent natural drainage in large parts of this area.[7] This poorly drained lowland tract has been divided in the Brokenhead River, the Whitemouth River, the Shoal Lake, the Reed River, the Rat and Roseau Rivers, and Seine River lowlands; the most extensive of these being the Whitemouth River Lowlands.

Lacustrine deposits of Lake Agassiz are widespread in this lowland area, but are thin and rarely exceed 16 to 20 feet in thickness.[8] They are thickest along the Whitemouth River. They consist of stratified sand, silt and clay. The sandy textures are found in the higher south-eastern parts and the clays, most abundantly, in the northern and lower parts of the area. Most of these lacustrine deposits are covered by 3 to 12 feet of peat.

Alluvium, which consists of stratified coarse and moderately fine textured flood-plain deposits, overlie lacustrine clay and occur in parts along many of the streams in the lowlands. These alluvial deposits are usually a few feet thick and extend in narrow strips, rarely more than a half mile wide along the streams. In places natural levees have been built up and the banks of those near the streams are slightly higher than the levees farther away. These ridges also impede natural drainage.

7. *Ibid.* p. 29.
8. *Ibid.* p. 31.

The Precambrian Drift Plain as it occurs in the north-east corner of the map area is the edge of the rugged, rocky, lake terrain of the Canadian Shield. The boundary between this area and the vast swampy lowlands to the south-west is difficult to define because relief gradually becomes less toward the south-west. However, it occupies the area north-east of a line drawn from the south-western end of Shoal Lake to the hamlet of McMunn on the Birch River. Prominent granitoid rock outcrop occurs over a considerable portion of the area but toward the south-west the outcrops are less prominent and fewer because of masking by drift and organic deposits. Variable textured drift deposits occur in the lower slopes and in undrained depressions between the rock outcrops and are usually covered with fibrous peat deposits. Topography of this area varies from gently sloping in the south-west to hilly in the north-east.

C. CLIMATE

In relation to world-wide climatic conditions, the South-Eastern map area of Manitoba is within the region designed by Koppen as Dfb.* This is an area which lies in the center of the continent, a great distance from the oceans and their moderating effect on temperatures. Summer temperatures are higher, winter temperatures are lower and the annual range much greater than the world average for the latitude. The area is sub-humid and has a definite summer maximum of precipitation. Approximately 70 percent of the precipitation falls as rain during the period of April to October and about 30 percent as snow during the five winter months of November to March.

(*i*) *Temperature*

The mean monthly temperatures recorded at Sprague, Indian Bay, Great Falls and Winnipeg are presented in Table 3. Sprague and Indian Bay Meteorological Stations, which occur in the southern and eastern fringe of the map area respectively, have been operating for more than 45 years. Great Falls is situated 46 miles north of the South-Eastern map area in T. 17 R. 11E of the Principal Meridian and has been in operation for about 40 years. Winnipeg, the oldest operating station (since 1873), occurs approximately 60 miles west of the map area in T. 10, R. 2E of the Principal Meridian.

Although the temperature data presented in Table 3 for Sprague, Indian Bay, Great Falls

*W. Koppen and Geiger, "Handbuch der Klimatologie", Bond 1; Teil C, Gebuder Borntraeger, Berlin, 1936.

TABLE 3

The Mean Monthly Temperatures in Degrees Fahrenheit Recorded at Sprague, Indian Bay, Great Falls and Winnipeg[1]

Station	Years Obs.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Mean
Sprague	46	-0.9	4.6	17.6	37.0	50.6	59.9	64.0	58.2	51.1	40.4	21.6	6.7	34.2
Indian Bay	46	-1.2	3.9	16.8	36.4	51.0	60.4	66.2	63.9	53.5	41.6	23.5	6.9	35.2
Great Falls	39	-1.2	3.2	16.7	36.1	50.8	61.6	68.1	65.4	54.4	42.8	23.4	6.0	35.6
Winnipeg	90	-2.0	2.3	16.6	38.0	52.1	62.2	67.2	64.6	54.1	41.6	22.2	6.8	35.5

and Winnipeg are not strictly comparable because of the variable length of records, they indicate that the yearly mean temperatures are slightly lower in the southern portion of the map area near Sprague than in the north-eastern portion near Indian Bay and at Great Falls and Winnipeg. This apparent anomaly may be due to local cool air drainage from the sandy uplands adjacent to the meteorological station at Sprague. The table also indicates that mean monthly temperatures are below 32 degrees during the five winter months of November to March. Mean monthly temperatures are above 50 from May to September, marking the period of summer. Transition from winter to summer is abrupt, occurring normally in April and the change from summer to winter is usually in October. While the mean monthly temperatures indicate general climatic conditions they do not show the great variations in seasonal and daily temperatures that are characteristic of Manitoba's "land controlled climate"[2]. Temperatures are particularly variable during the spring, fall and winter seasons when the area is affected by frequent frontal disturbances between cold "Continental Polar" air from the north and warm dry "Maritime Polar" air originating from the Pacific Ocean. The daily range in temperatures is normally 10 to 25 degrees. The winter season variation in mean temperatures is about 14 to 21 degrees, ranging from -1.7 to 19.4 degrees at Winnipeg, 1.6 to 17.6 degrees at Sprague, 3.8 to 18.2 degrees at Great Falls. Variation of mean summer temperatures from the normal is small throughout south-eastern Manitoba and range from 49.8 to 57.4 degrees from summer to summer.

Two commonly recognized values that indicate the length of the growing season are the average frost-free period and the vegetative season[3]. In the South-Eastern map area the frost-free period ranges from 72 days in the southern agricultural area near Sprague to 114 days in the north-eastern forested section near Indian Bay. This can be compared with 127 days 40 miles north of the map area at Great Falls. This apparent short growing season in the southern portion of the map area is not consistent with the frost-free period required by the crops grown successfully in this area. The vegetative season is approximately 170 days long, which is characteristic of most of southern Manitoba.

(ii) Precipitation

The mean monthly precipitation recorded at Sprague, Indian Bay, Great Falls and Winnipeg is presented in Table 4. The records indicate that the central and north-eastern forested section of the map area has higher annual precipitation than any other part of Manitoba. From the data presented in Table 3 it appears that the average annual precipitation varies from 20.63 inches in the southern agricultural area near Sprague to 22.29 inches in the forested central and north-eastern section near Indian Bay. This may be compared with precipitation of between 15 to 20 inches in the agricultural zone west of the Red River. June is the wettest month of the year in the southern section of the map area with an average rainfall of 3.02 inches; whereas July is the wettest month in the central and north-eastern section with an average of 3.46 inches. However, rainfall fluctuates widely from year to year and has varied from 0.55 inches in June, 1919 to 9.89 inches in July, 1937, at Sprague. This can be compared with a recorded variation of 0.27 inches in July, 1920 to 9.75 inches in June,

1. Data were obtained from the published records of the Dominion Meteorological Division, Department of Transport, Toronto, Ont.
2. Economic Atlas of Manitoba, T. R. Weir, Editor, Manitoba Department of Industry and Commerce, Winnipeg, Man., 1960. pp. 14-19.
3. Frost-free period is the length of time between average dates of the last frost in spring and the first frost in autumn. Vegetative season is the average length of time during the summer months when the daily temperature is above 42°F.

TABLE 4

The Mean Monthly Precipitation in Inches Recorded at Sprague, Indian Bay, Great Falls and Winnipeg[1]

Station	Years Obs.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Mean
Sprague	46	0.88	0.84	1.05	1.34	2.05	3.02	2.86	2.86	2.31	1.46	1.13	0.83	20.63
Indian Bay	46	1.14	0.92	1.15	1.20	2.12	3.21	3.46	2.77	2.49	1.47	1.31	1.05	22.29
Great Falls	34	1.05	0.82	0.96	0.91	1.63	2.62	2.61	2.22	2.29	1.27	1.09	0.97	18.44
Winnipeg	40	0.88	0.86	1.11	1.12	2.14	3.12	2.97	2.47	2.25	1.47	1.09	1.00	20.48

1925 at Indian Bay. The total yearly precipitation has ranged from 10.39 inches in 1919 to 33.90 inches in 1937 at Sprague as compared with 16.20 inches in 1952 to 34.92 inches in 1941 at Indian Bay.

On the average 15.90 inches of precipitation falls as rain during the summer months of April to October and 4.73 inches of precipitation, mainly as snow, during the winter months of November to March at Sprague. This may be compared with an average 16.72 inches of precipitation during summer and 5.57 inches of precipitation, as snowfall, during the winter at Indian Bay. Most of the precipitation both in the summer and winter is frontal in origin accompanying numerous successions of slow moving cyclonic storms or areas of "low pressure" characterized by thunderstorms in June, July and August and by "blizzards" (snow plus high winds) in the winter months.[2] These cyclonic storms are usually followed in succession by areas of "high pressure", bringing in winter clear, cold, dry conditions and in summer by periods of cool pleasant weather.[3] From June to August 15 to 20 such thunderstorms will occur on the average in South-Eastern Manitoba.[4] The greater the contrast between the hot humid air from the south and cool arctic air to the north, the more violent the storm.

D. VEGETATION[5]

Most of the South-Eastern map area lies within the Rainy River Section of the Great Lakes-St. Lawrence Forest Region as delineated by J. S. Rowe.[6] This area includes the Bedford Hills and surrounding lowlands. This area gives way to the Lower English River Section of the Boreal Forest Region to the north and to the Manitoba Lowlands Section of the Boreal Forest Region to the west and northwest. According to Rowe: "The forest cover shows the influence of the northward movement of the Great Lakes-St. Lawrence Forest, as well as the influence of the tension zone between forest and adjoining prairie to the west. The red and white pines (*Pinus resinosa, P. strobus*), formerly of greater extent, have now only a scattered representation on suitable sites, particularly in the eastern parts, for logging and fires have led to their almost complete replacement by jack pine (*Pinus banksiana*). Low relief and poor drainage has favoured the development of extensive swamps, with black spruce (*Picea mariana*), tamarack (*Larix laricina*), eastern cedar (*Thuja occidentalis*), willow and alder scrub, particularly in the western portions over sedimentary rocks. The northwestern limits of the Section are principally coincident with the range of this swamp association and the presence of cedar, though isolated populations of this species are also found farther to the northwest. Large areas of balsam poplar (*Populus balsamifera*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*) and scattered tamarack (*Larix laricina*) are found inland from the rivers. On the river banks white elm (*Ulmus americana*), basswood (*Tillia americana*), Manitoba maple (*Acer negundo*) and bur oak (*Quercus macrocarpa*) occur, the latter species often forming a savanna type with grassy openings. Trembling aspen (*Populus tremuloides*) is common throughout the section."

Although white spruce may be found in abundance in the more easterly parts of this Section surprisingly little is found in the South-Eastern map area.[7] (See Table 47).

1. Data were obtained from the published records of the Dominion Meteorological Division, Department of Transport, Toronto, Ont.
2. Economic Atlas of Manitoba, T. R. Weir, Editor, Manitoba Department of Industry and Commerce, Winnipeg, Man., 1960. pp. 14-19.
3. *Ibid.* 4. *Ibid.*
5. A section on the forestry aspects of the surveyed area is given in a section on Forestry on pages 94 to 104. This section contains a discussion of estimated soil suitability for the production of important tree species in the South-Eastern map area.
6. J. S. Rowe, Forest Regions of Canada, Bulletin 123, Canada Department Northern Affairs and Natural Resources, Forestry Branch, Ottawa, 1959.
7. Forest Service, Forest Resources Inventory, Report No. 1, Department of Mines and Natural Resources, Province of Manitoba, 1956.

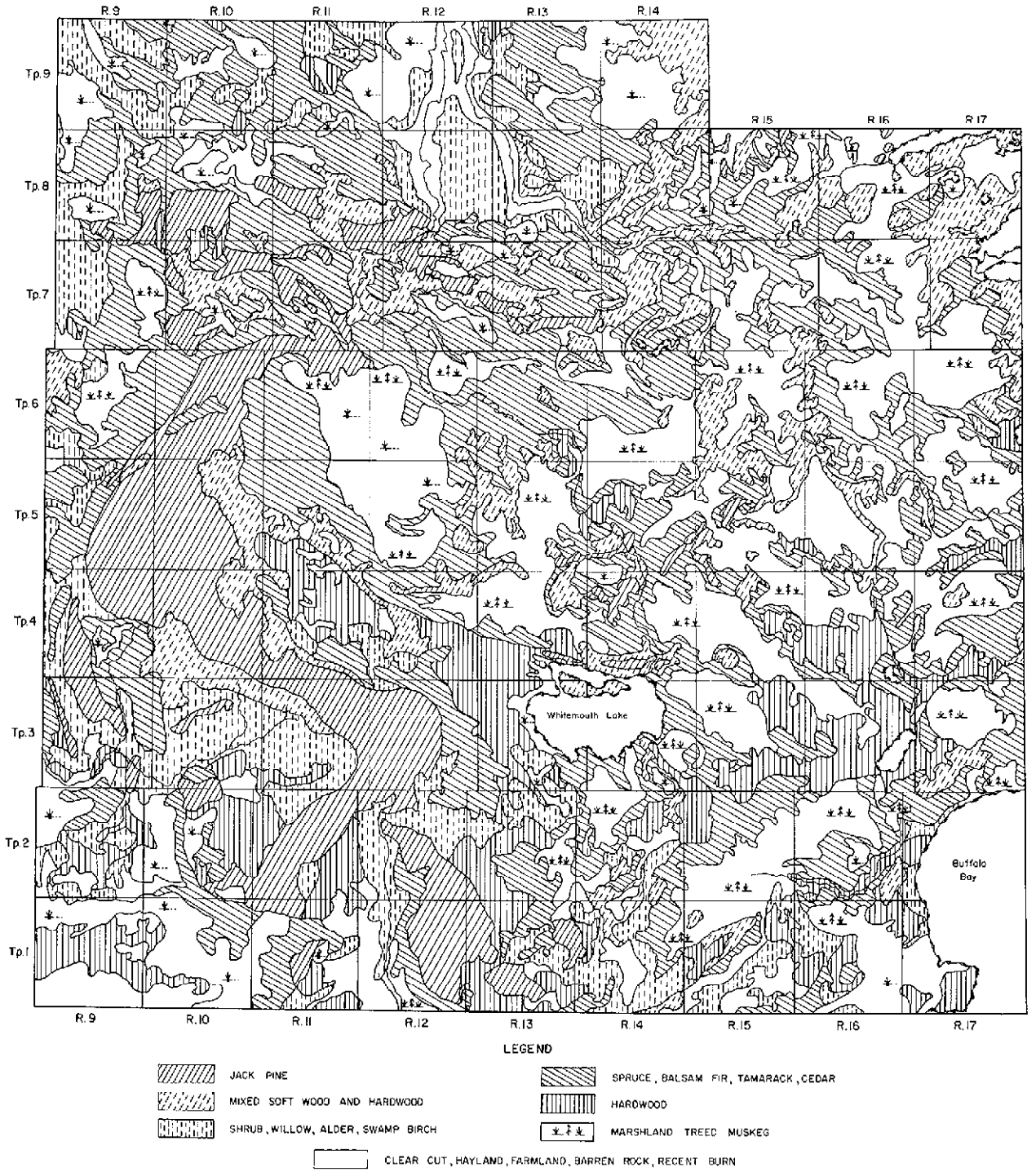


FIGURE 6
The distribution of vegetative types in the Rainy River section of the Great Lakes-St. Lawrence Forest Region of the South-Eastern Map Area.

PART III

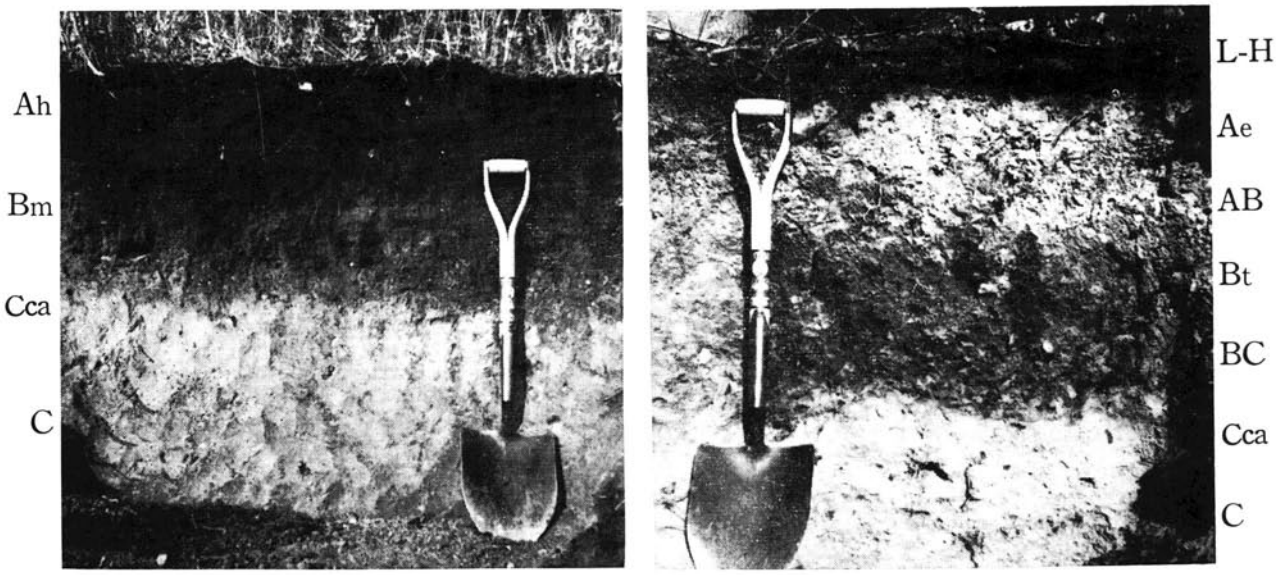
SOILS

The soils that have developed under the influence of the soil forming factors described in Part II exhibit physical characteristics which reflect their environment. Through observation of these characteristics it is possible to classify soils in accordance with their genesis or the processes involved in their formation. Such a classification scheme permits the grouping of soils into natural units. The recognition of these units is dependent on the study of the soil profiles.

A. THE SOIL PROFILE

The soil profile is a vertical section of the soil through all its horizons (or layers) extending downward into the unweathered material. The soil horizons differ from one another in one or more of the following features: colour, texture, structure, consistence, reaction, concretions and chemical and biological composition. The master horizons are designated L, F, H, A, B and C. Lower case letter suffixes are used to indicate the type of horizon and Arabic numeral suffixes are used when further divisions into sub-horizons are required. If the soil is developed from two or more nonconforming parent materials, Roman numeral prefixes are used to indicate the lithologic changes. The master horizon symbols and lower case letter suffixes are defined in Table 5. Examples of the use of these horizon symbols are given in Figure 7.

FIGURE 7
Examples of the Use of Soil Horizons Nomenclature.



Black soil profile showing subdivision into soil horizons.

Grey Wooded soil profile showing subdivision into soil horizons.

TABLE 5

Definition of Soil Horizon Symbols

ORGANIC HORIZONS

L *Horizon*—An organic layer characterized by the accumulation of organic matter in which the original structures are easily discernible.

F *Horizon*—An organic layer characterized by the accumulation of partly decomposed organic matter. The original structures are discernible with difficulty. Fungi mycelia often present.

H *Horizon*—An organic layer characterized by an accumulation of decomposed organic matter in which the original structures are undiscernible.

MASTER MINERAL HORIZONS

A *Horizon*—A mineral horizon or horizons formed at or near the surface in the zone of maximum removal of materials in solution and suspension, and/or maximum in situ accumulation of organic matter. It includes: (1) horizons in which organic matter has accumulated as a result of biological activity (Ah); (2) horizons that have been eluviated of clay, iron, aluminium, and/or organic matter (Ae); (3) horizons dominated by 1 and 2 above but transitional to underlying B or C (AB or A and B); (4) horizons markedly disturbed by cultivation or pasture (Ap).

B *Horizon*—A mineral horizon or horizons characterized by one or more of the following: (1) an enrichment (exclusive of dolomite or salts more soluble in water) in silicate clay, iron, aluminium, and/or illuvial organic matter (Bt, Bf, Bh, Bfh), (2) a prismatic or columnar structure which exhibits pronounced coatings or stainings and characterized by the presence of significant amounts of exchangeable sodium and/or magnesium (Bn); (3) an alteration by hydrolysis or oxidation to give a change in colour and/or structure and does not meet the requirements of (1) and (2) above (Bm).

C *Horizon*—A mineral horizon or horizons comparatively unaffected by the pedogenic processes operative in A and B, excepting (1) the process of gleying, and (2) the accumulation of dolomite and salts more soluble in water (Cca, Csa, and C).

LOWER CASE SUFFIXES

c —A *cemented* (irreversible) pedogenic horizon.

ca—A horizon with secondary *carbonate* enrichment where the concentration of lime exceeds that present in the unenriched parent material.

cc—Cemented (irreversible) pedogenic *concretions*.

e —A horizon characterized by the removal of clay, iron, aluminium or organic matter. Lighter in colour by one unit of value or chroma when dry than the layer below (*eluviated*).

f —A horizon enriched with hydrated iron (*fe*). It has a chroma of 3 or more and is redder than the horizon above or below.

g —A horizon characterized by reduction and grey colours; often mottled (*gley*).

h —A horizon enriched with organic matter. When used with A it must show at least one Munsell unit of value darker than the layer immediately below (*humus*). When used as the only suffix to B (Bh) this horizon must contain 10 percent or more of organic matter.

j —A horizon whose characteristics are weakly expressed (*juvenile*). It must be used with some other suffix.

k —Presence of carbonate as indicated by visible effervescence with dilute HCl (*kalk*).

m—A horizon slightly altered by hydrolosis, oxidation and/or solution to give a change in colour and/or structure (*mellowed*).

n —A horizon with distinctive morphological and physical characteristics as shown by black or dark colourations or coatings on the surface of the peds and characterized by prismatic or columnar structure, and hard to very hard consistency when dry. It contains more than 12 percent exchangeable sodium or more than 50 percent exchangeable sodium plus magnesium (*natrium*).

p —A layer disturbed by man's activities, i.e., by cultivation and/or pasturing. To be used only with A.

sa—A horizon with secondary enrichment of salts more soluble than carbonates where the concentration of salts exceeds that present in the unenriched parent material (*secondary salts*).

s —A horizon with salts including gypsum which may be detected as crystals or veins, or as surface crusts of salt crystals, or by distressed crop growth, or presence of salt tolerant plants (*salt*).

t —A horizon enriched with silicate clay (*ton*).

z —A permanently frozen layer (*zero*).

NOTES:

1—Lithologic changes are indicated by Roman numerals (I to be assumed) e.g., Ah, Ae, IIBt1, IIBt2, IIIC.

2—Transition horizons need capitals only, and
(a) If transition is gradual AB is used.
(b) If transition is interfingered A and B are used.
(c) Dominance of A or B in the transition horizon may be shown by AB or BA.

3—Horizon subdivisions are shown by Arabic numerals as suffixes eg., Ah1, Ah2, Bt1, Bt2, etc.

4—Capitals used alone indicates no further separations were made.

5—If more than one lower case suffix is required and if one is a weak expression then the j is linked to the suffix with a bar; eg., Bf$\overline{cj}$, etc.

6—Position of master horizons is applied with respect to A not B or C.

7—The suffix g covers all gleying. When used with A or B it indicates other processes have been operative and should be indicated. When used with C it indicates that gleying is dominant and has virtually prevented the operation of any other process.

8—The suffix m is used only with B and then only alone or with the suffixes k, s or g.

B. SOIL CLASSIFICATION

The basic unit in the field classification system used in this survey is the soil series. A soil series consists of soils that are developed on similar parent material and under similar environmental conditions, particularly drainage. Any significant variation in one or more of the soil forming factors results in dissimilarities of profile features and the soil is classified as a different series. Individual soil series may occupy large continuous land areas but more commonly are associated with other series in a complex landscape pattern.

When soils have similar profile characteristics but vary in some physical feature that is of importance to agriculture or forestry, the soils are classified as types or phases. Soil types are divisions of series based on minor variations in texture. Soil phases are based on external features, such as topography and stoniness, or on the presence of an unconforming substrate that may occur below the solum.

While series, types and phases are the basic units used in the field classification of soils, other categories are used to group soils into broader classes. In the classification system adopted by the National Soil Survey Committee there are six levels at which soils may be separated or grouped together. These are: great group, sub-group, family, series and type. In the three upper categories of order, great group and sub-group, divisions are based on major differences in morphological features exhibited in the soil profile. In the lower three categories of family, series and type, divisions within any one sub-group are based on soil variation resulting from differences in composition, texture of the parent materials, drainage, and difference in thickness and degree of development of soil horizons. The sub-group level of this classification system is used in this report to indicate the kind of profile that is characteristic of each soil series. A description of the profile features that characterize each of the sub-groups is given in Table 6.

Other classification systems based on certain soil features are used for grouping soils for various purposes. The soil association is a group of soils, consisting of different series, developed under various drainage conditions on similar parent material. Each soil series in the association occupies a different position in the landscape and differs in profile characteristics due to the local influence of drainage and vegetation. An example of this type of group in the South-Eastern map area is the Sandilands catena, composed of the Sandilands, Lonesand and Kerry series. Other types of soil classification are used to group soils that have similar productivity, management problems or engineering features. The land capability classes and sub-classes described in this report are an example of this type of classification.

TABLE 6

Description of Genetic Soil Types or Sub-Groups Occurring in the South-Eastern Map Area

WELL-DRAINED SOILS

Dark Grey Wooded—Originally developed under tall-prairie grass vegetation and later under deciduous forest.

L-H—Leaf and humus layers, slightly acid.

A —Grey to very dark grey layer (Ahe or Ah) that is 2 to 4 inches thick, moderately high in organic matter, granular, friable, slightly acid and underlain by a light grey layer (Ae) that is granular or platy, friable and slightly acid. The mixed plow layer (Ap) of these soils is darker than those of Grey Wooded soils and lighter than those of Dark Grey soils.

B —Well developed brownish horizon that is blocky (sands and gravels may be weakly structured), slightly acid in the AB and Bt sub-horizons to mildly alkaline in the BC. Pronounced clay accumulation is noted in the B horizon of soils developed from textures finer than sands.

C —Light coloured, relatively unaltered sub-surface material. A whitish lime carbonate layer (Cca) may be present under the B horizon.
Soils—Arnes Series
Birch Point Series
Seven Sisters Series

Orthic Grey Wooded—Developed under deciduous, coniferous or mixed forests.

L-H—Moderately thick leaf and humus layers, moderately to slightly acid.

A —Thin (less than 2 inches) Ah or Ahe layer and a strongly leached, light coloured Ae horizon that is medium to slightly acid and is generally coarser in texture than the B and C horizons.

B —Well developed brownish horizon that is blocky (sands and gravels may be weakly structured), medium to slightly acid in the AB and Bt sub-horizons to mildly alkaline in the BC. Contains clay concentration in B horizons.

TABLE 6—Continued

C —Light coloured, mildly alkaline, relatively unaltered sub-surface material. A whitish lime carbonate (Cca) horizon may be present under the B horizon.
Soils—Carrick Series Woodridge Series
St. Labre Series

Bisequa Grey Wooded—Developed mainly under coniferous forest.

L-H—Thin leaf and humus layer medium to slightly acid.

Ae —Light grey, structureless, strongly leached horizon that is medium to strongly acid in reaction.

Bfj —Weakly developed brownish horizon that is structureless to weakly granular, medium to strongly acid. Accumulation of sesquioxides is slight.

Ae —Light coloured, moderately leached horizon that is structureless to weakly platy, friable, and medium to strongly acid.

Bt —Moderately well developed, thin, continuous, brownish horizon that is slightly acid and occurs within 36 inches of the surface.

C —Light coloured, mildly to moderately alkaline, relatively unaltered sub-surface material. A whitish, lime carbonate (Cca) horizon may be present under the B horizon.
Soils—Badger Series Vassar Series

Grey Forested—Developed under deciduous, coniferous and mixed deciduous and coniferous forest.
Similar to Orthic Grey Wooded soils except that these soils have thick light grey Ae horizons and weakly developed textural B horizons, usually in the form of pockets or clay flows.
Soils—Pine Ridge Series

Minimal Podzol — Developed mainly under coniferous forest.

L-H—Thin leaf and humus layers, medium acid.

A —Weakly developed, light grey (Aej) horizon that is structureless, loose and strongly acid.

B —Weakly developed brownish (Bfj) horizon that is structureless to weakly granular, loose to very weakly cemented and strongly acid. The colour difference between Aej and Bfj is clear, however the color difference between the Bfj and C horizon is faint.

C —Light coloured, structureless, slightly to strongly acid, relatively unaltered sub-surface material (usually fine sand).
Soils—Sandilands Series

IMPERFECTLY DRAINED SOILS

Gleyed Dark Grey—Developed under grass vegetation recently invaded by deciduous forest.

L-H—Thin leaf and humus layers, neutral.

A —Grey to dark grey horizon (Ahe, often blotched with lighter colours) that is moderately high in organic matter, granular, neutral to slightly acid.

B —Weakly to moderately well developed dark grey to very dark greyish brown horizon that is coarse granular to blocky (sands are structureless or weakly structured), neutral to slightly acid in the AB and Bt sub-horizon to mildly alkaline in the BC. Contains concentration of clay (Bt) in soils developed from textures finer than sands. Dull colours and mottling indicate gleyzation.

C —Under the B, a whitish lime carbonate layer (Cca) may occur and grades into mottled, dull coloured, relatively unaltered sub-surface material.
Soils—Framnes Series Peguis Series

Gleyed Dark Grey Wooded—Originally developed under grass vegetation and later under deciduous and coniferous forest.
Similar to the Dark Grey Wooded except that the B and C horizons show evidence of gleyzation by duller colours and iron staining.
Soils—Elma Series Pine Valley Series
Hadashville Series Wampum Series

Gleyed Grey Wooded—Developed under deciduous, coniferous or mixed forests.
Similar to the Grey Wooded soils except that the B and C horizons show evidence of gleyzation by duller colours and iron staining.
Soils—Caliento Series Sirko Series
Piney Series Wintergreen Series

Gleyed Podzol—Developed under deciduous and coniferous forest.

L-H—Leaf and humus layers slightly to strongly acid.

A —Light coloured eluviated Ae horizon, that is strongly acid, weakly platy, friable (sands may be single grained and loose). The horizon is usually mottled with iron.

B —Moderately well to well developed brownish illuvial horizon in which organic matter and sesquioxides are the main accumulation products. This horizon is usually weakly granular, soft (sands may be single grained and loose), medium to strongly acid and shows evidence of gleyzation by duller colours and iron mottling.

C —Dull coloured, iron stained, medium to strongly acid, relatively unaltered sub-surface materials.
Soils—Lonesand Series

Gleyed Mull Regosol—In virgin areas developing under grass and deciduous forest vegetation. Soils with a weakly developed (non-chernozemic) Ah horizon, little or no L-H, and a C horizon that shows evidence of gleyzation by iron mottling and dull colours.
Soils—Alluvium, Medika Series

POORLY DRAINED SOILS

Peaty Carbonated Rego Humic Gleysol— Developed under swale grass and sedge vegetation.

L-H—Organic surface layer 6 to 12 inches thick, neutral to moderately alkaline in reaction and may contain free lime carbonate.

A —Very dark grey to black Ah horizon more than 3 inches thick, high in organic matter, granular, friable, alkaline and contains free lime carbonate.

C —Dull coloured horizon that is mottled and usually calcareous.
Soils—Balmoral Series Foley Series
Fyala Series Meleb Series
Malonton Series Sundown Series

TABLE 6—Continued

Peaty Rego Gleysol—Developed under swamp forest.

L-H—Organic layer 6 to 12 inches thick and slightly to medium acid in reaction.

A —Dark grey to black surface horizon (Ah) up to 3 inches thick, medium acid to neutral, friable and granular.

C —Non-calcareous, dull coloured horizon with iron mottles, neutral to medium acid.
Soils—Kerry Series

Organic Soils—Developed under swale grass, sedge, moss and swamp forest.

Shallow Peat—Contains 12 to 36 inches of peat or muck.

Deep Peat—Contains more than 36 inches of peat or muck.

C. SOIL MAPPING

The soils of the South-Eastern map area were classified into orders, great groups, subgroups, series, types and phases. The mapping units used were selected to permit the presentation of the most detailed information possible on the scale used for the soil maps. Wherever individual series, or phases of series, occupy continuous areas of sufficient size to be shown on the map, they were mapped separately. This was possible over a considerable portion of the sandy uplands. However, on the water-worked till plain of the Whitemouth Lake region and windblown outwash deposits which surround the Bedford Hills, various soil series frequently form complex landscape patterns and it was often impossible to show each series separately on the small-scale soil map. Where this occurred, soil complexes of two or more series formed the mapping units.

In conducting this survey a traverse, where possible, was made along each road allowance, giving lines of traverse one mile apart and permitting the observation of at least two sides of each quarter section. Traverses inside the sections were made only if some important detail was required which could not be obtained from the ordinary lines of traverse. The vast swampy lowlands of the South-Eastern map area are for the most part inaccessible during the summer and examination of these areas was conducted during the winter months along accessible winter roads. Examination of the soils along the road allowances and trails in the more remote areas were examined at frequent intervals, the frequency being based on the apparent soil variability in the area. Aerial photograph mosaics of the scale two inches equals one mile were used as base maps for plotting the soil information and as a guide to the location of soil boundaries within the sections.

D. GENERAL SOIL AREAS

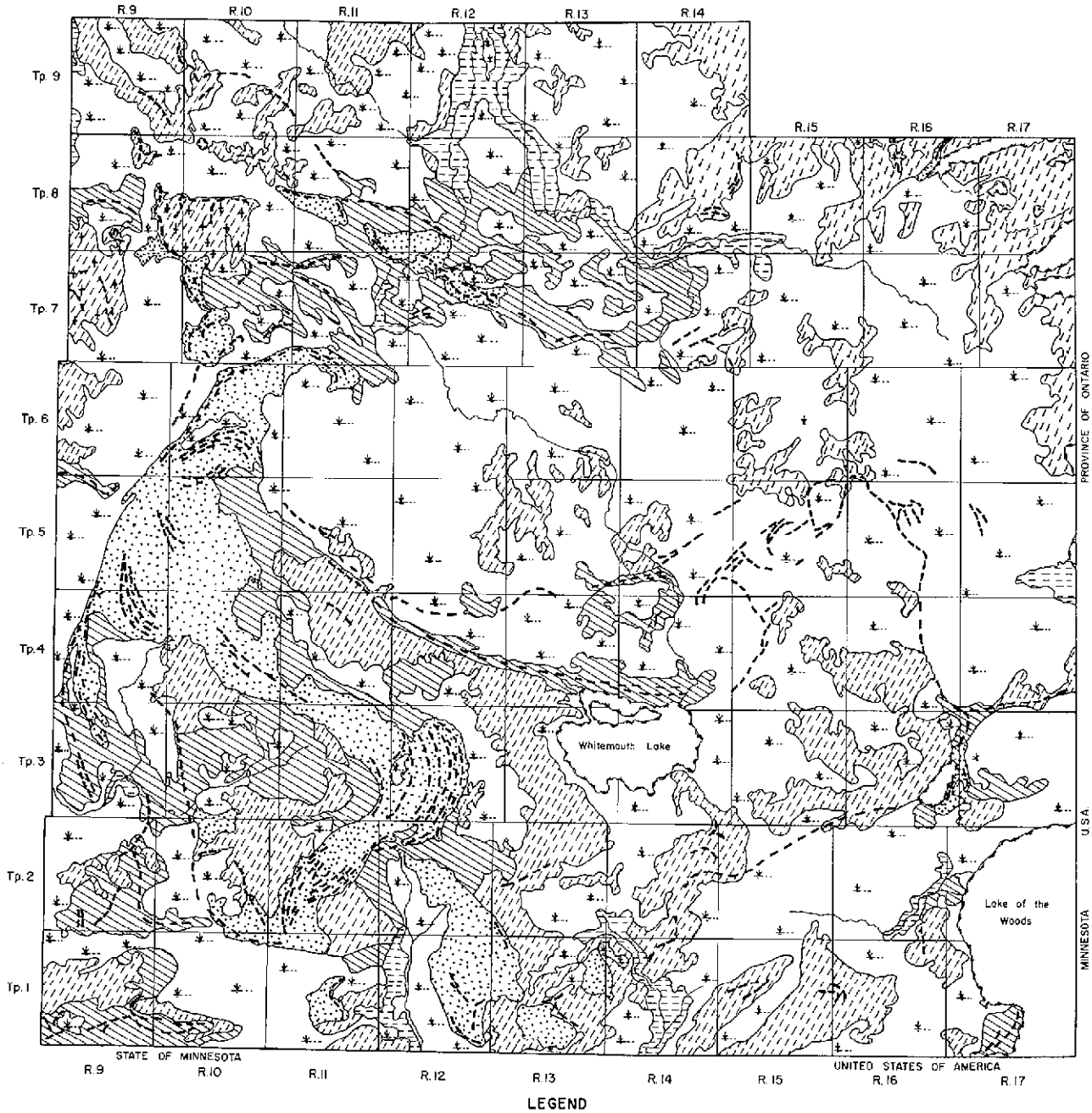
A generalized soil map covering the South-Eastern map area is presented in Figure 9. On this map the soils have been grouped into seven general soil areas based on similarities of parent materials, drainage patterns and soil profile. All of these areas are groups of soil associations or portions of soil associations as used in previous reports. A brief discussion of these general soil areas follows:

(1) *Sandilands-Woodridge Group*

This general soil area occupies all of the sandy uplands designated as the Bedford Hills. This group of soils consists of Minimal Podzol and Orthic Grey Wooded soils developed on sand and gravel deposits. These soils have been classified into the Sandilands and Woodridge series, with small areas of Pine Ridge, Badger and Vassar series. In the Winnipeg-Morris map area to the west similar soils were grouped into the Menisino and Birds Hill associations. Most of the land in this soil area is gently sloping to moderately sloping and the soils are dominantly rapidly well drained. This sandy upland is treed with jack pine and some red pine. A few areas formerly cultivated have since been abandoned.

FIGURE 8

Landscape view of Sandilands-Woodridge soil area showing semi-dense stands of jack pine growing on arid, nutritionally poor sites.



LEGEND

PODZOL AND GREY WOODED SOILS ON DRY SAND AND GRAVEL DEPOSITS

SANDILANDS - WOODRIDGE GROUP

GREY WOODED AND HUMIC GLEYSOL SOILS ON WATER-WORKED, STRONGLY CALCAREOUS TILL

CARRICK - ST. LABRE GROUP

SHALLOW AND DEEP PEAT SOILS

ORGANIC SOILS

GREY WOODED SOILS ON GRAVEL AND SAND

GRAVEL AND SAND BEACH RIDGES

PODZOL, GREY WOODED, HUMIC GLEYSOL AND LOW HUMIC GLEYSOL SOILS ON MOIST, WET SAND AND GRAVEL DEPOSITS

LONESAND - WINTERGREEN GROUP

DARK GREY, DARK GREY WOODED AND HUMIC GLEYSOL SOILS ON LOAM TO CLAY TEXTURED LAKE AND ALLUVIAL DEPOSITS

HADASHVILLE - PEGUIS GROUP

GRANITOID ROCK OUTCROPS ASSOCIATED WITH PODZOL, GLEYSOLIC AND ORGANIC SOILS

INDIAN BAY COMPLEX

PODZOL AND GREY WOODED SOILS ON BOULDERY, COARSE TEXTURED, MORAINIC DEPOSITS

RICHER COMPLEX

FIGURE 9
Generalized Soil Map of the South-Eastern Map Area.

(2) *Lonesand-Wintergreen Group*

The soils that occupy most of this soil area consist of Gleyed Podzols, Gleyed Grey Wooded, Peaty Rego Gleysol and Peaty Humic Gleysol types developed on sand and gravel deposits modified by wind and wave action. These soils have been classified into the Lonesand, Wintergreen, Sirko, Kerry, Malonton and Sundown series and can be compared with soils that have been grouped into the Pine Ridge and Birds Hill associations in the Winnipeg map area. This general soil area also contains minor amounts of Sandilands and Wampum series. The topography of this soil area varies from smooth level lacustrine deposits to gently sloping, micro-duned, aeolian deposits and the soils are dominantly imperfectly to poorly drained. Some portions of the duned areas have greater relief and better soil drainage. The native vegetation varies from mixed stands of jack pine and aspen woods, which ring undrained depressions with sedges in the duned areas, to mixed stands of aspen, balsam poplar, ash, Manitoba maple and elm in the smooth lacustrine and outwash areas. Small portions of this soil area have been brought under cultivation in the Sirko, Sundown, Prawda and East Braintree districts.

(3) *Carrick-St. Labre Group*

The soils that occupy this area are dominantly Grey Wooded and some Peaty Humic Gleysol soils developed on water-worked, strongly calcareous boulder till. These soils have been classified into the Carrick, Piney, Meleb, St. Labre, Vassar and Caliento Series. The area also contains the till substrate phase of the Balmoral, Foley, Fyala, Malonton, Peguis, Pine Valley, Seven Sisters and Woodridge series. The topography of the areas are level to irregular, very gently sloping, with ridge and swale pattern that trend in a north-west to south-east direction, except for the south-eastern corner of the map area. In the south-eastern portion of the map area these ridges trend in a north-east to south-west direction. The soils of this area are dominantly well to imperfectly drained, stony and have been degraded under a mixed stand of aspen and balsam poplar with some white spruce and jack pine. While most of this area is still under natural vegetation, some cultivation has occurred in a few portions, notably in the South Junction, Sprague, Middlebro, Sundown and St. Labre districts bordering the sandy uplands and peat covered swampy tracts.

FIGURE 10

Landscape view of Lonesand-Wintergreen soil area showing level topography and mixed stand of aspen and jack pine.

FIGURE 11

Landscape view of the Carrick-St. Labre soil area showing dense stand of aspen and white spruce.

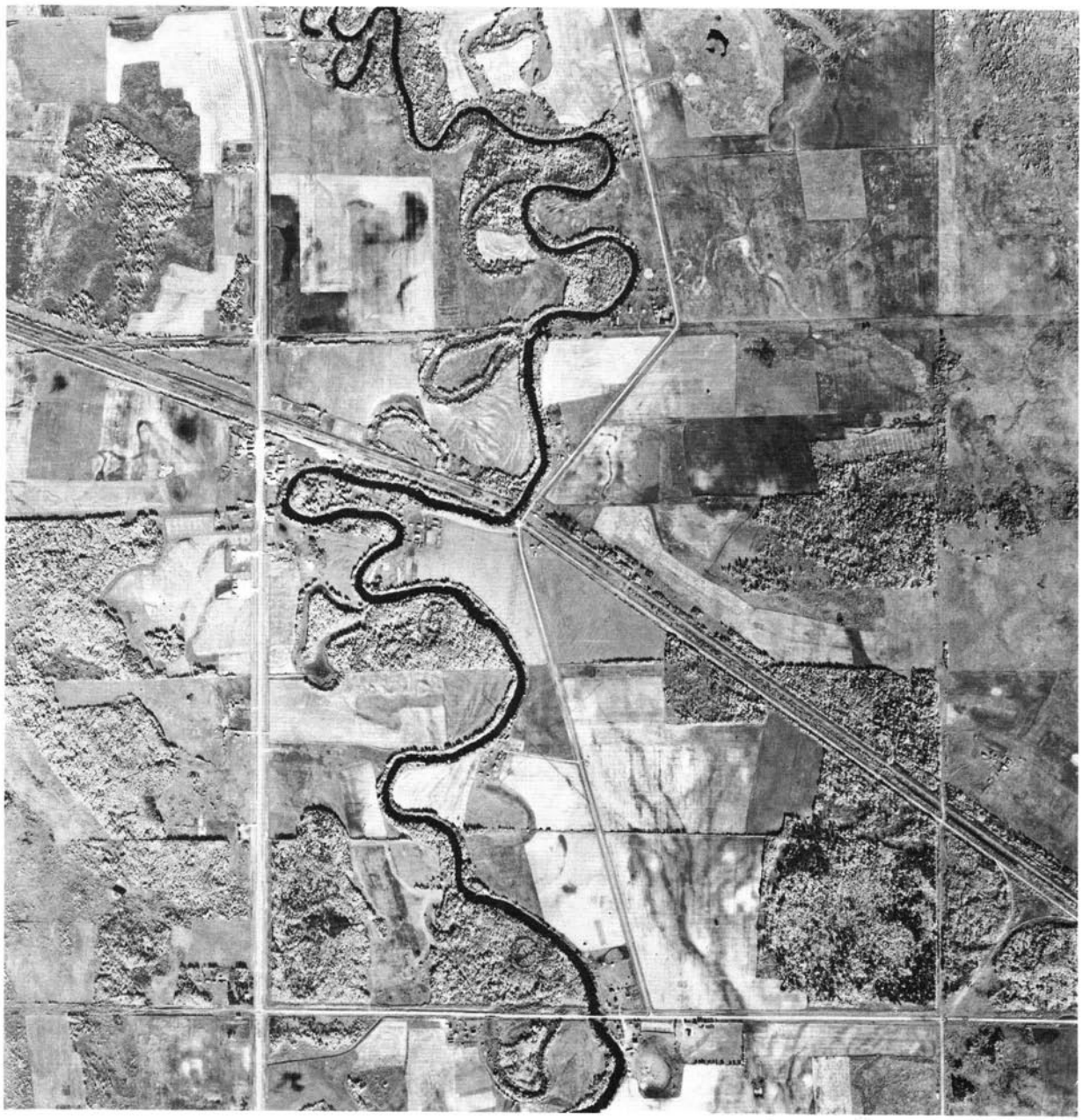


FIGURE 12
Aerial view of the narrow strip of cultivated Hadashville-Peguis soils along the Whitemouth River in the vicinity of Hadashville. Note the numerous oxbows and abandoned meandering channels.

(4) *Hadashville-Peguis Group*

This general area occurs principally in the southern and northern agricultural fringes of the map area which are coincident with the imperfectly to poorly drained lake and alluvial deposits along the Whitemouth, Birch, Boggy, Rat and Sprague Rivers and the Piney Creek. The soils that occupy most of this area are dominantly imperfectly drained, Dark Grey, Dark Grey Wooded and poorly drained Peaty Rego Humic Gleysol types developed on loam to clay-textured lake and alluvial deposits. Here they have been classified into undifferentiated alluvium, Hadashville, Medika, Elma, Peguis, Pine Valley and Framnes series. This area also contains the poorly drained Balmoral, Foley and Fyala series. The land is level to irregular, very gently sloping. There is little left of the natural vegetation which consists of aspen, balsam poplar, elm, ash, Manitoba maple, some white spruce and balsam fir. Most of the soils that have been cleared are being cultivated or are used as pasture and hay land.

(5) *Organic Soils*

Shallow Peat occurs in depressional areas throughout the South-Eastern map area. Large, broad tracts of Deep Peat deposits, broken occasionally by small islands of stony, water-worked till and by numerous wave-built beaches and bars, surround the Bedford Hills-Whitemouth Lake Plateau. These areas of thick organic soils are very poorly drained and are underlain by thin lacustrine deposits of glacial Lake Agassiz. These lacustrine deposits consist of stratified sand, silt and clay. The sandy textures are found in the higher south-eastern parts and the clays in the northern lower parts of the map area. Natural vegetation consists of black spruce, tamarack, eastern white cedar, willow, alder shrub, sedges and reeds. Cultivation has been attempted only where peat soils adjoin better drained mineral soils along the banks of the rivers that flow through the swampy lowlands and along the borders of other cultivated upland areas.

(6) *Indian Bay Complex*

This general area occurs in the Precambrian Drift Plain in the north-eastern corner of the map area. Prominent granitoid rocks outcrop over a considerable portion of the area but toward the south-west the rock outcrops become gradually smaller and fewer because of masking by drift and peat deposits. Associated with these rock outcrops are a complex of Podzolic, Gleysolic and Organic soils developed on drift and peat deposits and are variable as to mode of deposition, mineralogical composition, drainage and stoniness. The topography of this area varies from gently sloping in the south-west to steeply sloping in the north-east. The natural vegetation varies mainly with drainage and consists of a mixed stand of jack pine, aspen, birch, balsam fir, white spruce, black spruce, cedar and tamarack. Cultivation has never been attempted in this area.

(7) *Richer Complex*

This general soil area lies immediately north-west of the Bedford Hills and consists of well to imperfectly drained Grey Wooded and Podzol soils developed on extremely bouldery and stony, coarse textured, strongly water-worked, morainic deposits. This area contains the stony phases of the Sandilands, Woodridge, Pine Ridge, St. Labre, Vassar, Lonesand, Wintergreen and Sirko series. Most of the land in this general area is irregular, gently to moderately sloping and the soils are dominantly well-drained. The native vegetation over most of this area has been burned and jack pine and scrub aspen are regenerating profusely. This soil area is non-arable due to excessive stoniness.

E. DESCRIPTIONS OF SOIL SERIES AND MAPPING UNITS

A key to the soils of the South-Eastern map area is presented in Table 7. The soil series are grouped according to parent materials and drainage, and the sub-group to which each series belongs is also indicated. The acreage figures recorded in this table are estimated total acreage covered by each series. They include the areas mapped as the individual series and phases and estimates of the portion of areas covered by each series within the mapping complexes. As an example the total area of 38,124 acres reported for the Carrick series consists of 27,850 acres mapped as Carrick series, two-thirds of 3,400 acres mapped as Carrick-Meleb Complex, one-half of 9,340 acres mapped as Carrick-St. Labre Complex and one-half of 6,667 acres mapped as Carrick-Vassar Complex.

These soil series descriptions are discussed in alphabetical order and generally include: descriptions of the profile type, texture, parent material, topography, drainage and vegetation; a detailed description of a representative

FIGURE 13
Aerial view of a portion of the Deep Peat Soil Complex which lies northeast of the Bedford Hills-Whitemouth Lake Plateau in T. 4, R. 15E. Note patterned-fen, the large islands of stunted tamarack and black spruce and the partially buried beach. Slope is toward lower right.

FIGURE 14
Aerial view of the rugged rock and lake terrain characteristic of the Precambrian Drift Plain. Note sparse vegetation on rock outcropping and dense black spruce and tamarack stands in some of the peat filled depressions.

profile; a table of chemical and physical analyses of a representative profile; a brief description of mapping units and a discussion of agricultural features of the soils. A separate section of the report deals with the forestry aspects of the soils.

FIGURE 15
Landscape view of Richer Complex showing extreme stoniness.

TABLE 7

Key to Soils and their Estimated Acreages in the South-Eastern Map Area

	Acreage	% of Total Map Area
1. Soils Developed on Strongly Calcareous Till		
(a) Well and moderately well drained		
(i) Carrick Series (Orthic Grey Wooded)	38,124	2.04
(b) Imperfectly drained		
(i) Piney Series (Gleyed Grey Wooded)	55,030	2.94
(c) Poorly drained		
(i) Meleb Series (Peaty Carbonated Rego Humic Gleysol)	21,740	1.16
2. Soils Developed on Calcareous, Stratified Sand and Gravel Outwash and Beach Deposits		
(a) Well to excessively drained		
(i) Woodridge Series (Orthic Grey Wooded)	94,140	5.03
(b) Imperfectly drained		
(i) Sirko Series (Gleyed Grey Wooded)	13,580	0.73
(c) Poorly drained		
(i) Sundown Series (Peaty Carbonated Rego Humic Gleysol)	9,120	0.49
3. Soils Developed on Sand Deposits		
(a) Well to excessively drained		
(i) Sandilands Series (Minimal Podzol)	106,616	5.69
(ii) Pine Ridge Series (Grey Forested)	840	0.04
(iii) Badger Series (Bisequa Grey Wooded)	1,040	.06
(b) Imperfectly drained		
(i) Lonesand Series (Gleyed Podzol)	48,620	2.60
(ii) Wintergreen Series (Gleyed Grey Wooded)	27,120	1.45
(c) Poorly drained		
(i) Kerry Series (Peaty Rego Gleysol)	38,465	2.05
(ii) Malonton Series (Peaty Carbonated Rego Humic Gleysol)	30,460	1.63
4. Soils Developed on a Thin Layer of Sand over Moderately to Strongly Calcareous Clay Loam to Clay, Lucustrine or Till Deposits		
(a) Well drained		
(i) St. Labre Series (Orthic Grey Wooded)	5,820	0.31
(ii) Vassar Series (Bisequa Grey Wooded)	13,923	0.74
(b) Imperfectly drained		
(i) Wampum Series (Gleyed Grey Wooded)	4,885	0.26
(ii) Calicnto Series (Gleyed Grey Wooded)	31,525	1.68
5. Soils Developed on Moderately to Strongly Calcareous, Medium Textured Sediments		
(a) Well to moderately well drained		
(i) Birch Point (Dark Grey Wooded)	700	0.04
(b) Imperfectly drained		
(i) Hadashville Series (Gleyed Dark Grey Wooded)	9,910	0.53
(ii) Medika Series (Gleyed Mull Regosol)	6,830	0.36
(c) Poorly drained		
(i) Foley Series (Peaty Carbonated Rego Humic Gleysol)	4,860	0.26
6. Soils Developed on Strongly Calcareous, Moderately Fine Textured Sediments		
(a) Imperfectly drained		
(i) Elma Series (Gleyed Dark Grey Wooded)	610	0.03
(b) Poorly drained		
(i) Balmoral Series (Peaty Carbonated Rego Humic Gleysol	10,340	0.55
7. Soils Developed on a Thin Mantle of Clay over Strongly Calcareous Silty Sediments		
(a) Imperfectly drained		
(i) Framnes Series (Gleyed Dark Grey)	720	0.04
8. Soils Developed on a Thin Mantle of Lacustrine Clay over Strongly Calcareous Till		
(a) Well to moderately well drained		
(i) Arnes Series (Dark Grey Wooded)	4,650	0.25
9. Soils Developed on Weakly to Moderately Calcareous Lacustrine Clay		
(a) Well drained		
(i) Seven Sisters Series (Orthic Dark Wooded)	4,000	0.21
(b) Imperfectly drained		
(i) Pine Valley Series (Gleyed Dark Grey Wooded)	7,575	0.40
(ii) Peguis Series (Gleyed Dark Grey)	3,120	0.17
(c) Poorly drained		
(i) Fyala Series (Peaty Carbonated Rego Humic Gleysol)	5,400	0.29
10. Soils Developed on Peat Deposits over Undifferentiated Mineral Deposits		
(i) Peat Deposits 12 to 36 inches thick (Organic Soils)	187,444	10.01
(ii) Peat Deposits over 36 inches thick (Organic Soils)	934,700	49.91
11. Soils Developed on Excessively Bouldery, Coarse Textured Stratified Drift Deposits		
(i) Richer Complex (Orthic, Bisequa and Gleyed Grey Wooded; Minimal and Gleyed Podzols)	12,710	0.68
12. Granitoid Rock Outcrop and Soils Developed on Variable Textured Drift and Peat Deposits		
(i) Indian Bay Complex (Rock Outcrop plus a Complex of Podzolic, Gleysolic and Organic Soils)	57,680	3.08
(ii) Granitoid Rock Outcrop	11,850	0.63
13. Soils Developed on Variable Textured Recent Alluvium		
(i) Alluvium (Gleyed Mull Regosol and Peaty Carbonated Rego Gleysol)	1,060	0.06
14. Lakes	67,390	3.60
Total Area	1,872,597	100.0

ALLUVIUM (1,060 acres)

The narrow ribbons of recent alluvial deposits occurring along streams and rivers were mapped as undifferentiated alluvium. These materials are stratified and vary in texture from fine sand to clay, but are generally high in silt content. Soil profile development has not progressed beyond the formation of layers of organic matter accumulation which may be within the stratified material or on the present surface due to frequent deposition of fresh mineral material during high water stages of the rivers. The topography of this stone-free soil area is level to irregular, very gently sloping. The soils, dominantly imperfectly to poorly drained, are classified as Gleyed Mull Regosols and Peaty Carbonated Rego Gleysols. Native vegetation varies with drainage and consists of aspen, balsam poplar, ash, elm, Manitoba maple and bur oak on imperfectly drained sites with minor amounts of sedges and meadow grasses on poorly drained sites.

Agriculture

Cultivation is restricted to a few garden plots that surround small farmsteads. Poor drainage, the risk of flooding and the dense cover of hardwoods are the main problems associated with agricultural utilization of these soils.

ARNES SERIES

The Arnes series are well-drained, Dark Grey Wooded soils developed on a thin mantle of lacustrine clay over moderately to strongly calcareous glacial till. The surface clay layer may be up to 30 inches thick but is usually between 6 to 20 inches in thickness. These soils occur in small scattered areas in the south-eastern section of the Bedford Hills-Whitemouth Lake Plateau area and in the vicinity of the village of South Junction. The topography is level to irregular gently sloping. Native vegetation is mainly aspen with some birch, balsam poplar, balsam fir and white spruce; shrubs such as hazelnut, rose, raspberry, saskatoon, dogwood, snowberry; a profusion of herbs and some grasses.

The Arnes soils have a light grey to grey Ae horizon which gives rise to a dark grey Ap layer when cultivated, and a moderately to strongly developed textural B horizon. The BC horizon extends down to the contact of the clay mantle and the underlying till. A representative Arnes soil profile is described below:

L-H—2 to 0 inches, very dark grey (10YR‡ 2/2, dry), partially to moderately decomposed, leaf, forb and grass litter; medium acid; abrupt, smooth, lower boundary.

Ae —0 to 3 inches, light grey (10YR 7/1, dry), loam; moderate medium platy; very friable when moist, soft when dry; medium acid; abrupt, wavy, lower boundary.

BA —3 to 6 inches, light brownish grey (10YR 6/2, dry), clay; strong coarse granular to medium subangular blocky; firm when moist, hard when dry; medium acid; clear, wavy, lower boundary.

Bt —6 to 12 inches, brown to dark greyish brown (10YR 4/3 to 4/2, dry), clay; weak medium columnar which breaks readily to strong medium blocky; very firm when moist, very hard when dry; slightly acid; gradual, wavy, lower boundary.

BC —12 to 16 inches, dark yellowish brown to yellowish brown (10YR 4/4 to 5/4, dry), silty clay; strong coarse granular; firm when moist, very hard when dry; mildly alkaline and calcareous; gradual, irregular, lower boundary.

IIC —At 24 inches, very pale brown (10YR 7/3 to 8/3, dry), silty clay loam glacial till; moderate coarse platy to fine subangular blocky; mildly alkaline and strongly calcareous.

Mapping Units

Arnes Series (4,650 acres)

Areas consisting dominantly of normal Arnes soils. Minor occluded areas are mainly Carrick, Pine Valley till substrate phase, Peguis till substrate phase and Fyala till substrate phase soils.

Agriculture

Arnes soils are among the best agricultural soils in the South-Eastern map area. They are moderately well to well drained, moderately fertile, possess a favourable reaction, and have good structure and water-holding capacity. Crops will respond to applications of nitrogen and phosphate fertilizers. Stoniness may be a minor problem in some areas.

BADGER SERIES

The Badger series consists of well drained Bisequa Grey Wooded soils developed on weakly calcareous, fine sand deposits. These sand deposits are frequently stratified and may contain thin lenses of coarse sand and gravel. These soils occupy small areas in the irregular, moderately sloping, Bedford Hills. All of these soil areas are uncleared and support a mixed stand of jack pine, aspen and birch.

The dominant features of the Badger soil profile is the occurrence of a podzol sequence of

‡YR—Munsell color designation.

TABLE 8

Analysis of Arnes Clay

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
Ae	0-3	36	49	15	5.7	—	—	0.7	0.06	12	7.3	3.9	0.5	0.05	0.2	1.8
BA	3-6	20	38	42	5.8	—	—	0.8	0.07	11	—	—	—	—	—	—
Bt	6-12	12	20	68	6.1	—	—	1.1	0.1	11	38.3	23.1	7.7	0.2	1.01	3.2
BC	12-16	10	44	46	7.4	0.3	34.0	—	—	—	—	—	—	—	—	—
IIC	at 24	9	53	38	7.6	0.3	47.2	—	—	—	12.1	10.4*	1.4	0.1	0.2	—

*Calcium by difference.

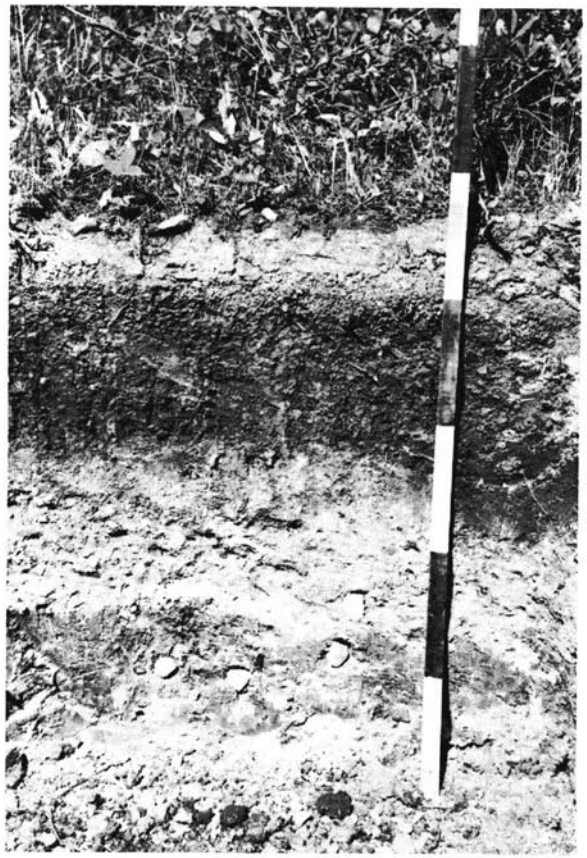


FIGURE 16
Soil profile of Arnes Clay. A Dark Grey Wooded developed on a thin mantle of lacustrine clay over calcareous glacial till. (Stick interval = 6 inches)

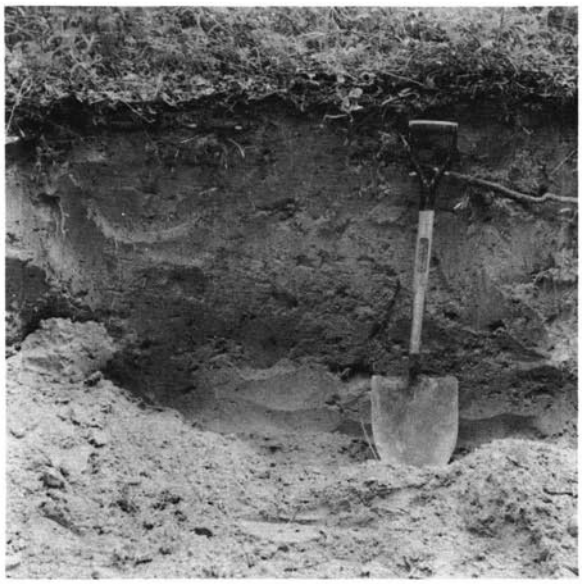


FIGURE 17

Soil profile of Badger Series. A Bisequa Grey Wooded developed on weakly calcareous fine sand. The Podzol sequence is weakly developed in this profile.

FIGURE 18

Excavation in an area of Badger soils showing the continuous, wavy Bt horizon of this soil. Note the mixed stand of jack pine and birch.

horizons in an Ae horizon overlying a continuous textural (Bt) horizon at depths of less than 30 inches from the surface. The Bf horizon is weakly developed and the underlying Ae and Bt horizons are usually weakly to moderately well developed. Textures of the surface horizons vary from fine sand to loamy fine sand. Texture of the Bt horizon varies from gravelly sandy loam to fine sandy clay loam. The weakly calcareous, sandy parent material usually is stratified and as a consequence the Bt horizon frequently is found in a coarse sand to gravel lense. The weakly developed Podzol solum sometimes exceeds 18 inches in depth but rarely merges with the Bt horizon of the Grey Wooded solum. The Cca horizon usually is absent but sometimes occurs as a weakly developed, broken and irregular horizon in association with limestone pebbles. The soil is very strongly to strongly acid in the Podzol sequence and strongly acid to neutral in the underlying Grey Wooded solum.

The Badger series forms a catenary group with Wintergreen (Gleyed Grey Wooded) and

TABLE 9

Analysis of Badger Loamy Fine Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	2-0	—	—	—	5.8	—	—	18.31	—	—	—	—	—	—	—	—
Aej	0-3	86.3	11.7	2.0	4.8	—	—	0.28	.02	14	2.10	0.85	0.29	0.03	0.06	0.48
Bfj	3-15	88.5	8.7	2.8	5.7	—	—	0.18	.01	18	2.85	1.09	0.40	0.01	0.10	1.05
Ae	15-24	39.7	7.4	2.9	6.0	—	—	0.10	.01	10	1.74	0.76	0.31	0.04	0.04	0.45
Bt	24-30	76.4	10.1	13.5	5.5	—	—	0.21	.01	21	8.88	9.81	2.78	0.07	0.24	1.34
BC	30-48	90.3	5.4	4.3	6.9	—	—	—	—	—	—	—	—	—	—	—
C	48+	87.1	9.8	3.1	7.8	—	13.1	—	—	—	1.66	—	—	0.05	0.02	—

Malonton (Peaty Carbonated Rego Humic Gleysol) series. The following profile description is representative of Badger loamy fine sand:

L-H—2 to 0 inches, very dark brown (10YR 2/2, dry), partially to well decomposed leaf, herb and grass litter; medium acid; abrupt, smooth, lower boundary.

Aej —0 to 3 inches, light grey (10YR 6/1 to 7/1, dry), loamy fine sand; structureless; loose when moist or dry; very strongly acid; abrupt, wavy, lower boundary.

Bfj —3 to 15 inches, light yellowish brown (10YR 6/4, dry), very fine sand; structureless; loose when moist or dry; medium acid in reaction; clear, wavy, lower boundary.

Ae —15 to 24 inches, light grey (10Y 7/2, dry), very fine sand; structureless; loose when moist or dry; medium acid; mottled with small yellowish brown (10Y 5/6, dry), blotches of iron; abrupt, wavy, lower boundary.

Bt —24 to 30 inches, brown (7.5YR 5/4, dry), very fine sandy loam; weak medium granular; friable when moist, slightly hard when dry; medium acid; stained with yellowish brown (10YR 5/6), iron mottles; clear, irregular, lower boundary.

BC —30 to 48 inches, very pale brown (10YR 7/4, dry), fine sand; structureless; loose when moist or dry; neutral; stained with dark brown (2.5YR 4/4, dry), mottles of iron; gradual, irregular, lower boundary.

C —48 inches+, very pale brown (10YR 7/3, dry), loamy very fine sand; structureless; loose when moist or dry; mildly alkaline; weakly calcareous; stained with dark brown (7.5YR 4/4, dry), iron mottles.

Mapping Units

Badger Series (1,040 acres)

Areas consisting dominantly of Badger soils, but may contain minor occluded areas of Sandilands, Woodridge and Pine Ridge soils. Although only minor amounts of Badger soils have been mapped, these soils do occur extensively throughout the Bedford Hills area in small unmappable pockets, particularly in association with Sandilands, Woodridge and Pine Ridge soils.

Agriculture

These soils are droughty, low in natural fertility and are not suitable for the production of grain and forage crops.

BALMORAL SERIES

The Balmoral series consists of poorly drained, Peaty Carbonated Rego Humic Gleysol soils developed on strongly calcareous, moderately fine textured lake and alluvial sediments. Surface textures vary from very fine sandy loam to clay loam and the clay content usually decreases with depth. Texture throughout the Balmoral profile found in the South-Eastern map area is usually coarser textured than the Balmoral series described in the Fisher-Teulon report. The parent material is high in lime carbonate content and is not normally saline. These soils occupy a small acreage along the Whitemouth, Birch, Powawassan, Reed and Sprague Rivers and the Pine Creek. The topography is smooth level to depressional. The native vegetation varies with small differences in surface drainage and consists of balsam poplar, aspen, sedges, willow and alder shrubs. Surface stones occur only on the till substrate phase and are not a serious hindrance to cultivation.

Virgin Balmoral soils consist of a thin layer of peat, underlain by a very dark grey to black Ah horizon that is approximately 6 inches thick, usually clay loam in texture, granular, moderately alkaline and calcareous. A thin, grey transitional layer containing some organic matter separates the Ah horizon from the very pale brown, strongly calcareous parent material. In cultivated areas the peat layer has been partially or totally destroyed or incorporated with the mineral soil. Cultivation also has resulted in a mixing of the surface horizon with the strongly calcareous parent material, so that the plow layer is high in lime carbonate and dry fields have a light grey colour. A representative virgin Balmoral profile is described on page 39.

FIGURE 19

Soil profile of Balmoral Series. A Peaty Carbonated Rego Humic Gleysol developed on strongly calcareous, clay loam textured sediments.
(Stick interval = 6 inches)

TABLE 10

Analysis of Balmoral Very Fine Sandy Clay Loam

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	6-0	—	—	—	7.1	—	—	40.4	2.4	17	—	—	—	—	—	—
Ahg	0-6	52.4	20.	27.6	7.6	1.2	0.7	0.8	0.1	8	28.4	18.9*	8.9	0.4	0.2	—
C1g	6-14	71.0	18.1	10.9	7.9	0.8	25.8	0.2	—	—	4.2	—	2.3	0.1	0.1	—
C2g	14+	39.4	51.6	9.0	7.9	0.5	42.1	—	—	—	—	—	—	—	—	—

*Calcium by difference.

L-H 6 to 0 inches, very dark brown (10YR 2/2, dry), mucky peat; mildly alkaline; abrupt, smooth, lower boundary.

Ahg—0 to 6 inches, very dark grey (10YR 3/1, dry), very fine sandy clay loam; moderate fine granular structure; friable when moist, slightly hard when dry; mildly alkaline; abrupt, irregular, lower boundary.

Cg1—6 to 14 inches, white (2.5Y 8/2, dry), very fine sandy loam; weak fine granular structure; very friable when moist, soft to slightly hard when dry; mildly alkaline; moderately calcareous; iron stained; gradual, wavy, lower boundary.

Cg2—14 inches+, pale yellow (2.5Y 7/4, dry), silt loam; weak fine granular structure; very friable when moist, weakly cemented when dry; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Balmoral Series (6,120 acres)

Areas consisting dominantly of Balmoral soils, but may contain minor occluded areas of Foley, Fyala and Malonton soils.

Balmoral sand substrate phase (660 acres)

Areas of Balmoral soils in which a substrate of moderately calcareous sand occurs within 30 inches of the surface. This sand substrate is not as limy and is more permeable than the overlying sediments. The solum is usually contained within the finer textured surface sediments.

Balmoral till substrate phase (3,560 acres)

Areas of Balmoral soils in which a substrate of strongly calcareous glacial till occurs within 30 inches of the surface. This till substrate is somewhat finer in texture and is as limy as the overlying silty sediments. The solum, found within the lacustrine or alluvial sediments has not been affected by the underlying till. Areas of the till substrate phase are distinguishable by the occurrence of scattered stones on the surface.

Agriculture

The chief problems which affect agricultural utilization of Balmoral soils are associated with their poor drainage, high lime content and, in some phases, thin peat cover. In the most extensive area of Balmoral soils near Piney Creek, surface drainage has been improved through the installation of drainage ditches; however, local flooding is still a hazard. The thin organic layer has been largely destroyed by fire and by incorporation of the residues in the surface mineral layer. Excessive lime in Balmoral soils is associated with low available soil phosphorus and consequently is considered a detriment to crop production. Good response to phosphate and nitrogen fertilizers are obtained when applied to grain and forage crops.

BIRCH POINT SERIES

Birch Point series consists of well drained Dark Grey Wooded soils developed on moderately to strongly calcareous medium textured alluvial sediments. Surface textures of the plow layer range from very fine sand to silt loam and the underlying stratified material usually has layers of fine sand to silty clay loam. These soils occur principally on well drained sites along the margins of streams and creeks, particularly along the Whitemouth, Birch and Boggy Rivers. They are underlain by weakly calcareous lacustrine clay. The topography is level to irregular, very gently sloping. Most of these soil areas are now cultivated, but the native vegetation appears to have been dominantly aspen, birch, balsam poplar, with some white spruce, elm, ash and maple.

The Birch Point soils show variable degrees of degradation. Soils with sandy surface textures have a thicker and more strongly developed, leached Ae horizon than those with finer

TABLE 11

Analysis of Birch Point Very Fine Sandy Loam

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	K	Na	H
Ah	0-2	—	—	—	7.4	—	—	15.19	—	—	—	—	—	—	—	—
Aeh	2-8	64	28	8	7.2	—	—	0.50	0.05	10	4.7	3.5	1.4	.02	0.02	—
Bt	8-13	44	21	35	5.8	—	—	0.48	0.06	8	22.8	12.0	7.6	0.8	0.1	2.4
BC	13-15	54	29	17	7.6	0.3	24.54	0.48	0.05	10	6.8	3.5*	2.6	0.2	0.05	—
C1	15-22	46	36	18	7.8	0.3	39.41	0.34	—	—	—	—	—	—	—	—
C2	22+	33	44	23	7.8	0.3	42.73	0.42	—	—	—	—	—	—	—	—

*Calcium by difference.

textured surface layers. A thin, very dark grey Ah horizon is present in some soils. The Bt horizon is usually well developed and is clay loam in texture. These soils are coarser textured than the related Whitemouth soils in the map area just north of the South-Eastern area. The Birch Point soils also have a narrower textural range than the related Morton soils of the Interlake district of Manitoba. The Birch Point series form a catenary group with the Hadashville (Gleyed Dark Grey Wooded), and Foley (Peaty Carbonated Rego Humic Gleysol) series. A representative profile of the Birch Point soils on stratified parent material follows.

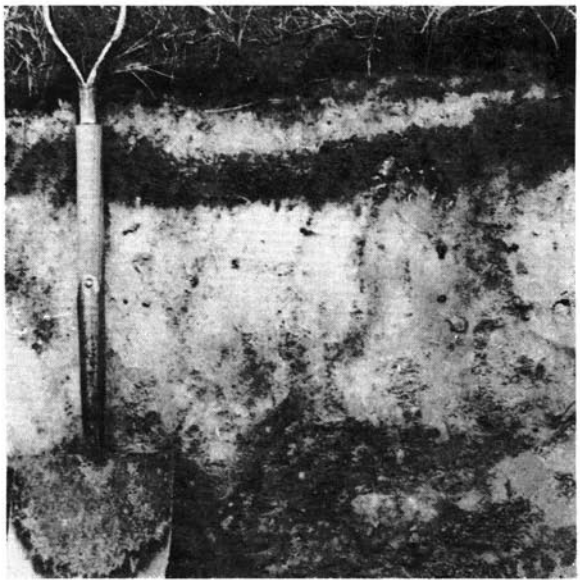


FIGURE 20

Soil Profile of Birch Point Series. A Dark Grey Wooded developed on loam textured sediments.

Ah —0 to 2 inches, black (10YR 2/1, dry), fermented to well decomposed leaf, bark and grass litter; neutral; abrupt, smooth, lower boundary.

Aeh—2 to 8 inches, light grey to light brownish grey (10YR 6/1 to 6/2, dry), loamy very fine sand; weak, fine platy; very friable when moist, soft when dry; slightly acid; clear, wavy, lower boundary.

Bt —8 to 13 inches, brown to pale brown (10YR 5/3 to 6/3, dry), clay loam; moderate fine subangular blocky; firm when moist, hard when dry; medium acid; clear, wavy, lower boundary.

BC —13 to 15 inches, pale brown (10YR 6/3, dry), very fine sandy loam; weak fine to medium granular; friable when moist and slightly hard when dry; mildly alkaline and weakly calcareous; clear, irregular, lower boundary.

C1 —15 to 20 inches, very pale brown (10YR 7/3, dry), silt loam; weak fine pseudo-granular; very friable when moist, weakly cemented when dry; moderately alkaline and strongly calcareous; clear, irregular, lower boundary.

C2 —22 inches+, white to very pale brown (10YR 8/2 to 8/3, dry), stratified very fine sand to silty clay loam; moderate fine pseudo-granular; friable when moist, weakly cemented when dry; moderately alkaline and strongly calcareous.

Mapping Units

Birch Point series (700 acres)

Areas consisting dominantly of Birch Point soils. Small occluded areas of Whitemouth and Hadashville soils may be present. Although only minor amounts of Birch Point soils have been mapped, these soils do occur in small unmappable pockets in association with the clay substrate phase of Hadashville, Medika, Wampum and Elma soils along the Whitemouth, Birch, Boggy and Sprague Rivers and Harrison's Creek.

Agriculture

Birch Point soils are moderately fertile and are suited to grain and forage production. The organic matter content is low and crops grown

TABLE 12

Analysis of Caliento Fine Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	K	Na	H
L-H	1½-0	—	—	—	—	—	—	26.89	1.4	19	—	—	—	—	—	—
Aheg	0-1	82.3	12.4	5.3	5.8	—	—	2.24	0.2	11	14.98	10.20	2.04	0.11	0.03	2.61
Aeg	1-17	90.6	8.1	1.3	6.2	—	—	0.06	0.01	6	10.24	6.53	3.25	0.13	0.06	0.27
IIABg	17-18½	70.1	13.8	16.1	6.0	—	—	0.23	0.01	23	—	—	—	—	—	—
IIBtg	18½-22	43.5	26.8	29.7	6.6	—	—	0.47	0.04	12	20.15	13.05	6.10	0.33	0.02	0.86
IIBCg	22-26	71.6	20.7	7.7	7.7	0.28	16.51	0.44	0.02	22	—	—	—	—	—	—
IICcag	26-28	24.8	63.9	11.3	7.9	0.33	51.56	0.69	—	—	—	—	—	—	—	—
IICg	28+	75.5	17.8	6.7	7.9	0.27	21.31	0.2	—	—	2.05	—	1.05	0.04	0.06	—

on these soils will likely respond to nitrogen and phosphorus fertilization. Available potassium level in these soils appears to be adequate for grain and forage crop production but may not be adequate for root crops such as potatoes. In uncleared areas the dense cover of mixed hardwoods presents a major obstacle to cultivation.

CALIENTO SERIES

Caliento series consist of imperfectly drained Gleyed Grey Wooded soils developed on 6 to 30 inches of weakly calcareous, fine to medium sand overlying strongly calcareous glacial till. Surface textures vary from fine to medium sand. These soils occur on irregular, gently sloping terrain where surface runoff is negligible and internal drainage is rapid in the upper portion of the solum to impeded in the lower portion. Native vegetation is dominantly aspen and balsam poplar. These soils are slightly to moderately stony; the degree of stoniness depending upon the depth of the sand deposit over the till.

Caliento soils normally are characterized by L-H, Aeg, IIBtg, IICg horizon sequences. The iron stained Aeg horizon varies with the thickness of the sand deposit, normally 15 to 20 inches thick, and overlies a weak to moderate Btg horizon developed in the strongly calcareous, sandy loam to silty clay textured glacial till. A weakly to moderately calcareous IICcag horizon sometimes occurs below the solum. In some sites the solum of this series is contained completely within the sand deposit. Where this occurs the soil is characterized by L-H, Aeg, Btjg, Ccag, IICg horizon sequences.

A representative virgin profile of Caliento fine sand is described below:

L-H —1½ to 0 inches, dark brown (10YR 3/2, dry), partially to well decomposed leaf, twig, herb and grass litter; medium acid; abrupt, wavy, lower boundary.

Aheg —0 to 1 inch, dark grey (10YR 4/1, dry), loamy fine sand; structureless; loose when moist or dry; medium acid; clear, wavy, lower boundary.

Aeg —1 to 17 inches, light grey (10YR 7/1, dry), fine sand; structureless; loose when moist or dry; slightly acid; numerous medium sized, reddish brown (5YR 4/3, dry), iron mottles; clear, wavy, lower boundary.

IIABg—17 to 18½ inches, very pale brown (10YR 7/3, dry), fine sandy loam, weak fine granular; friable when moist, soft when dry; slightly acid; numerous medium sized, weakly cemented, reddish brown (5YR 5/4, dry), iron concretions; abrupt, wavy, lower boundary.

IIBtg —18½ to 22 inches, brown (10YR 5/3, dry), clay loam; moderate fine subangular blocky; firm when moist, hard when dry; slightly acid; few medium sized, reddish brown (5YR 5/4, dry), iron mottles; clear, wavy, lower boundary.

IIBCg—22 to 26 inches, very pale brown (10YR 7/3, dry), fine sandy loam; weak fine pseudo-fragmental; friable when moist, slightly hard when dry; mildly alkaline and moderately calcareous; numerous, reddish brown (10YR 5/4, dry), iron mottles; clear, wavy, lower boundary.

IICcag—26 to 28 inches, white (10YR 8/1, dry), silt loam; fine pseudo-granular structure; friable when moist, weakly cemented when dry; moderately alkaline and strongly calcareous; clear, broken boundary.

IICg —28 inches+, very pale brown (10YR 7/3, dry), fine sandy loam; fine pseudo-granular; friable when moist, slightly hard when dry; moderately alkaline and moderately calcareous; numerous, reddish brown (5YR 5/4, dry), iron mottles.

Mapping Units

Caliento Series (17,070 acres)

Areas are dominantly imperfectly drained Caliento soils. Contains minor occluded areas of Piney and Wintergreen soils.

Caliento-Malonton Till Substrate Complex (2,910 acres)

Dominantly irregular, gently sloping areas of Caliento and Malonton till substrate phase soils. Local relief in these areas is not great. The imperfectly drained Caliento soils occur on the knoll and upper slope positions while the poorly drained Malonton soils occur in the intervening depressions. Both soil types occur in equally significant proportions and in small unmappable complex patterns.

Piney-Caliento Complex (17,380 acres)—see Piney Series

Wintergreen-Caliento Complex (8,800 acres) —see Wintergreen Series

Agriculture

Caliento soils are not generally suited to arable culture because of low fertility and coarse surface textures. A dense cover of aspen and balsam poplar renders these soils almost useless for pasturage. Only a small portion of the Caliento soils are being used for grain and forage crops. Management practices should include rotations that keep these soils under grasses and legumes almost exclusively. In addition, trash cover, shelterbelts and suitable tillage practices are needed to reduce susceptibility to wind erosion. The use of complete fertilizers may be necessary to establish good stands of forage.

Caliento Series are good forest soils and are able to produce good stands of aspen, balsam poplar, balsam fir, white spruce, tamarack and white cedar.

CARRICK SERIES

Carrick Series are well drained Orthic Grey Wooded soils developed on strongly calcareous, very stony glacial till. Surface texture of the plow layer, which consists of a mixture of material from the A, B and C horizons is generally fine sandy clay loam but ranges from fine sandy loam to clay. This wide range in surface texture is due to the inclusion of soils developed on a very thin (0-6 inches thick) lacustrine deposit over the till. Carrick soils occupy the well drained till ridges and hillocks scattered throughout the transitional area that lies between the sandy Bedford Hills and the swampy lowlands, mainly in the vicinity of the

FIGURE 21

Soil profile of Caliento fine sand. A Gleyed Grey Wooded developed on 6-30 inches of fine sand overlying very calcareous glacial till.

FIGURE 22

Soil profile of Carrick Series. A thin Orthic Grey Wooded developed on very calcareous glacial till. (Stick interval = 6 inches)

St. Labre, Whitemouth and Moose Lake districts. The topography varies from smooth, very gently sloping to irregular, gently sloping, commonly in the form of broad ridges. Surface runoff is moderate and permeability is medium. Native vegetation consists mainly of aspen, followed by some pure stands of birch, mixed aspen and birch; and a thin scattering of balsam fir and white spruce. All Carrick soils are very stony.

Although Carrick soils are characterized by strongly developed Orthic Grey Wooded features their horizons are thin. The entire solum is normally less than 12 inches thick, and in some places does not exceed 6 inches. In virgin sites a thin, slightly acid leaf and herb mat overlies a 2 to 6 inch Ae horizon that is medium acid in reaction. Frequently a very weak AB horizon occurs in the lower portion of the Ae horizon. The Bt horizon is strongly developed but thin. A thin BC horizon usually separates the Bt horizon from the strongly calcareous C horizon. Cultivated Carrick soils are neutral to mildly alkaline in the plow layer and often contain free lime carbonate. The Carrick series differ from the Garson soils of the Interlake district of Manitoba in having thicker sola. These thicker sola of the Carrick soils are probably due to a more humid climate and a lower lime content in the parent material.

FIGURE 23

Landscape view of Carrick soil area showing a mixed stand of aspen and scattered white spruce.

A representative, virgin profile of Carrick fine sandy loam soil is described below:

L-H—1 to 0 inches, black to very dark brown (10YR 2/1 to 2/2 dry), partially to well decomposed leaf twig, herb and grass mat; neutral; abrupt, smooth, lower boundary.

Ah —0 to ½ inches, very dark grey (10YR 3/1, dry), fine sandy loam; weak fine granular; very friable when moist or dry; medium acid; abrupt, smooth, lower boundary.

Ae1—½ to 2 inches, light grey (10YR 7/2, dry), fine sandy loam; weak fine to medium platy; very friable when moist, soft when dry; medium acid; clear, smooth, lower boundary.

Ae2—2 to 6 inches, very pale brown to light yellowish brown (10YR 7/3 to 6/3, dry), fine sandy loam; weak medium platy, very friable when moist, soft when dry; medium acid; clear, smooth, lower boundary.

Bt —6 to 10 inches, brown (10YR 5/3, dry), clay loam; weak fine granular structure; firm when moist, hard when dry; mildly alkaline; gradual, wavy, lower boundary.

BC —10 to 12 inches, very pale brown (10YR, 7/3, dry), clay loam; weak fine granular; firm when moist, hard when dry; mildly alkaline; gradual, wavy, lower boundary.

C —12 inches+, white to light grey (10YR 8/2 to 7/2, dry), loam; strong medium pseudo-granular; firm when moist; strongly cemented when dry; moderately alkaline and strongly calcareous.

Mapping Units

Carrick Series (27,850 acres)

Areas of dominantly well drained Carrick soils. Minor occluded areas of Piney, St. Labre and Vassar soils.

Carrick-Meleb Complex (3,400 acres)

Areas of dominantly (approximately 60 percent) Carrick soils which contain numerous sharp and elongated depressions occupied by poorly to very poorly drained Meleb soils.

Carrick-St. Labre Complex (9,340 acres)

Irregular, very gently to gently sloping complex areas of strongly calcareous boulder till and thin sand deposits which overlie calcareous till. Carrick and St. Labre soils occur in equally significant amounts and in mosaic patterns where individual soil areas are not large enough to allow separation at the mapping scale used.

Carrick-Vassar Complex (6,667 acres)

Irregular, gently sloping areas of strongly calcareous glacial till and thin sand deposits overlying clay loam to clay textured lacustrine and glacial till deposits. These areas are very similar to Carrick-St. Labre area, however, the sand deposits normally are thicker. They also occur in equally significant amounts and in complex patterns that are too small to be shown separately on the soil map.

TABLE 13

Analysis of Carrick Fine Sandy Loam

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	K	Na	H
L-H	1-0	—	—	—	6.6	—	—	—	—	—	—	—	—	—	—	—
Ah	0-½	75.7	15.2	9.1	6.1	—	—	7.70	.44	19	25.4	15.37	6.20	0.51	0.08	2.86
Ael	½-2	68.4	26.2	5.5	5.8	—	—	0.24	.04	6	3.25	1.81	0.32	0.07	0.06	0.68
Ae2	2-6	71.7	23.1	5.3	5.7	—	—	0.13	.02	6	2.33	1.02	0.68	0.04	0.04	0.43
Bt	6-10	40.2	19.8	40.0	6.5	—	—	0.68	.05	13	23.92	13.98	7.51	0.50	0.12	1.91
BC	10-12	40.8	31.8	27.4	7.9	0.45	21.13	0.78	.05	15	—	—	—	—	—	—
C	12+	36.4	45.2	18.4	8.2	0.42	44.46	0.3	—	—	7.30	5.1*	2.0	0.1	0.1	—

*Calcium by difference.

Agriculture

The Carrick soils have a low supply of available soil phosphorus and are low in organic matter content. Tillage is hampered by the presence of large quantities of stones and boulders over much of this soil area. Stones appear to be more of a problem in the north-western section than in the south-eastern part of the map area.

Only a very small portion of the Carrick soils are under cultivation. Their main use is for the production of aspen, birch and white spruce trees. In some areas they are also being used for pasturage. Management practices should include phosphorus fertilizers on all grain and forage crops. Native grasses growing on these soils are low in phosphorus and livestock raised here may show symptoms of phosphorus deficiency and in such cases a phosphate supplement should be fed. Hay production can be improved considerably by growing more suitable species of grass and by the use of phosphorus fertilizers.

Carrick Series are fairly good forest soils, moderately well suited for the production of aspen, balsam poplar, white birch, jack pine, red pine, white pine and white spruce.

DEEP PEAT SOIL COMPLEX

Deep Peat soils consist of a complex of soils developed from organic materials in various stages of disintegration and humification and usually vary in depth from 3 to 12 feet. These soils occupy approximately 50 percent of the map area and occur mainly in vast lowland expanses surrounding the Bedford Hills-Whitemouth Lake Plateau. They also occur in small depressional areas between ridges of water-worked till in the Brokenhead River Plains, and in rock bound depressions in the Precambrian Shield.

In general these organic deposits consist of mosses, sedges, aquatic and semi-aquatic plants, reeds, and woody materials that are weakly to moderately decomposed and usually strongly acid to neutral in reaction. Disintegration and decomposition of materials increases with depth and the organic layer has a black humified appearance near and at the contact with the underlying mineral sediments. The underlying mineral sediments are dominantly weakly to moderately calcareous clay; silt and sandy substrates occur in areas bordering the better drained mineral soils of similar texture.

The surface of areas of Deep Peat soils in the lowlands is nearly level, but in most places has a slope of 4 to 8 or more feet per mile. Some of the small areas occupy natural depressions which have no visible outlet. In many places beach ridges act as dams and restrict free natural drainage. In nearly all areas these organic soils have some slope so that artificial drainage is possible, particularly for areas with outlets like those along the lower parts of the Whitemouth River, the Birch and Reed Rivers and Harrison's Creek. The huge bog area of the Whitemouth River Lowlands on the other hand would be difficult to drain because of its large size, low gradient and the few natural outlets.

Native vegetation on Deep Peat soils varies with a number of environmental factors, the most important of these being moisture regime. On very wet sites where the peat is unconsolidated and the surface of which fluctuates with the water table the dominant species are open stands of stunted larch and black spruce. Under this type of canopy the ground cover and

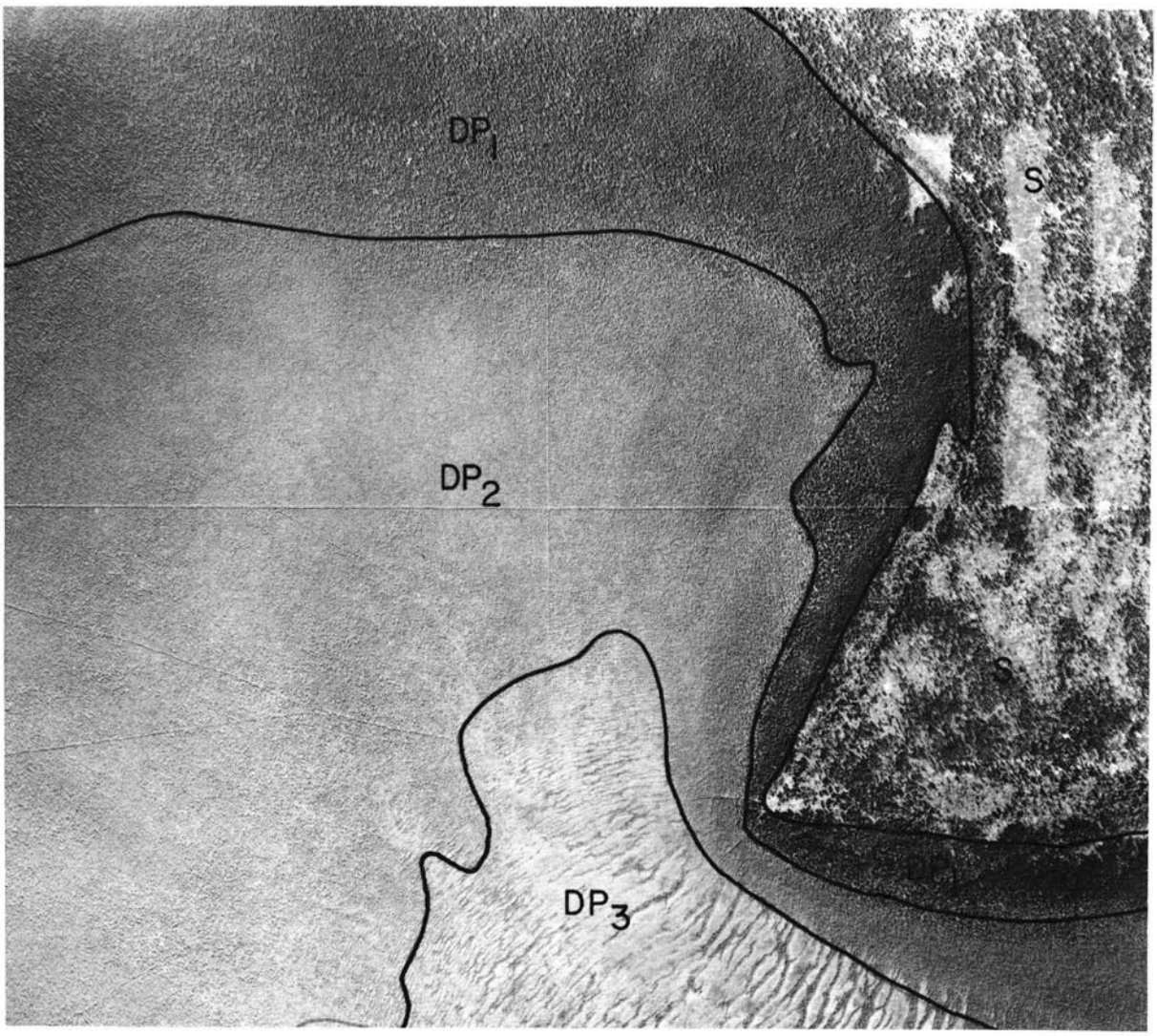


FIGURE 24
Detailed map of a portion of the Deep Peat Soil Complex in T. 6, R. 11E. DP_1 = Productive black spruce-tamarack site, main peat formers are sphagnum and feather mosses; DP_2 = Stunted tamarack-black spruce site, main peat former is sphagnum moss; DP_3 = Treeless, patterned fen-like area having alternate, more or less parallel, mossy ridges and sedge-filled swales; S = Sandilands Series, an upland site. Slope is toward lower right.

main peat formers are sphagnum mosses, some sedges, Labrador tea, leather leaf, small cranberry and swamp birch. On slightly better drained sites pure stands of black spruce and/or larch occur. Ground cover on this site is mainly swamp birch, sedge, marsh marigold and sphagnum mosses. On consolidated peat soils where the water table is able to recede to some extent, merchantable dense stands of black spruce and some mixed stands of black spruce and larch occur. Under this type of canopy the main peat formers appear to be sphagnum and feather mosses of varying proportions with minor amounts of such shrubs as Labrador tea and leather leaf. Treeless sites occur along the western edge of the map sheet in the Sundown-St. Genevieve areas. Here the dominant types are sedge with clumps of willow and larch and some semi-aquatic plants like bulrushes, reed-grass, and cattails.

While no attempt has been made to separate the various kinds of organic soils which occur, other than to separate shallow peat from deep peat, significant differences in the features of the soils are found under the different environments. The most extensive type (about 45 percent of the Deep Peat soil complex), occurs under stunted larch and black spruce. This type is a low nutrient (oligotrophic), spongy, coarse to medium fibered, dominantly sphagnum peat. A representative profile of this type is given below:

0- 4 inches, brown (10YR 5/3, dry), non-disintegrated; coarse fibered; spongy; strongly acid; sphagnum peat.

4-36 inches, brown to dark brown (10YR 5/3 to 3/3, dry), somewhat disintegrated; coarse to medium fibered; loose; strongly acid; sphagnum peat with small amounts of sedge remains. Many invertebrate remains.

36-54 inches, dark brown (10YR 3/3, dry), partly disintegrated; medium fibered; matted to felt-like structured; medium acid, sedge and sphagnum peat.

54-90 inches, dark brown to very dark brown (10YR 3/3 to 2/2, dry), moderately to almost completely converted; medium to fine fibered; compacted; medium acid; sedge peat with small amounts of cottongrass (*Eriophorum sp.*), sphagnum and brown mosses.

90-92 inches, very dark brown (10YR 2/2, dry), completely converted; very finely divided; compacted; neutral to slightly acid; sedge-brown moss muck.

at 92 inches, grey (5YR 6/1, dry), silty clay; massive; very plastic when wet; very hard when dry; mildly alkaline and moderately calcareous.*

A similar soil to the oligotrophic peat described above is one which occurs under well stocked, healthy black spruce or tamarack

*Grateful acknowledgment is made to Professor J. C. Ritchie, Botany Department, The University of Manitoba, for identification of plant species in the soil profile.

FIGURE 25

Landscape view of stunted tamarack-black spruce site in Deep Peat Soil Complex.

FIGURE 26

Landscape view of a productive 100 to 120-year-old black spruce stand on Deep Peat Soil Complex yielding 20 to 25 cords of pulpwood per acre.

TABLE 14

Analysis of Oligotrophic Deep Peat

Horizon	Depth Inches	pH	Cond. mmhos/cm.	% Org. C	% Total N	C/N	Ash Content % Total Ash	Ash Content m.e./100 gms. Ca & Mg*	Ash Content m.e./100 gms. K	Ash Content m.e./100 gms. Na	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms. Ca	Exchangeable Cations m.e./100 gms. Mg	Exchangeable Cations m.e./100 gms. K	Exchangeable Cations m.e./100 gms. Na
L_1	0-4	5.1	0.4	40.5	1.1	36.8	10.5	32.8	2.9	0.8	116.1	21.5	8.2	2.3	0.9
F_1	4-36	5.6	0.4	45.7	2.1	21.7	7.6	67.6	0.5	0.8	124.9	41.0	12.3	0.2	0.6
F_2	36-54	6.0	0.4	45.1	2.5	18.0	13.7	140.0	0.4	0.7	148.5	77.9	14.8	0.1	0.6
F_3	54-90	6.1	0.4	41.5	2.6	16.0	21.5	126.5	0.5	0.7	114.2	53.3	18.0	0.1	0.7
H_1	90-92	6.2	0.5	25.3	1.4	18.0	52.2	96.3	0.5	0.6	96.0	61.5	8.4	0.2	0.5
Cg**	at 92	7.3	0.6	4.4	0.3	14.6	—	—	—	—	—	—	—	—	—

*Unable to determine calcium and magnesium satisfactorily, however, it has been estimated that the calcium content in ash is approximately 5 to 7 times greater than the magnesium content.

**High organic C & N content of the Cg horizon is due to mechanical mixing of organic matter with the mineral soil which was unavoidable.

and occupies about 30 percent of the Deep Peat Complex. The soil profile in this environment consists of 3 to 5 feet of coarse to medium fibered, felty or compacted, very strongly acid brown to dark brown (10YR 5/3 to 3/3) sphagnum-feather moss peat with small amounts of sedge, and Labrador tea remains. This grades gradually into a medium to fine fibered, compacted or matted, strongly to slightly acid, dark brown to black (10YR 3/3 to 2/1) sedge—brown moss peat. The significant differences between this soil and the previous soil described is that it is more compacted, contains considerably less sphagnum moss and that its water table generally is able to recede to about 18 or 24 inches below the surface by mid-summer.

The remaining 25 percent of the Deep Peat Complex consists of a nutrient-rich (eutrophic) but very wet soil. This soil occurs in patterned fen-like areas‡ having alternate, more or less parallel, mossy ridges about 6 to 12 inches high and sedge filled swales. These ridges spaced 10 to 50 feet apart, lie transverse to the slope at right angles to water movement. These areas tend to be dominated by fen species such as the sedges, reed-grasses and Menyanthes because the wet swales cover much more area than the narrow shrub and moss covered ridges and because the mineral-influenced waters in these areas are circum-neutral in reaction. These soils are usually medium to fine fibered, fluid or loose, close to neutral in reaction and dark brown to very dark brown (10YR 3/3 to 2/2, dry) in colour.

‡M. L. Heinselman, Forest sites, bog processes, and Peatland types in the Glacial Lake Agassiz Region, Minnesota. Ecological Monographs, 33:327-374, Autumn, 1963.

Mapping Units

Deep Peat Complex (927,660 acres)

Areas consisting of 45 percent of oligotrophic relatively undecomposed sphagnum peat supporting unmerchantable black spruce and tamarack; 30 percent of eutrophic, fibrous, sphagnum-feathermoss peat supporting merchantable black spruce, tamarack and some cedar; and 25 percent of very wet, eutrophic, fibrous, sedge peat occurring in treeless, patterned, fen-like areas having alternate, more or less parallel, mossy ridges and sedge filled swales, which lie at right angles to water movement.

Shallow Peat-Deep Peat Complex (14,080 acres)—see Shallow Peat Complex.

Agriculture.

Deep Peat soils are of no agricultural value in their natural state. Some areas can be drained and utilized as hay and pasture land or cultivated, but the cost of reclamation is usually prohibitive. The most limiting physical factors to the economic reclamation of Deep Peat soils in the South-Eastern map area is the lack of adequate drainage outlets, the low gradient over most of these areas and the restriction of free natural drainage by the damming effect of beach and till ridges. The underlying mineral material in most of the peat covered lowlands are dominantly calcareous, moderately fine to fine textured lacustrine deposits and pose no serious problem to reclamation.

The development of the peat moss industry in Manitoba since 1939 has stimulated an increased interest in the location, with respect to market and transportation, and quality of sphagnum peat bogs in the South-Eastern map area. It appears that a number of areas are of value for the production of quality peat moss products such as poultry litter, soil conditioner for horticultural plants, fertilizer, insulating agent and packing material. A number of bogs in the Piney and Sprague areas have sphagnum peats, approaching commercial quality, that have water absorptive capacities of 10 to 18 times its own dry weight.

Deep Peat soils are the most extensive, productive forestry soil in the South-Eastern map area. About 30 percent, or 278,000 acres of Deep Peat soils support merchantable timber or young growth that will produce merchantable timber within a reasonable time.* Other forestry aspects of Deep Peats will be discussed in a special section of the report.

ELMA SERIES

The Elma Series consists of imperfectly drained Gleyed Dark Grey Wooded soils developed on moderately calcareous, stratified, medium to moderately fine textured alluvial sediments, which, frequently may have a lacustrine clay substrate within 30 inches of the surface. The surface textures range from loamy fine sand to loam and the underlying stratified material usually has layers of very fine sand to silty clay. These soils occur principally on imperfectly drained sites along the Sprague and Whitemouth Rivers and along Harrison's Creek in association with coarser textured Hadashville soils.

The following is a description of a representative profile of Elma loam, clay substrate phase:

Ah —0 to 3 inches, black to very dark grey (10YR 2/1 to 3/1), fine sandy loam; moderate fine granular structure; friable when moist, soft when dry; neutral; possesses an abrupt, smooth, lower boundary.

Aegj —3 to 7 inches, light grey to grey (10YR 6/1 to 5/1, dry), loamy fine sand; loose; very friable; neutral; a few small iron mottles stain the sand; clear, wavy, lower boundary.

Btgj —7 to 13 inches, dark brown (10YR 3/3, dry), fine sandy clay loam; moderate medium to coarse granular; firm when moist, hard when dry; slightly acid; a few small blotches of iron stains; clear, wavy, lower boundary.

BCgj—13 to 28 inches, pale brown (10YR 6/3, dry) loamy fine sand; weak fine to medium granular; friable when moist; mildly alkaline; numerous, yellowish brown (10YR 5/6 to 5/8) iron mottles; clear wavy lower boundary.

Cgj —28 to 32 inches, greyish brown (10YR 5/2, dry), clay loam and light grey (10YR 7/2) fine sand; stratified alluvial sediments; moderate, medium granular to loose; firm to very friable when moist, weakly cemented when dry; mildly alkaline; moderately calcareous; numerous flecks of iron stains; abrupt, smooth, lower boundary.

IICgj—at 36 inches, dark greyish brown (2.5Y 4/2, dry), clay; massive to moderate coarse granular; very firm when moist, very hard when dry; light grey (10YR 7/2) lime concretions; numerous, small iron stains and concretions; moderately alkaline.

Mapping Units

Elma Series

While no areas of Elma Series appear on the map, minor amounts are found in association with Hadashville Series along the Whitemouth, Birch, Boggy Reed and Sprague Rivers and along Harrison's Creek.

Elma Clay Substrate Phase (610 acres)

A small area of Elma clay substrate phase soils occurs along the Sprague River of dominantly Elma soils developed on thin clay loam textured alluvial sediments over lacustrine clay. Small occluded areas are principally Framnes and Peguis soils. In this phase the clay substrate impedes internal drainage and causes a wetter regime than that which occurs in the normal Elma Series.

Agriculture

The Elma soils are used for grain and forage crop production. The chief problems are low fertility, wind erosion of bare fields and low water holding capacity of the sandy surface horizons. Agricultural crops require fertilization with nitrogen and phosphate for optimum yields. If grains are to be grown, they should be rotated periodically with forage crops; the latter crops are more suitable than grain.

Under natural conditions Elma Series are productive forest soils, particularly for such species as aspen, ash, elm, white birch, balsam fir and white spruce.

FOLEY SERIES

Foley Series consists of poorly drained, Peaty Carbonated Rego Humic Gleysol soils developed on strongly calcareous, medium to moderately coarse textured lake and alluvial sediments. These deposits are usually strati-

*Estimate derived from unpublished statistics provided by Mr. A. J. Kotowycz, Forest Service, Manitoba Department of Mines and Natural Resources.

TABLE 15

Analysis of Elma Clay Substrate Phase

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
Ah	0-3	59	27	14	7.2	—	—	6.03	0.36	15	—	—	—	—	—	—
Aegj	3-7	78	17	5	7.1	—	—	0.37	0.03	12	4.33	3.2	1.7	0.02	0.07	—
Btgj	7-13	54	13	33	7.1	—	—	0.31	0.03	10	22.5	17.5	6.3	0.05	0.4	—
BCgj	13-28	81	10	9	7.8	0.2	16.1	0.06	0.02	—	—	—	—	—	—	—
Cgj	28-32	58	17	25	7.8	0.2	22.0	—	—	—	—	—	—	—	—	—
IICgj	at 36	33	17	50	7.9	0.2	23.9	—	—	—	—	—	—	—	—	—

fied and are commonly underlain by clay or strongly calcareous glacial till within 30 inches of the surface. Surface textures range from fine sandy loam to silt loam. Small areas of this soil occur on the margins of better drained soils along the Whitemouth and Birch Rivers and along Piney Creek. They are level to depressional and have very slow surface runoff. While the soils are highly permeable internal drainage is normally impeded by a high water-table. These soils are mostly stone-free, with scattered surface stones occurring only in areas where the underlying glacial till comes near the surface.

Native vegetation on Foley soils in very poorly drained sites consists of segdes, reed-grasses, and clumps of willow and alder. In areas where water is able to move off slowly by lateral movement, the dominant species are mixed stands of aspen and balsam poplar with some black spruce and larch. Where tree stands are open a thick cover of shrubs, herbs and grasses occur.

The Foley soils usually have a 3 to 12 inch layer of fibrous to mucky sedge peat; a very dark grey Ahg horizon that is iron stained, weak granular, moderately alkaline and calcareous; and a light grey to pale yellow Cg horizon that is very fine sand to silt loam in texture, iron stained, strongly calcareous and moderately alkaline in reaction. A description of a representative profile in this series is given below:

L-H—3 to 0 inches, very dark brown to black (10YR 2/2 to 2/1, dry), moderately to well decomposed sedge, herbs and leaf litter; neutral to slightly acid; clear, smooth lower boundary.

Ahg—0 to 5 inches, very dark grey (10YR 3/1, dry), very fine sandy loam; weak fine granular; very friable when moist; neutral to mildly alkaline; numerous small blotches of iron staining, lime flecks; gradual, wavy to irregular, lower boundary.

ACg—5 to 8 inches, grey to brownish grey (2.5Y 5/1 to 5/2, dry), very fine sandy loam; weak fine granular; very friable when moist; moderately alkaline and strongly calcareous; iron stained; gradual, irregular, lower boundary.

Cg1—8 to 10 inches, light grey (2.5Y 7/2, dry), very fine sandy loam; granular; very friable when moist; moderately alkaline and strongly calcareous; iron stained; gradual, irregular, lower boundary.

Cg2—At 18 inches, pale yellow (2.5Y 7/3, dry), very fine sandy loam; granular; very friable when moist; moderately alkaline and strongly calcareous; iron stained; numerous snail shells.

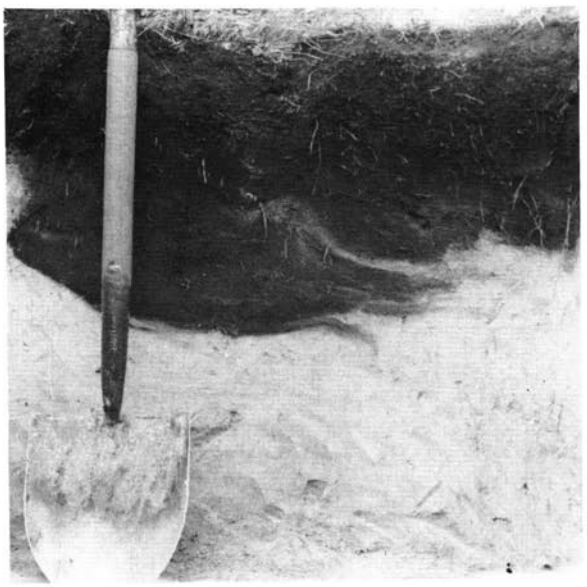


FIGURE 27

Soil profile of Foley loam. A Peaty Carbonated Rego Humic Gleysol developed on strongly calcareous loam textured lake and alluvial sediments. Note irregular Ahg horizon.

TABLE 16

Analysis of Foley Very Fine Sandy Loam

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	3-0	—	—	—	6.5	—	.4	30.00	1.18	30	—	—	—	—	—	—
Ahg	0-5	56	25	19	7.0	—	1.2	1.58	.12	13	22.5	17.5	5.7	0.1	0.3	—
ACg	5-8	68	19	13	7.9	—	10.6	.38	.03	13	—	—	—	—	—	—
Cg1	8-10	68	21	12	8.2	—	28.7	.08	.01	8	—	—	—	—	—	—
Cg2	at 18	64	27	9	8.1	—	33.5	.04	—	—	4.36	3.7*	1.5	0.06	0.08	—

*Calcium by difference.

Mapping Units

Foley Series (2,760 acres)

A large area occurs in the Piney Creek area consisting dominantly of normal Foley soil. Minor occluded areas of other kinds of soils are mostly Balmoral and Malonton Series.

Foley Clay Substrate Phase (1,260 acres)

Areas consisting dominantly of Foley soils in which a substrate of slightly to moderately calcareous clay occurs within 30 inches of the surface found along the Whitemouth and Birch Rivers. Associated with these soils are occluded areas of Fyala soils.

Foley Till Substrate Phase (840 acres)

This phase has a substrate of strongly calcareous glacial till occurring within 30 inches of the surface. This till substrate is similar in texture and calcium carbonate equivalent to the overlying lacustrine or alluvial deposits and does not affect the morphology of the soil profile. Areas of Foley till substrate phase are identified by the occurrence of scattered stones on the surface.

Agriculture

The productivity of Foley soils is limited by poor drainage, thin solum and relatively low fertility. Artificial drainage is required in all areas for the production of cultivated crops. Coarse grains are very responsive to phosphate fertilizer applications when grown on these soils. Some areas are being used for native hay and pasturage.

Foley Series are not productive forest soils. They are suited to a limited degree for such species as aspen, balsam poplar and white cedar.

FRAMNES SERIES

Framnes Series consist of imperfectly drained, Gleyed Dark Grey soils developed on a thin mantle of lacustrine clay over strongly calcareous silty sediments. These underlying sediments are usually stratified and are sometimes underlain by clay. These soils occur along the Spraguc River on smooth level topography. Surface drainage and internal drainage is moderately slow to slow. The native vegetation in virgin sites consists of aspen, balsam poplar, American elm, short black ash and some Manitoba maple. Associated shrubs and herbs are hazelnut, rose, high-bush cranberry, raspberry, saskatoon, bracken fern, bush honeysuckle, dogwood, wild sarsaparilla, northern bedstraw, wild pea, aster, rose mandarin, strawberry and a few grass species.

In natural conditions these soils have a thin, slightly acid leaf mat underlain by a very dark grey Ah horizon that may contain blotches of lighter coloured, slightly leached material. The Ah horizon is 2 to 6 inches thick but frequently tongues through the B horizon to depths of 10 to 15 inches. The $B\overline{tg}j$ horizon has a coarse granular to medium blocky structure and contains a slight clay accumulation. It is neutral to slightly acid in reaction. The $B\overline{tg}j$ horizon, developed in the clay mantle, usually extends down to the underlying silty sediments. The thickness of solum varies with the depth of the clay to the silty, strongly calcareous substrate. A portion of the Cg horizon may occur in the clay layer where it exceeds 20 inches in thickness. A representative Framnes soil profile is described below:

Ahc —0 to 4 inches, very dark grey (10YR 4/1, dry), clay with tongues to 15 inches; moderate fine granular; firm when moist, hard when dry; slightly acid; clear irregular boundary.

$B\overline{tg}j$ —4 to 8 inches, greyish brown (10YR 5/2, dry), clay; strong fine blocky; very firm when moist, very hard when dry; mildly alkaline and weakly calcareous; iron stained; clear irregular boundary.

TABLE 17

Analysis of Framnes Clay*

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
Ahe	0-4	9	35	56	6.3	—	—	5.5	0.4	13	54.7	28.4	22.3	0.2	1.1	4.3
Btgj	4-8	6	35	59	7.4	—	13.8	1.7	0.2	10	37.3	21.8	17.4	0.2	1.1	—
IICcag	8-18	7	44	48	8.1	—	44.5	.9	0.07	12	—	—	—	—	—	—
IICg	18-36	4	46	50	8.2	—	40.2	0.01	0.02	—	—	—	—	—	—	—

*Profile taken from Fisher-Teulon Map Area.

IICcag—8 to 18 inches, light grey (2.5Y 7/2, dry), silty clay; moderate medium pseudo-granular; friable when moist, cemented when dry; moderately alkaline and strongly calcareous; iron stained; diffuse irregular boundary.

IICg —18 to 36 inches, pale yellow (2.5Y 8/4, dry), silty clay; weak fine pseudo-granular; friable when moist, cemented when dry; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Framnes Series (720 acres)

A small area occurs along the Sprague River in the southern section of the map area. This area is comprised of normal Framnes soils and occluded areas of Elma clay substrate soils.

FIGURE 28

Soil profile of Framnes Series. A Gleyed Dark Grey developed on a thin mantle of lacustrine clay over strongly calcareous silty sediments.

Agriculture

This is a good agricultural soil suited to the production of grain and forage crops. Soil variability, particularly the occurrence of sandy surface textures, may tend to reduce the fertility.

They are good forest soils suited to the production of white spruce, balsam fir, aspen, elm, ash and white birch.

FYALA SERIES

The Fyala Series consists of poorly drained Peaty Rego Humic Gleysol soils developed on weakly to moderately calcareous lacustrine clay deposits. Surface texture of cultivated soils is clay but usually contains a high percentage of peaty material that has been incorporated with the mineral material. While the normal Fyala series are clay textured throughout their profiles, layers of silty clay may occur. These soils are widespread throughout the lacustrine basin of glacial Lake Agassiz. They occur along the margins of the numerous peat covered lowlands surrounding the Bedford Hills-Whitemouth Lake Plateau and in depressional positions in the Brokenhead River Plain. Since Fyala soils occupy level to depressional positions in the landscape they have slow surface runoff and very slow internal drainage impeded by fine textures and a high ground water-table. Native vegetation in the depressional positions is mainly sedges, reed-grasses and marsh plants with clumps of willow, alder and larch or black spruce; in level positions tree species, such as black spruce, balsam poplar and aspen prevail. The soils are stone-free except for scattered stones on areas with a substrate of glacial till within 30 inches of the surface.

The virgin Fyala soils have a surface layer of fibrous, medium acid to neutral peat and

TABLE 18

Analysis of Fyala Clay

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	6-0	—	—	—	5.5	—	—	37.1	1.9	18	—	—	—	—	—	—
Ahg	0-8	28	23	49	6.7	—	—	1.5	0.1	15	34.7	21.3	13.4	.2	.7	1.8
Cg	at 20	4	30	66	7.5	—	24.3	0.4	—	—	27.1	—	—	.2	.6	—

muck that is 3 to 12 inches thick and is underlain by a thin, very dark grey Ah horizon high in organic matter and neutral to mildly alkaline in reaction. The Ah horizon is from 2 to 6 inches thick but frequently tongues down into the Cg horizon to depths of 8 to 12 inches. The Cg horizon is greyish brown to olive grey, contains numerous large concretions of lime carbonate and is iron stained. A representative profile description of the Fyala Series is given below:

L-H—6 to 0 inches, very dark brown (10YR 2/2, dry), fibrous and mucky peat; acid to neutral, abrupt, smooth lower boundary.

Ahg—0 to 8 inches, very dark grey (10YR 3/1, dry), clay; moderate fine to medium granular; firm when moist, plastic and sticky when wet; neutral; stained with iron; clear, irregular, lower boundary.

FIGURE 29

Soil profile of Fyala clay. A Peaty Rego Humic Gleysol developed on weakly to moderately calcareous lacustrine clay.

Cg —At 20 inches, light olive grey (5Y 6/2, dry), clay massive to weak coarse granular; plastic and sticky when wet, firm when moist; mildly alkaline and moderately to strongly calcareous; iron stained.

Mapping Units

Fyala Series (3,010 acres)

Areas that are dominantly normal Fyala soils but may contain small occluded areas of Osborne, Tarno and Fyala till substrate soils.

Fyala Till Substrate Phase (2,390 acres)

Areas of Fyala soils in which a substrate of glacial till occurs within 30 inches of the surface. Within the area mapped as this phase are Fyala, Osborne and Meleb soils.

Agriculture

In their natural condition Fyala soils are too wet for the production of grain crops. In areas now under cultivation some artificial drainage has been provided but local flooding, water-logging and weeds are serious problems. Maintaining good tilth in these soils is important and can be accomplished by incorporating the peat layer with the mineral soils when bringing new areas under cultivation and by incorporating crop residues with the mineral soil in cultivated fields. Soil fertility is moderately low and the use of nitrogen and phosphate fertilizers for better yields is recommended. With improved drainage these soils are more suited to forage than grain production.

The best drained Fyala soils in their natural condition are good productive forest soils with some areas supporting a dense mixed stand of spruce, aspen, balsam poplar and some cedar. The very wet soils, on the other hand, occurring in the deeper undrained basins, are unsuited for tree production.

HADASHVILLE SERIES

The Hadashville Series consists of imperfectly drained Gleyed Dark Grey Wooded soils

developed on moderately to strongly calcareous, stratified, medium to moderately coarse textured alluvial and lacustrine deposits. These deposits may be underlain by unconforming clay or strongly calcareous glacial till substrates within 30 inches of the surface. This soil type occurs in narrow strips along the Whitemouth, Birch, Boggy, Reed and Sprague Rivers and along Harrison's Creek. Topography is level to irregular, very gently sloping. Surface runoff is slow and internal drainage is medium to moderately rapid but may be impeded by a high water-table. Native vegetation consists of aspen, balsam poplar, white spruce, elm and ash. In open stands dense shrub, herb and grass layers are found. The soils are free of stones except for scattered surface stones in areas where the underlying glacial till is close to the surface.

The Hadashville soils are characterized by a thin, very dark brown slightly acid leaf mat overlying a 2 to 8 inch light greyish brown Aeg horizon neutral in reaction. The dark greyish brown Btg horizon has a slight clay accumulation and is slightly acid to neutral in reaction. Occasional flooding by lime-charged water causes these soils in some areas to be mildly alkaline and limy to the surface. A representative profile of Hadashville fine sandy loam is described below:

Ah —2 to 0 inches, very dark brown (10YR 2/2, dry), partially to well decomposed leaf, herb and grass litter; neutral; clear, smooth, lower boundary.

Aeg —0 to 2 inches, light brownish grey (10YR 6/2, dry), fine sandy loam; weak fine granular; very friable when moist and soft when dry; neutral; iron stained; clear, wavy, lower boundary.

Btg1—2 to 4 inches, greyish brown (10YR 5/2, dry), fine sandy loam; moderate fine to medium granular; friable when moist and soft when dry; neutral; iron stained; clear, wavy, lower boundary.

Btg2—4 to 8 inches, dark greyish brown (10YR 4/2, dry), fine sandy loam; moderate medium granular; friable when moist and slightly hard when dry; neutral; iron stained; clear, wavy, lower boundary.

BCg—8 to 10 inches, pale brown (10YR 6/3, dry), fine sandy loam; weak fine granular; friable when moist and soft when dry; mildly alkaline; clear, wavy, lower boundary.

Cg —At 12 inches, white to very pale brown (10YR 8/2 and 7/3, dry), very fine sandy loam to silt loam; friable when moist, weakly cemented when dry; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Hadashville Series (7,110 acres)

Areas consisting dominantly of normal Hadashville soils. Minor occluded areas are principally Hadashville clay substrate phase

FIGURE 30

Landscape view of Hadashville clay substrate phase soil area along the Whitemouth River north of the hamlet of Medika. Note wooded margin along the river in the background.

FIGURE 31

Soil profile of Hadashville loam. Note the occurrence of a remnant Aeg horizon just below the cultivated surface layer.

TABLE 19

Analysis of Hadashville Fine Sandy Loam

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca*	Mg	Na	K	H
Ah	2-0	—	—	—	7.1	—	—	15.8	1.09	14	—	—	—	—	—	—
Aeg	0-2	63	21	16	7.1	—	—	1.0	0.08	12	14.6	11.0	3.4	0.03	0.2	—
Btg1	2-4	60	19	21	7.1	—	—	1.2	0.09	13	—	—	—	—	—	—
Btg2	4-8	61	18	21	7.2	0.3	1.1	0.9	0.08	11	17.2	13.5	4.4	0.04	0.3	—
BC	8-10	62	21	17	7.5	0.3	13.6	0.6	0.05	12	—	—	—	—	—	—
Cg	12+	30	50	20	7.7	0.3	45.8	—	—	—	7.07	4.1	2.8	0.04	0.1	—

*Calcium by difference.

and Wampum soils in areas along the Whitemouth River, and Elma soils in areas along Harrison's Creek, Reed and Sprague Rivers.

Hadashville Clay Substrate Phase (1,640 acres)

Areas of Hadashville soil in which a substrate of lacustrine clay occurs within 30 inches of the surface. These soils occur on thin alluvial sediments over clay along the Whitemouth River in the Hadashville-Medika district. Minor occluded areas are Peguis, Pine Valley, Framnes and Wampum soils. Drainage is impeded by the clay substrate causing a wetter regime than in soils of loam texture. Variability in texture and profile development are characteristic of these soils.

Hadashville Till Substrate Phase (1,160 acres)

Areas of Hadashville soils in which a substrate of strongly calcareous glacial till occurs within 30 inches of the surface. These soils are recognizable by the presence of scattered stones on the surface of cultivated fields. The till is similar in texture and lime content to the overlying material but it is usually denser and thus may impede internal drainage.

Agriculture

Hadashville soils are moderately fertile and are suited to grain and forage crop production. They are low in organic matter and in available nutrients and the crops grown on these soils will likely respond to nitrogen and phosphorus fertilization. Finer than average textures prevail along the Whitemouth River, and in other areas where the clay substrate comes near the surface, resulting in a wetter regime and a greater problem in tilth and in workability of the soils.

These soils are very productive forest soils and are best suited for aspen, white spruce, balsam poplar, balsam fir, elm and ash.

INDIAN BAY COMPLEX (49,380 acres)

The Indian Bay complex consists of 75 percent granitoid rock outcrop, about 10 percent of rapidly to imperfectly drained Podzol and Grey Wooded soils and about 15 percent of poorly to very poorly drained Humic Gleysol, Gleysol, Eluviated Gleysol, Shallow and Deep

FIGURE 32

Landscape view of Indian Bay Complex showing variable rockiness and variable composition of the vegetative cover.

Peat soils. The topography varies from irregular, gently sloping at the south-western edge of this complex to steeply sloping in the Falcon Lake area. The native vegetation varies mainly with drainage and consists of jack pine on the rocky knolls; mixed stand of aspen, jack pine, white spruce, balsam fir and some birch on the more moist mineral soil sites; and black spruce, larch and some cedar on the wet Organic Soil sites.

The mineral soils in these areas are developed on glacial drift derived mainly from acidic granitoid rock and as a consequence most of them are extremely stony. Associated with this complex on the small scattered areas of low relief are soils developed on moderately calcareous lacustrine deposits.

Agriculture

Soils of the Indian Bay Complex have little agricultural value under present conditions. However, this complex as a whole with its lakes and rugged, treed landscape is highly suitable for recreation and wildlife.

KERRY SERIES

The Kerry Series consists of poorly drained, Peaty Rego Gleysol soils developed on siliceous sandy outwash, lacustrine and aeolian deposits.

FIGURE 33

Soil profile of Telford Series, an Orthic Podzol developed on extremely stony drift derived from acidic granitoid rock commonly found in the Indian Bay Complex area.

FIGURE 34

Landscape view of Kerry soil area showing smooth topography and character of the native vegetation.

Kerry soils occur in small depressional areas associated with the duned aeolian and outwash deposits which surround the sandy uplands of the Bedford Hills-Whitemouth Lake Plateau. The topography is level to depressional and soil drainage is poor due to lack of surface runoff and a ground water table that is at or near the surface for a considerable part of the growing season. Native vegetation is dominantly sedges and reed-grasses with clumps of swamp birch, alder and willow. Black spruce and larch with some cedar are found in level areas, where the water-table is able to recede. These soils are stone-free.

In their natural condition Kerry soils are characterized by a thin, acid, fibrous to mucky peat surface layer 6 to 12 inches thick underlain by a strongly iron stained, medium acid Cg horizon. The upper portion of the Cg horizon appears to be leached or bleached. Frequently in very wet sites where the water-table is at the surface for most of the growing season the Cg horizon is strongly gleyed and lacks iron mottling. A representative soil profile of the Kerry Series is described below:

L-H—6 to 0 inches, dark reddish brown to very dark brown (5YR 2/2 to 10YR 2/2) dry, partially to well decomposed organic matter; strongly acid; clear, smooth lower boundary.

Ahg—0 to 2 inches, dark grey to grey (10YR 4/1 to 5/1, dry), loamy fine sand; loose; strongly acid; some iron staining; clear, wavy lower boundary.

TABLE 20

Analysis of Kerry Fine Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	6-0	—	—	—	5.1	—	—	21.1	1.2	18	—	—	—	—	—	—
Ahg	0-2	85	10	5	5.3	—	—	1.0	0.08	12	5.5	2.7	0.7	0.02	0.04	1.7
Cg1	2-17	94	4	2	5.9	—	—	0.2	0.01	20	2.7	0.8	0.2	0.01	0.01	0.7
Cg2	at 53	98	1	1	6.5	—	—	—	—	—	1.2	0.7	0.14	0.01	0.01	0.4

Cg1—2 to 17 inches, light grey (2.5Y 7/2, dry), fine sand; loose; acid; some iron staining; gradual, wavy, lower boundary.

Cg2—At 53 inches, light yellowish brown (2.5Y 6/4, wet), fine sand; loose; acid; numerous, small to medium sized iron concretions.

Mapping Units

Kerry Series (8,220 acres)

Areas consisting dominantly of normal Kerry soils. Minor occluded areas of Shallow Peat soils.

Kerry-Shallow Peat Complex (25,240 acres)

Areas containing approximately equal proportions of both Kerry and Shallow Peat soils in which individual soil areas are too small to be shown on the soil map. Most of these areas occur along the margin of the Shallow Peat and Deep Peat soils adjacent to the sandy uplands of the Bedford Hills.

Lonesand-Kerry Complex (24,370 acres)—see Lonesand Series.

Sandilands-Kerry Complex (4,160 acres)—see Sandiland Series.

Sandilands Catena (13,440 acres)—see Sandilands Series.

Agriculture

The Kerry soils are poorly drained, low in organic matter and in available plant nutrients. They are not suited to arable culture; their use at present is utilization as a source of native hay during the driest years.

These soils are generally unsuitable for trees except for a few small better drained areas that support merchantable stands of black spruce, larch and cedar.

LONESAND SERIES

The Lonesand Series consists of imperfectly drained, Gleyed Podzol soils developed on siliceous sandy outwash, lacustrine and aeolian deposits. Surface textures are loamy fine sand to sand. These soils occur mainly in the sandy outwash and lacustrine deposits surrounding the Bedford Hills-Whitemouth Lake Plateau. The topography is irregular gently sloping (micro-duned) to level. Soil drainage is impeded by a high ground-water table. The native vegetation varies from good, pure stands of jack pine to mixed stands of aspen, jack pine, black spruce, and balsam poplar. Associated vegetation consists of dense layers of shrubs

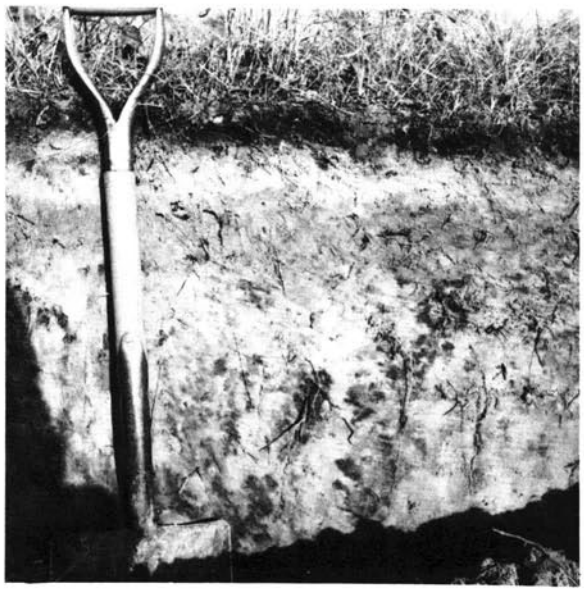


FIGURE 35

Soil profile of Lonesand Series. A Gleyed Podzol developed on siliceous sandy outwash, lacustrine and aeolian deposits.

such as dogwood, rose, alder, chokecherry, saskatoon, and raspberry; herbs such as wild sarsaparilla, sweet coltsfoot, northern bedstraw, asters, strawberries and bunchberries; and some grass species. These soils are stone-free.

The Lonesand soils are more strongly degraded than the associated Sandilands Series as evidenced by the lighter colour of the Ae and more distinctive Bfg horizon. The virgin soils have a thin, acid, partially to well decomposed litter of needles, leaves and twigs. The Ae horizon is weakly gleyed and distinct. The brown Bf horizon is usually strongly acid and contains numerous small to medium sized iron concretions. The amount of iron concretion in the solum appears to increase with depth to a maximum at about 15 to 20 inches. A representative Lonesand profile is described below:

L-H —2 to 0 inches, very dark brown to very dark greyish brown (10YR 2/2 to 3/2, dry), partially to well decomposed litter; acid; abrupt, smooth, lower boundary.

Aheg —0 to 1 inch, grey (10YR 5/1, dry), loamy fine sand; loose; extremely acid; clear, wavy, lower boundary.

Aeg —1 to 3 inches, light grey (10YR 7/2, dry), fine sand; loose; very strongly acid; a number of small iron stains; clear, wavy, lower boundary.

ABg —3 to 5 inches, brown (10YR 5/3, dry), fine sand; loose; very strongly acid; numerous small blotches of iron stains; clear, wavy, lower boundary.

FIGURE 36

A 40 to 50-year-old jack pine stand with scattered black spruce understorey growing on Lonesand soil. Jack pine is 50 feet tall.

Bfg —5 to 11 inches strong brown (7.5YR 5/6, dry), fine sand; weakly cemented when dry; very strongly acid; many yellowish red (5YR 5/6, dry), iron concretions; gradual, wavy, lower boundary.

Cg1 —11 to 30 inches, light yellowish brown (10YR 6/4, dry), fine sand; loose; medium acid; many small blotches of yellowish red (5YR 5/6, dry), iron concretions and stains; diffuse, irregular, lower boundary.

Cg2 —At 40 inches, light yellowish brown (2.5Y 7/2, dry), very fine sand; loose; moderately alkaline; stained with iron mottles; moderately calcareous.

Mapping Units

Lonesand Series (23,540 acres)

Areas that are dominantly Lonesand soils. Some occluded areas are mostly Moodie Series, an associated Orthic Podzol, and Sandilands Series.

Lonesand-Kerry Complex (24,370 acres)

Areas of Lonesand and Kerry soils occurring in complex patterns, with no individual soil area large enough to warrant separation. These areas usually occur in the micro-duned areas that surround the sandy uplands of the Bedford Hills. The Lonesand soils occupy the imperfectly drained, knoll positions, that are influenced by a high ground-water table, while Kerry soils occupy the poorly drained depressions. The areas have mixed vegetation with jack pine and mixed jack pine, aspen and balsam poplar on the Lonesand soils and sedges, swamp birch, alder, occasional clumps of black spruce and larch on the Kerry soils.

Sandilands-Lonesand Complex (18,710 acres) —see Sandilands Series.

Sandilands Catena (13,440 acres)—see Sandilands Series.

Agriculture

These soils are not naturally suited for grain production. They are suitable for permanent improved pastures or haylands and are responsive to improvement practices such as clearing trees, reseeding to adapted grasses and legumes, fertilizing and drainage. The main problems of these soils are coarse textures, low natural fertility and imperfect drainage. It is expected that crops will respond to applications of nitrogen, phosphorus and potassium fertilizers. Local flooding may be a hazard in wet seasons.

Lonesand Series are moderately productive forest soils. They provide favourable sites for the production of jack pine, aspen and balsam poplar.

TABLE 21

Analysis of Lonesand Fine Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	2-0	—	—	—	5.7	—	—	32.1	1.50	21	—	—	—	—	—	—
Aheg	0-1	85	11	4	4.4	—	—	2.3	0.13	18	12.9	1.8	1.1	0.1	0.2	9.4
Aeg	1-3	91	7	3	4.8	—	—	0.35	0.03	12	2.7	0.7	0.5	0.1	0.03	1.2
ABg	3-5	92	4	4	4.7	—	—	0.28	0.03	9	4.3	0.5	0.3	0.1	0.02	3.3
Bfg	5-11	94	4	2	5.1	—	—	0.36	0.03	12	5.3	0.4	0.3	0.1	0.02	5.1
Cg1	11-30	93	4	3	5.7	—	—	0.22	0.01	22	—	—	—	—	—	—
Cg2	at 40	90	6	4	7.9	—	8.3	—	—	—	2.8	1.3	1.1	0.1	0.04	—

MALONTON SERIES

The Malonton Series consists of poorly drained, Peaty Carbonated Rego Humic Gleysol soils developed on moderately to strongly calcareous sandy lacustrine and outwash deposits. These deposits may have a strongly calcareous till or clay substrate within 30 inches of the surface. The texture of the upper mineral soil horizons vary from sand to fine sandy loam. These soils occur in small areas along the margins of Shallow and Deep Peat soils near Hadashville in the northern portions of the map area and near the village of Piney in the southern section. The topography is level to depressional and soil drainage is poor due to lack of surface runoff and a high water-table at or near the surface for a significant period of time during the summer season. Native vegetation is dominantly sedges, reed-grasses and marsh plants; in slightly better drained sites, good stands of aspen, balsam poplar and some black spruce also occur. Scattered surface stones and boulders are present on the till substrate phase.

In virgin Malonton soils, a very dark grey Ahg horizon approximately 3 to 10 inches thick underlies a 6 to 12 inch surface layer of fibrous to mucky peat. The Cg horizon is iron stained, moderately alkaline, moderately calcareous and contains numerous small snail shells. A representative Malonton soil profile is described below:

L-H—6 to 0 inches, very dark brown to black (10YR 2/2 to 2/1, dry), partially to well decomposed, fibrous and mucky peat; neutral; slightly calcareous; abrupt, smooth, lower boundary.

Ahg—0 to 4 inches, very dark grey (10YR 3/1, dry), fine sandy loam; weak fine granular; very friable when moist, soft when dry; mildly alkaline and calcareous; iron stained; clear, irregular lower boundary.

Cg1—4 to 10 inches, white (10YR 8/2, dry), fine sand; loose; moderately alkaline and calcareous; iron stained; contains snail shells; clear, wavy, lower boundary.

Cg2—18 inches+, very pale brown (10YR 8/3, dry), fine sand; structureless; loose; moderately alkaline and moderately calcareous; profusely iron stained; contains snail shells.

Mapping Units

Malonton Series (18,710 acres)

Areas of dominantly Malonton soils. Small occluded areas are mainly Foley, Balmoral and Malonton clay substrate phase soils.

FIGURE 37

Soil profile of Malonton Fine Sand. A Peaty Carbonated Rego Humic Gleysol developed on moderately to strongly calcareous sandy deposits.

Malonton Clay Substrate Phase (4,160 acres)

Areas of Malonton soils in which a weakly to moderately calcareous clay substrate occurs dominantly within 30 inches of the surface and normally below the solum. These areas have level to depressional topography but the depth to the clay substrate may vary considerably in short distances. The clay substrate impedes internal drainage causing a more moist regime than normal for Malonton soils.

Malonton Till Substrate Phase (3,130 acres)

Areas of Malonton soils in which a strongly calcareous till substrate occurs within 30 inches of the surface and normally below the solum. These areas have irregular, level to very gently sloping topography and the depth to the till substrate may vary considerably within short distances. The till substrate impedes internal drainage. Minor occluded areas are mainly normal Malonton, Foley till substrate and Meleb soils.

Caliento-Malonton Till Substrate Complex (2,910 acres)—see Caliento Series.

Agriculture

The Malonton soils occurring in flat, smooth lacustrine basins like the area near Piney are limited in their suitability to a few cultivated crops if artificial improvement of drainage is maintained. In their natural state, these soils are best suited for the production of hay or as native pasture land. They are low in available nutrients and most crops will likely respond to applications of fertilizer. Soils in small undrained basins without natural outlets are usually impractical to drain and therefore are restricted to wild hay production and grazing.

Malonton series are not productive forest soils. They are suited to a limited degree for such species as aspen, balsam poplar and white cedar.

MEDIKA SERIES

The Medika Series consists of imperfectly drained, Gleyed Mull Regosol soils developed on stratified alluvial deposits ranging in texture from very fine sand to silty clay loam and may be underlain by a clay substrate within 30 inches of the surface. These soils are developing on flood plain deposits bordering the Whitemouth, Birch, Boggy and Rat Rivers, mainly in the vicinity of Hadashville. The topography is smooth, very gently sloping but appears undulating in areas containing moderately developed levees and meandering channels. Soil drainage over most of the area is moderate but subject to flooding in very wet seasons and during spring runoff. Native vegetation is principally aspen and balsam poplar, with some short black ash, elm, and Manitoba maple. In open stands of trees a dense undergrowth of shrubs and herbs such as alder, some rose, willow, cranberry, raspberry, saskatoon, sweet coltsfoot, aster, anemone and several species of grass occur. The soils are stone-free.

Soil development on these alluvial sediments is limited to a thin, weak Ahg horizon. The surface layer is 2 to 6 inches thick, dark grey, fine granular, friable, neutral to mildly alkaline in reaction and is usually limy. The underlying material is stratified, moderately to strongly calcareous and contains dark coloured layers of some soil development on former surfaces. A representative virgin soil profile is described below:

L-H—1½ to 0 inches, very dark brown (10YR 2/2, dry), moderately to well decomposed litter; neutral; weakly calcareous; abrupt, smooth, lower boundary.

Ahg—0 to 3 inches, dark grey to very dark grey (10YR 4/1 to 3/1, dry), silt loam; moderate medium granular; friable when moist, soft when dry; neutral to mildly alkaline, weakly calcareous; a number of small iron mottles; abrupt, wavy, lower boundary.

TABLE 22

Analysis of Malonton Fine Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	6-0	—	—	—	7.1	0.6	6.2	20.9	1.1	20	—	—	—	—	—	—
Ahg	0-4	78	10	12	7.4	0.3	5.6	1.5	0.1	15	20.6	18.3	2.2	0.04	0.1	—
Cg1	4-10	96	2	2	8.0	0.3	8.9	0.1	—	—	—	—	—	—	—	—
Cg2	at 18	88	8	4	7.9	0.2	20.7	—	—	—	—	—	—	—	—	—

Cg1—3 to 8 inches, greyish brown to light greyish brown (2.5Y 5/2 to 10YR 6/2, dry), loam; weak fine granular; friable when moist, slightly hard when dry; flecked with iron stains; mildly alkaline; moderately calcareous; clear, wavy, lower boundary.

Cg2—8 to 12 inches, light grey (2.5Y 7/2, dry), loam; weak fine granular; friable when moist, slightly hard when dry; mildly alkaline; moderately calcareous; strongly flecked with iron stains; gradual, wavy, lower boundary.

Cg3—12 to 20 inches, white (2.5Y 8/2, dry), silty clay loam; weak, fine granular; friable when moist, hard when dry; mildly alkaline; moderately calcareous; flecked with iron stains; abrupt, wavy, lower boundary.

Cg4—20 to 28 inches, dark grey (5Y 4/1, dry), clay; moderate medium to coarse granular; firm when moist, very hard when dry; mildly alkaline; strongly flecked with iron concretions; slightly calcareous.

Cg5—At 36 inches, light grey (5Y 7/2, dry), loam; moderate medium granular; friable when moist to slightly hard when dry; mildly alkaline; moderately calcareous; iron stained.

Mapping Units

Medika Series (2,050 acres)

Areas consisting dominantly of Medika soils. Minor occluded areas are mostly Medika clay substrate, Peguis and Hadashville soils. There are two areas of significance in the map sheet; one borders the Whitemouth River near Hadashville and the other along the Rat River near Lonesand Post Office.

FIGURE 38

Soil profile of Medika Series. A Gleyed Mull Regosol developed on silty alluvial sediments. Note the occurrence of dark coloured bands below the cultivated surface layer.

FIGURE 39

Medika soil area along the Whitemouth River inundated by runoff water during break-up in the early spring.

Medika Clay Substrate Phase (4,780 acres)

A fair sized area of Medika soils with a clay substrate within 30 inches of the surface occurs along the Whitemouth River in the vicinity of Medika. Minor occluded areas are mainly Medika, Hadashville and Peguis soils.

Agriculture

Medika soils, though small in extent, are among the most fertile soils in the South-Eastern map area. They are suited to the production of grain and forage crops and to a lesser degree suited to the production of small fruits and vegetables. The main problem is periodic flooding during the spring runoff and in wet seasons. A lesser problem is the occurrence of local areas of clay in the plow layer. This clay soil is dense and tough and presents a tilth problem particularly in the production of roots and small fruits.

These are productive forest soils and can support vigorous stands of mixed hardwoods and white spruce.

MELEB SERIES

The Meleb Series consists of poorly drained, Peaty Carbonated Rego Humic Gleysol soils developed on very strongly calcareous glacial

TABLE 23

Analysis of Medika Silt Loam

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca*	Mg	Na	K	H
L-H	1½-0	—	—	—	7.0	0.7	3.7	25.4	1.66	15	—	—	—	—	—	—
Ahg	0-3	26	53	21	7.4	0.4	8.3	5.4	0.57	9	46.1	36.7	8.7	.01	0.6	—
Cg1	3-8	32	43	24	7.5	0.2	26.4	1.3	0.12	10	—	—	—	—	—	—
Cg2	8-12	34	44	22	7.6	0.3	31.2	0.5	0.06	8	15.6	11.7	3.5	0.1	0.3	—
Cg3	12-20	4	61	35	7.7	0.4	35.2	0.4	0.05	8	—	—	—	—	—	—
Cg4	20-28	6	37	57	7.4	0.2	2.1	1.7	0.15	11	46.3	27.2	18.3	0.2	0.6	—
Cg5	at 36	50	33	17	7.6	0.2	31.0	0.3	0.03	10	10.3	—	—	7.9	.3	—

*Calcium by difference.

till and on water-worked till with a textural range of sandy loam to clay. These soils occur mainly in the Whitemouth Lake Plateau area, occupying the swales in areas of low ridge and swale topography, and the larger flat poorly drained land surrounding bogs and small lakes. The native vegetation is dominantly sedges, reed-grasses and herbs, but extensive areas are covered with willow, balsam poplar, aspen and some tamarack and cedar. All soils are sufficiently stony to hinder cultivation, however, in some areas the stones are partly covered by a thin lacustrine mantle (less than 6 inches) over the till.

In their natural condition Meleb soils consist of a thin layer of fibrous to mucky peat overlying a thin, dark grey Ahg horizon that is alkaline and calcareous. In many places this horizon tongues into the light grey to white, very strongly calcareous till. In soils with a thin lacustrine mantle over the till the Ahg horizon ends at the contact of the two materials. In areas of water-worked till the mantle varies from sandy loam to clay and a gravel or cobble lense commonly occurs at the junction with the loam to clay till. A representative profile of Meleb clay is described below:

L-H—8 to 0 inches, very dark brown to black (10YR 2/2 to 2/1, dry), partially to well decomposed peat; slightly acid; abrupt, smooth, lower boundary.

Ahg—0 to 5 inches, very dark grey (10YR 3/1, dry), clay; moderate fine to medium granular; plastic and sticky when wet, firm when moist; mildly alkaline and calcareous; clear, irregular, lower boundary.

Cg —At 12 inches, light grey to white (5Y 7/2 to 10YR 8/1, dry), stony clay; moderate fine granular; plastic and sticky when wet, firm when moist; moderately alkaline and strongly calcareous; iron stained.

Mapping Units

Meleb Series (4,050 acres)

Areas of dominantly Meleb soils. Minor occluded areas are principally the till substrate phases of Fyala, Balmoral, Foley and Malonton series and Shallow Peat soils.

Meleb-Shallow Peat Complex (4,080 acres)

Areas containing equally significant portions of Meleb and Shallow Peat soils in which individual soil areas are too small to be shown on the soil map at the scale used. This complex occurs along the margins of Deep Peat soils and adjacent to the Piney and Carrick soil areas in the Whitemouth Lake Plateau area.

Carrick-Meleb Complex (3,400 acres)—see Carrick Series.

Piney-Meleb Complex (43,570 acres)—see Piney Series.

Agriculture

Practically all of the area of Meleb soils is unbroken and is used to some extent as native pasture land. Carrying capacity is low, particularly in treed areas. These soils are unsuitable for cultivation because of excessive wetness, stoniness, high frequency of flooding from local runoff and relatively low supply of available phosphorus. Improvement in surface drainage is difficult in most areas because of the ridges which lie across the direction of land fall.

They are fairly productive forest soils, particularly for such species as aspen, balsam poplar, white cedar and tamarack.

PEGUIS SERIES

The Peguis Series consists of imperfectly drained, Gleyed Dark Grey soils developed on

TABLE 24

Analysis of Meleb Clay

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms. Ca	Mg	Na	K	H
L-H	8-0	—	—	—	6.3	—	—	42.3	1.7	25	—	—	—	—	—	—
Ahg	0-5	23	32	45	7.3	—	1.6	0.9	0.07	12	31.5	20.5	8.5	0.1	0.4	—
Cg	at 12	18	39	43	7.8	0.3	45.5	0.2	—	—	13.4	7.3*	5.7	0.1	0.3	—

*Calcium by difference.

weakly to moderately calcareous lacustrine clay. These soils, of which the till substrate phase is the more common, occur in small scattered areas in the southern agricultural fringe of the South-Eastern map area. Runoff is slow because of smooth level topography and internal soil drainage is restricted by the clay texture. A ground-water table persists for a significant time during the wet periods of the growing season. Vegetative cover of the virgin sites is mainly aspen followed by balsam poplar and white spruce; shrubs of dogwood, rose and raspberry; and a ground cover of sweet coltsfoot, northern bedstraw, wild sarsaparilla, wild pea, aster, poison ivy, strawberry, bunchberry and several species of grass. The normal Peguis soils are stone-free and the scattered stones that occur on areas of the till substrate phase do not seriously interfere with cultivation.

The Peguis soils are slightly degraded, as indicated by a blotchy Ahegj horizon and a very dark grey Btgj horizon with blocky structured aggregates coated with clay skins. The virgin soils are slightly acid in the Ahegj and range from slightly acid to mildly alkaline in the Btgj horizon. The lower part of the B horizon is usually slightly calcareous. Tongues of the dark grey Ahegj horizon commonly extend into the Cg horizon. A representative profile of Peguis till substrate phase is described below:

L-H —2 to 0 inches, very dark brown to black (10YR 2/2 to 2/1, dry), partially to well decomposed litter; slightly acid in reaction; abrupt smooth, lower boundary.

Ahegj—0 to 3 inches, dark grey (10YR 4/1, dry), clay with blotches of grey (10YR 6/1, dry), clay; strong, medium granular; very firm when moist, very hard when dry; slightly acid; weakly iron stained; clear, wavy, lower boundary.

Btgj1—3 to 6 inches, very dark grey (10YR 3/1, dry), clay; moderate to medium subangular blocky; very firm when moist, very hard when dry; slightly acid; weakly iron stained; gradual, wavy, lower boundary.

Btgj2—6 to 24 inches, very dark grey (10YR 311, dry), clay; strong, medium blocky; very firm when moist, very hard when dry; medium acid; weakly iron stained; gradual, wavy, lower boundary.

BCgj —24 to 30 inches, light greyish brown (2.5Y 6/2, dry), clay; moderate coarse granular to fine subangular blocky; very firm when moist, very hard when dry; neutral flecked with iron stains; clear, wavy, lower boundary.

TABLE 25

Analysis of Peguis Till Substrate Phase

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms. Ca	Mg	Na	K	H
L-H	2-0	—	—	—	6.8	—	0.8	14.3	1.6	9	—	—	—	—	—	—
Ahegj	0-3	15	27	58	6.4	—	—	1.6	0.15	11	37.5	23.3	8.4	0.1	1.0	2.3
Btgj1	3-6	8	16	76	6.1	—	—	1.0	0.10	10	—	—	—	—	—	—
Btgj2	6-24	4	12	84	6.0	—	—	0.5	0.06	9	52.3	29.4	14.2	0.1	1.3	2.7
BCgj	24-30	4	20	76	7.2	—	—	0.4	0.05	9	—	—	—	—	—	—
IICgj	at 36	18	43	39	7.8	.5	41.6	0.6	—	—	12.5	7.7*	4.4	0.1	0.3	—

*Calcium by difference.

IICgj—At 36 inches, light grey to white (2.5Y 7/2 to 8/2, dry), clay loam till; moderate coarse granular structure; firm when moist, weakly cemented when dry; moderately alkaline; flecked with iron stains.

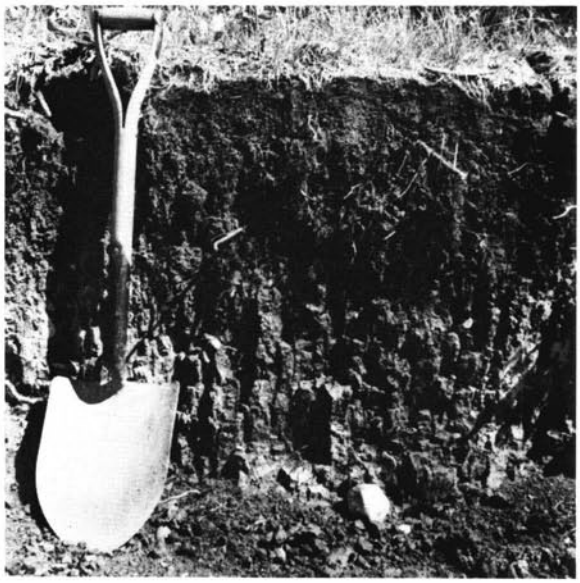


FIGURE 40

Soil profile of Peguis till substrate phase. A Gleyed Dark Grey developed on weakly to moderately calcareous lacustrine clay overlying strongly calcareous glacial till.

Mapping Units

Peguis Series (800 acres)

Areas consisting dominantly of normal Peguis soils. Minor occluded areas are principally Peguis till substrate phase, Framnes and Morris soils.

Peguis Till Substrate Phase (2,320 acres)

Areas of Peguis soils in which a substrate of strongly calcareous glacial till or water-worked till occur within 30 inches of the surface and normally below the solum. These areas have irregular level to very gently sloping topography and the depth to the till substrate may vary considerably within short distances. Profile development appears to end at the contact of the clay and the underlying till. Scattered stones occur on the surface of most areas.

Agriculture

The Peguis soils are good agricultural soils and well suited to grain and forage crop production. They are naturally fertile, have a favourable reaction, and can be maintained in a reasonably good state of tilth if the organic matter content is maintained. Local flooding and water-logging may be a hazard in wet seasons.

They are productive forest soils capable of producing merchantable stands of aspen, balsam poplar, white birch, elm, and white spruce.

PINE RIDGE SERIES

The Pine Ridge Series consists of rapidly drained, Grey Forested soils developed on slightly to moderately calcareous sandy outwash and beach deposits. Surface textures are loamy fine sand to sand. These soils occur in proximity to Woodridge soils, particularly in the sandy uplands of the Bedford Hills. The topography is smooth level to irregular, very gently sloping. Native vegetation is dominantly jack pine with some saskatoon, rose, chokecherry, common juniper, bearberry, snowberry, anemone, aster, antennaria, and mountain-rice grass.

The Pine Ridge soils are developed on sandy deposits with a very low clay content and consequently the development of the textural B horizon is very weak. Very frequently the B horizon is developed in a thin gravel lense comprised of decomposing dolostones coated with a film of clay. The Ae horizon is thick, often extending to 20 or more inches below the surface. The solum is slightly to medium acid in reaction and the C horizon moderately alkaline and calcareous. A Pine Ridge profile is described below:

L-H—0.5 to 0 inches, dark brown (10YR 3/2, dry), partially to moderately decomposed litter of pine needles, twigs and grasses; slightly acid; abrupt, smooth, lower boundary.

Ahe—0 to 1 inch, dark yellowish brown (10YR 4/1, dry), sand; loose; slightly acid; clear, smooth, lower boundary.

Aej —1 to 8 inches, very pale brown (10YR 7/4, dry), sand; loose; slightly acid; clear, smooth, lower boundary.

Btj —8 to 12 inches, yellowish brown (10YR 5/4, dry), sand; loose; slightly acid; clear, wavy, lower boundary.

BC —12 to 18 inches, yellow (10YR 7/6, dry), fine sand; loose; neutral; gradual, irregular, lower boundary.

C1 —18 to 22 inches, very pale brown (10YR 7/3, dry), fine sand; loose; moderately alkaline and calcareous; clear, irregular, lower boundary.

C —At 36 inches, white (10YR 8/2, dry), fine sand; loose; moderately alkaline and calcareous.

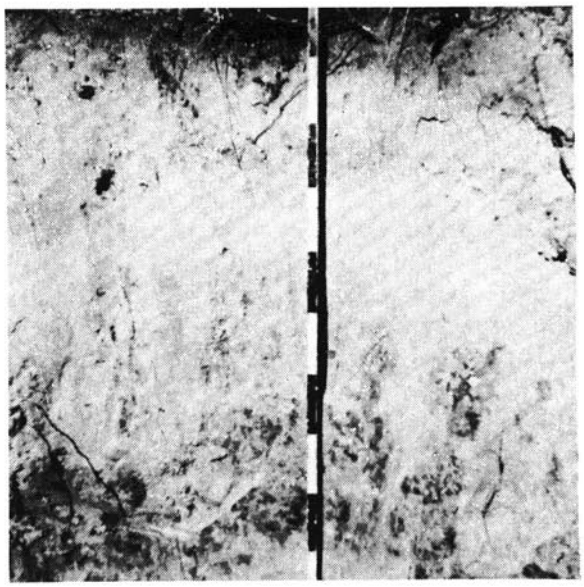


FIGURE 41

Soil profile of Pine Ridge Series. An Orthic Grey Forested developed on weakly calcareous sandy deposits. Note the rather deeply leached surface horizon and the weakly developed B horizon. (Stick interval = 6 inches)

Mapping Units

Pine Ridge Series (840 acres)

Areas consisting dominantly of normal Pine Ridge soils. Small occluded areas are mostly Woodridge and Sandilands soils. They also occur in small unmappable areas with the Woodridge soils in the sandy uplands of the Bedford Hills.

Agriculture

Pine Ridge soils are unsuited for agriculture. They are leached, sandy types low in available plant nutrients, organic matter and water-holding capacity. They have limited use in pasture but provide fair sites for the production of jack pine and red pine.

PINE VALLEY SERIES

The Pine Valley Series consist of imperfectly drained, Gleyed Dark Grey Wooded soils developed on weakly to moderately calcareous lacustrine clay that may be underlain by till within 30 inches of the surface. Surface textures range from loamy sand to clay because of the inclusion of soils with a thin sandy mantle (less than 6 inches thick) over the clay. The topography is smooth to irregular, very gently sloping. Run-off and internal drainage are slow. Native vegetative cover consists mainly of aspen, balsam poplar, white spruce, birch and balsam fir; shrubs, such as willow and dogwood; and dense ground cover of herbs and grasses. The normal Pine Valley soils are stone-free. Scattered stones occur on the surface of areas of the till substrate phase but do not seriously hinder cultivation.

The Pine Valley soils are moderately degraded soils characterized by thin Aheg and Aeg horizons, which may occur completely within a very thin sandy outwash mantle, and by a textural B horizon with strongly developed coarse granular to medium subangular blocky structure. The solum is iron stained and slightly acid in the Ahg, Ae and upper part of the B horizon. The lower part of the B horizon is usually mildly alkaline and slightly calcareous. Tongues of dark grey Ahe and Bt material may extend down into the Cg horizon.

TABLE 26

Analysis of Pine Ridge Fine Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	1-0	—	—	—	6.2	—	—	—	—	—	—	—	—	—	—	—
Ahe	0-1	87	9	4	6.2	—	—	1.7	0.08	20	8.5	4.8	0.8	0.1	0.02	1.7
Aej	1-8	87	10	3	6.4	—	—	0.2	0.02	10	2.5	0.9	0.9	0.03	0.05	0.5
Btj	8-12	87	9	4	6.6	—	—	0.06	—	—	1.2	1.0	0.1	0.05	0.02	0.3
BC	12-18	96	2	2	6.8	—	—	0.06	—	—	—	—	—	—	—	—
C1	18-22	97	2	1	8.2	0.2	8.3	—	—	—	0.8	—	—	0.3	0.01	—
C2	at 36	—	—	—	8.6	0.1	8.6	—	—	—	—	—	—	—	—	—

TABLE 27

Analysis of Pine Valley Sandy Loam

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
Aheg	0-3	62	15	23	6.2	—	—	2.6	0.4	7	29.7	20.7	9.6	0.1	0.4	0.2
Aeg	3-6	77	11	12	6.8	—	—	0.7	0.06	11	9.7	5.0	5.6	0.1	0.1	—
BAg	6-8	53	7	40	7.1	—	—	0.9	0.08	11	—	—	—	—	—	—
Btgl	8-13	25	6	69	7.3	—	—	0.8	0.07	11	47.7	28.8	20.7	0.5	0.8	—
Btg2	13-17	10	5	85	7.8	—	6.1	0.6	0.06	10	—	—	—	—	—	—
Cg	at 24	5	11	84	8.0	3.5	16.0	0.3	—	—	38.9	—	—	1.0	1.5	—

A representative virgin profile of Pine Valley clay is described below:

Aheg—0 to 3 inches, dark grey (10YR 4/1, dry), fine sandy clay loam; moderate fine granular; friable when moist, soft when dry; slightly acid; clear, irregular, lower boundary.

Aeg —3 to 6 inches, light grey (10YR 6/1, dry), fine sandy loam; moderate fine platy; friable when moist, soft when dry; neutral; flecked with iron stains; clear, smooth, lower boundary.

BAg —6 to 8 inches, greyish brown (10YR 5/2, dry), fine sandy clay; moderate coarse granular; friable when moist, slightly hard when dry; neutral; flecked with iron stains; clear, wavy, lower boundary.

Btg1—8 to 13 inches, very dark greyish brown (10YR 3/2, dry), clay; moderate medium subangular blocky; very firm when moist, very hard when dry; neutral; flecked with iron stains; clear, wavy, lower boundary.

Btg2—13 to 17 inches, dark greyish brown (2.5Y 4/2, dry), clay; moderate fine subangular blocky; very firm when moist, very hard when dry; mildly alkaline and slightly calcareous; iron stained; gradual, wavy, lower boundary.

Cg —At 24 inches, light brownish grey (2.5Y 6/2, dry), clay; massive breaking to weak coarse granular; very firm when moist, very hard when dry; moderately alkaline and calcareous; flecked with iron stains and contains numerous concretions of lime carbonate.

Mapping Units

Pine Valley Series (170 acres)

Areas consisting dominantly of normal Pine Valley soils. Minor occluded areas are mainly Peguis and Pine Valley till substrate soils.

Pine Valley Till Substrate Phase (6,690 acres)

Areas of Pine Valley soils where a till substrate occurs within 30 inches of the surface; the depth of clay to the underlying calcareous till varies considerably over short distances. These soils occur in small scattered, level to irregular very gently sloping areas throughout the water-worked till areas of the Whitemouth Lake Plateau. Minor occluded areas are mainly Peguis, Peguis till substrate phase, Pine Valley and Piney soils.

Agriculture

The soils are moderately fertile and produce good crops of grains, grasses and legumes. The main problems are imperfect soil drainage and hazards of local flooding in wet seasons. The application of fertilizers to grain crops is expected to increase yields.

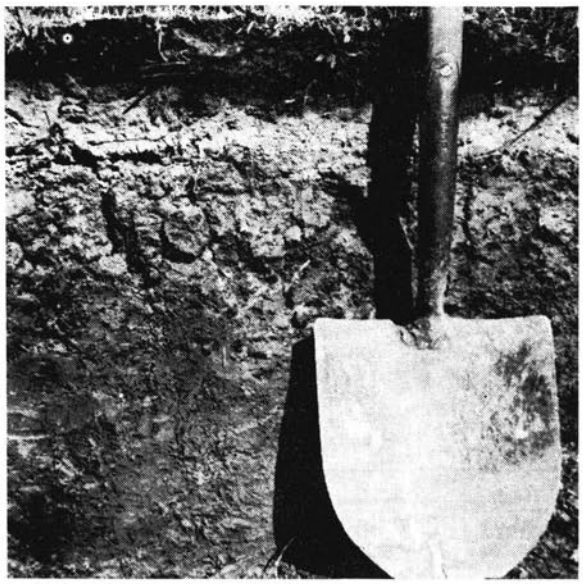


FIGURE 42

Soil profile of Pine Valley Series. A Gleyed Dark Grey Wooded developed on weakly calcareous lacustrine clay.

Pine Valley Series are productive forest soils best suited for the production of aspen, balsam poplar, balsam fir, white elm, white birch and white spruce.

PINEY SERIES

The Piney Series consists of imperfectly drained, Gleyed Grey Wooded soils developed on strongly calcareous glacial till and water-worked till. Surface texture varies from fine sandy loam to clay because of the inclusion of soils with a very thin lacustrine mantle less than 6 inches thick. The Piney soils are widespread in small tracts occurring mainly in the area adjacent to Whitemouth Lake and in the Middlebro, Sirko and Sadlow districts. They occur on low, broad ridges with a smooth, level surface where run-off is slow and internal drainage is moderate to slow. The native vegetation is dominantly aspen with an association of some white spruce and balsam poplar; shrubs such as dogwood, rose, raspberry and brush-honeysuckle; and a ground cover of wild sarsaparilla, northern bedstraw, wild pea, coltsfoot, aster, poison ivy, strawberry, bunchberry, and several species of grass.

In the virgin condition Piney soils are characterized by a thin Aeg horizon overlying a thin, moderately developed textural B horizon that grades abruptly into stony, strongly calcareous till. These soils, with a solum

FIGURE 43

Soil profile of Piney Series. A Gleyed Grey Wooded developed on strongly calcareous glacial till.

FIGURE 44

Landscape view of a Piney soil area showing a good young stand of aspen.

generally less than 8 inches thick, when cultivated have a plow layer consisting of a mixture of A and B horizons; and in some sites the layer may include some limy material from the C horizon. A representative virgin profile of the Piney series is described below:

L-H—2 to 0 inches, very dark brown to black (10YR 2/2 to 2/1, dry), partially to well decomposed litter; slightly acid to neutral; abrupt, smooth, lower boundary.

Aeg—0 to 3 inches, light grey (10YR 6/1, dry), fine sandy loam; weak fine platy; friable when moist, soft when dry; acid; iron stained; clear, wavy, lower boundary.

Btg—3 to 6 inches, dark greyish brown (10YR 4/2, dry), fine sandy clay loam; moderate medium granular; friable when moist, slightly hard when dry; mildly alkaline and weakly calcareous; flecked with iron concretions; clear, wavy, lower boundary.

BCg—6 to 8 inches, greyish brown (2.5Y 5/2, dry), fine sandy loam; moderate fine granular structure; moderately alkaline and moderately calcareous; clear, wavy, lower boundary.

Cg —At 12 inches, very pale brown (10YR 7/3, dry), loam; weak, fine granular; friable when moist, weakly cemented when dry; moderately alkaline and moderately calcareous.

Mapping Units

Piney Series (17,380 acres)

Areas consisting dominantly of Piney soils Minor occluded areas are principally Carrick and Meleb soils. In association are small un-

TABLE 28

Analysis of Piney Fine Sandy Loam

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	2-0	—	—	—	6.6	—	—	28.2	1.5	19	—	—	—	—	—	—
Aeg	0-3	65	28	7	6.0	—	—	0.9	0.06	15	7.0	5.3	1.1	0.1	0.1	1.5
Btg	3-6	61	19	20	7.5	—	6.6	1.1	0.08	14	20.5	13.9	5.1	0.1	0.2	—
BCg	6-8	54	29	17	8.0	—	17.6	0.5	0.05	10	—	—	—	—	—	—
Cg	at 12	48	35	17	8.2	—	28.6	0.2	0.02	10	7.5	4.5*	2.8	0.1	0.1	—

*Calcium by difference.

mappable areas of Gleyed Dark Grey soils developed on similar parent material of the Piney Series.

Piney-Caliento Complex (17,200 acres)

Areas containing about equal proportions of Piney and Caliento soils, occurring adjacent to the Bedford Hills. The Piney soils occur on the stony till deposits, while the Caliento soils occur on the less stony, thin sandy deposits, usually 15 to 20 inches thick, overlying calcareous till. Minor occluded areas are mainly Wintergreen, Lonesand and Carrick soils.

Piney-Meleb Complex (43,570 acres)

Extensive areas occur adjacent to Whitemouth and Moose Lakes. They are areas of low, broad ridge and narrow swale topography in which the Piney soils occupy the imperfectly drained, ridges and the Meleb soils the intervening swales. These ridges are oriented dominantly in a northwest-southeast direction; except in Township 1, Ranges 15E and 16E where a northeast-southwest pattern is shown. In this complex, the Piney soils cover approximately two-thirds of the land area and Meleb most of the remainder. Others in this complex are Carrick, Peguis till substrate, Caliento and Fyala till substrate phase soils.

Agriculture

The Piney soils are severely limited in crop production by their stoniness, low fertility, water-logging in wet seasons, and thin soils. The productivity of these soils may be further restricted where the limy subsoil is brought to the surface with tillage implements. Crops respond well to application of nitrogen and phosphate fertilizer. As native pasture land, the carrying capacity of these soils is restricted by the dense tree cover consisting mainly of aspen and balsam poplar.

These soils provide a good growth medium for trees and presently support good stands of aspen, balsam poplar, some birch, white spruce and balsam fir.

RICHER COMPLEX (12,710 acres)

The Richer complex consists of rapidly to imperfectly drained Grey Wooded and Podzol soils developed on extremely bouldery and stony, coarse to moderately coarse textured, strongly water-worked morainic deposits. This complex contains the stony phases of the Sandilands, Woodridge, Woodridge till sub-

FIGURE 45

Landscape view of Richer Complex soil area showing the stony character of the parent material and condition of the native vegetation after a forest fire.

strate phase, Pine Ridge, St. Labre, Vassar, Lonesand, Wintergreen, Caliento, Sirko and Sirko till substrate phase soils. Most of the land area in this complex is irregular gently sloping to moderately sloping and the soils are dominantly rapid to moderately well drained. The most extensive area of this complex occurs immediately north of the sandy uplands of the Bedford Hills and is traversed by the Trans-Canada Highway east of Richer corner. Native vegetation is dominantly jack pine; about 10 percent of the area is covered with a mixed stand of aspen and jack pine and with pure stands of aspen.

Agriculture

The areas of Richer complex have no agricultural value due to excessive stoniness. The soils are coarse textured, low in fertility and have a low water-holding capacity. These soils provide fair sites for the production of jack pine.

ROCK (11,850 acres)

Areas of rugged, barren, granitoid rock outcrop were mapped as Rock. These areas occur in the rugged terrain of the Precambrian Shield located in the north-eastern corner of the South-Eastern map area. The outcrops become less prominent and fewer toward the south-west because of thicker deposits of drift and peat over the rock. The most westerly outcrop along the Trans-Canada Highway is at McMunn's corner. The outcrops have only a sparse and scrubby cover of birch, balsam fir, aspen and non-merchantable jack pine rooted in rock crevices and slight depressions containing a few inches of rock debris and vegetable material. The rocks are of Precambrian age, consisting mainly of acidic intrusive rocks such as granite, granodiorite and quartz diorite and to a lesser extent of minor pegmatite, quartz-feldspar porphyry gneisses, schists, sedimentary and volcanic rocks.

FIGURE 46

Granitoid rock outcrop characteristic of the Precambrian Shield.

Agriculture

Areas of rock outcrop have no agricultural value. However, their rugged treed terrain and numerous lakes have considerable aesthetic value for recreational development.

ST. LABRE SERIES

The St. Labre Series consists of rapidly to well drained Orthic Grey Wooded soils developed on 6 to 30 inches of sandy outwash overlying moderately to strongly calcareous loam to clay textured lacustrine or glacial till deposits. The surface layer is sand to very fine sand and averages about 15 to 20 inches in thickness. These soil areas have an irregular, very gently sloping to gently sloping topography. They occur as small scattered islands throughout the Whitemouth Lake Till Plateau. Native vegetation is mainly aspen, mixed jack pine and aspen, birch, occasional white spruce and balsam fir; and a profusion of shrubs such as hazelnut, bush-honeysuckle, rose, raspberry; herbs and grasses. A few scattered stones occur on some cultivated fields.

In virgin sites St. Labre soils consist of a thin, partially humified L-H horizon; a thick, light grey, acid Ae horizon which usually comprises all of the sand layer overlying the finer textured substrate; a thin textural B horizon; and a moderately to strongly calcareous, light grey to very pale brown, moderately fine to fine textured C horizon. A representative virgin profile of St. Labre Series is described below:

L-H —2 to 0 inches, very dark brown (10YR 2/2, dry), partially to well decomposed leaf, forb and grass litter; medium acid; abrupt, smooth, lower boundary.

Ahe —0 to 1½ inches, dark grey (10YR 4/1, dry), fine sandy loam; weak fine granular; very friable when moist, soft when dry; medium acid; abrupt, broken lower boundary.

Ae —1½ to 13 inches, light grey (10YR 7/2, dry), loamy fine sand; loose; medium acid; flecks of iron stains just above the Bt horizon; abrupt, wavy, lower boundary.

IIBt —13 to 16 inches, brown to yellowish brown (10YR 4/3 to 5/4, dry), fine sandy loam; weak medium granular to fine subangular blocky; friable when moist, slightly hard when dry; neutral; clear, irregular, lower boundary.

IIBC—16 to 26 inches, light yellowish brown (10YR 6/4, dry), fine sandy loam; weak, fine granular; very friable when moist, soft when dry; mildly alkaline and calcareous; gradual, irregular, lower boundary.

IIC —At 30 inches, very pale brown (10YR 7/3, dry), stony, fine sandy loam; glacial till; weak, coarse granular to fine blocky; friable when moist, weakly cemented when dry; mildly alkaline and moderately calcareous; some iron stains.

Mapping Units

St. Labre Series (1,150 acres)

Areas consisting dominantly of St. Labre soils. Minor occluded areas are mainly Pine Ridge, Sandilands and Carrick series.

Agriculture

St. Labre soils have a fertility limitation restricting the kind of crops that can be grown. The soils are coarse textured, low in water-holding capacity, in available nutrients and in organic matter. Soils under cultivation are very susceptible to wind and water erosion and therefore require careful management such as trash cover and growing of grasses and legumes in rotation with grain crops. They are, however, best suited for tame hay and pasture.

St. Labre Series are good forest soils best suited for the production of jack pine and red pine.

SANDILANDS SERIES

Sandilands Series consists of rapidly drained, Minimal Podzol soils developed on siliceous sandy outwash, beach and aeolian deposits.

FIGURE 47

Soil profile of St. Labre Series. An Orthic Grey Wooded developed on 6 to 30 inches of fine sand over strongly calcareous till.
(Stick interval = 6 inches)

These soils occupy the main portion of the sandy morainic Bedford Hills and the sandy outwash deposits surrounding the uplands. The deposits in the uplands are relatively thick and appear to have been reworked by water and to a minor extent by wind. Those surrounding the uplands are thinner and are duned to some extent. Most extensively duned areas occur in the vicinity of the hamlets of Sandilands, Woodridge, Badger and St. Labre.

Sandilands soils have very weakly developed horizons distinguishable only by faint change in colour and reaction. They have a thin, light brownish grey, medium acid, very

TABLE 29

Analysis of St. Labre Fine Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	2-0	—	—	—	5.4	—	—	25.7	1.7	15	—	—	—	—	—	—
Ahe	0-1½	70	22	8	5.6	—	—	1.1	0.1	11	7.8	4.8	1.9	0.1	0.1	0.7
Ae	1½-13	80	16	4	6.0	—	—	0.2	0.01	20	1.8	0.7	1.0	0.04	0.03	0.5
IIBt	13-16	67	13	20	6.9	—	2.5	0.5	0.04	12	13.1	6.1	5.6	0.1	0.3	0.7
IIBC	16-26	72	20	8	7.5	0.2	18.0	0.3	0.02	12	—	—	—	—	—	—
IIC	at 30	68	27	5	7.6	0.2	21.7	0.1	—	—	2.2	—	2.0	0.1	0.1	—

FIGURE 48

Jack pine-white birch stand with scattered aspen growing on St. Labre soil. The jack pine is 50 years old and 50 feet tall.

thin Ahe horizon underlain by a light grey to light brownish grey strongly acid Ae horizon and an indefinite Bf horizon of variable depth, consisting of light yellowish brown, medium acid sand. The B horizon grades very gradually into structureless, very pale brown sand which may contain a slight amount of lime carbonate at 3 or more feet below the surface. A representative virgin profile of the Sandilands Series is described below:

L-F—½ to 0 inches, very dark brown (10YR 2/2) partially to moderately decomposed pine needles, twigs, mosses, herbs and grass; medium acid; abrupt, smooth, lower boundary.

Ahe—0 to 1½ inches, brownish grey (10YR 5/2, dry), fine sand; loose; strongly acid; abrupt, smooth, lower boundary.

Aej —1½ to 8 inches, light grey (10YR 7/2, dry), fine sand; loose; strongly acid; clear, smooth, lower boundary.

Bfj —8 to 13 inches, light yellowish brown (10YR 6/4, dry), fine sand; loose; medium acid; gradual, smooth, lower boundary.

C —At 36 inches, very pale brown (10YR 7/3 to 8/4, dry), fine sand; loose; medium acid.

Mapping Units

Sandilands Series (67,151 acres)

Areas that are dominantly Sandilands Series. Small occluded areas are mainly Woodridge and Pine Ridge soils.

Sandilands Catena (13,440 acres)

The Sandilands Catena consists of Shallow Peat soils, Sandilands, Lonesand and Kerry Series. These soils occur in about equal proportions in an intricate pattern in which the individual soil areas are too small to map at the scale used. This complex occupies a large proportion of the micro-duned sandy deposits surrounding the Bedford Hills in the vicinity of the hamlets of Sandilands, Woodridge, Badger and St. Labre. The Sandilands soils occupy the rapidly to moderately well drained knoll positions, the Lonesand soils the imperfectly drained slope positions, and the Kerry and Shallow Peat soils occur in the poorly to very poorly drained sites.

The native vegetation, a reflection of the moisture regime, varies with the soil series. On the Sandilands Series, jack pine is most common; on the Lonesand series, pure stands of jack pine and of aspen and mixtures of the two with occasional black spruce are found; and, in the poorly drained areas are sedges with clumps of alder, swamp birch, black spruce and larch.

Sandilands-Kerry Complex (4,160 acres)

Areas containing significant proportions of both Sandilands and Kerry soils. This complex occupies a significant portion of the micro-duned, sandy deposits surrounding the Bedford

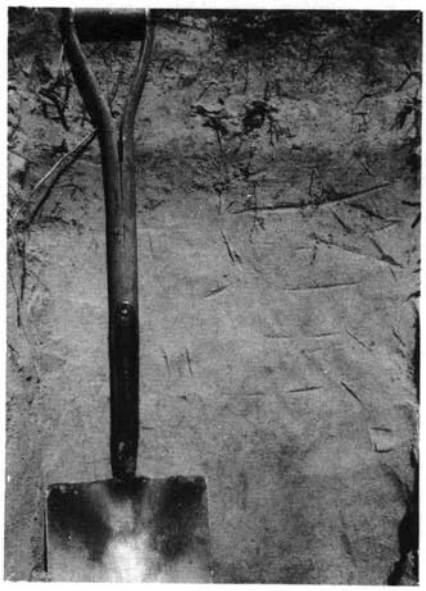


FIGURE 49

Soil profile of Sandilands Series. A Minimal Podzol developed on siliceous sand. Note the weak development of the soil.

TABLE 30

Analysis of Sandilands Fine Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	% Extractable Fe_2O_3	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
											Ca	Mg	Na	K	H
L-F	½-0	—	—	—	5.8	—	—	—	—	—	—	—	—	—	—
Ahe	0-1½	93	5	2	5.2	—	1.7	0.06	29	9.8	2.8	0.9	0.6	0.1	4.3
Ae	1½-8	94	5	1	5.4	0.27	0.5	0.02	25	3.7	1.4	0.5	0.1	0.03	1.8
Bfj	8-13	97	2	1	5.7	0.33	0.4	0.01	40	2.1	0.7	0.2	0.2	0.02	1.1
C	at 36	100	0	0	6.1	0.15	—	—	—	0.6	0.3	0.03	0.01	—	0.4

Hills. This complex, compared with the Sandilands Catena complex, has a sharp rather than a gradual change from the well-drained knolls to the poorly drained depressions with very little imperfectly drained soil between the two positions. Sandilands soils occupy the rapidly to moderately well drained knoll positions, while the Kerry soils occupy the poorly drained depressions. Minor occluded areas are mostly Lonesand and Shallow Peat soils. Native vegetation is principally jack pine on the Sandilands soils, and sedges, reed-grasses, clumps of swamp birch, alder, larch, black spruce and some cedar on the poorly drained Kerry soils.

FIGURE 50

A 50 to 55-year-old jack pine stand growing on Sandilands soils.

FIGURE 51

Landscape view of Sandilands-Kerry Complex in S. 12, T. 5, R. 10E showing a sedgy depression in the foreground and sharp duned ridges with jack pine in the background.

Sandilands-Lonesand Complex (18,710 acres)

Areas consisting dominantly of Sandilands and Lonesand soils. These areas are of low, irregular, gently sloping sand dunes occurring in close association with Sandilands Catena complex and Sandilands-Kerry complex. This complex occupies the largest portion of the duned sandy deposits surrounding the Bedford Hills. Sandilands Series occur on the rapidly to moderately well drained low knoll positions, and the Lonesand Series occur on the imperfectly drained level positions. Minor occluded areas are mainly Kerry soils. Dominant

vegetative cover is jack pine with some aspen and clumps of alder and willow shrubs. The jack pine stands are usually sparse, and thus a fair undercover of mountain-rice grasses (*Oryzopsis asperifolia* and *O. pungens*), bearberry, low bush blueberry, bunchberry, sweet coltsfoot, wild sarsaparilla, dogwood, alder, saskatoon and willow are found and provide limited pasturage for livestock.

Sandilands-Vassar Complex (8,500 acres)

Areas consisting of equally significant proportions of Sandilands and Vassar soils. These areas of irregular level to very gently sloping topography occur in small scattered pockets throughout the Bedford Hills-Whitemouth Lake Plateau. These areas are characterized by a variable, thin mantle of fine to very fine sand over loam to clay textured lacustrine or till deposits. Sandilands soils are found where the sand is 3 feet or more thick, while the Vassar soils occupy sites where the underlying fine substrates occur within 30 inches of the surface. Minor occluded areas are mainly Pine Ridge and St. Labre soils.

Sandilands-Woodridge Complex (40,840 acres)

The Sandilands-Woodridge Complex occupies extensive areas in the Bedford Hills-Whitemouth Lake Plateau. This complex consists of irregular gently sloping areas of siliceous sandy outwash and stratified, sandy and gravelly beach deposits. The Sandilands soils occupy the relatively thick sandy outwash deposits and the Woodridge soils occupy the numerous, narrow, stratified sand and gravel beach ridges. Native vegetation consists of open stands of jack pine with some red pine and a sparse ground cover of prostrate ericoid (heath family) shrubs, herbs and mosses.

Agriculture

These soils have very serious soil limitations restricting their use for cultivated crops or improved permanent pasture and are not naturally suitable as native pasture. Their major limitations are principally coarse textures, low organic matter content, low available plant nutrient status and low water-holding capacity. Their value as permanent native pasture is limited severely by the lack of desirable grass species and herbs in the areas sparsely covered by jack pine and restricted more severely in areas of greater tree density.

These soils provide good sites for the production of jack pine and red pine.

SEVEN SISTERS SERIES

The Seven Sisters Series consists of moderately well drained, Dark Grey Wooded soils developed on slightly to moderately calcareous, moderately fine to fine textured lacustrine deposits. The surface textures vary from clay loam to clay. These soils occur in small scattered areas throughout the Whitemouth Till Plateau; mainly in the Sprague and South Junction districts. The topography is smooth level to very gently sloping. Run-off is moderately slow and permeability of the clay is moderately slow. The native vegetation is comprised principally of aspen, white spruce, balsam fir, some birch and balsam poplar and an undergrowth of dogwood, hazelnut, rose, raspberry, wild sarsaparilla, northern bedstraw, rose mandarin, wild pea, vetch, sweet coltsfoot, strawberry, wild lily-of-the-valley, bunchberry and several grass species (*Oryzopsis asperifolia, Poa canadensis*).

The solum of Seven Sisters Series is characterized by a thin, dark grey, leached Ahe horizon, a light grey, platy, strongly acid Ae horizon and a moderately well developed textural B horizon with a well developed blocky structure that is dark greyish brown in colour and neutral in reaction. The description of a representative virgin Seven Sisters clay profile is given below:

L-H—1 to 0 inches, very dark brown (10YR 2/2, dry), partially to well decomposed herb, grass and leaf litter; neutral; abrupt, smooth, lower boundary.

Ahe—0 to 2 inches, very dark grey (10YR 3/1, dry) loam; moderate fine granular; friable when moist, slightly hard when dry; strongly acid; clear, smooth, lower boundary.

Ae —2 to 4 inches, greyish brown (10YR 5/2, dry), clay loam; moderate fine granular; strong fine to medium granular; friable when moist, slightly hard when dry; clear, smooth, lower boundary.

Bt —4 to 12 inches, dark greyish brown (10YR 4/2, dry), clay; strong coarse granular to fine subangular blocky; firm when moist, very hard when dry; neutral; clear, wavy, lower boundary.

BC —12 to 16 inches, light brownish grey (10YR 6/2, dry) clay; moderate coarse granular to fine subangular blocky; very firm when moist, hard when dry; mildly alkaline and calcareous; gradual, wavy, lower boundary.

C1 —16 to 24 inches, light brownish grey (2.5Y 6/2), clay; moderate coarse granular; firm when moist and very hard when dry; moderately alkaline and strongly calcareous; numerous medium sized lime carbonate concretions; gradual, wavy, lower boundary.

C2 —At 30 inches, greyish brown (2.5Y 5/2, dry), clay; massive to moderate fine blocky; plastic and sticky when wet, very firm when moist; moderately alkaline and strongly calcareous.

TABLE 31

Analysis of Seven Sisters Clay

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	1-0	—	—	—	6.9	—	—	17.4	0.8	22	—	—	—	—	—	—
Ahe	0-2	—	—	—	5.5	—	—	1.5	0.1	15	—	—	—	—	—	—
Ae	2-4	45	43	12	5.1	—	—	0.5	0.03	13	4.8	1.2	0.7	0.1	0.1	1.2
Bt	4-12	23	21	56	6.8	—	—	0.8	0.06	12	34.8	19.2	12.0	0.1	1.5	1.0
BC	12-16	14	32	54	7.8	0.3	26.1	0.4	0.03	13	—	—	—	—	—	—
C1	16-24	11	39	50	7.9	0.3	40.3	0.2	—	—	20.2	—	7.2	0.1	0.8	—
C2	at 30	6	32	62	7.9	0.3	38.3	0.2	—	—	—	—	—	—	—	—

Mapping Units

Seven Sisters Series (3,850 acres)

Areas consisting dominantly of Seven Sisters soils. Minor occluded areas are principally Arnes and Pine Valley soils.

Agriculture

The Seven Sisters soils are suited to sustained production of field crops but have moderately severe limitations restricting the choice of crops. These soils are moderately productive with low organic matter content and moderately low available plant nutrients.

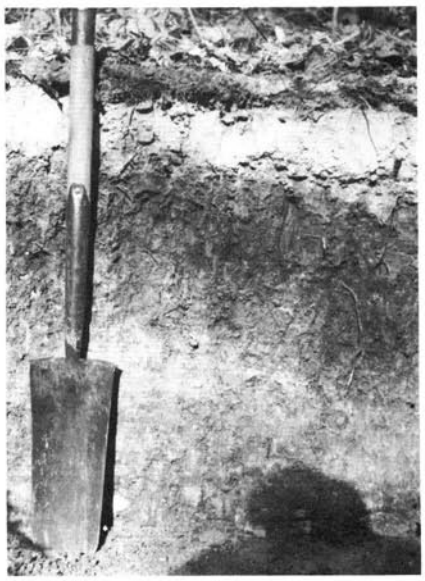


FIGURE 52

Soil profile of Seven Sisters Series. A Dark Grey Wooded developed on fine textured sediments.

Manure and grass-legume crops are needed to maintain organic matter and to improve tilth and workability of these soils. Crops will respond to application of nitrogen and phosphate fertilizer.

These soils are productive forest soils and presently are supporting merchantable stands of aspen, some white spruce, balsam fir and birch.

SHALLOW PEAT COMPLEX

Shallow Peat includes all soils with a 12 to 36 inch surface layer of organic matter. These soils occur at the margins of extensive areas of Deep Peat in the river lowlands surrounding the Bedford Hills-Whitemouth Lake Plateau and in numerous shallow swales and basins. Under the peat the mineral soils were undifferentiated. In most sites, however, the mineral deposits are moderately fine to fine textured, moderately calcareous, lacustrine deposits.

This organic soil complex consists of several different types based on the type of vegetation from which the peat was derived and on the degree of decomposition that has taken place.

The dominant Shallow Peat soil found in South-Eastern Manitoba is a moderately fertile (mesotrophic), fibrous peat under a dense stand of black spruce and derived mainly from hummock-forming mosses such as *Sphagnum spp*, *Hylocomium spp* and *Pleurozium spp*. In association are shrubs such as *Ledum spp*, *Vaccinium vitis-idaea;* sedges; and herbs.

A less extensive Shallow Peat soil type is a relatively fertile (eutrophic) but very wet, fibrous to mucky peat derived mainly from sedges, reed-grasses and marsh plants. These soils usually occur in open sedge meadows, particularly in the Sundown and Sirko districts.

TABLE 32

Analysis of Eutrophic Shallow Peat

Horizon	Depth Inches	pH	Cond. mmhos/cm.	% Org. C	% Total N	C/N	Ash Content % Total Ash	Ash Content meg/100 gms. Ca & Mg*	Ash Content meg/100 gms. K	Ash Content meg/100 gms. Na	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms. Ca	Exchangeable Cations m.e./100 gms. Mg	Exchangeable Cations m.e./100 gms. K	Exchangeable Cations m.e./100 gms. Na
L	0-4	6.0	0.5	35.6	1.2	30	27.5	139	1.6	.6	115.5	64.6	13.7	0.6	0.3
F_1	4-12	6.7	0.5	35.6	1.3	28	26.5	276	1.2	.7	141.1	138.4	17.0	0.3	0.7
F_2	12-20	6.6	0.5	31.8	1.2	27	35.7	244	1.2	1.0	68.9	—	19.5	0.3	0.6
Ahg	20-22	7.3	0.5	3.4	0.2	15	—	—	—	—	9.6	—	2.8	0.2	0.1

*Unable to determine Calcium and Magnesium satisfactorily but find that the Calcium content is approximately 5 to 7 times greater than the Mg content.

A representative, moderately fertile (eutrophic), fibrous peat profile is given below:

0- 4 inches, greyish brown to light greyish brown (10YR 5/2 to 6/2, dry), coarse fibered, spongy, partially decomposed (N.S.S.C. Class 1),** *Sphagnum* spp. and feather-mosses; medium acid; a few snail shells; abrupt, smooth lower boundary.

4-12 inches, very dark greyish brown (10YR 3/2, dry) moderately decomposed (N.S.S.C. Class 2),** mosses, sedges, reed-grass, forbs and marsh plants; fine fibered; granular; slightly acid; with a few fairly large intrusions of woody remains; abrupt, smooth, lower boundary.

20-22 inches, very dark grey (10YR 3/1, dry), fine sandy loam; weak fine granular; slightly sticky when wet, slightly hard when dry; neutral; a few blotches of iron stains.

Mapping Units

Shallow Peat Complex (159,379 acres)

Areas consisting dominantly of mesotrophic and eutrophic fibrous Shallow Peat. Minor occluded areas are mainly Kerry, Malonton, Meleb, Foley, Balmoral, Fyala and Deep Peat soils.

Shallow Peat-Deep Peat Complex (14,080 acres)

Areas of this soil complex generally occur along the margins of the extensive Deep Peat soils found in the various river lowlands surrounding the Bedford Hills-Whitemouth Lake Plateau. Here the Shallow and Deep Peat soils occur in complex patterns with no individual soil area being large enough to be shown on the soil map. Both the Shallow and Deep Peat soils are well stocked with merchantable stands of black spruce, larch and some cedar.

**Stages of decomposition of the peat material as suggested by the N.S.S.C. in their report of the 5th meeting, March, 1963.

FIGURE 53

Soil profile of a fibrous, eutrophic Shallow Peat Soil developed mainly from sedges and reed-grasses.

Kerry-Shallow Peat Complex (25,240 acres) —see Kerry Series.

Meleb-Shallow Peat Complex (4,080 acres)—see Meleb Series.

Malonton Shallow Peat Complex (5,780 acres)—see Malonton Series.

Malonton Till Substrate Phase-Shallow Peat Complex (230 acres)—see Malonton Series.

Sandilands Catena Complex (13,440 acres)—see Sandilands Series.

Agriculture

Shallow Peat soils in their natural state have little agricultural value. In open areas, the

sedges and reed-grass are of poor quality and the soil is commonly too wet for hay or pasture. With controlled drainage and with the use of suitable grasses and fertilizers, these soils can be used for hay or pasture land, and for crops that are grown for leaf and stem rather than grain. A limited acreage may be suitable for growing special crops such as lettuce, carrots, radishes and celery. Drained Shallow Peat soils pose a serious fire hazard, hence all drainage should be controlled by check dams, installed in the drainage channels. Burning of peat after drainage is often practised, but in most cases is unwise. Where the peat is sufficiently dry a fire may destroy it completely and thus expose the underlying mineral soil. In some areas the exposed areas may be stony or unproductive because of wetness, coarse textures and low organic matter. Burning of peat provides ashes with increased amounts of phosphorus and potassium and may have some fertilizing value for several years.

To sustain crop production on peat land it is necessary to have continued controlled drainage, organic matter additions in the form of crop residues or farmyard manures, and applications of fertilizers.

Next to Deep Peat soils the Shallow Peat complex is the second most extensive forest soil in the South-Eastern map area. More than 90 percent of this complex is supporting merchantable stands of black spruce, larch and cedar.

SIRKO SERIES

The Sirko Series consists of imperfectly drained, Gleyed Grey Wooded soils developed on moderately calcareous, coarse sandy to gravelly outwash, beach and stratified drift deposits. These deposits may have strongly calcareous glacial till substrate within 30 inches of the surface. There is commonly a thin sandy surface mantle over the gravelly material and surface textures range from loamy coarse sand to clay loam. These soils occur throughout the map area but are most common on the beach ridges bordering the lowlands. The topography is level to irregular gently sloping. There is little or no surface run-off as the soils are very permeable, but internal drainage is impeded by a high ground-water level. Native forest consists mainly of aspen, mixed aspen and jack pine, some balsam poplar, balsam fir and cedar. Shrubs are mainly dogwood, rose, some alder, willow and raspberry.

In their natural condition Sirko soils are characterized by a thin light brownish grey, acid, Aeg horizon and a textural Bg horizon. These surface horizons are commonly developed partly in the surface sandy mantle and partly in the underlying coarse sand and gravel. A representative virgin profile of Sirko Series is described below:

L-H—2 to 0 inches, very dark greyish brown to black (10YR 3/2 to 2/1, dry), partially to well decomposed leaf, herb and grass litter; medium acid; abrupt, smooth, lower boundary.

Aeg—0 to 2½ inches, light brownish grey (10YR 6/2, dry), loamy fine sand; loose; strongly acid; weakly iron stained; clear, smooth, lower boundary.

Btg—2½ to 8 inches, yellowish brown (10YR 5/4, dry), gravelly loamy fine sand; weak medium granular; very friable when moist, soft when dry; neutral; weakly iron stained; clear, wavy, lower boundary.

BCg—8 to 13 inches, light yellowish brown (10YR 6/4, dry), gravelly fine sand; loose; mildly alkaline and calcareous; iron stained; clear, wavy, lower boundary.

Cg —At 18 inches, light grey to very pale brown (10YR 7/2 to 8/3, dry), stratified sand and gravel; loose; moderately alkaline and moderately calcareous; weakly iron stained.

TABLE 33

Analysis of Sirko Loamy Fine Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	2-0	—	—	—	5.6	—	—	—	—	—	—	—	—	—	—	—
Aeg	0-2½	85	10	5	5.6	—	—	0.4	2.03	13	5.7	3.4	1.5	0.1	0.04	1.2
Btg	2½-8	80	9	11	7.2	—	7.1	0.8	0.06	13	11.9	7.7*	4.0	0.1	0.1	—
BCg	8-13	94	4	2	7.8	—	10.5	0.2	0.03	9	—	—	—	—	—	—
Cg	at 18	98	2	0	8.1	—	14.3	0.2	—	—	0.6	0.4*	0.2	0.02	0.01	—

*Calcium by difference.

Mapping Units

Sirko Series (11,160 acres)

Areas consisting dominantly of Sirko soils. Minor occluded areas are mainly Wintergreen, Woodridge and Sundown soils.

Sirko Till Substrate Phase (2,420 acres)

Areas of normal Sirko soils in which a moderately permeable, strongly calcareous glacial substrate occurs within 30 inches of the surface. These soils occur on thin outwash and beach deposits bordering the beach ridges and in scattered areas in the Whitemouth Lake Till Plateau area. Minor occluded areas are Sirko, Caliento and Wintergreen soils. These soils have scattered surface stones and boulders.

Agriculture

Sirko soils are unsuited for cultivated field crops but are capable of use for permanent pastures and are responsive to improvement practices such as clearing trees, reseeding to adapted grasses and legumes, fertilizing, and drainage. The major soil limitations are coarse textures, low organic matter content, low available plant nutrient status and low water-holding capacity. These soils also are subject to local flooding and water-logging in wet seasons.

Sirko Series are good forest types, particularly for such tree species as aspen, balsam poplar, jack pine, white spruce, white cedar and balsam poplar.

SUNDOWN SERIES

Sundown Series consists of poorly drained, Peaty Carbonated Rego Humic Gleysol soils developed on moderately calcareous coarse sand and gravel deposits commonly with a very thin (usually less than 6 inches) mantle of moderately coarse to fine textured sediments. These soils occupy level to depressional areas bordering gravelly beach ridges, particularly in the vicinity of the Sundown and Sirko districts. The gravel and sand deposits are thin and frequently are underlain by a calcareous glacial till substrate within 30 inches of the surface. Run-off is very slow and internal drainage is impeded by a high ground-water table. Most areas of the till substrate phase are stony and cobbly on the surface. Native vegetation is dominantly sedges and reed-grasses, with clumps of larch or tamarack, black spruce, swamp birch and alder.

Under natural conditions Sundown soils have a thin layer of fibrous to mucky peat that varies from 6 to 12 inches in thickness, is alkaline in reaction and usually calcareous. This peaty surface horizon usually rests on a thin, dark grey, alkaline and calcareous Ahg horizon. The Ahg horizon is developed in the finer textured mantle and is underlain by a strongly calcareous and strongly iron stained, light grey, stratified, sandy and gravelly Cg horizon.

Mapping Units

Sundown Series (7,730 acres)

Areas consisting dominantly of normal Sundown soils. Minor occluded areas are mainly Sirko till substrate and Sirko soils.

Sundown Till Substrate Phase (1,390 acres)

Areas of Sundown soils in which a till substrate is dominantly within 30 inches of the surface. Minor occluded areas are mainly Sundown, Sirko, Sirko till substrate phase and Meleb soils. These areas contain numerous surface stones and cobbles.

Agriculture

Sundown soils are low in fertility, coarse textured and are subject to prolonged periods of excessive wetness. They are unsuited for grain crops but are fair for improved hay and pasture land if adequate drainage is maintained.

Sundown Series are not productive forest soils but do provide fair sites for the growth of balsam poplar and white cedar.

TABLE 34

Analysis of Sundown Sandy Clay Loam

Horizon	Depth Inches	% Sand	% Silt	% Clay	pH	% $CaCO_3$ Equiv.	% Org. C	Total N	C/N
L-H	6-0	—	—	—	7.8	—	—	—	—
Ahg	0-4	51.0	27.0	22.0	7.7	31.1	1.7	0.1	17

VASSAR SERIES

The Vassar Series consists of rapidly to well drained Bisequa Grey Wooded soils developed on 6 to 30 inches of fine to medium sand underlain by moderately to strongly calcareous loam to clay textured lacustrine or glacial till deposits. These soils occur in the Bedford Hills-Whitemouth Lake Plateau, mainly near the village of Vassar. The topography is irregular, gently sloping. Native vegetation consists of pure stands of jack pine, mixed jack pine and aspen or birch with some balsam fir, red pine and white pine (in the vicinity of Moose Lake) and a profusion of tall and short shrubs in association with a dense ground cover of herbs and grasses. A few scattered surface stones occur on areas with a substrate of stony glacial till.

In their native state, Vassar soils are characterized by a weakly developed Podzol sequence of horizons (Ae and Bf) occurring in the thick leached, sandy Ae horizon originally of the Grey Wooded profile overlying a thin, continuous, moderately to strongly developed textural B horizon, usually occurring within 36 inches of the surface. The Bf horizon of the Podzol solum usually extends 15 to 20 inches below the surface and seldom merges with the IIBt horizon. The IIC horizon is frequently stratified, stony, moderately alkaline and calcareous. A representative profile of Vassar fine sand is described below:

L-F —1 to 0 inches, very dark brown (10YR 2/2, dry), partially to moderately decomposed pine needle, leaf, twig and grass litter; strongly acid; abrupt, smooth, lower boundary.

Aej —0 to 4 inches, light grey (10YR 7/1, dry), loamy fine sand; loose; strongly acid; clear, smooth, lower boundary.

Bfjl —4 to 8 inches, brown (10YR 5/3, dry), loamy fine sand; weak fine granular; very friable when moist, soft when dry; strongly acid; clear, smooth, lower boundary.

Bfj2 —8 to 15 inches, yellowish brown (10YR 5/4, dry), fine sand; weak fine granular; very friable when moist, soft when dry; medium acid; abrupt, wavy, lower boundary.

Ae —15 to 16½ inches, very pale brown (10YR 7/3, dry), loamy fine sand; weak fine granular; very friable when moist and soft when dry; medium acid; abrupt, wavy, lower boundary.

II BA—16½ to 18 inches, brown (10YR 5/3, dry) loam; moderate fine subangular blocky; firm when moist, hard when dry; medium acid; clear, wavy, lower boundary.

II Bt —18 to 24 inches, brown (10YR 4/3, dry), clay; strong fine to medium blocky; very firm when moist, very hard when dry; medium acid; gradual, wavy, lower boundary.

II BC—26 to 30 inches, brown to very pale brown (10YR 5/3 to 7/3, dry), clay; weak, fine blocky to coarse granular; firm when moist, hard when dry; mildly alkaline and calcareous; gradual, irregular, lower boundary.

II C —At 36 inches, light olive brown to light yellowish brown (2.5Y 5/3 and 6/3, dry), stratified clay and silt loam; moderate coarse platy and weak fine granular; firm and friable when moist, very hard and slightly hard when dry; mildly alkaline and strongly calcareous; iron stained.

Mapping Units

Vassar Series (6,340 acres)

Small scattered areas consisting dominantly of Vassar soils. Minor occluded areas are mainly Sandilands, Carrick, Arnes and St. Labre soils.

Sandilands-Vassar Complex (8,500 acres)—see Sandilands Series.

Carrick-Vassar Complex (6,667 acres)—see Carrick Series.

Agriculture

Vassar soils are unsuitable for cultivated crops or improved pasture and are not naturally suitable for native pasture. Their major limitations are coarse textures, low water-

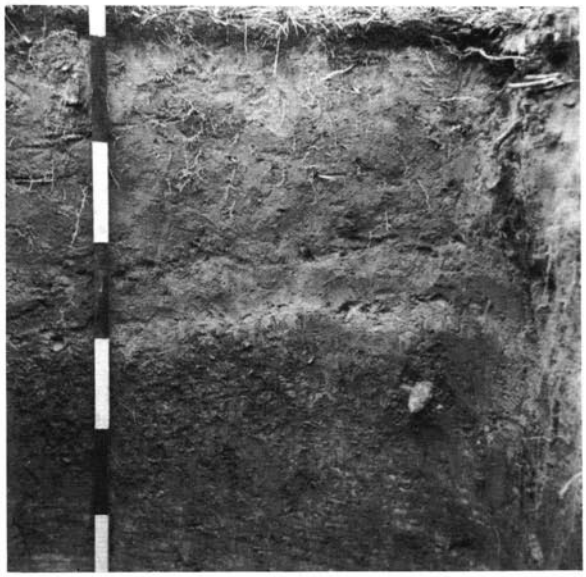


FIGURE 54

Soil profile of Vassar Series. A Bisequa Grey Wooded Soil developed on 6 to 30 inches of fine sand over fine textured sediments.

TABLE 35

Analysis of Vassar Loamy Fine Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
Aej	0-4	83	14	3	5.6	—	—	0.25	0.02	12	2.3	1.0	0.5	1.06	0.06	0.6
Bfj1	4-8	84	13	3	5.2	—	—	0.28	0.02	14	—	—	—	—	—	—
Bfj2	8-15	92	6	2	5.8	—	—	0.10	0.01	10	1.6	0.6	0.2	0.1	0.1	0.6
Ae	15-16½	86	10	4	5.9	—	—	0.20	0.01	20	2.4	0.8	0.6	0.1	0.1	0.8
IIBA	16½-18	48	19	33	5.7	—	—	0.4	0.04	10	—	—	—	—	—	—
IIBt	18-26	18	22	60	5.9	—	—	0.4	0.07	6	30.9	18.9	8.9	0.2	1.0	1.1
IIBC	26-30	11	38	51	7.6	—	23.1	0.4	0.05	8	—	—	—	—	—	—
IIC	at 36	14	42	44	7.8	—	38.8	—	—	—	18.1	10.7*	6.7	0.3	0.4	—

*Calcium by difference.

holding capacity and a low supply of available plant nutrients.

These soils provide a good site for the production of jack pine, red pine, white pine, aspen and birch.

WAMPUM SERIES

The Wampum Series consists of imperfectly drained, Gleyed Dark Grey Wooded soils developed on 6 to 30 inches of medium to fine sand underlain by slightly to moderately calcareous, loam to clay textured lacustrine sediments. The sandy surface deposits usually range between 15 to 20 inches in thickness. The soils occur mainly along the Birch River and in small scattered areas in the Middlebro, Sprague and Wampum districts. The topography is irregular, very gently sloping and, as a result of low relief, surface drainage is slow. Internal drainage is impeded by high groundwater table perched on a slowly permeable, fine textured substrate. The native vegetation consists of aspen, balsam poplar and some birch; a fairly dense shrub layer of dogwood, rose, alder, willow, raspberry; a profusion of herbs and some grasses. The soils are stonefree.

FIGURE 55

Mixed stand of red pine, jack pine, birch and aspen growing on Vassar soils in T. 4, R. 16E.

The Wampum soils have a thin, partially to well decomposed leaf, forb and grass, surface organic layer; a thin dark grey Ah horizon; a weak, deeply leached, sandy, iron stained, slightly acid, light grey Ae horizon, and a weakly to moderately developed textural B horizon. The soils usually are developed partly in the sandy surface mantle and partly in the underlying stratified, loam to clay textured lacustrine sediments. A representative Wampum soil profile is described below:

L-H —1 to 0 inches, very dark greyish brown (10YR 3/2, dry), partially to well decomposed leaf, forb and grass litter; medium acid; abrupt, smooth, lower boundary.

Aheg —0 to 2 inches, dark grey to grey (10YR 4/1 to 5/1, dry), fine sandy loam; weak fine granular; very friable when moist, soft when dry; slightly acid; flecked with iron stains; abrupt, wavy boundary.

Aeg —2 to 12 inches, light grey (10YR 7/2, dry), fine sand; loose; slightly acid; numerous small to medium sized blotches of iron stains; abrupt, wavy, lower boundary.

IIBtg—12 to 19 inches, dark brown to yellowish brown (10YR 4/3 to 5/4, dry), fine sandy clay loam; very weak medium columnar which breaks readily to moderate coarse granular to medium subangular blocky; firm when moist, hard when dry; neutral; iron stained; clear, smooth lower boundary.

IICg —At 24 inches, light brownish grey (2.5Y 6/2, dry), clay; massive to moderate medium plate-like structure; very firm when moist, very hard when dry; mildly alkaline and slightly calcareous.

FIGURE 56

Soil profile of a cultivated Wampum Series. A Gleyed Dark Grey Wooded soil developed on 6 to 30 inches of fine sand over fine textured sediments.

Mapping Units

Wampum Series (4,170 acres)

Areas consisting dominantly of Wampum soils. Minor occluded areas are mainly Pine Valley, Peguis, Wintergreen and Hadashville clay substrate phase soils.

FIGURE 57

Landscape view of the Wampum soil area along the Birch River showing irregular level topography and land-use.

Wampum-Piney Valley Till Substrate Phase Complex (1,430 acres)

Areas containing equally significant proportions of Wampum and Piney Valley till substrate phase soils. In these areas of irregular gently sloping topography the Wampum soils occupy moderately drained narrow, elongate sandy ridges, while the Pine Valley till substrate soils occur on the intervening level positions. A few scattered surface stones occur where the glacial till substrate comes close to the surface. Minor occluded areas are principally Wintergreen, Pine Valley, Peguis, Peguis till substrate and Piney soils.

TABLE 36

Analysis of Wampum Fine Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	1-0	—	—	—	6.4	—	—	—	—	—	—	—	—	—	—	—
Aheg	0-2	66	25	9	6.6	—	—	1.1	0.1	11	7.8	5.2	0.2	0.03	0.2	1.0
Aeg	2-12	90	8	2	6.6	—	—	0.1	0.01	10	1.3	0.8	0.4	0.01	0.05	0.3
IIBtg	12-19	54	14	32	6.6	—	—	0.3	0.04	9	22.2	6.3	10.7	0.1	0.5	1.9
IICg	at 24	3	18	79	7.5	0.4	8.5	—	—	—	41.9	25.9	24.6	0.3	0.9	—

Agriculture

Wampum soils are best suited for hay and pasture. They have limited suitability for coarse grains if grown in rotation with improvement crops. The main problems of these soils are coarse surface textures, low natural fertility and imperfect drainage. Crops respond well to applications of nitrogen and phosphate fertilizers, and in areas with a thick sand layer some response may be obtained with additions of potassium. Local flooding may be a hazard in wet seasons.

Wampum soils are suited for the production of hardwoods, white spruce, white cedar and tamarack.

WINTERGREEN SERIES

The Wintergreen Series consists of imperfectly drained, Gleyed Grey Wooded soils developed on slightly to moderately calcareous, sandy lacustrine and outwash deposits. Surface textures are fine sand to fine sandy loam. These soils occur in small scattered areas, mainly bordering gravelly beach ridges on the margins of the lowlands surrounding the Bedford Hills-Whitemouth Lake Plateau. The topography is level to irregular very gently sloping. Soil permeability is rapid, but internal drainage is impeded by a high ground water-table. Native vegetation is comprised of pure stands of jack pine; mixed jack pine, aspen, balsam poplar, birch; a dense understory of tall and short shrubs like dogwood, rose, speckled alder, raspberry, currant, saskatoon; a profusion of herbs; and some grasses. The soils are stone-free.

These soils have a thin leaf mat which grades sharply into an iron stained, neutral to slightly acid, light grey, Ae horizon. This horizon grades gradually into a textural Bg horizon that is neutral and blotched with iron stains. A representative Wintergreen soil profile is described below:

L-H —3 to 0 inches, very dark greyish brown to black (10YR 3/2 to 2/1, dry), partially to well decomposed leaf, forb and grass litter; slightly acid; abrupt, wavy, lower boundary.

Aeg1—0 to 3 inches, light grey (10YR 7/1, dry), fine sand; loose; neutral; weakly iron stained; clear, wavy, lower boundary.

Aeg2—3 to 10 inches, light grey (10YR 7/2, dry), loamy fine sand; loose; neutral; strongly iron stained; clear, wavy, lower boundary.

Btg —10 to 16 inches, light yellowish brown (10YR 6/4, dry), loamy fine sand; weak fine granular; very friable when moist, soft when dry; neutral; strongly iron stained; clear, wavy, lower boundary.

BCg —16 to 23 inches, very pale brown (10YR 7/4, dry), fine sand; loose; mildly alkaline and slightly calcareous; strongly iron stained; gradual, irregular, lower boundary.

Cg —At 30 inches, light grey (2.5Y 7/2, dry), loamy fine sand; weak fine granular; very friable when moist and soft when dry; mildly alkaline and calcareous; iron stained.

Mapping Units

Wintergreen Series (22,720 acres)

Areas consisting dominantly of Wintergreen soils. Minor occluded areas are mainly Lonesand, Pine Ridge, Caliento and Sirko soils.

Wintergreen-Caliento Complex (8,800 acres)

Areas with about equal proportions of Wintergreen and Caliento soils in which the individual soils are too intermixed to be mappable on the scale used. These areas are level to irregular very gently sloping. They occur in small scattered areas at several places near the base of the sandy Bedford Hills and in the Whitemouth Lake Till Plateau. Caliento soils occur on slightly stony, low ridges and are separated from each other by intervening level areas of Wintergreen soils. The sandy deposits between ridges are almost equal in elevation to the ridges so that the present land surface is quite level and smooth. The Caliento soils are discernible in cultivated fields by the presence

FIGURE 58

Soil profile of Wintergreen Series. A Gleyed Grey Wooded soil developed on calcareous sand.

TABLE 37

Analysis of Wintergreen Loamy Fine Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-H	3-0	—	—	—	6.0	—	—	36.4	—	—	—	—	—	—	—	—
Aegl	0-3	86	12	2	6.8	—	—	0.4	0.03	13	4.2	4.2	0.1	0.05	0.02	0.2
Aeg2	3-10	86	9	5	7.1	—	—	0.2	0.02	10	—	—	—	—	—	—
Btg	10-16	82	7	11	6.8	—	—	0.1	0.01	10	9.5	8.0	1.0	0.1	0.1	0.5
BCg	16-23	89	3	8	7.4	0.2	3.9	0.1	—	—	—	—	—	—	—	—
Cg	at 30	68	25	7	7.7	0.2	26.3	—	—	—	4.1	4.0*	0.8	0.1	0.1	—

*Calcium by difference.

of some stones. Minor occluded areas are mainly Lonesand, Piney and Wampum soils.

Agriculture

These soils are low in natural fertility, coarse textured, are subject to local flooding and thus are not naturally suited for grain production. They are suitable for permanent improved pastures and haylands and are responsive to improvement practices such as clearing trees, reseeding to adapted grasses and legumes, fertilizing and drainage.

FIGURE 59

Landscape view of the Wintergreen soil area along the Birch River used for hay and pasture. Peat soils occur in the background.

Wintergreen soils support merchantable stands of hardwood, some white spruce, balsam fir, and provide good sites for the growth of jack pine and aspen.

WOODRIDGE SERIES

The Woodridge Series consists of rapidly drained, Orthic Grey Wooded soils developed on sandy and gravelly beach, outwash and stratified drift deposits which may be underlain by a calcareous till substrate within 30 inches of the surface. A thin, fine to medium sand mantle which ranges from 6 to 30 inches in thickness frequently overlies the coarse sediments. These areas are usually in the form of narrow, elongate, gently sloping, beach ridges. They are about 6 to 10 feet high and 100 to 500 feet wide and are wave-built barrier beaches or bars, such as are formed on a low shelving shore.* Gravelly wave-cut terraces occur in the sandy uplands of the Bedford Hills, particularly near the Sandilands, Badger and Menisino districts. The prominent Campbell beach which occurs from 1,050 to 1,100 feet above sea level can be traced for miles and it approximately delineates the Bedford Hills-Whitemouth Lake Plateau in the South-Eastern map area. Native vegetation on Woodridge soils consists of a semi-open stand of jack pine and sparse ground cover of prostrate ericoid (heath family) shrubs, herbs and mosses.

These soils are characterized by a very thin, patchy, partially to moderately decomposed organic layer; a pale brown, weakly but usually deeply leached, strongly acid, Ae horizon; a dark yellowish brown, weakly developed, slightly acid textural B horizon

*W. A. Johnston, Winnipegosis and Upper Whitemouth River Areas, Manitoba Pleistocene and Recent Deposits. Canada Department of Mines, Geological Survey, Memoir 128, 1921.

TABLE 38

Analysis of Woodridge Sand

Hor.	Depth Inches	% Sand	% Silt	% Clay	pH	Cond. mmhos/cm.	% $CaCO_3$ Equiv.	% Org. C	% Total N	C/N	Exch. Cap. m.e.	Exchangeable Cations m.e./100 gms.				
												Ca	Mg	Na	K	H
L-F	½-0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ahe	0-½	93	3	4	5.5	—	—	1.2	0.1	12	8.5	3.5	0.9	0.05	0.2	3.7
Ael	½-6	93	4	3	5.4	—	—	0.1	0.01	10	2.7	0.9	0.3	0.04	0.04	1.3
Ae2	6-9	94	3	3	5.7	—	—	0.05	0.01	5	—	—	—	—	—	—
Bt1	9-11	91	4	5	5.8	—	—	0.11	0.01	11	4.2	1.3	0.6	0.05	0.04	1.6
Bt2	11-13	91	4	5	5.8	—	—	0.3	0.01	30	4.7	1.3	0.6	0.05	0.03	1.7
BC	13-15	92	5	3	7.6	—	11.1	0.7	0.1	7	—	—	—	—	—	—
C	15-19	98	1	1	8.1	—	9.9	0.2	—	—	0.6	—	0.3	0.02	—	—

which usually occurs partly in the sandy surface mantle and partly in the underlying stratified coarse sand and gravel. Where a large percentage of coarse gravel and cobbles prevail, the horizons are thinner and the textural B horizon appears to be prominent. A representative Woodridge profile is described below.

L-F —½ to 0 inches, dark greyish brown to very dark brown (10YR 4/2 to 2/2, dry), partially to moderately decomposed pine needle, bark, twigs, grass and herb remains; strongly acid; abrupt, smooth, lower boundary.

Ahe —0 to ½ inches, greyish brown (10YR 3/2, dry), sand; loose; strongly acid; clear, smooth, lower boundary.

Ael —½ to 6 inches, pale brown (10YR 6/3, dry), sand; loose; strongly acid; clear, smooth, lower boundary.

Ae2 —6 to 9 inches, light yellowish brown (10YR 6/4, dry), sand; loose; medium acid; clear, smooth, lower boundary.

Bt 1 —9 to 11 inches, yellowish brown (10YR 5/4, dry), sand; weak, fine granular; very friable when moist, soft when dry; medium acid; clear, smooth, lower boundary.

Bt 2 —11 to 13 inches, dark yellowish brown (10YR 4/4, dry), sand; weak, fine granular; very friable when moist, soft when dry; medium acid; abrupt, smooth, lower boundary.

BC —13 to 15 inches, dark greyish brown (10YR 4/2, dry), gravelly coarse sand mixed with a considerable amount of disintegrating root hairs; loose; mildly alkaline and calcareous; abrupt, smooth, lower boundary.

C —15 to 19 inches, very pale brown (10YR 7/3 to 7/4, dry), stratified, coarse sand and gravel; loose; moderately alkaline and calcareous.

Mapping Units

Woodridge Series (69,200 acres)

These are areas which consist dominantly of normal Woodridge soils. Minor occluded areas are principally Pine Ridge, Sandilands and Badger soils.

Woodridge Till Substrate Phase (4,520 acres)

Areas of Woodridge soils in which a substrate of calcareous, glacial till occurs within 30 inches of the surface. These soils occur in thin outwash and beach deposits bordering beach ridges, in the Brokenhead River Plain area to the northwest and at other scattered locations in the South-Eastern map area. The substrate of loam to clay loam textured till impedes internal percolation and thus its moisture regime is more favourable than that

FIGURE 60

Soil profile of Woodridge Series. An Orthic Grey Wooded Soil developed on sandy and gravelly outwash and beach deposits.

FIGURE 61

Jack pine growing on Woodridge soils.

of the normal Woodridge soils. Native vegetation reflects this more humid micro-climate as indicated by the occurrence of hardwoods and mixed hardwoods and jack pine forests on these soils. Many surface stones and boulders may occur, especially in the Brokenhead River Plain area.

Sandilands-Woodridge Complex (40,840 acres)—see Sandilands Series.

Agriculture

Woodridge soils are unsuitable for grain production. They are coarse textured, low in organic matter and available plant nutrients, and have a low water-holding capacity. The occurrence of trees and lack of desirable herb and grass species on virgin sites severely limit their value for use as hay and pasture lands.

Woodridge Series are best suited for forestry and provide fair sites for jack pine and red pine.

Many of the roads in the South-Eastern map area are located on Woodridge soils which, because of their natural drainage and gravelly character, are well adapted for the purpose. These gravel ridges provide access to those parts of the map area that otherwise would be difficult to traverse. Some of the thicker deposits of gravel are being used as a source of gravel for road building purposes.

PART IV

AGRICULTURE

Agricultural interpretations of soil survey information contained in this report and accompanying map are made to provide a better understanding of soils as individual entities, their land-use potential, productivity, and present utilization. Principally, these interpretations are based on extensive field observations, soil analyses and to a limited extent on experimental data provided by research workers in soils and in crops.

A. ESTIMATED SUITABILITY OF SOILS FOR VARIOUS PURPOSES

The estimated suitability of the soils in the South-Eastern map area for various purposes is shown in Table 39. The estimates in this table are based on the assumptions that average or normal farm management is practiced, present drainage conditions will prevail and that these average estimates are modified on some farms to conform with local variations. The estimates given are not absolute values based on crop yield data, but they represent the considered opinion and field observations of soils and soil-plant relationships of the soil surveyors.

B. LAND-USE CAPABILITY CLASSES, SUB-CLASSES AND UNITS

The soils of the South-Eastern map area can be grouped into capability classes, sub-classes and units on the basis of their observed characteristics. In this classification the arable soils (Classes I to IV inclusive) are grouped according to their potentialities and limitations for sustained production of the common cultivated crops and non-arable soils (Classes V to VII inclusive) are grouped according to their potentialities and limitations for use as hay or grazing lands and according to their risks of soil damage if mismanaged.

The capability class, the broadest category, places the soils in the South-Eastern map area into six out of the maximum of seven classes. Each one is interpreted on the basis of its degree of limitation affecting land-use. These limitations, either singly or collectively, may become major problems and thus limit the use of the soil.

The sub-class is a grouping of soils on the basis of the kind of limitations. These are climate (c); dense soil condition (d); erosion (e); low fertility (f); overflow (i); moisture limitation mainly because of coarse texture (m); salinity (n); stoniness (p); rock or hard pan near or at the surface (r); accumulative adverse inherent soil characteristics such as thin solum, salinity, liminess, coarse texture, low fertility, etc. (s); topography, slope and pattern (t); and wetness (w).

The unit is a grouping of soils that have about the same responses to systems of management of common cultivated crops and pasture plants. Soils in any one capability unit are adapted to the same kinds of common cultivated and pasture plants and require similar alternative systems of management for these crops. Brief descriptions of the various classes, sub-classes and units, together with the soils contained in each unit, are given under the following headings:

(a) *Soils Suited to Sustained Production of Cultivated Field Crops*

CLASS I—Soils in this class have level or gently sloping topography, they are deep, well to imperfectly drained and have good water-holding capacity. These soils are naturally well supplied with plant nutrients. They are easily maintained in good tilth and fertility, and damage from erosion is slight. They are moderately high to high in productivity for a wide range of field crops.

No soils in the South-Eastern map area are listed in this land-use capability class.

CLASS II—Soils in this class have moderate limitations that reduce the choice of crops or require moderate conservation practices. These soils have good water-holding capacity and are either naturally well supplied with plant nutrients or are highly responsive to inputs of fertilizer. They are moderately high to high in productivity for a fairly wide range of crops. The limitations are not severe and good soil management and cropping practices can be

TABLE 39

Estimated Suitability of Soils in the South-Eastern Map Area for Various Purposes

RATING SYMBOLS: E = excellent; G = good; FG = fairly good; F = fair; P = poor; VP = very poor; V = variable; X = not naturally favourable, but could be used if suitable corrective measures were adopted; ++ = well adapted; + − = more or less suitable; − − = not suitable or of relatively low value.

NOTE: The following estimates are given as a guide to the average suitability of each soil for land use in average seasons.

Soil Name	Cultivated Land					Unbroken Land			Forestry*
	Grain Crops		Cultivated Hay and Pasture Crops		Gardens and Fruits	Native Hay	Grazing	Wild Life	
	Wheat	Coarse Grains	Legumes	Grasses					
Alluvium (undifferentiated) (Al)	−	−	−	−	−	−	−	+−	++
Arnes Series (An)	FG	FG	G	G	FG	−	P	+−	++
Balmoral Series (Ba)	(X)FG	(X)FG	(X)FG	(X)G	(X)F	F	FG	+−	+−
Badger Series (Bg)	−	−	−	−	−	−	P	+−	++
Birch Point Series (Bp)	FG	FG	G	G	FG	−	P	+−	++
Carrick Series (C)	(X)F	(X)F	FG	FG	F	P	P	+−	++
Caliento Series (Co)	P	P	FG	FG	F	P	P	+−	++
Deep Peat Complex (Dp)	−	−	−	−	−	(X)P	−	−−	+−
Elma Series (E)	FG	G	G	G	FG	P	P	+−	++
Foley Series (Fo)	(X)FG	(X)FG	(X)FG	(X)FG	(X)FG	G	G	+−	+−
Framnes Series (Fr)	G	G	G	G	FG	P	P	++	++
Fyala Series (Fy)	(X)FG	(X)FG	(X)G	(X)G	(X)F	G	G	+−	+−
Hadashville Series (H)	FG	FG	FG	G	G	P	P	+−	++
Indian Bay Complex (IB)	−	−	−	−	−	−	−	++	+−
Kerry Series (Ky)	−	−	−	−	(V)P	(V)P	(V)P	+−	+−
Lonesand Series (L)	−	−	−	−	P	P	P	+−	++
Malonton Series (Mn)	(X)F	(X)F	(X)F	(X)FG	(V)F	(V)F	(V)F	+−	+−
Medika Series (Ma)	G	G	G	G	P	P	P	+−	++
Meleb Series (Ml)	(X)F	(X)F	(X)FG	(X)FG	(V)P	(V)P	(V)P	+−	+−
Peguis Series (Pe)	G	G	G	G	(V)P	(V)F	(V)F	+−	++
Piney Series (P)	(X)F	(X)F	(X)FG	(X)F	(X)F	−	P	+−	++
Pine Ridge Series (Pr)	−	−	−	−	−	−	P	+−	++
Pine Valley Series (Py)	FG	FG	G	G	FG	−	P	+−	++
Rock Outcrop (R)	−	−	−	−	−	−	−	++	−−
Richer Complex (Rh)	−	−	−	−	−	−	P	+−	++
St. Labre Series (Sl)	P	P	F	P	P	−	P	+−	++
Sandilands	−	−	−	−	−	−	P	+−	++
Seven Sisters Series (Sr)	FG	FG	FG	FG	−	−	P	+−	++
Shallow Peat Complex (SP)	(X)P	(X)P	−	(X)FG	−	(V)P	(V)P	+−	++
Sirko Series (Si)	−	−	P	P	−	−	P	+−	++
Sundown Series (Su)	−	−	−	(X)F	−	(V)F	(V)F	+−	+−
Vassar Series (V)	P	P	F	P	−	−	P	+−	++
Wampum Series (Wa)	P	P	FG	FG	P	−	(V)P	+−	++
Wintergreen Series (Wg)	P	P	F	F	P	−	P	+−	++
Woodridge Series (W)	−	−	−	−	−	−	P	+−	++

*See section dealing with forestry.

applied without serious difficulty. Limitations may include the adverse effects of one of the following: climate, accumulative undesirable soil characteristics, low fertility, structure or permeability, erosion, topography, overflow, and wetness. The capability units in this class are described below:

II w—The soils in this unit are level to very gently sloping. They are imperfectly drained due to slow run-off, have slow internal drainage and may have a high ground-water table in the spring. Ponding of water occurs for short periods in the spring and after heavy rains and therefore adequate surface drainage is required for crop production. Other problems include difficult tillage and weeds.
Frames Series (clay)
Peguis Series (clay)

II i —These soils are level to irregular very gently sloping and subject to damaging periodic flooding. These soils are permeable and with adequate drainage produce good crops.
Medika Series (loam)

CLASS III—Soils in this class have moderately severe limitations that reduce the choice of crops or require special conservation practices. These soils have more severe limitations than those in Class II. These limitations affect one or more of the following farm practices: the timing and ease of tillage, planting and harvesting, the choice of crops, the application and maintenance of conservation practices. However, they are medium to moderately high in productivity for a range of crops. The limitations include the adverse effects of one or two of the following: climate, accumulative undesirable soil characteristics, low fertility, deficiencies in the storage capacity or release of soil moisture to plants, structure or permeability, salinity, erosion, topography, overflow, wetness, stoniness and depth of soil to consolidated bedrock. The capability units in this class are described below:

III df —These soils are very gently sloping and relatively unaffected by wind or water erosion. They are clay soils which have a moderate fertility status and are difficult to till because of fine textures and poor structure.
Arnes Series (clay)
Seven Sisters Series (clay)

III f —These soils are gently sloping and are slightly eroded by wind and water. Organic matter content and nitrogen supply are low and addition of organic materials is necessary for fertility maintenance.
Birch Point Series (loam)

III wf1—These soils are level to very gently sloping and are subject to ponding for a significant period in the spring if artificial drainage is not provided. In addition these soils have a slow infiltration rate because of fine textures. Other problems include difficult tillage and weeds.
Pine Valley Series (clay)

III wf2—These soils are very gently to gently sloping and are slightly eroded by wind and water. These soils are medium to moderately fine textured, are moderately low in organic matter and in available plant nutrients. Internal soil drainage is imperfect for a significant period in the spring or in wet seasons as a result of a high ground-water level.
Elma Series (clay loam)
Hadashville Series (loam)

III w 1—These soils are depressional to level in topography and are subject to ponding for considerable periods of time if artificial drainage is not provided. These soils are medium to moderately fine in texture, have thin sola, and are low in available phosphorus and nitrogen. Response of grain to fertilizers is expected.
Balmoral Series (clay loam)
Foley Series (very fine sandy loam)

III w 2—These soils are depressional to level and are subject to ponding for considerable periods of time if artificial drainage is not provided. In addition these soils have slow internal drainage because of fine textures and high ground water-table. Grain and forage crops can be grown if adequate surface drainage is provided.
Fyala Series (clay)

(b) *Soils Limited in Use for Cultivated Field Crops*

CLASS IV—Soils in this class have severe limitations that restrict the choice of crops or require special conservation practices or both. These soils have such limitations that they are only suited for a few crops, or the yield for a range of crops may be low, or the risk of crop failure is high. The limitations may seriously affect such farm practices as the timing and ease of tillage, planting and harvesting, and the application and maintenance of conservation practices. These soils are low to medium in productivity for a narrow range of crops but may have higher productivity for a specially adapted crop.

The limitations include the adverse effects of one or more of the following: climate, accumulative undesirable soil characteristics, low fertility, deficiencies in the storage or release of soil moisture to plants, structure or permeability, salinity, erosion, topography, overflow, wetness, stoniness, depth of soil to consolidated bedrock.

The capability units in this class are described below:

IV ps1 —These soils have irregular gently sloping topography. They are very stony, well-drained, thin, medium textured soils that are naturally low in available plant nutrients. Fair response of grain crops to fertilization is expected. Alfalfa seed set is successful in most years.
Carrick Series (fine sandy loam)

IV ps2 —These soils occur in areas that are irregular very gently sloping to gently sloping and are imperfectly drained. These soils are very stony, thin, medium textured, low in available plant nutrients and are subject to water-logging for a significant period in the spring.
Piney Series (fine sandy loam)

IV mf1—These coarse textured, well-drained soils are low in natural fertility and water-holding capacity. They are mainly suited for the production of deep rooted forage crops able to reach the finer textured subsoil for nutrients and water.
St. Labre Series

IV mf2—The soils in this unit are irregular very gently sloping to gently sloping and are imperfectly drained. These coarse textured soils are low in natural fertility, have a low water-holding capacity and are subject to water-logging in the spring because of a high ground-water table. They are best suited for pasture and hay land.
Caliento Series (fine sand)
Wampum Series (fine sand)

IV ws —These soils occur in level to depressional areas and are subject to water-logging for a considerable part of the growing season. The soils are coarse textured and low in natural fertility. Grain and forage crops may be produced if adequate surface drainage is maintained.
Malonton Series (fine sand)

(c) *Soils Limited in Agricultural Use to Permanent Pasture*

CLASS V—Soils in this class are capable only of producing perennial forage crops and improvement practices are feasible. These soils have such serious soil, climatic or other limitations that they are not capable of use for the production of annual field crops. However, they may be improved by the use of farm machinery for the production of native or tame species of perennial forage plants. Feasible improvement practices may include clearing of bush, cultivation, seeding, fertilizing and water control.

The capability units in this class are:

Vi —These soils occur in level to depressional areas adjacent to youthful streams and are subject to frequent overflow. In addition these soils have impeded internal drainage due to a high ground-water table.
Alluvium (undifferentiated)

V wp —These soils occur in depressional areas and are normally flooded for a considerable part of the year. The soils are stony, thin, and low in natural fertility. They are best suited for hay and pasture.
Meleb Series (fine sandy loam to clay)

V mf1—These coarse textured well-drained soils are low in natural fertility and water-holding capacity. They are best suited for the production of deep rooted forage crops able to reach the finer textured subsoil for nutrients and water.
Vassar Series (fine sand)

V mf2—These soils occur in level to very gently sloping areas and are imperfectly drained. They are coarse textured, low in natural fertility, low in water-holding capacity and are subject to water-logging in the spring because of impeded internal drainage by a high ground-water table. They are best suited for pasture and hay.
Sirko Series (coarse sand)
Wintergreen Series (fine sand)

Vw —These soils occur in level to depressional areas and are normally flooded for a considerable part of the growing season. They are coarse textured, low in water-holding capacity and low in natural fertility. Forage crops can be grown successfully if adequate surface drainage is provided.
Sundown Series (coarse sand)

CLASS VI—Soils in this class are capable only of producing perennial forage plants and improvement practices are not feasible. Class VI soils have some natural sustained grazing capacity for farm animals but have such serious soil, climatic or other limitations as to make impractical the application of improvement practices that can be carried out on Class V soils. Soils may be placed in this class because their physical nature prevents the use of farm machinery to improve them, or because the soils are not responsive to improvement practices, or because of a short grazing season or because stock watering facilities are inadequate. Such improvement practices as may be effected by seeding and fertilizing by hand or by aerial methods shall not change the classification of these soil areas. Where costly clearing is required to change Class VII areas to Class VI areas, those areas shall remain classified as Class VII.

The capability units in this class are:

VI m1—These soils are largely confined to the undulating sandy, morainic uplands of the Bedford Hills. They are coarse textured, droughty, low in natural fertility and when under cultivation are susceptible to wind and water erosion. The soils are suitable only for limited grazing.
Badger Series (fine sand)
Pine Ridge Series (fine sand)
Sandilands Series (sand)
Woodridge Series (sand)

VI m2—These soils occur in level to very gently sloping areas and are imperfectly drained. They are coarse textured, low in natural fertility, low in water-holding capacity and are subject to water-logging in the spring because of impeded internal drainage by a high ground water-table.
Lonesand Series (fine sand)

VI p —These soils have gently sloping to undulating topography and are extremely stony, coarse textured and are low in natural fertility. They are limited in use to grazing land of very low carrying capacity.
Richer Complex (gravel to sand)

VI w —These soils occur in small enclosed depressions in micro-duned, sandy outwash deposits and are water-logged for most of the growing season. They may be used for hay or limited grazing in dry years.
Kerry Series (sand)

(d) *Lands Not Suited to Agriculture Use*

CLASS VII—Soils and lands in this class have no capability for arable agriculture or permanent pasture. Class VII soils or lands have limitations so severe that they are not capable of use for arable agriculture or permanent pasture. These lands may or may not have a high capability for trees, native fruits, wildlife and recreation.

The following soils and land types may be listed in this class:

Deep Peat Complex	Indian Bay Complex
Shallow Peat Complex	Rock Outcrop

C. HISTORY OF SETTLEMENT*

The development and distribution of settlement in the South-Eastern map area of Manitoba has been influenced not only by the natural land-use possibilities and limitations peculiar to the various districts but also by historic events, transport routes, and by the capabilities of the varied population groups that settled in the area.

The first historical records show Indians of the Cree nation located around the Lake of the Woods. The first definite record of white exploration is that of Pierre La Verendrye who built a fort and fur trading post at the Northwest Angle of the Lake of the Woods in 1732. Cross country trips to the Red River were made in winter for a short time. The summer route seems to have been by way of Reed River, Savanne Portage to Mud Creek then down the Sprague and Roseau rivers. This route was soon abandoned, except by local fur traders, in favour of the Winnipeg River route. There is no record of a fur trading post in the South-Eastern area; the American Fur Company established a post a short distance south of the 49th parallel at Warroad in 1820 and the Hudson Bay Company a post further west near Rouseau Lake.

Settlement of the Red River area in 1812 had little effect on population growth in this area. There was some activity in 1870 with the passing of the Manitoba Act which brought Ruperts Land into the Dominion of Canada. This Act provided the occupants of Manitoba, namely: those associated with the fur trade, retired fur traders, casual half-breed farmers settled or squatting on river lots and others to obtain a title under the Manitoba Grants Act by proving prior residence. Although the Act stimulated development and settlement in the Red River Valley and westward there is no record of any person in the South-Eastern area taking title to property. The rapid population growth and settlement in the valley during this period led to a heavy demand for lumber. The Red River with its eastern tributaries coming from the forested area of South-Eastern Manitoba offered a route for the transportation of logs to the saw mills that opened in Winnipeg.

Dawson Road was built between the Northwest Angle and Fort Garry and a stage service was initiated. This road was later abandoned when the Canadian Pacific Railway reached Winnipeg in 1885. The opening of the Canadian Pacific Railway between Fort William and Winnipeg provided a new outlet for sawlogs by way of the Whitemouth River but had little or no effect on land settlement in the district. The Winnipeg-Rainy River line of the Canadian Northern Railway, completed and in operation by 1901, traversing the South-Eastern map area from northwest to southeast, brought the district out of its relative isolation and favoured settlement at various points along the railway. The construction of the Emerson-Sprague branch of the Canadian National Railway, completed in 1906, opened the southern portion of the area and provided access for settlement to areas now designated as Local Government Districts of Stuartburn and Piney. The construction of the Greater Winnipeg Water District Railway in 1914 gave access to the northern part of the South-Eastern map area. This line was built in connection with the pipe-line which brings water from Shoal Lake to Winnipeg but to date has had no appreciable influence on settlement. (See Figure 62.)

At the turn of the century land settlement by homesteading immigrants began and was accelerated by the rapid construction of railways into the forested regions of the South-Eastern map area.

The three decades between 1900 and 1930 was the period of greatest activity in land settlement throughout the district.

Much of the land homesteaded was on sand ridges best suited for growing jack pine, while the better soils with a heavy growth of white spruce and aspen were left undeveloped because of high clearing costs. After the removal

*Acknowledgement is made to C. B. Gill for information contained in this section. A historical summary of the settlement pattern in the area is given in his report, Forest Resources Inventory—Report No. 1, South-Eastern Forest Section, pp. 14-15, 1956, Department of Mines and Natural Resources, Manitoba. Acknowledgment is also given to Prof. J. H. Ellis, Agricultural Consultant, Lands Branch, Department of Mines and Natural Resources. A comprehensive summary of land settlement is contained in his unpublished "Report on South-Eastern Manitoba from a Land-Use Standpoint, 1959".

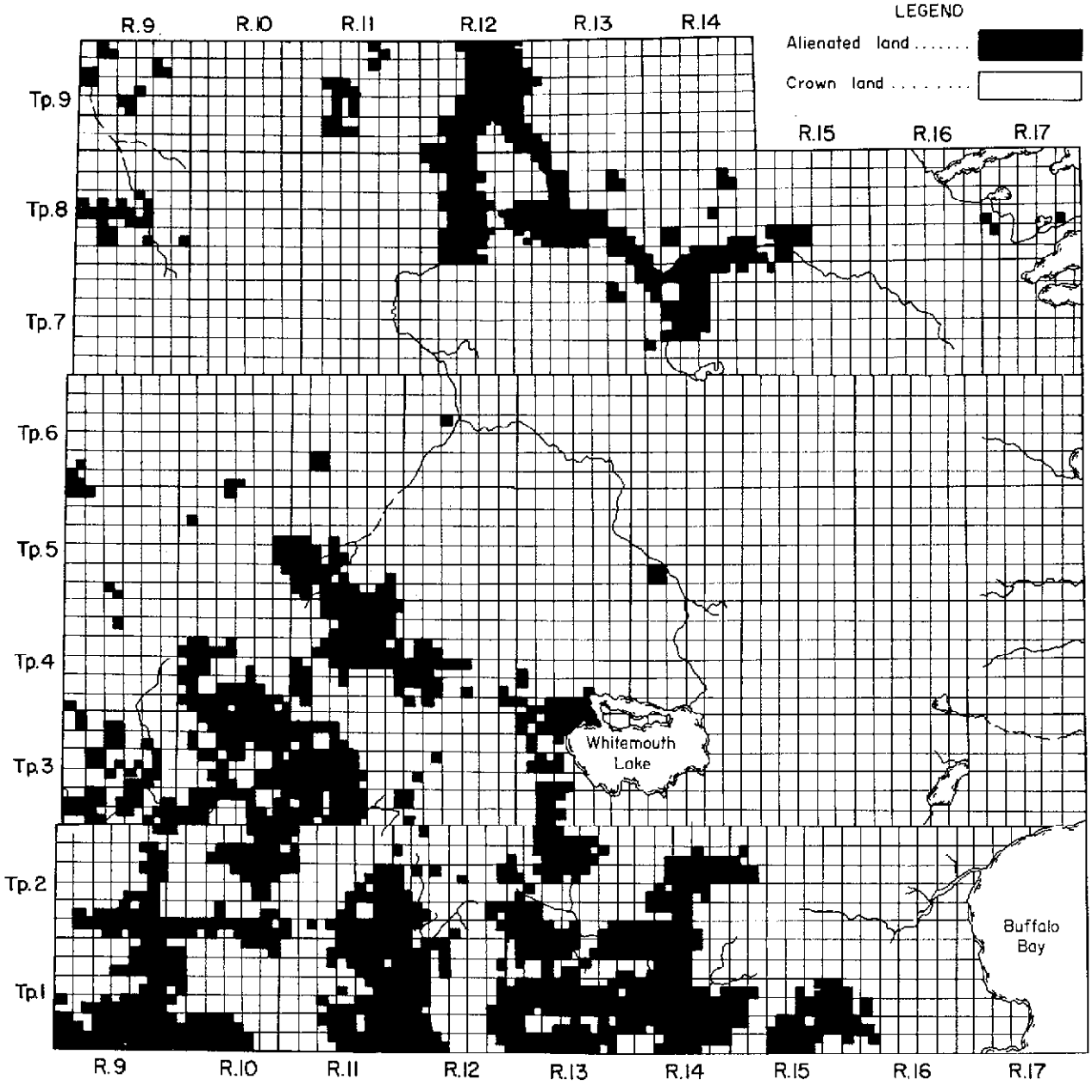


FIGURE 62

Land Tenure in the South-Eastern Map Area.

of jack pine, either by fire or cutting, the settlers were unable to obtain additional income from these sandy soils. The pulpwood boom of the 1920's furnished employment for settlers cutting spruce on private lands but with the arrival of the economic depression of the early 1930's this source of income was lost. Much of the land came into the possession of the local municipalities as a result of non-payment of taxes. The four municipalities in the South-Eastern map area lost their charters before the end of the depression and local affairs from that date have been handled by the Provincial Government.

In recent times small areas of better land have been opened up to agriculture, with emphasis placed on livestock and forage crop production. Up to the present time private owners have shown little interest in wood-lot development although a movement in that direction is predicted.

D. AREA AND PRESENT USE OF FARM LAND

The area and present use of land in the South-Eastern map area is indicated in the figures contained in the Census of Canada and in Provincial Municipal Records. However, it is apparent that the acquisition of land in this forested region of the province, in the main, was for the purpose of exploiting or harvesting the wood products found on these lands. On lands where residence has been established and little or no attempt has been made to put the cleared land under cultivation, the inclusion of these holdings in the numbers of farms can be misleading.

The area and use of land in Local Government Districts in the South-Eastern map area are given in Table 40. The data show that the amount of improved and cultivated land in all districts is very low. The larger amount of improved land indicated for the Stuartburn district occurs mainly outside of the map area. Not much additional land will be improved in this area because of the high percentage of land that is wet, stony or coarse textured.

The farm land in percent of total district acreage, number of farms, acres in farms and average size of farms in each Local Government District are given in Table 41. The data show the area of land held as farms is very low, particularly in the Local Government District of Reynolds. During the period of 1951 to 1961 the amount of land held as farms has not changed significantly, however, there has been a steady decline in numbers of farms and an increase in their average size.

The utilization of farm land in each Local Government District is presented in Table 42. The cultivated land, consisting of less than one percent of the total South-Eastern Area, is used mainly for the production of forage and oat crops. Improved pasture occupies about five percent of the farmland, followed by smaller acreages of flax and wheat. About 43 to 54 percent of the farmland is either waste land or land utilized as native pasture. All districts except Reynolds, which occurs mainly along the Whitemouth and Birch rivers, have farmlands with a high percentage (greater than 19 percent), of woodland with a very low grazing capacity.

The only data available for annual yields of the dominant crops are those for 1939-1962 period for the Provincial Crop Reporting District, No. 12, which included the Local

TABLE 40

Land Use by Local Government District in the South-Eastern Map Area
Canada Census Data, 1961

Local Government District	Total Area of L.G.D. (Approx. Acreage)	Farmland		Cultivated Farmland and Improved Pasture		Unimproved Farmland		Crown Land	
		Acreage Area	Percent of Total District	Acreage	Percent of total District Area	Acreage	Percent of Total District Area	Acreage	Percent of total District Area
Piney.....	583,680	96,633	16.6	35,536	6.1	61,097	10.5	487,047	83.4
*Reynolds.....	857,600	37,038	4.3	18,693	2.2	18,345	2.1	820,562	95.7
*Stuartburn...	276,480	133,327	48.2	38,696	14.0	94,631	34.2	143,153	51.8
Unorganized Territory ..	478,080	—	—	—	—	—	—	—	—

*A major portion of Reynolds Local Government District and only a small part of Stuartburn Local Government District occur in the map area.

TABLE 41

Number, Area and Average Size of Farm by Local Government District, Canada Census Data, 1961, 1956, 1951, 1941

Local Government District	Total Acreage of District	Farmland in Percent of Total District Area				Number of Farms				Acres in Farms				Average Size			
		1961	1956	1951	1941⊙	1961	1956	1951	1941⊙	1961	1956	1951	1941⊙	1961	1956	1951	1941⊙
Piney	583,680	16.6	17.4	17.0	15.7	320	402	443	505	96,633	101,436	99,476	91,849	302.0	252.3	224.6	181.8
*Reynolds	857,600	4.3	5.2	4.9	3.7	167	218	265	243	37,038	44,487	41,959	31,623	221.8	204.1	158.3	135.1
*Stuartburn	276,480	48.2	50.0	52.8	55.6	448	524	605	793	133,327	138,125	145,893	150,363	297.1	263.6	241.1	199.3
Unorganized Territory	478,080	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

*A major part of Reynolds Local Government District and a small part of Stuartburn Local Government District occur in the map area.
⊙Figures not strictly comparable because of reorganized census districts after 1941.

TABLE 42

Utilization of Farm Land in the South-Eastern Map Area Expressed as Percent of Acreage Held as Farms, Canada Census Data 1961

Local Government District	Acreage in Farms	Fallow	Wheat	Barley	Oats	Rye	Flax	Mixed Grains	Tame Hay	Rape-seed	Potatoes	Im-proved Pasture	Wood-land	Unimproved Pasture and Wasteland
Piney	96,633	3.0	0.7	0.3	6.3	0.1	2.5	0.2	17.3	0.1	0.1	4.0	22.7	42.7
*Reynolds	37,038	6.3	5.5	0.8	9.2	—	3.2	0.1	16.8	0.1	0.1	6.2	6.7	45.0
*Stuartburn	133,327	4.0	0.4	—	6.7	—	0.1	0.3	10.2	—	0.1	5.2	19.3	53.7
Unorganized Territory	—	—	—	—	—	—	—	—	—	—	—	—	—	—

*A major portion of Reynolds Local Government District and only a small part of Stuartburn Local Government District occur in the map area.

TABLE 43

Average Yields of Field Crops in Manitoba Crop Reporting District No. 12 (Eastern) 1939 to 1962*

Year	Wheat Bus./acre	Oats Bus./acre	Barley Bus./acre	Fall Rye Bus./acre	Spring Rye Bus./acre	Flax Bus./acre	Potatoes Bus./acre	Forage Crops[1] tons/acre
1939	18.3	24.6	20.3	14.8	11.8	10.7	60.0	1.2
1940	21.2	26.2	24.6	14.3	13.4	10.4	38.0	1.2
1941	20.6	28.9	23.7	18.1	17.8	7.7	93.0	2.6
1942	25.7	40.0	35.0	19.5	21.0	11.0	81.0	2.1
1943	20.0	29.0	21.5	15.7	16.0	10.0	75.0	1.9
1944	17.0	28.0	15.0	14.0	15.0	8.0	30.0	1.8
1945	17.7	32.7	23.7	17.0	—	10.0	60.0	1.8
1946	18.3	30.0	21.0	17.0	15.0	10.0	50.0	1.3
1947	13.7	24.7	16.6	13.0	12.0	9.2	52.0	2.5
1948	19.2	35.9	20.0	13.5	—	9.8	46.7	2.6
1949	16.0	27.6	23.0	14.0	—	7.0	68.0	2.7
1950	17.3	36.5	19.0	16.0	—	8.0	75.0	3.1
1951	16.4	32.5	24.0	16.4	13.9	10.0	131.0	2.4
1952	18.0	39.4	26.0	16.5	15.0	9.0	141.0	3.3
1953	24.1	34.6	20.0	16.0	14.0	8.7	160.0	3.9
1954	8.2	23.4	11.4	9.0		6.0	85.0	3.6
1955	16.0	29.2	16.7	14.4		8.2	140.0	4.0
1956	25.4	44.7	25.0	16.5		9.4	20.0	4.1
1957	17.4	30.2	15.6	9.0		7.0	106.0	3.4
1958	22.3	38.8	27.9	12.2		10.3	101.9	2.9
1959	14.5	24.7	16.8	15.4		8.7	145.9	3.4
1960	23.4	36.0	25.5	16.3		10.8	102.8	3.4
1961	11.0	20.1	13.1	6.0		7.7	58.3	2.3
1962	21.0	32.0	21.2	15.0		10.0	13.7	4.5
Average Yield	18.4	31.2	21.1	15.7	15.0	9.1	80.6	2.7

*Includes the Local Government Districts of Piney, Stuartburn, Reynolds, Pinawa, Alexander and the municipalities of Whitemouth and Lac du Bonnet. Data condensed from Report on Crops, Livestock, etc., Manitoba Department of Agriculture, 1939 to 1962.

[1]Does not include wild hay.

Government Districts of Piney, Stuartburn, Reynolds, Alexander, Pinawa and the municipalities of Whitemouth and Lac du Bonnet (Table 43). These data, obtained in part from outside of the map area, are only an indication of the probable yields of the various crops. It is evident also that no data are available for comparison of crop yields on the different soil types. An additional assumption is that higher average yields than those given

TABLE 44

Number of Horses, Cattle, Sheep, Swine and Poultry by Local Government District in the South-Eastern Map Area Expressed as Average Numbers per Farm Canada Census Data, 1961

Local Government District	Horses	Cattle		Swine	Sheep	Poultry		Number of Farms
		Total	Milk Cows			Total	Hens and Pullets	
Piney	.6	15.3	5.8	2.7	2.6	70.4	27.3	320
*Reynolds	.7	13.6	4.6	3.3	1.3	54.3	19.1	167
*Stuartburn	1.9	25.3	9.2	2.7	2.7	71.8	20.4	448

*A major portion of Reynolds Local Government District and a small part of Stuartburn Local Government District occur in the map area.

in Table 43 can be expected on the better soils and lower than average yields on the poorer soils. The data show that the average yield of wheat and other crops fluctuate widely. These fluctuations are the result of hazards such as frost, drought, excessive spring moisture, local flooding, insects, plant diseases, etc.

The average yield for all crops grown in the South-Eastern map area is slightly lower than those for crops grown in the Red River Valley bordering this map area on the west side.

The average number of horses, cattle, sheep, swine, and poultry per farm in each Local Government District is given in Table 44. The data indicated that cattle and poultry occupy a moderately important place in the farming enterprise. Horses, sheep and swine are present in very low numbers; average numbers ranging from one to about three animals per farm. The horses are used primarily for work around the farm during the winter and the sheep and swine appear to be produced principally for home consumption.

PART V

FORESTRY[1]

A. FOREST CONDITIONS

The land within the surveyed area is currently used primarily for forestry purposes and slightly more than one-half of it is occupied by productive forests (Table 45). Another ten percent, consisting largely of burned-over and cut-over areas, is not now occupied by forests but capable of producing a forest crop.

The area includes 78 townships located in the southeast corner of the South-Eastern Administrative Region of the Manitoba Department of Mines and Natural Resources. Eighty-five percent of the surveyed area is Crown land and the remainder is privately owned (see Figure 62).

(1) *Area and Volume of Forests*[2]

The area classification of productive forest land for three broad cover types—softwood, mixedwood and hardwood—by 20-year age classes is shown in Table 46. The total productive forested area is nearly 922 thousand acres, of which 64.6 percent is softwood, 9.6 percent is mixedwood and 25.8 percent is hardwood. The table shows the prevalence of forest land supporting stands 80 years or less in age.

Gross merchantable volume[3] for all species on Crown lands is 3,927,896 cunits, of which 2,571,014 cunits are softwood and 1,356,882 cunits are hardwood (Table 47). More than 70 percent of this volume is accounted for by black spruce, aspen and jack pine. Table 47 shows the volume distribution by species.

(2) *Utilization*

With respect to markets for forest products, the area is favourably located. It is close to Winnipeg and to pulp and paper mills in north-western Ontario, Manitoba, Minnesota, and Wisconsin. It is served by road and railway transportation systems, and adjacent Lake of the Woods provides a water transportation route to a pulp mill at Kenora.

There are a number of portable saw mills that use locally produced logs. In Winnipeg

1. Department of Forestry, Canada, Forest Research Branch Contribution No. 643.
2. Source—Manitoba Forest Service Inventory, 1961.
3. Trees 3.6 inches diameter at breast height and larger.

TABLE 45
Area Classification[4]

Class of area	Crown land		Patented land		Indian reserves		Total	
	Acres	% of land area	Acres	% of land area	Acres	% of land area	Acres	% of land area
Forest land								
Productive	801,358	52.6	109,284	41.7	11,331	75.0	921,973	51.2
Potentially productive[5]	122,137	8.0	49,153	18.8	422	2.8	171,712	9.5
Treed muskeg, treed rock, willow and alder	362,097	23.7	31,608	12.1	1,731	11.5	395,436	21.9
Non-Forest land								
Agricultural	795	0.1	56,035	21.4	—	—	56,830	3.2
Meadow, marsh, muskeg, roads, townsites, etc.	173,658	11.3	15,607	5.9	1,497	9.9	190,762	10.6
Total land	1,460,045	95.7	261,687	99.9	14,981	99.2	1,736,713	96.4
Total water	65,007	4.3	218	0.1	127	0.8	65,352	3.6
Total area	1,525,052	100.0	261,905	100.0	15,108	100.0	1,802,065	100.0
	84.6		14.6		0.8		100.0	

4. Excludes T. 1, R. 9E and the northern half of T. 8 in R. 15, 16 and 17E.
5. Not restocked to forests due to cutting or burning.

TABLE 46

Area Classification of Productive Forest Land by Cover Types and Age Classes[1]

Age class (years)	Cover types			
	Soft-wood	Mixed-wood	Hard-wood	Total
	(Acres)			
1-20....	59,093	13,241	83,943	156,277
21-40....	40,844	12,554	48,061	101,459
41-60....	161,802	27,148	83,050	272,000
61-80....	186,085	28,488	21,515	236,088
81-100...	89,817	5,475	667	95,959
101+....	57,733	1,560	897	60,190
Total....	595,374	88,466	238,133	921,973

1. Excludes T. 1, R. 9, E.

there are two plants that use poplar, pine, and spruce for the manufacture of insulating board; and numerous smaller wood-using plants that utilize local wood. In Sprague there is a flake-board plant, opened in 1961, that is capable of using some 18,000 cords of poplar annually (Anon. 1963).

Pulpwood production is about 28,000 cords annually, of which some 18,000 cords is spruce. Lumber production for the five-year period ending March 31, 1962 (Anon. 1959-1963) averaged about 7,500,000 board feet, of which 4,500,000 board feet were jack pine. A small volume of wood is used for poles, ties, fence posts and fuelwood; and Christmas trees are cut from the area. The annual cut of spruce and jack pine is equal to the allowable cut, but the annual cut of other species is much less than the allowable cut.

Forest lands in this region are also used for recreation, particularly for hunting and picnicking. The few lakes and rivers are used for fishing, swimming, and boating.

B. FOREST HISTORY

The first use of the forests in south-eastern Manitoba followed settlement in the agricultural area to the west in the 1870's, when there was a good demand for lumber. White pine and red pine were the most important species, but white spruce, cedar, and jack pine were also harvested. A large timber berth was operated by the Sprague Lumber Company in the vicinity of Moose Lake, and white pine and cedar stumps from this operation are still visible. Following settlement to the north in 1880, spruce and red pine sawlogs were cut in the northern portion of the forest area.

Between 1900 and 1930 there was considerable land settlement in this district and during this period much of the jack pine growing on sandy ridges was cleared either by fire or cutting. In the 1920's there was heavy cutting of spruce for pulpwood, with a peak in 1927.

During the depression years of the 1930's jack pine fuelwood was the main product and in 1935-36, 70,000 cords were cut. Following the second World War the demand for all forest products, except fuelwood, increased greatly.

The dry sandy ridges of the area with their pine cover, dry out rapidly and present an unusually high fire hazard during summer months. This has resulted in a high fire incidence for the area.

As a result of the past history of cutting and burning, few undisturbed stands occur and there is presently a preponderance of young stands.

C. ESTIMATED PRODUCTIVITY AND REPRODUCTION OF FOREST TREE SPECIES

The estimated productivity of each soil type for growth of tree species, and the methods recommended for establishing reproduction of tree species, are shown in Table 48. Productivity ratings and reproduction methods are based on the results of forest research carried

TABLE 47

Gross Merchantable Volume by Species for Crown Land[2]

Species	Volume[3] (100 cu. feet)	Percent
Black spruce.....	1,102,339	28.1
Jack pine.....	705,399	18.0
Tamarack.....	358,758	9.1
White spruce.....	36,380	0.9
Balsam fir.....	49,775	1.3
Cedar.....	314,136	8.0
Red pine.....	3,912	0.1
White pine.....	315	<0.1
Total softwoods.....	2,571,014	65.5
Trembling aspen.....	1,007,854	25.7
Balsam poplar.....	239,152	6.1
White birch.....	91,284	2.3
Ash.....	14,153	0.4
White elm.....	4,439	0.1
Total hardwoods.....	1,356,882	34.5
Total.....	3,927,896	100.0

2. Excludes T. 1, R. 9, E.
3. Trees 3.6 inches diameter breast height and larger.

TABLE 48

Estimated Forest Productivity and Reproduction for Soils in South-Eastern Manitoba

Soil Name	PRODUCTIVITY												FOREST REPRODUCTION																								Approximate habitat types
													jP		rP		wP		wS		bS		tL		wCe		bF		tA bPo		As		wB		wE		
	jP	rP	wP	wS	bS	tL	wCe	bF	tA bPo	As	wB	wE	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	
Alluvium									B	B		B	**	**															a		a,b	1			m	1	cvm
Arnes				C				BC	AB		BC								h,l, p	4							b,m		a				k				mm; mf
Balmoral						D	C		C														i		i				a								ew; SC; TP
Badger	CD	BC		DE				DE	BC		DE		e,f, g,h	3,4	h,o, p	3,4											b,m		a				k				mf; mf-
Birch Point				BC				BC	AB		BC								h,l, p	4							b,m		a				k				mf; mm
Carrick	C	C	C	CD				C	B		C		f,h	4	h,o, p	3,4	b,h	4	h,l, p	4							b,m		a				k				mf; mm
Caliento				BC	C	B	B	BC	AB		CD								h,l, p	4	h	4	h	4	i		b,m, n		a				k				mm; mvm
*Deep peat					35% DE	35% DE	35% E														b,j		i		i												S; skS; BC; TM; M
Elma				B				B	A	A	BC	AB							h,l, p	4							m,n		a		a,b	3	k		m	3	mm; evf
Foley						D	C		C														i		i				a								ew; SC; TP
Framnes				BC				B	A	B	BC	B							h,l, p	4							m,n		a		a,b	3	k		m	3	mm
Fyala						D	C		C														i		i				a								ew; SC; TP
Hadashville				B				B	A	A	BC	AB							h,l, p	4							m,n		a		a,b	3	k		m	3	evf; mm
*Indian Bay Complex	10% BC		5% BC	10% BD	15% DE	15% DE	15% DE	10% C	10% B		10% CD										j		i		b,i		b										of; om; mf; mm; mvm; S; sk; skS; FS; BC; TM; M; R
Kerry					E	D	C		C												j		i		i				a								ew; SC; TP
Lonesand	BC	CE		DE	CE				BC		DE		d,e, g	2,3	o	3													a				k				of; om
Medika				B				B	A	A	BC	AB							h,l, p	4							m,n		a		a,b	3	k		m	3	mm; evf
Meleb						D	C		C														i		i				a								ew; SC; TP
Malonton					E	D	C		C												j		i		i				a								ew; SC; TP
Piney				BC				BC	AB		CD								h,l, p	4							b,m, n		a				k				mm; mvm
Peguis				BC				B	A	AB	BC	B							h,l, p	4							b,m, n		a		a,b	3	k		m	3	mm; mvm
Pine Ridge	CD	BC		DE				DE	BC		DE		e,f, g,h	3,4	h,o, p	3,4											b.m.		a				k				mf-; mf
Pine Valley				BC				B	A	AB	BC	B							h,l, p	4							b,m, n		a		a,b	3	k		m	3	mm; mvm
Rock outcrop																																					R

TABLE 48

Estimated Forest Productivity and Reproduction for Soils in South-Eastern Man

Soil Name	PRODUCTIVITY												FOREST REPRODUCTION																	
													jP		rP		wP		wS		bS		tL		wCe		bF		tA bPo	
	jP	rP	wP	wS	bS	tL	wCe	bF	tA bPo	As	wB	wE	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A
*Richer Complex	90% CD 10% B			90% DE 10% C	10% C			90% DE 10% C	90% C 10% B		90% DE 10% D		d,e, g	2,3					h,l, p	4	g,h	3,4					b,m, n		a	
Sandilands	CE	CE							CE				c,d, e	1,2, 3	o	3														
*Sandilands Catena	25% BC 25% CE	50% CE		25% DE	25% C 50% DE	50% DE	50% DE		25% BC 25% DE				d,c, g	2,3	o	3					b,g, j	3,4								
Sirko	B			BC	C	BC	B	C	BC		D		h	4					h,l, p	4	h	4	h	4	b,h	4	b,m, n		a	
St. Labre	BC	B		D				CD	B		C		f,h	4	h,p	4											b,m		a	
*Shallow peat					95% DE	95% DE	95% DE	95% E													b,j		i		i					
Seven Sisters				BC				B	A		BC								h,l, p	4							m,n		a	
Sundown					E	D	C		C												j		i		i				a	
Vassar	BC	B	B	D				CD	B		C		f,h	4	h,p	4	b,h	4									b,m		a	
Woodridge	CD	BC	CD	DE				DE	BC		DE		e,f, g,h	3,4	h,o, p	3,4	b,h	4									b,m		a	
Wampum				BC	C	B	B	BC	AB		CD								h,l, p	4	h	4	h	4	i		b,m n		a	
Wintergreen	B			C	C	B	B	C	BC		D		h	4					h,l, p	4	h	4	h	4	b,h	4	b,m, n		a	

SPECIES

jP —jack pine
rP —red pine
wP —white pine
wS —white spruce
bS —black spruce
tL —eastern tamarack
wCe—white cedar
bF —balsam fir
tA —trembling aspen
bPo—balsam poplar
As —ash
wB —white birch
wE —white elm

PRODUCTIVITY CLASSES

A More than 45 cubic feet per acre per year.

B 36-45 cubic feet per acre per year.

C 26-35 cubic feet per acre per year.

D 16-25 cubic feet per acre per year.

E 6-15 cubic feet per acre per year.

- Unsuitable for the species.

*These soils vary in productivity and the areal distribution of each rating is given in percent. Where less than 100 percent is shown, the remaining area is unsuitable.

FOREST REPRODUCTION CLASSES

**Seed source present (P)

(a) Clear cut, reproduction from suckers.
(b) Clear cut, reproduction from advance growth.
(c) Clear cut, scatter slash.
(d) Clear cut, seedbed preparation, scatter slash.
(e) Clear cut, seedbed preparation, seed.
(f) Clear cut, seedbed preparation, seed, control vegetation.
(g) Clear cut, seedbed preparation, plant.
(h) Clear cut, seedbed preparation, plant, control vegetation.
(i) Modified clear cut.
(j) Modified clear cut, pile or burn slash.
(k) Modified clear cut, seedbed preparation.
(l) Modified clear cut, seedbed preparation, control vegetation.
(m) Partial cut.
(n) Partial cut, control vegetation.
(o) Partial cut, seedbed preparation.
(p) Partial cut, seedbed preparation, control vegetation.

**Seed source absent (A)

(1) Remove tree canopy, plant.
(2) Remove tree canopy, seedbed preparation, seed.
(3) Remove tree canopy, seedbed preparation, plant.
(4) Remove tree canopy, seedbed preparation, plant, control vegetation

out in the survey area and in other regions and on the experience, observations, and judgements of the authors.

A forest ecological land classification developed by Mueller-Dombois (1964) for south-eastern Manitoba was of importance for assigning productivity ratings and for suggesting methods for reproduction practices. This classification resulted in the recognition of fourteen forest habitat types and two treeless habitats. Each of the habitat types was described by Mueller-Dombois (1964) by landform occurrence, soil profile, tree and lesser vegetation, forest productivity, and interpreted in terms of forest management. In Table 48 approximate habitat types are designated for each of the soils to show the range of habitat types that each soil represents. The authors have recognized three additional habitat types, treed muskeg, muskeg, and rock. The former supports an unmerchantable forest cover, while the latter two are treeless.

(1) *Productivity*

Studies of the productivity of jack pine, black spruce, white spruce, and trembling aspen, growing on various soils have been undertaken in several localities throughout the forested regions of Manitoba and Saskatchewan, and use was made of the results (Jameson 1963, 1964a, 1964b, and unpublished data[1]) to establish forest productivity classes for south-eastern Manitoba soils.

Five potential forest productivity classes and a non-productive, or unsuitable class have been used for each species. The five classes, designated A to E in decreasing order of productivity, are based on the net mean annual increment in merchantable cubic feet of wood volume. Productivity Class A has a mean annual increment exceeding 45 cubic feet per acre per year, while Class E has a mean annual increment of six to 15 cubic feet per acre per year. Mean annual increment was determined for moderately well to well stocked stands to a rotation age which varies from 70 years for jack pine and trembling aspen, to 100 years for black spruce.

Each soil was rated for productivity of each species occurring naturally on it, assuming full stocking to the one species. Generally, a single class rating was used for each species, but occasionally a two-class rating indicating intermediate productivity was given. When no rating is given for a species, the soil generally is unsuitable for that species or it does not occur naturally thereon.

Hardwoods were found to produce more volume per acre than softwoods in well stocked natural stands on fresh, moist and very moist sites. On dry and wet sites, softwood volume production tended to be higher than hardwood volume production.

(2) *Reproduction Practices*

Results from ecological and silvicultural experiments undertaken in south-eastern Manitoba and in other localities in Manitoba and Saskatchewan provide suggested methods for establishing reproduction of tree species. These studies have included observations of factors affecting white and black spruce and jack pine reproduction (Rowe 1955, Johnson 1956, Jameson 1961), and studies of silvicultural methods for regenerating jack pine (Cayford 1958, 1959b, 1961, 1964), red pine (Cayford 1959a, 1963), black spruce (Jarvis and Cayford 1961), and white spruce (Jarvis 1963, Waldron 1963). For the determination of methods for establishing reproduction of other tree species, particular reference was made to a series of publications on the silvical characteristics of tree species prepared by the Forest Service, United States Department of Agriculture.

In Table 48 suggestions for obtaining reproduction are included both for areas where the species under consideration is present either in pure stands or as an important element in mixed stands, and where the species is not present. The two conditions are referred to in the table as seed source present (P), and seed source absent (A).

In regenerating a forest stand, first consideration must be given to method of cutting or harvesting the existing stand. The effectiveness of standing trees as a seed source and the effect of residual stand on seedling development are important. Seedbeds suitable for germination of seed and survival of seedlings or planting stock must be prepared, and provision must be made to ensure that seed or seedlings are placed on them.

Three methods of harvesting are included—clear cutting, modified clear cutting, and partial cutting. Reproduction after clear cutting may occasionally be obtained from advance growth or, in the case of poplar and ash, from suckers that develop after cutting. However, in most instances seeding or planting are recommended practices following clear cutting. Both modified clear cutting and partial cutting provide a source of seed in standing trees and do not rely on seeding or planting.

1. Canada, Department of Forestry, Forest Research Branch. Unpublished file data Projects MS-21, MS-151, MS-154 and MS-213.

Site preparation to expose mineral soil and reduce competition to tree seedlings is commonly recommended. It is generally undertaken mechanically using such equipment as bulldozer blades, ploughs, disks, or harrows. Methods can be varied depending upon soil and vegetation conditions. On the very stony soils of the Richer Complex, site preparation would, by necessity, be done using hand tools.

Seed may be sown directly on prepared seedbeds, may be dispersed from standing trees following modified clear cutting or partial cutting, or dispersed from jack pine slash scattered on the ground during harvesting. Planting of two- to four-year-old nursery stock is recommended when regeneration cannot be obtained by any of the above methods.

On the more productive sites vegetation control is recommended for coniferous species. Normally this control can be provided chemically, particularly through the use of selective herbicides which at recommended dosages will not damage coniferous species. Generally, herbicides are applied as a foliage spray.

In stands where the desired species is absent, the tree cover is removed and a seedbed prepared prior to seeding or planting. On the more productive sites vegetation control is required.

D. FOREST LAND-USE CAPABILITY CLASSES, SUB-CLASSES AND UNITS

The soils of the area are grouped by use-capability classes, sub-classes and units for hardwoods and softwoods, primarily according to their potentialities for production of wood volume, but also on the basis of observed soil features. Classes for both hardwoods and softwoods were established because their volume production varies on the same soil.

The use-capability concept[1] places these soils into five classes, based on the net mean annual increment in units of ten merchantable cubic feet of wood volume per acre for the most productive hardwood and softwood species. In general, growth is limited by the regional climate, but other factors also influence growth and reproduction and these are indicated by sub-classes as follows: overflow (i); droughtiness mainly because of soil texture (m); stoniness (p); rock or hardpan (r); wetness (w); and vegetative competition (v). Additional factors considered but not applied to soils in this area include climate (c); dense soil condition (d); erosion (e); low fertility (f); salinity (n); and topography (t).

The unit is a grouping of soils within the sub-class that have the same regeneration methods and are adapted to similar management practices for specific tree crops, but may differ from one another in soil features.

Tables 50 and 51 provide a grouping of soils into forest land use-capability classes, sub-classes and units for hardwoods and softwoods, respectively.

1. Basis of class, sub-class and unit concept is similar to that for agriculture.

E. REFERENCES

ANON. 1956. Forest resources inventory 1956. Report No. 1, Southeastern Forest Section. Manitoba Dept. Mines and Natural Resources, Forest Service. 32 pp.

ANON. 1959-1963. Annual reports for periods ending March 31st 1958 to March 31st 1962. Manitoba Dept. Mines and Natural Resources.

CAYFORD, J. H. 1958. Scarifying for jack pine regeneration in Manitoba. Canada Dept. Northern Affairs and National Resources, Forestry Branch, For. Res. Div., Tech. Note 66. 14 pp.

CAYFORD, J. H. 1959a. Germination and survival of jack pine and red pine after scarification in south-eastern Manitoba. Canada Dept. Northern Affairs and National Resources, Forestry Branch, For. Res. Div., Tech. Note 78. 14 pp.

CAYFORD, J. H. 1959b. Seeding jack pine on the Sandilands Forest Reserve, Manitoba, 1925 to 1955. Canada Dept. Northern Affairs and National Resources, Forestry Branch, For. Res. Div., Tech. Note 79. 16 pp.

CAYFORD, J. H. 1961. Broadcast seeding jack pine at weekly intervals in Manitoba. Canada Dept. Forestry, Forest Research Branch, Tech. Note 106. 12 pp.

CAYFORD, J. H. 1963. Reproduction and residual stand development following cutting in red pine-jack pine stands in Manitoba. Canada Dept. Forestry, Forest Research Branch, Pub. 1010. 19 pp.

CAYFORD, J. H. 1964. Clear cutting and clear cutting in strips, seedbed preparation, and scattering slash in jack pine stands to secure jack pine regeneration, Manitoba and Saskatchewan. Canada Dept. Forestry, Forest Research Branch, Unpubl. MS., 64-MS-18. 33 pp.

JAMESON, J. S. 1961. Observations on factors influencing jack pine reproduction in Saskatchewan. Canada Dept. Forestry, For. Res. Div., Tech. Note 97. 24 pp.

JAMESON, J. S. 1963. Comparison of tree growth on two sites in the Riding Mountain Forest Experimental Area. Canada Dept. Forestry, Forest Research Branch, Pub. 1019. 36 pp.

JAMESON, J. S. 1964a. Preliminary yield tables for black spruce, Manitoba-Saskatchewan. Canada Dept. Forestry, Forest Research Branch, Pub. 1064. 32 pp.

JAMESON, J. S. 1964b. Relation of jack pine height growth to site in the Mixedwood Forest Section of the Southern Boreal Forest of Saskatchewan. Proc. Second North American Forest Soils Conference. (in press.)

JARVIS, J. M. 1963. Clear cutting alternate strips and scarifying in pure white spruce stands to induce white spruce regeneration, Saskatchewan. Canada Dept. Forestry, Forest Research Branch, Unpubl. MS., 63-MS-2. 18 pp.

JARVIS, J. M. and J. H. CAYFORD. 1961. Regeneration following various methods of cutting in black spruce stands in Manitoba. For. Chron. 37:339-349.

JOHNSON, H. J. 1956. Some aspects of black spruce reproduction in the Central Boreal Forest Region of Manitoba. Canada Dept. Northern Affairs and National Resources, Forestry Branch, For. Res. Div., S. & M. 56-3. 15 pp.

MUELLER-DOMBOIS, D. 1964. The forest habitat types in southeastern Manitoba and their application to forest management. Can. J. Bot. (In press.)

ROWE, J. S. 1955. Factors influencing white spruce reproduction in Manitoba and Saskatchewan. Canada Dept. Northern Affairs and National Resources, Forestry Branch, For. Res. Div., Tech. Note 3. 27 pp.

WALDRON, R. M. 1963. Factors affecting natural white spruce regeneration on artificially prepared seedbeds on the Riding Mountain Forest Experimental Area. Canada Dept. Forestry, Forest Research Branch, Unpubl. MS., 63-MS-30. 36 pp.

F. GLOSSARY

Advance growth—A collective term for all young trees that have become established naturally in a forest before cutting or regeneration operations are begun.

Allowable cut—The volume of wood which can be cut, under management, for a given period.

Annual cut—The quantity of forest products cut on a given forest area in a year.

Board foot—A unit of measurement represented by a board 1 foot long, 1 foot wide and 1 inch thick.

Clear cutting—The removal of an entire forest stand in one cut. In its usual application only the merchantable timber is removed.

Cord—A unit of measurement of stacked wood. One cord contains 128 cubic feet within its outside surfaces.

Cover type—A descriptive term used to group together softwood (coniferous), hardwood (deciduous), or mixedwood (a mixture of softwoods and hardwoods) stands.

Cunit—A unit of volume measure containing 100 cubic feet.

Forest habitat—A locality throughout which the primary environmental factors—climate, soil, water and nutrients—have an essentially uniform physiological potential, as observed on the growth and reproduction pattern of a tree population. (Mueller-Dombois 1964.)

Habitat type—A class derived through abstraction of the combined characteristics of several (concrete) habitats that have biologically equivalent physiological potentials. (Mueller-Dombois 1964.)

Modified clear cutting—A clear cutting system in which the size and shape of the cut areas are varied, so as to provide for a source of seed onto the cut areas from timber margins.

Net mean annual increment—Total growth of trees on a stand up to a given age (usually rotation age) divided by that age.

Partial cutting—A system of cutting in which only a portion of the stand is removed during the first cut. The remainder of the stand is used as a seed source and to provide shade for seedlings, and is ordinarily removed following the successful establishment of reproduction.

Residual stand—The stand remaining after the completion of cutting.

Rotation age—The age at which a stand is grown to a specified condition of maturity.

Site—syn. habitat type.

Sucker—Shoots that arise from the lower portion of a stump, or especially from the root, following cutting of the original stem.

TABLE 49

Common and Scientific Names of Tree Species Used in the Text.

Aspen, trembling	*Populus tremuloides* Michx.
Ash	*Fraxinus pennsylvanica* Marsh
Birch, white	*Betula papyrifera* Marsh
Cedar, eastern white	*Thuja occidentalis* L.
Elm, white	*Ulmus americana*. L.
Fir, balsam	*Abies balsamea* (L.) Mill.
Larch	*Larix laricina* (Du Roi) K. Koch
Maple, Manitoba	*Acer negundo* L.
Oak, bur	*Quercus macrocarpa*, Michx.
Pine, jack	*Pinus banksiana* Lamb.
Pine, red	*Pinus resinosa* Ait.
Pine, white	*Pinus strobus* L.
Poplar, balsam	*Populus balsamifera* L.
Spruce, black	*Picea mariana* (Mill.) BSP.
Spruce, white	*Picea glauca* (Moench) Voss.

TABLE 50

Grouping of Soils by Forest Land-Use Capability Classes, Sub-Classes and Units

HARDWOODS

Class	Net mean annual increment (cu. ft. per acre per year)	Class Description	Sub-class *	Unit	Unit Description	Soil	Recommended Species
A	>45	Fresh to very moist (well to imperfectly drained) soils generally with high water holding capacity. Moderate limitations due to wetness, or inundation; severe limitations due to vegetative competition. Generally well supplied with nutrients. Topography is level to irregular very gently sloping. Highest production and suitable for all hardwood species in region.	Aiv	1	Moist (imperfectly drained) sites on level to irregular very gently sloping topography. They are subject to periodic flooding and severe vegetative competition.	Medika	1. Trembling aspen 2. White elm 3. Ash 4. White birch
			Awv	1	Moist to very moist (imperfectly drained) sites on level to gently sloping topography. Slow internal drainage and high water table in spring. Ponding occurs after heavy rains and in spring. Severe vegetative competition.	Elma Hadashville	1. Trembling aspen 2. White elm 3. Ash 4. White birch
			Awv	2		Peguis Pine Valley Framnes	1. Trembling aspen 2. White elm 3. Ash 4. White birch
			Av	1	Moist (moderately well drained) and some fresh (well drained) sites on gently sloping topography. Subject to severe vegetative competition.	Arnes Seven Sisters	1. Trembling aspen 2. White birch
			Av	2	Moist to very moist (imperfectly drained) sites on gently sloping to irregular very gently sloping topography. Soils have low water holding capacity but are subject to a high ground water table in spring and to severe vegetative competition.	Caliento Wampum	1. Trembling aspen 2. White birch
			Av	3	Fresh (well drained) to moist (moderately well drained) sites on very gently sloping topography. The sites tend to be moisture deficient in later part of growing season. Severe vegetative competition.	Birch Point	1. Trembling aspen 2. White birch
			Apv	1	Moist to very moist (imperfectly drained) sites on very gently sloping to gently sloping topography. These are very stony soils, subject to high water table in spring and to severe vegetative competition.	Piney	1. Trembling aspen 2. White birch
B	36-45	Fresh (well drained) to very moist (imperfectly drained) soils. They have slight limitations due to periodic summer droughtiness and have moderate to slight limitations due to vegetative competition. They are reasonably well supplied with nutrients and have a moderately high level of productivity for aspen and a moderate level for white birch.	Bvp	1	Fresh (well drained) to moist (moderately well drained) sites on irregular gently sloping topography. Soils are very stony. Vegetative competition is moderate.	Carrick	1. Trembling aspen 2. White birch
			Bv	1	Fresh (well drained) sites on gently sloping topography. Vegetative competition is moderate.	St. Labre. Vassar	1. Trembling aspen 2. White birch
			Bv	2	Moist to very moist (imperfectly drained) sites on level to very gently sloping topography. Soils are coarse textured but have a high ground water table throughout year. Vegetative competition is severe.	Lonesand Sirko Wintergreen	1. Trembling aspen or balsam poplar 2. White birch
			Bm	1	Moderately fresh to fresh (rapidly to well drained) sites on undulating sandy morainic uplands. Vegetative competition varies from negligible to slight.	Badger Pine Ridge Woodridge	1. Trembling aspen 2. White birch
			Biv	1	Very moist (imperfectly drained) sites on level to depressional topography adjacent to existing streams. Subject to frequent overflow and have a high water table. Competition from vegetation is moderate to severe.	Alluvium	1. Trembling aspen or balsam poplar 2. Ash 3. White elm

*i—overflow
m—droughtiness, mainly because of soil texture
p—stoniness
r—rock
v—vegetative competition
w—wetness

TABLE 50—Continued

Class	Net mean annual increment (cu. ft. per acre per year)	Class Description	Sub-class *	Unit	Unit Description	Soil	Recommended Species
C	26-35	Dry (rapidly drained) to very moist (poorly drained) soils on variable topography. Moderate level of productivity for aspen.	Cwv	1	Very moist to wet (poorly drained) sites on depressional to level topography. They are subject to ponding for much of growing season. Vegetative competition is severe.	Balmoral Foley Fyala Kerry Malonton Meleb Sundown	1. Trembling aspen or balsam poplar
			Cp	1	Dry to moist (rapidly drained to imperfectly drained) but dominantly dry and fresh sites on gently sloping to undulating topography. Soils are coarse textured and extremely stony. Vegetative competition is negligible.	Richer complex	1. Trembling aspen 2. White birch
D	16-25	Dry (rapidly drained) coarse textured soils to wet (poorly drained) organic soils on undulating sandy morainic uplands and depressions. Low level of production for aspen. Vegetative competition is negligible.	Dm	1	Dry (rapidly drained) sites on undulating morainic uplands. Soils are coarse textured and summer droughtiness is frequent.	Sandilands	Hardwoods not recommended on these sites.
			Dm & Dw	1	Dry sites with coarse textured soils to wet sites on undulating moraines to level peaty areas. Summer drought on dry and excessive moisture on wet sites are limiting factors.	Sandilands catena	Hardwoods not recommended on these sites.
E	6-15	These soils have low natural fertility and are practically unsuitable for production of hardwoods due to soil limitations. Included in this group are peats and rock outcrops.	Er	1	Shallow glacial till over granitic bedrock. Topography is irregular gently sloping to steeply sloping. Only 10% of area is suitable for hardwoods.	Indian Bay complex	Hardwoods not recommended on these sites.
			Er	2	Rugged barren rock outcrop. Forest cover is scrubby and unmerchantable and occurs only in depressions and crevices.	Rock outcrop	Hardwoods not recommended on these sites.
			Ew	1	Wet (poorly and very poorly drained) peat soils on level topography. Limited productivity due to wetness.	Shallow peat Deep peat	Hardwoods not recommended on these sites.

* i—overflow
m—droughtiness, mainly because of soil texture
p —stoniness
r —rock
v —vegetative competition
w—wetness

TABLE 51

Grouping of Soils by Forest Land-Use Capability Classes, Sub-Classes and Units

SOFTWOODS

Class	Net mean annual increment (cu. ft. per acre per year)	Class Description	Sub-class *	Unit	Unit Description	Soil	Recommended Species
B	36-45	Fresh (well drained) to moist and very moist (imperfectly drained) soils, generally with moderate to high water holding capacity on level to gently sloping topography to undulating topography. Slight limitations due to wetness. Generally well supplied with nutrients. Highest productivity for most regional softwoods.	Bpv	1	Moist to very moist (imperfectly drained) sites on very gently sloping to gently sloping topography. These are stony soils subject to high water table in spring and to severe vegetative competition.	Piney	1. White spruce 2. Balsam fir
			Bwv	1	Moist to very moist (imperfectly drained) sites on level to gently sloping topography. Internal drainage is slow and ponding occurs after heavy rains and in spring. Vegetative competition is severe.	Elma Hadashville	1. White spruce 2. Balsam fir
			Bwv	2		Peguis Pine Valley Framnes	1. White spruce 2. Balsam fir
			Bv	1	Moist (moderately well drained) to fresh (well drained) sites on gently sloping topography. Subject to severe vegetative competition.	Arnes Seven Sisters	1. White spruce 2. Balsam fir
			Bv	2	Moist to very moist (imperfectly drained) sites on level to gently sloping to irregular very gently sloping topography. Subject to a high ground water table in spring and to severe vegetative competition.	Caliento Wampum	1. White cedar or larch 2. White spruce 3. Black spruce
			Bv	3	Moist to very moist (imperfectly drained) sites on level to gently sloping to irregular very gently sloping topography. Subject to a high ground water table in spring and to severe vegetative competition.	Lonesand Sirko Wintergreen	1. Jack pine (red pine on Lonesand) 2. Black spruce 3. White cedar
			Bv	4	Fresh (well drained) sites on gently sloping topography. Vegetative competition is moderate.	St. Labre Vassar	1. Red pine 2. Jack pine
			Bv	5	Fresh (well drained) to moist (moderately well drained) sites on very gently sloping topography. Tends to be some moisture deficiency in later part of growing season. Subject to severe vegetative competition.	Birch Point	1. White spruce 2. Balsam fir
			Biv	1	Moist (imperfectly drained) sites on level to irregular very gently sloping topography. They are subject to periodic flooding and severe vegetative competition.	Medika	1. White spruce 2. Balsam fir
			Bm	1	Moderately fresh to fresh (rapidly to well drained) sites on undulating sandy morainic uplands. Vegetative competition varies from negligible to slight.	Badger Pine Ridge	1. Jack pine 2. Red pine
C	26-35	Dry to moist (rapidly to imperfectly drained) soils with variable water holding capacity on irregular gently sloping to undulating topography. Nutrient level is moderate. Level of productivity is moderate.	Cpv	1	Fresh (well drained) to moist (moderately well drained) sites on irregular gently sloping topography. Soils are stony. Vegetative competition is moderate.	Carrick	1. Jack pine 2. Red pine 3. White spruce
			Cm	1	Moderately fresh to fresh (rapidly to well drained) sites on undulating topography. Soils tend to be droughty. Vegetative competition is negligible.	Woodridge	1. Jack pine 2. Red pine
			Cp	1	Dry to moist (rapidly to imperfectly drained) but dominantly dry and fresh sites on gently sloping to undulating topography. Soils are coarse textured and extremely stony. Vegetative competition is negligible.	Richer complex	1. Jack pine 2. Black spruce 3. White spruce

*
i—overflow.
m—droughtiness, mainly because of soil texture.
p—stoniness.
r—rock.
v—vegetative competition.
w—wetness.

TABLE 51—Continued

Class	Net mean annual increment (cu. ft. per acre per year)	Class Description	Sub-class *	Unit	Unit Description	Soil	Recommended Species
D	16-25	Dry to wet (rapidly to poorly drained) soils on variable topography. Low level of productivity.	Dm	1	Dry (rapidly drained) sites with coarse textured soils on undulating topography. Low moisture holding capacity. Low nutrient level. Summer drought is frequent.	Sandilands	1. Jack pine 2. Red pine
			Dm & Dw	1	Dry sites with coarse textured soils, to wet sites with organic soils on undulating moraines, to level peaty areas. Low moisture holding capacity on dry sites and low nutrient level on all sites. Summer drought on dry and excessive moisture on wet sites are limiting factors.	Sandilands catena	1. Jack pine 2. Black spruce
			Dw	1	Wet (poorly drained) sites on level topography. Although largest volume of wood is produced on these sites, productivity is low due to low nutrient level and to excessive moisture.	Shallow peat	1. Black spruce 2. Larch 3. White cedar.
			Dwv	1	Very moist (poorly drained) sites on depressional to level topography. These sites are subject to ponding for much of the growing season and to severe vegetative competition.	Balmoral Foley Fyala Kerry Malonton Meleb Sundown	1. White cedar 2. Larch
E	6-15	These soils have a very low level of productivity and are practically unsuitable for timber production except over a long period of time. Included in this group are peat soils and rock outcrops.	Er	1	Shallow glacial till over bedrock. Topography is irregular gently sloping to steeply sloping. Only 25% of area is suitable for softwood production.	Indian Bay complex	1. Jack pine (dry) 2. Black spruce (wet)
			Er	2	Rugged barren rock outcrop. Forest cover is limited to crevices and depressions in rock.	Rock outcrop	1. Jack pine
			Ew	1	Wet (very poorly drained) peat soils on level topography. Only 1/3 of type capable of supporting softwood stands due to wetness.	Deep peat	1. Black spruce 2. Larch 3. White cedar
			Eiw	1	Very moist (imperfectly drained) soils on level to depressional topography adjacent to existing streams. Subject to frequent overflow and to a high water table.	Alluvium	Softwoods not recommended.

*
i—overflow,
m—droughtiness, mainly because of soil texture.
P—stoniness.
r—rock,
v—vegetative competition.
w—wetness.

APPENDIX

GLOSSARY OF TERMS

Acid soil—Generally a soil having a pH value less than 6.6. Usually a soil that is acid throughout most or all of its parts occupied by plant roots. Commonly applied to the surface layer or some other specific horizon of the soil.

Adsorption—The attachment of compounds or ionic parts of salts to a surface or another phase. Nutrients in solution (ions) carrying a positive charge become attached to (adsorbed by) negatively charged soil particles.

Aeration, soil—The exchange of air in soil with air from the atmosphere.

Aggregate (of soil)—A single mass or cluster of many fine soil particles held in a cube, granule, prism or other forms.

Alkaline soil—A soil having a pH value above 7.3. Generally a soil that is alkaline throughout most or all of the parts of it occupied by plant roots.

Alluvial soil—Soils developing from transported and relatively recently deposited material (alluvium) with little or no modification of the original materials by soil-forming processes.

Ash—The nonvolatile residue resulting from the complete burning of organic matter.

Association (synonymous with Catena as defined in Manitoba)—A group of soils within the same zone formed from similar parent materials but with unlike soil characteristics because of difference in drainage or relief.

Available nutrient in soils—The part of the supply of a plant nutrient in the soil that can be taken up by plants at rates and in quantities significant to plant growth.

Bedrock—The solid rock underlying soils and other earthy surface formations.

Calcareous soil—A soil containing calcium carbonate. It effervesces visibly when treated with hydrochloric acid.

Carbon-Nitrogen ratio—Weight ratio of organic carbon to total nitrogen.

Catena—See association.

Cation—An ion carrying a positive charge of electricity. The common soil cations are calcium, magnesium, sodium, potassium and hydrogen.

Cation-Exchange Capacity (C.E.C.)—A measure of the total amount of exchangeable cations that can be held by the soil. It is expressed in terms of milliequivalents per 100 grams.

Clay—As a soil separate, the mineral soil particles less than 0.002mm. in diameter. As a soil textural class, soil material that contains 40 percent or more of clay, less than 45 percent of sand and less than 40 percent of silt.

Clay loam—Soil material that contains 27 to 40 percent of clay and 20 to 45 percent of sand.

Clod—A mass of soil produced by plowing or digging which usually slakes easily with repeated wetting and drying in contrast to a ped, which is a natural soil aggregate.

Complex soil—An intimate mixture of different kinds of soil that are too small to be shown separately on a published soil map.

Concretions—Hard grains, pellets or nodules from concentration of compounds in the soil that cement soil grains together.

Conductivity, electrical—A physical quantity that measures the readiness with which a medium transmits electricity. Commonly used for expressing the salinity of irrigation waters and soil extracts because it can be directly related to salt concretion. It is expressed in (mmhos/cm) at 25°C.

Consistence—The combination of properties of soil material that determine its resistance to crushing and its ability to be molded or changed in shape. Consistence depends mainly on forces of attraction between soil particles. Consistence is described by such words as loose, friable, firm, soft, plastic and sticky, etc.

Continental climate—A general term for the climate typical of great land masses where wide ranges in temperature and other weather conditions occur because the area is not greatly influenced by nearness to the sea.

Contour—An imaginary line connecting points of equal elevation on the surface of the soil.

Deflocculate—To separate or to break up soil aggregates into individual particles.

Degradation (of soils)—The change of one kind of soil to a more highly leached kind, such as the change of a Chernozem to a Grey Wooded.

Drainage, soil—(1) The rapidity and extent of the removal of water from the soil by runoff and flow through the soil to under-ground spaces. (2) As a condition of the soil, it refers to the frequency and duration of periods when the soil is free of saturation.

Drift—Material, of any sort deposited by geological processes in one place after having been removed from another. Glacial drift includes the materials deposited by glaciers and by the streams and lakes associated with them.

Dune—A mound or ridge of loose sand piled up by wind. Occasionally during extreme dry periods granulated clayey materials may be piled into low dunes.

Environment—All external conditions that may act on an organism or soil to influence its development.

Erosion—The wearing away of the land surface by detachment and transport of soil and rock material through the action of moving water, wind or other geological processes.

Eutrophic, Organic Soil—Organic soils high in available plant nutrients with favourable soil reaction, moderately to well decomposed, high ash content and with C/N ratios of 15 to 30.

Fallow—Cropland left idle in order to restore productivity, mainly through accumulation of water, nutrients or both.

Family, soil—The third category (III) in the Canadian Soil Classification system. Differentiae of these soils are primarily or similarity in texture, drainage, thickness of horizons, permeability, mineralogy, consistence and reaction.

Friable—Soil aggregates that are soft and easily crushed between thumb and forefinger.

Genesis, soil—Mode of origin of soil with special reference to the processes responsible for the development of the solum from parent material.

Gleyzation—(1) Development of dull, neutral grey colour in a soil horizon produced by lack of oxygen caused by water-logging. (2) Development of yellow and grey mottling in the soil produced by partial oxidation and reduction of iron caused by intermittent water-logging.

Granular structure—Soil structure in which the individual grains are grouped into small spherical aggregates with indistinct sides. A well granulated soil has the best structure for most ordinary crop plants.

Great Soil Group—This is the fifth category (V) in the Canadian Soil Classification scheme. This is a subdivision of the Order, each division consists of one or more broad groups of soils with some fundamental characteristics in common. Examples are Black, Podzol, Grey Wooded, Solonetz, Regosol, Humic Gleysol, Brown Forest, etc.

Ground water—Water that fills all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Humification—A process or condition of decay in which plant or animal remains are so thoroughly decomposed that their initial structures or shapes can no longer be recognized.

Inherited soil characteristics—Any characteristic of a soil that is due directly to the nature of the material from which it is formed, as contrasted to the characteristics that are the result of soil forming processes acting on parent material. For example, some soils are stony because the parent material was stony.

Leaching—The removal of material in solution by the passage of water through soil.

Loam—The textural class name for a soil having 7-27 percent of clay, or 28 to 50 percent of silt, and less than 52 percent of sand.

Massive soil structure—Large cohesive masses, no evidence of arrangement into definite forms.

Milliequivalent (m.e.)—One thousandth of an equivalent. An equivalent is the weight in grams of an ion or compound that combines with or replaces one gram of hydrogen. The atomic weight or formula weight divided by valence.

Millimhos (mmhos)—Units of electrical conductance.

Morphology, soil—The constitution of the soil including texture, structure, consistence, colour and other physical, chemical and biological properties of the various soil horizons that make up the soil profile.

Mottled—Soil horizons irregularly marked with spots of colour. A common cause of mottling is imperfect or poor drainage.

Muck—Highly decomposed organic soil material developed from peat. The peat is decomposed to the point that the original plant parts cannot be identified.

Mull—A humus rich surface layer of soils consisting of mixed organic and mineral matter.

Neutral soil—A soil that is neither significantly acid nor alkaline. Strictly a neutral soil has a pH of 7.0; in practice a neutral soil has a pH between 6.6 and 7.3.

Oligotrophic, organic soil—Organic soils low in available plant nutrients, strong acid in reaction, largely undecomposed, low ash content and with C/N ratios greater than 30.

Order, soil—The highest category (VI) in the Canadian Soil Classification system. These are: Chernozemic, Solonetzic, Podzolic, Brunisolic, Regosolic, Gleyzolic and Organic.

Organic soil—Soils that contain 30 percent or more of organic matter and have a depth of 12 inches or more of consolidated material.

Parent material—Unconsolidated mineral material or peat from which the soil profile develops.

Parts per million (P.P.M.)—A notation for indicating a small amount of material. The expression gives the number of units by weight of the substance per million weight units of oven dry soil.

Peat—Unconsolidated soil material consisting largely of partly to moderately decomposed organic matter accumulated under conditions of excessive moisture.

Ped—An individual natural soil aggregate such as granule, prism or block, in contrast to clod, which is a mass of soil brought about by digging or other disturbance.

Pedology—The science that treats of soil.

Percolation—The downward movement of water through soil.

Permeability, soil—The quality of a soil horizon that enables water or air to move through it.

pH—A numerical designation of relatively weak acidity or alkalinity as in soils and in other biological systems. Technically pH is the common logarithm of the reciprocals of the hydrogen concentration of a solution. A pH of 7 indicates precise neutrality, higher values indicate increasing alkalinity and lower values increasing acidity.

Plant nutrients—The element taken in by the plant essential to its growth and used by it in the elaboration of its food and tissue. These include nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, copper, boron and perhaps others, obtained from the soil; and carbon, hydrogen and oxygen obtained chiefly from air and water.

Platy Soil structure—Soil aggregates with thin vertical axes and long horizontal axes.

Productivity (of soils)—The present capability of a kind of soil for producing a specified plant or sequence of plants under a defined set of management practices.

Profile (soil)—A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil—The degree of acidity or alkalinity of a soil mass, expressed in either pH value or in words as follows:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 - 5.0
Strongly acid	5.1 - 5.5
Medium acid	5.6 - 6.0
Slightly acid	6.1 - 6.5
Neutral	6.6 - 7.3
Mildly alkaline	7.3 - 7.8
Moderately alkaline	7.9 - 8.4
Strongly alkaline	8.5 - 9.0
Very strongly alkaline	9.1 and higher

Regolith—The unconsolidated mantle of weathered rock and soil material on the earth's surface.

Relief—Elevations or inequalities of the land surface, considered collectively.

Run-off—The surface flow of water from an area.

Saline soil—A soil containing enough soluble salts to impair its productivity for plants.

Salts—The products of the reaction of an acid with a base.

Sand—Individual rock or mineral fragments in soils having diameters ranging from 0.5 mm. to 2.0 mm. The textural class name of any soil that contains

5 percent or more of sand and not more than 10 percent of clay.

Sandy clay—The textural class name of any soil containing 35 percent or more of clay and 45 percent or more of sand.

Sandy loam—Soils of this textural class contain less than 20 percent clay and more than 50 percent sand.

Sedimentary rock—A rock composed of particles deposited from suspension in water; e.g. limestone, shale, sandstone.

Separate, soil—One of the individual size groups of mineral soil separates sand, silt or clay.

Series, soil—The second category (II), in the Canadian Soil Classification system. A group of soils that have soil horizons similar in their differentiating characteristics and arrangement in the profile, except for surface texture, and are formed from a particular type of parent material.

Sesquioxides—The oxides of trivalent cations such as iron and aluminium.

Silt—(1) Individual mineral particles of soil that range in diameter between 0.05 mm to 0.002 mm. (2) Soil of the textural class silt contains 80 percent silt and less than 12 percent of clay.

Silt loam—Soil of this textural class having (1) 50 percent or more of silt and 12 to 27 percent of clay or (2) 50 to 80 percent of silt and less than 12 percent clay.

Silty clay—Soil of this textural class has 40 percent or more of clay and 40 percent or more of silt.

Silty clay loam—Soil of this textural class has 27 to 40 percent clay and less than 20 percent sand.

Single grained soil—A structureless soil in which each particle exists separately, as in dune sand.

Slope—The incline of the surface of a soil. It is usually expressed in percentage of slope, which equals the number of feet of fall per 100 feet of horizontal distance. One hundred percent slope is equal to a 45 degree angle of slope.

Soil—A collection of natural bodies occupying parts of the earth's surface that support plants and that have properties due to the intergrated effect of climate and living matter acting upon parent material, as conditioned by relief over periods of time.

Soil management—The preparation, manipulation and treatment of soils for the production of food and fiber.

Solum—The upper part of a soil profile, above the parent material in which the processes of soil formation are active.

Sphagnum—A group of hummock-forming mosses which grow in moist places.

Stratified materials—Unconsolidated sand, silt and clay arranged in strata or layers.

Sub-Group, soil—The fourth (IV) category in the Canadian Soil Classification system. These soils are subdivisions of Great Groups and therefore each soil is defined more specifically.

Substratum—A layer lying beneath the solum or true soil. It is applied to both parent materials and to other unconforming layers below the solum.

Surface soil—The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches.

Textural class or texture—Names given to soil material, and refers to the proportions of sand, silt and clay in a mass of soil on a percentage basis. (See Figure 63).

Till, glacial—The unsorted and non-stratified deposits laid down by the action of glacial ice.

Tilth—The physical condition of a soil in respect to its fitness for the growth of plants.

Topography—The shape of the ground surface, such as hills, mountains or plains.

Type, soil—The first category (1) in the Canadian Soil Classification system. It is a sub-group of the soil series and is based on the texture of the surface soil.

Water table—The upper limit of the part of the soil or underlying rock material that is wholly saturated with water.

Water-holding capacity—The ability of soil to hold water. The water-holding capacity of sandy soils is usually considered to be low while that of clayey soils is high. Often expressed in inches of water per foot depth of soil.

Weathering—The physical and chemical disintegration and decomposition of rocks and minerals.

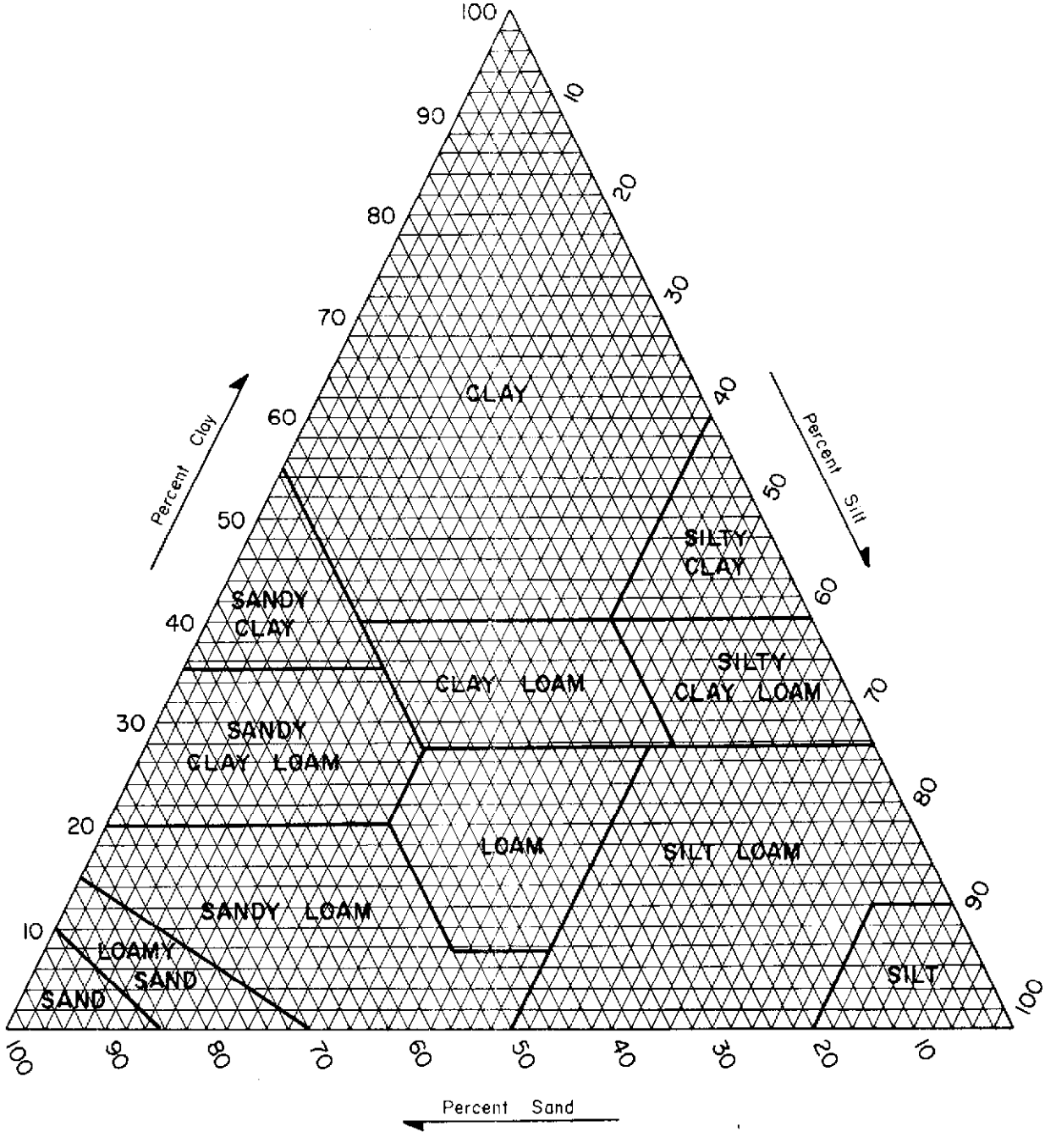


FIGURE 63

Chart showing the percentages of clay, silt and sand in the main soil textural classes.