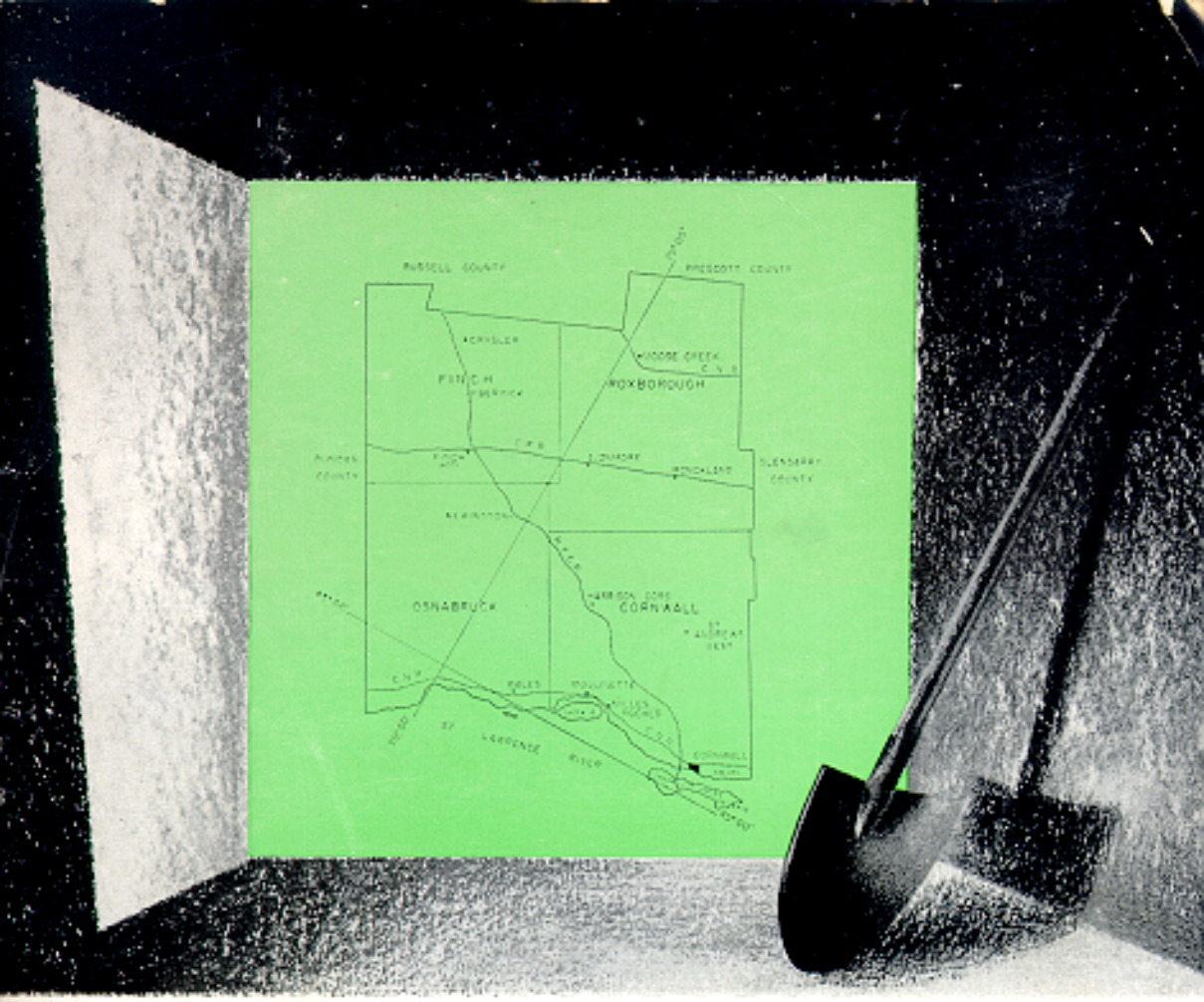

SOIL SURVEY OF STORMONT COUNTY

REPORT NO. 20 OF THE ONTARIO SOIL SURVEY

Experimental Farms Service, Dominion Department of Agriculture and the Ontario Agricultural College

SOIL SURVEY OF STORMONT COUNTY

by

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and

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Ontario Agricultural College, Guelph, Ontario

November 1954

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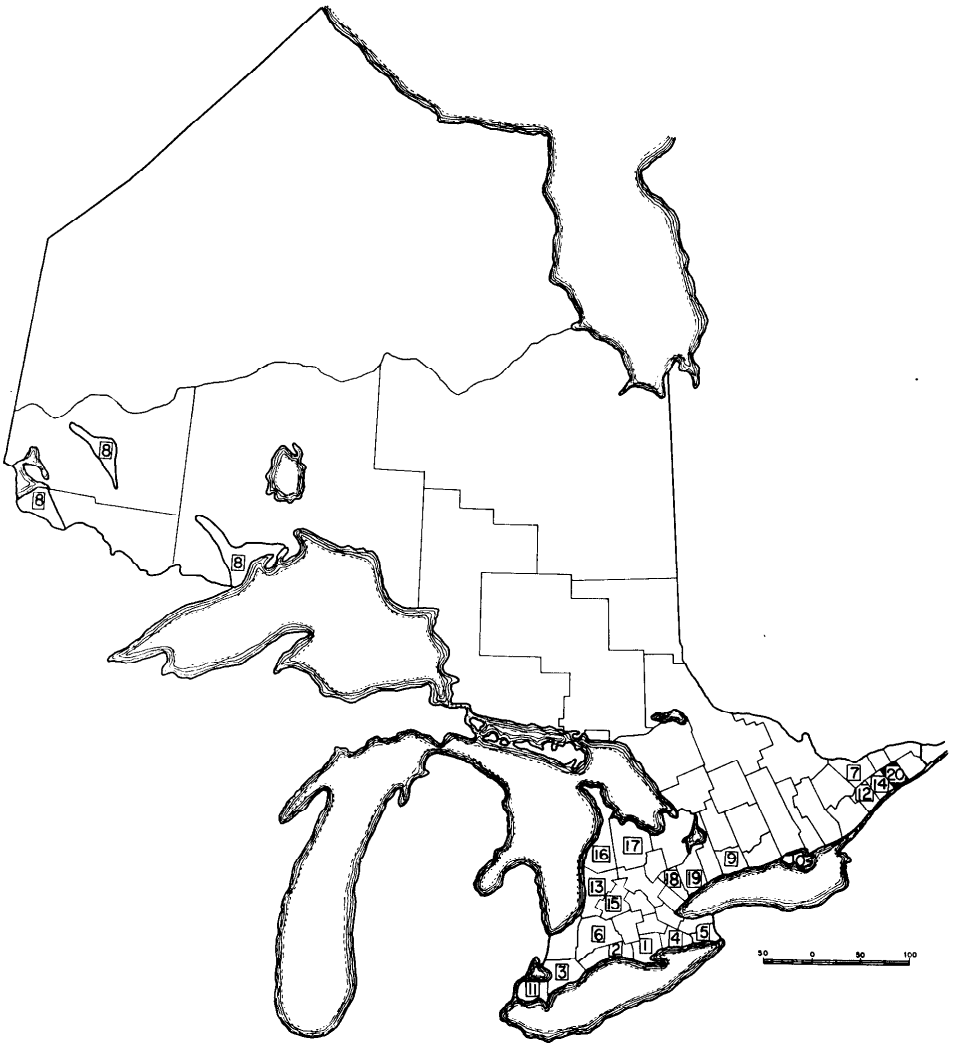

FIG. 1—Outline map of Ontario showing location of Stormont County and other areas for which soil maps and reports have been published.

ACKNOWLEDGMENTS

The Canada Department of Mines and Technical Surveys, Surveys and Mapping Branch, supplied the base maps. The final copy of the soil map was prepared for lithographing by the Cartographic Section of the Division of Field Husbandry, Soils and Agricultural Engineering, Central Experimental Farm, Ottawa.

Dr. P. C. Stobbe, Canada Department of Agriculture, assisted with the classification and correlation in the field and critically reviewed the manuscript. Much valuable assistance was provided by Dr. A. Leahey, Canada Department of Agriculture, during the course of this project.

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Soil Survey of Stormont County

by

B. C. MATTHEWS *and* N. R. RICHARDS[1]

INTRODUCTION

The primary purpose of a soil survey is the classification and description of the soils of an area. Such features as colour, structure, texture, depth, and number of horizons as well as some chemical characteristics are described for the different soils. Finally, some recommendations for land use are suggested. In seeking information regarding the soils of the area, reference should be made to the map as well as to the report.

THE MAP—The map presents all the important features of the County such as cities, towns, railways, roads, post offices, lakes and rivers as well as the soils information. The different soil areas are delineated by solid black boundary lines and the soil type is identified on the map by the use of colours, letter combinations, and symbols, the key for which appears at the bottom of the map as well as in the report itself. In studying the map, it must be kept in mind that the scale of the map prohibits the presentation of sufficient detail to show variations of very small acreages (i.e. less than twenty-five acres). However, the map and report when properly used can furnish information of valuable assistance in estimating the productivity of the soil even in rather limited areas.

THE REPORT—The report is divided into several sections as listed in the table of contents. Several tables of statistics in the text and, in the appendix, a table of physical and chemical analyses of samples of surface soils are presented to support statements made in the text of the report.

HOW SOILS ARE CLASSIFIED

The development of a soil from unweathered broken rock is an intriguing story. Under the influence of the vegetation, climate, and drainage acting on the raw soil material, called parent material, different soil layers develop over a period of time. Accordingly in a vertical cut through the soil, two or more layers or horizons may be observed above the grey parent material. The different soil horizons from the surface down to the parent material make up the soil profile.

Entire Soil Profile is Important

The entire soil profile must be considered in estimating the productivity of a given soil. Two soils, for instance, may have similar surface layers but one may have a compact subsoil that restricts water movement and root penetration while the other may have an open porous subsoil that permits rapid water movement and easy root penetration.

In classifying soils, therefore, the entire soil profile is considered. In Stormont County, twenty-six different soils have been recognized and delineated on the map. These soils differ from one another in one or more of the following features of the soil profile: number, colour, thickness, structure, and chemical composition of the different horizons.

[1] Head, Department of Soils, Ontario Agricultural College, formerly Senior Pedologist, Experimental Farms Service.

Soils of Brown Forest Great Soil Group exhibit shallow profiles and a brownish colour in the subsoil.

In any given area of Stormont County, there are two major groups of soil profiles-the well drained and imperfectly drained group, and the poorly drained group. The same general kind of profile occurs in all poorly drained areas in the County because the restricted drainage has had a dominating influence over differences in parent material. In the well drained and imperfectly drained locations, however, the general appearance of the profiles differs greatly from place to place. Indeed, the best drained soils are the keys to the understanding of any given association of soils.

Well drained Soil Profiles

Differences among well drained soils can be observed in different parts of the County. Because the climatic conditions and vegetation do not vary significantly within the County, the observable differences in the well drained profiles can

usually be related to the parent materials, especially to the lime content. In Stormont County, there are three great groups of well drained profiles, namely Brown Forest, Grey-Brown Podzolic, and Podzol.

The differences among the three groups of profiles may be explained on the basis of age of the soil and the progressive loss of lime from the soil materials. Figure 2 shows the probable relationship between the three Great Soil Groups and indicates (1) the course of soil profile development as lime is lost in time, or (2) the differences in profiles resulting from different original lime contents of the parent materials.

The following is a description of a soil profile that represents the Brown Forest Great Soil Group in Stormont County*.

A_0 — ¼-0 inches of matted leaf litter.

A_1 — 0-5 inches of very dark grey loam; friable consistency; medium crumb structure; few stones; medium

* For chemical analyses of a Brown Forest soil profile see Appendix Table 2.

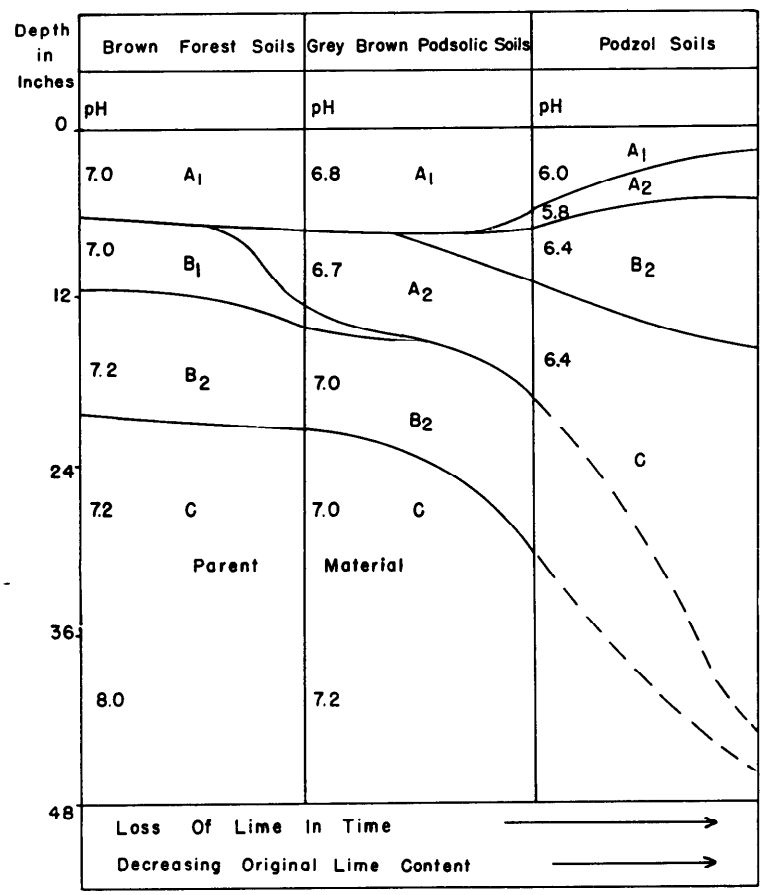


FIG. 2—Relationships between the well drained great soil groups in Stormont County.

to high in organic matter; free carbonates may be present; pH—7.0.

B_1 — 5-10 inches of grey-brown loam; friable consistency; fine nuciform structure; few stones, free carbonates; pH—7.0.

B_2 — 10-18 inches of very dark grey-brown loam; friable consistency; medium nuciform structure; stones and boulders; free carbonates; pH—7.2.

C_1 — 18-23 inches of grey-brown loam; friable consistency; very weak fine nuciform structure; stony; calcareous; pH—7.6.

C_2 — Grey or grey-brown loamy calcareous till; stony; somewhat compacted; pH—8.0.

On a well drained site, where lime has been partially lost from the soil material (or where the material had only a medium lime content originally), the kind of profile that commonly occurs belongs to the Grey-Brown Podzolic Great Soil Group. The Kars gravelly sandy loam as described below is a good example of such a soil:

A_0 — ½-0 inches of leaf litter.

A_1 — 0-4 inches of dark grey-brown sandy loam; very fine crumb to single grained structure; few stones; pH—6.8.

A_2 — 4-12 inches of yellow-brown sandy loam; single grained structure; few stones; pH—6.7.

B — 12-20 inches of dark brown loam or sandy loam; small nuciform structure; few stones; pH—7.0.

C — Rough unsorted gravel and sand; low in carbonates; stony; some boulders; pH-7.0.

In well drained positions on materials that were originally low in lime or are so open in texture that leaching has rapidly removed the lime, a profile representative of the Podzol Great Soil Group has developed. The following is a description of a profile showing the characteristics of the Podzol group in Stormont County:

A_0 — 1-0 inch of litter of twigs and needles.

A_2 — 0-2 inches of grey sand; extremely friable consistency; single grain structure; pH—5.8.

B_2 — 2-15 inches of dark brown sand; friable consistency; single grain to very fine nuciform structure; pH—6.4.

C_1 — 15-22 inches of brownish yellow sand; friable consistency; single grain structure; pH—6.4.

C_2 — Grey sand and gravel; non-calcareous; pH—6.6.

Poorly drained Soil Profiles

For each well drained profile there is a drainage association of three profiles representing three drainage conditions which are usually related to topography. The two best drained members are named in terms of one of the profiles described above. The poorly drained member, however, has a completely different set of horizons and is called a "glei soil".

Commonly, the restricted drainage has far outweighed all other factors of soil development so that the same general kind of profile occurs in the poorly drained locations throughout the County. The poorly drained profiles of Stormont County are classified in the Dark Grey Gleisolic Great Soil Group. A description of a Dark Grey Gleisolic soil profile found in the County is presented below:

A_0—½-0 inches of matted leaf litter.

A_1—0-6 inches of very dark brown clay; friable consistency; crumb structure; high in organic matter which is well incorporated with the mineral fraction; no free carbonates; pH—6.8.

G_1—6-10 inches of grey clay; mottled with rusty brown; plastic consistency ; massive structure ; pH—7.0.

G_2—l0-30 inches of mottled rusty brown and grey clay; extremely plastic ; massive or very coarse blocky

Note profile characteristics of a Dark Grey Gleisolic Soil–Surface soil is dark grey colour; subsoil a drab grey with reddish brown mottling.

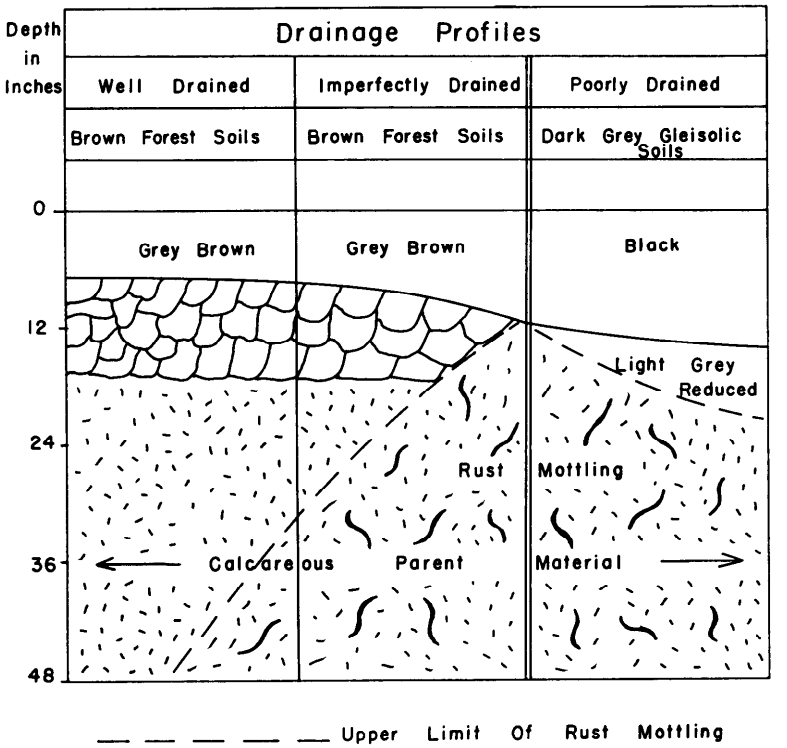


FIG. 3—Relationships among the soil profiles of a Catena.

structure; no free carbonates; pH—7.2.

C — Grey clay; massive; plastic; pH—7.2.

The mottling that is evident in the "G" (glei) horizon is indicative of a fluctuating water table and the consequent alternate oxidation and reduction of the iron.

The differences in soils that are due to differences in drainage are usually observable within field or farm boundaries. Figure 3 shows the drainage associates of the Brown Forest soils and represents the kinds of profiles commonly found in sequence down a slope. Because of the fact that well drained, imperfectly drained, and poorly drained soils occur in close geographical association, it is convenient to use the term "catena" to designate two or more soil series developed on similar parent material but differing in drainage.

Soil Type and Soil Series

The principal unit of soil mapping is the soil type. The soil type consists of a group of soils with profiles having similar genetic horizons, developed from similar parent material.

In using the map, it is important to keep in mind that a given soil type may include a limited range in properties. The boundaries between soil types vary in sharpness. Between two soil types in the field there is a zone that includes some of the features of each type. Also within a given type, there are often discrete areas of other types too small to be shown on the soil map.

Soil types do not occur at random, nor is their nature a matter of chance. The factors that have determined soil type differences in Stormont County are discussed in Part II. If one knows the conditions under which a given soil type has developed, he will be able to obtain from the soil map a picture not only of the present character of the soil but also of the slope of the area where it occurs, the native vegetation, drainage, and other factors that have affected its formation.

Two or more soil types developed on similar parent material, under similar drainage conditions, but differing in texture of the surface horizon are grouped together as a Soil Series.

In certain instances, soil of a certain type or series may possess certain features that limit its agricultural value; hence phases of a soil type or soil series are mapped. For example, a physical characteristic such as stoniness or topography may drastically change the agricultural value of a soil without altering the profile characteristics sufficiently to place it in another soil type; hence phases of soil types have been mapped to delineate areas that have special problems for agricultural use.

SALIENT FEATURES OF CLIMATE AND SOILS THAT AFFECT LAND USE IN STORMONT COUNTY

A soil survey provides the only sound basis for any programme for improved land use and soil conservation. It is only with a clear broad understanding of a problem that any progress can be made toward its solution. All of the important factors of climate and soil are discussed later in the report. A brief resumé of these factors in relation to crop production is presented here as an introduction to the soils of Stormont County.

Parent Materials

The effect of parent material on the type of soil developed is discussed in Part II. Parent material is a fixed factor which the farmer cannot alter. Hence it is an important factor in determining the agricultural value of a land area.

TABLE 1

ACREAGES AND SALIENT CHARACTERISTICS OF THE SOIL PARENT MATERIALS

Parent Material	Acreage	% Total Acreage	Salient Characteristics of Soil
Glacial till	114,900	45.0	Medium fertility; tendency to be stony; some erosion susceptibility.
Glacio-fluvial material	19,100	7.4	Coarse texture; medium to low fertility; stony; subject to erosion.
Outwash material	37,400	14.2	Coarse texture; low to medium fertility.
Lacustrine material	37,200	14.1	Medium to fine texture; inadequate drainage; stonefree.
Organic	35,100	13.3	Deep organic surface; poor drainage.
Alluvial	15,700	6.0	Flood land along stream courses of variable texture and fertility.

The economy of production depends on the extent to which the farmer can adapt his cropping practices to the natural capabilities of his soil. Fortunately a large portion of Stormont County is till material that develops a good soil for

SOIL PROBLEM AREAS

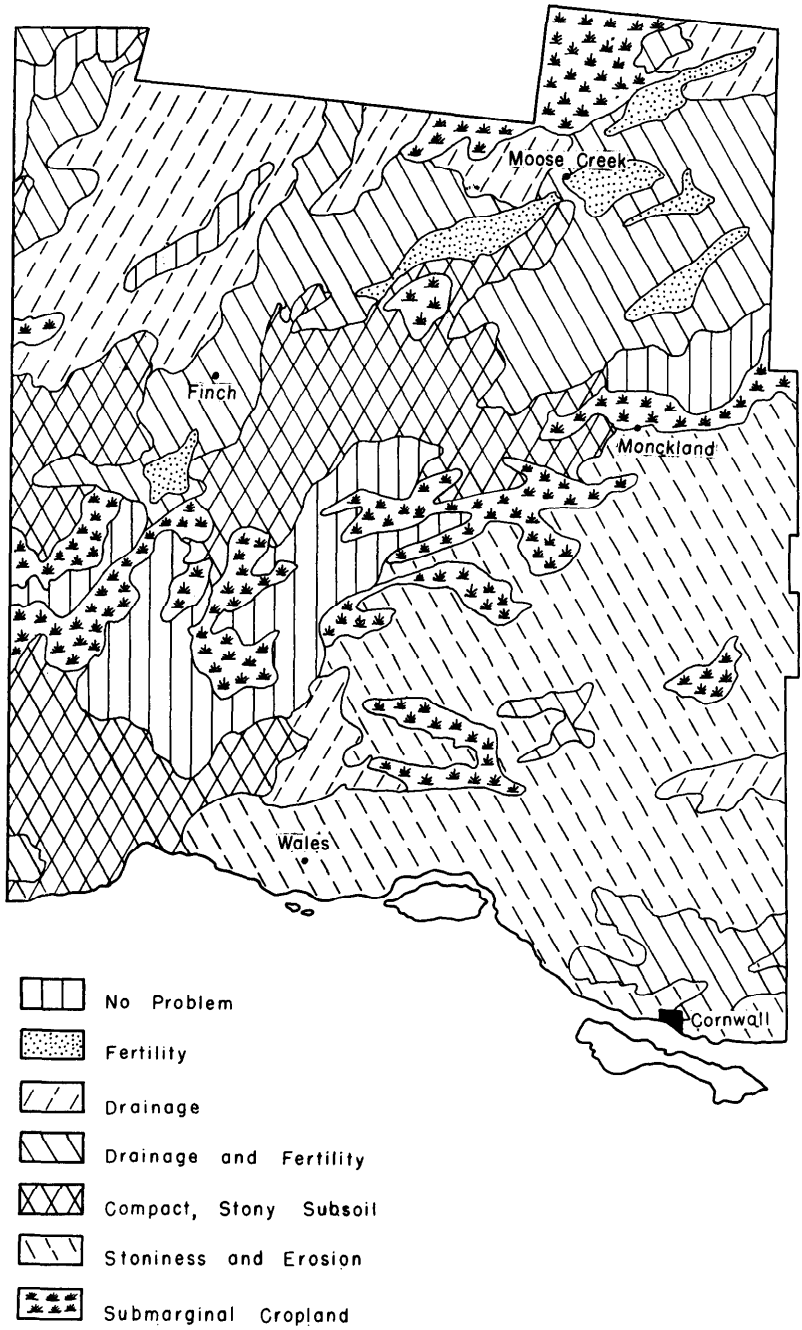


FIG. 4—Soil problem areas in Stormont County.

general farming which stresses dairying for replenishment of organic matter. This also creates a need for pasture which controls erosion on the slopes.

Texture

There is a wide variation in texture of the surface soils of the County. For the purpose of this discussion the soils may be grouped into three groups as in Table 2.

TABLE 2

APPROXIMATE PERCENTAGES OF COARSE, MEDIUM AND FINE TEXTURED SOILS IN STORMONT COUNTY

Texture	% Total Area
Coarse	21.4
Medium	33.8
Fine	24.9

Soils of coarse texture usually contain fewer plant nutrients originally and they are less capable of holding nutrients than the fine textured soils. The open structure of the sandy soils promotes relatively rapid destruction of organic matter which must be constantly renewed.

The medium and fine textured soils have a relatively high fertility level but the latter tend to be inadequately drained.

Climate

The climate of Stormont County is suitable for general farm crops. The temperature is usually too low in the winter months for the survival of winter wheat. However, the temperature and the amount and distribution of rainfall are usually adequate for the economical production of many common crops.

The three factors mentioned above cannot be altered by the farmer to suit his crop needs. However, there are several factors concerning the soil which can be altered; these, as described in following paragraphs, require special attention in order to make the best possible use of the land.

Land Use Problems in Stormont County

No one knows the peculiarities of a particular parcel of land better than the man who is concerned with making a living from it. The knowledge of soil management, in many instances, has been built up through generations by the system of trial and error. Soil scientists are now seeking to learn which management practices are good and why new ones should be adopted in some instances. This section is concerned with the mutable factors of the soil with no regard for factors foreign to the soil such as disease, economics, and weather.

Drainage—This is a factor in soil productivity that is of great importance in Stormont County. Approximately 40% of the soils in the area have a drainage problem to some degree. One half of this area, however, consists of very poorly drained soils which are costly to reclaim for general farming. The remainder consists of fine textured lacustrine materials of high fertility. The natural drainage varies from fair to poor. Because of the comparatively impervious subsoil, the internal movement of water is slow even on those areas with a low water table. More open ditches should be installed and existing ones should be kept clean. Increased use of tile drainage should prove economical. The growth of deep rooted crops will improve those soils where inadequate drainage is a result of an impervious

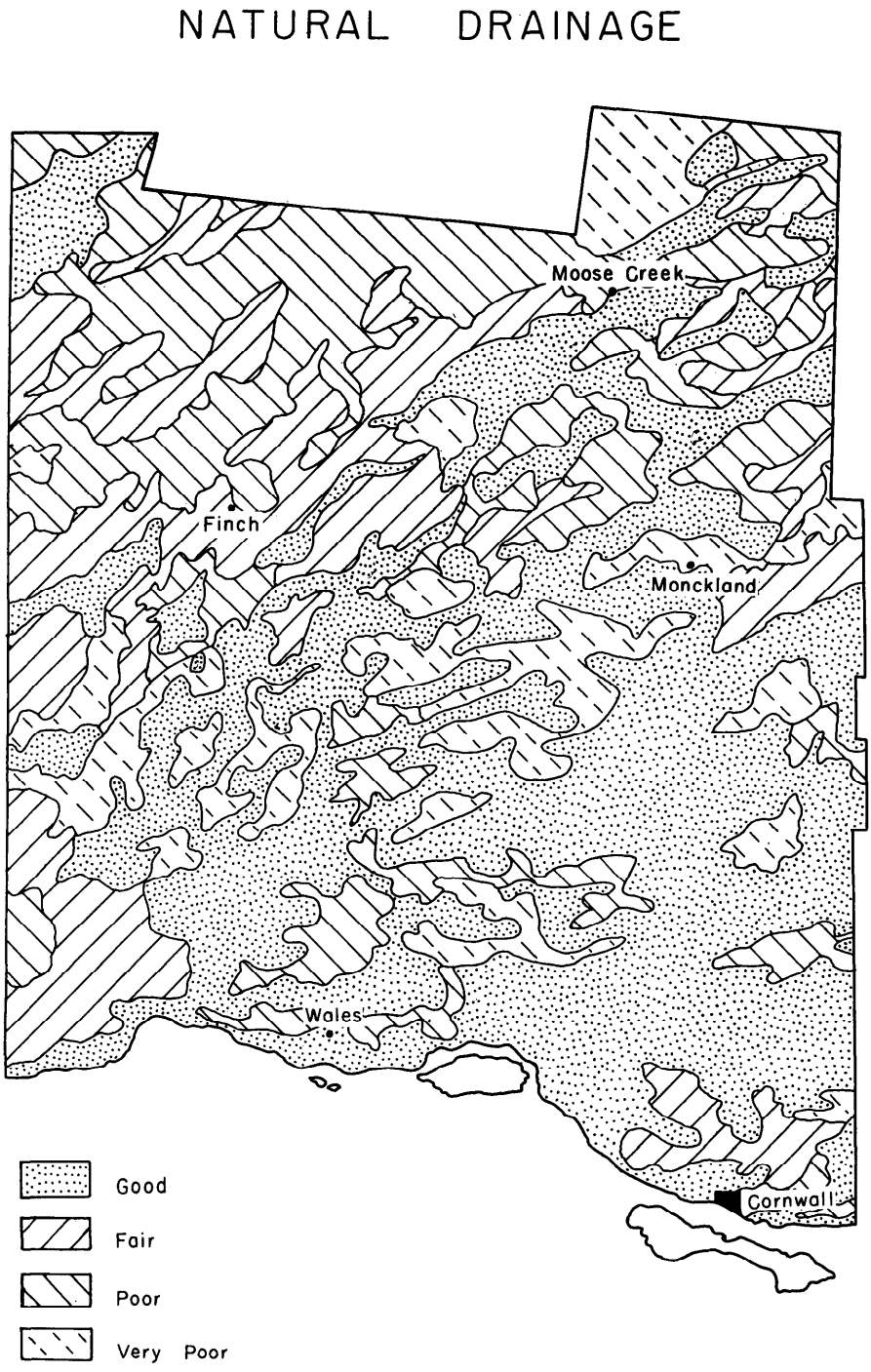


FIG. 5—Natural drainage of soils in Stormont County.

subsoil. There is a need for investigational work to determine the most effective means of overcoming the drainage problem in Stormont County to improve the reliability and versatility of the soils.

TABLE 3

CLASSIFICATION OF STORMONT COUNTY SOILS ACCORDING TO NATURAL DRAINAGE

Drainage Class	Soil Series	Acreage	% of Total
Well drained	Wolford Eamer Grenville Manotick Uplands Kars	112,200	42.8
Imperfectly drained	Morrisburg Matilda Rubicon Mountain Carp	43,900	16.7
Poorly drained	Lyons Osnabruck Granby Allendale North Gower Marionville Osgoode	53,800	20.5
Very poorly drained	Belmeade Muck Bottom Land	52,300	20.0

Table 3 indicates that more than forty per cent of Stormont County is well drained. When these soils are interspersed with the inadequately drained soils, the latter become of greater value in producing pasture while the former soils produce the cereal grains. As a number of farms, however, have no well drained soils, drainage is an important problem.

Fertility—The natural fertility of the soils of Stormont County is medium. The fine textured soils are relatively higher in plant nutrients than the coarse textured soils. The fact that the coarse textured soils tend to be better drained and hence more highly cultivated has intensified their lack of fertility. Because organic matter oxidation and removal is rapid, constant addition of commercial fertilizers and barnyard manure is necessary for continued crop production.

The till soils which have a high lime content usually respond to phosphatic fertilizers. For certain crops, commercial nitrogen and potash may be beneficial.

The fine textured soils are usually well supplied with plant nutrients, phosphorus being particularly high when compared to similar soils in Western Ontario.

The most satisfactory beginning for any fertilizer programme is to obtain soil tests of individual fields as a basis for fertilizer recommendations. Facilities for such tests are provided at the Kemptville Agricultural School.

Drainage and Fertility—Some soils present a combination of drainage and fertility deficiencies. Coarse textured soils on level to depressional topography present a grave problem in land use. Usually the organic matter content is adequate in the natural state, but when drainage is improved and cultivation is begun the organic matter is lost rapidly. Hence, the fertility is depleted after a few years. Extreme care must be exercised in the utilization of such soils and even under the

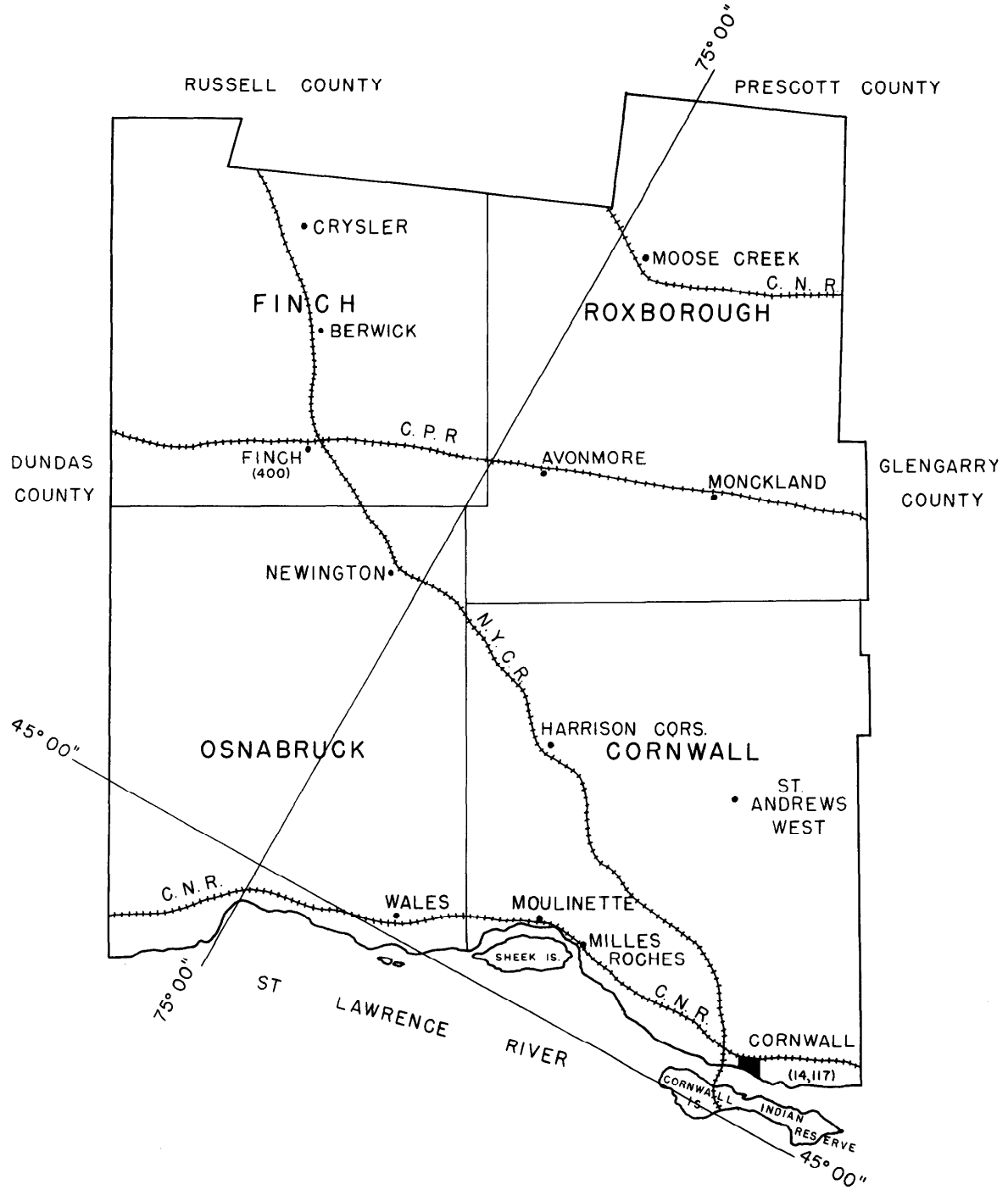


FIG. 6—Townships, Principal centres and Railways in Stormont County.

best known soil management practices they never become better than mediocre agricultural soils.

Stoniness and Erosion

The problem of stoniness is a physical one which is especially important in the south eastern part of the County. In many instances, the stones occur on soil types that otherwise would be good agricultural land. It is difficult to make a general statement as to the advisability of stone removal. The cost of removing the stones must be charged against the resulting increase in returns. Parts of the area have been cleared of stones and are producing good crops. Even if the stones are not removed, the land can usually be used for permanent pasture production.

The topography of Cornwall Township is rolling and as a result there are several slopes where erosion is a hazard. Care must be exercised in farming these soils. Contour cultivation and strip cropping may be advisable on some farms.

Submarginal Cropland

Approximately 20 per cent of the land area of Stormont County consists of submarginal cropland. The bottom land along stream courses is generally devoted to permanent pasture and is especially valuable for this purpose during dry summer months. The major part of the submarginal land is muck. Muck soils are not developed agriculturally in the County. The distance to larger centres of population minimizes the value of the muck land for the production of truck crops.

Only a very small part of the County has no serious land use problem. Even in these areas, however, the farmer must exercise good management practices to protect his soil. Whenever man upsets the balance of nature by growing cultivated crops, he must proceed with caution.

PART I

GENERAL DESCRIPTION OF STORMONT COUNTY

Location, Area, Farms

The St. Lawrence River flows along the southern boundary of Stormont County; Dundas and Glengarry Counties border the west and east sides respectively; and adjoining to the north are Russell and Prescott Counties. From the city of Ottawa the nearest part of Stormont County is approximately 40 miles, while Montreal lies about 75 miles away from the southeast corner of the County.

The area of this Eastern Ontario County is approximately 263,680 acres (1941 Census) of which 238,208 acres are listed as occupied land. The remainder of the total area is taken up by roads, railways, and rivers. According to the 1941 Census of the Dominion of Canada, there are 2,215 farms in the County with an average area of 100 acres per farm. About 8% of the area of Stormont County still retains its native forest vegetation.

County Seat and Principal Towns

Cornwall, located on the banks of the St. Lawrence River, is the County seat and is the largest centre in the area, having a population of approximately 14,100. This bustling city has at least two important industries and is a well known port for the ships that ply the Great Lakes System. The Roosevelt International Bridge joins Cornwall and the surrounding area to New York State immediately across the river.

There are a few villages scattered throughout the County. Finch with a population of about 400 is the largest of these; Avonmore, Moose Creek, Newington, Monckland, Aultsville, Wales, and others are of lesser size.

Transportation and Markets

Stormont County is well supplied with transportation facilities. The main line of the Canadian National Railway traverses the southern part of the County closely paralleling the St. Lawrence River. The Canadian Pacific Railway from Toronto to Montreal runs across the central part of the County while the New York Central Railway from Ottawa to New York traverses the area from north to south to cross the St. Lawrence River via the international bridge. In addition to the railroads, there is a good network of roads throughout the County. No. 2 Highway traverses the County along the banks of the St. Lawrence River and three well kept County roads run northward from the highway. The Township roads are kept in a reasonably good state of repair.

The main markets for the agricultural products of Stormont County are at Montreal and Ottawa. In recent years, there has been considerable movement of dairy cattle to the United States as well. Transportation facilities are adequate for the rapid and efficient movement of goods to market.

Population and Racial Origin

According to the 1941 Census the total population of Stormont County is 40,905 or 1.1% of the total population of Ontario. Classed as rural dwellers are 26,391 persons or 64.5% of the population while there are 14,514 urban dwellers, 14,117 of whom live in the city of Cornwall.

There are about equal numbers of people of British and French origins in the

County along with a small number of people of other origins and a few Indians on the Indian Reserve.

Total Population	40,905
Canadians of British Origin	17,762
English	5,422
Irish	5,270
Scotch	6,969
Others	101
Canadians of French Origin	18,567
Canadians of Netherlands Origin	2,881
Canadians of Indian Origin	466
Canadians of Other Origins	1,229

PART II

FACTORS AFFECTING THE FORMATION AND DEVELOPMENT OF STORMONT COUNTY SOILS

A knowledge of the soils of any area requires a knowledge of the factors that cause soil differences and that are responsible for the various soil conditions. The more important of these factors are: (1) soil parent material, which determines the kind of material from which the soil has developed; (2) relief, which includes the surface features of the land, the drainage conditions, etc; (3) climate, which influences the kind and intensity of weathering and leaching of the soil material; (4) vegetation which affects the content of organic matter in the soil; (5) soil age or length of time weathering forces have acted. In any given location, all the factors are operative but usually one factor is dominant over the others. Thus it is that the character of some soils is mainly determined by the character of the material from which they are derived, while at other places parent material is of minor influence and the properties of the soils are to a large extent governed by conditions of relief.

A knowledge of the factors affecting soil formation will add greatly to our understanding of the soils in Stormont County.

Geology of the Soil Materials

This part of North America was subject to at least three glaciations. However, only the surface deposits or those of the last (Wisconsin) glaciation influence the soils of Stormont County.

The movement of the ice was generally in a north-south direction although in the southern part of the County the drumlins (elongated rounded ridges) roughly parallel the St. Lawrence River valley, indicating that the ice advanced locally from the northeasterly direction. Following the recession of the ice, an arm of the sea, named Gilbert Gulf, entered this area. During this period many of the fine particles were washed from the ridges leaving the boulders. As the ice retreated farther the land commenced to rise and eventually came above sea-level.

Most of Stormont County is underlain by Trenton limestone with some Black River and Chazy limestone in the southern part. The Trenton limestone is readily broken up and, therefore, is generally covered with a good depth of till. There is very little rock outcrop in the County.

A more complete report on the physiography of the area has been written by Chapman and Putnam*.

Although the soil materials have been transported, they do bear some relation to the surface rock formation. The Trenton limestone is dominantly calcium carbonate but has a rather high percentage of insoluble matter as shown in table 4.

The dominant chemical characteristics of the underlying bedrock is reflected in the soils which have a high content of calcium carbonate.

Another factor that affects the soil parent materials is the mode of deposition Materials of two general groups occur in Stormont County: (1) unsorted tills laid down by ice, (2) sorted clays, silts, sands and gravels deposited by water. The tills are further differentiated on the basis of size and kind of stones and the kind of fine material between them. The water-laid materials are grouped according to the size of the particles.

*Chapman, L. J. & Putnam, D. F., The Physiography of Eastern Ontario, Sci. Agr. 20:7, 1940.

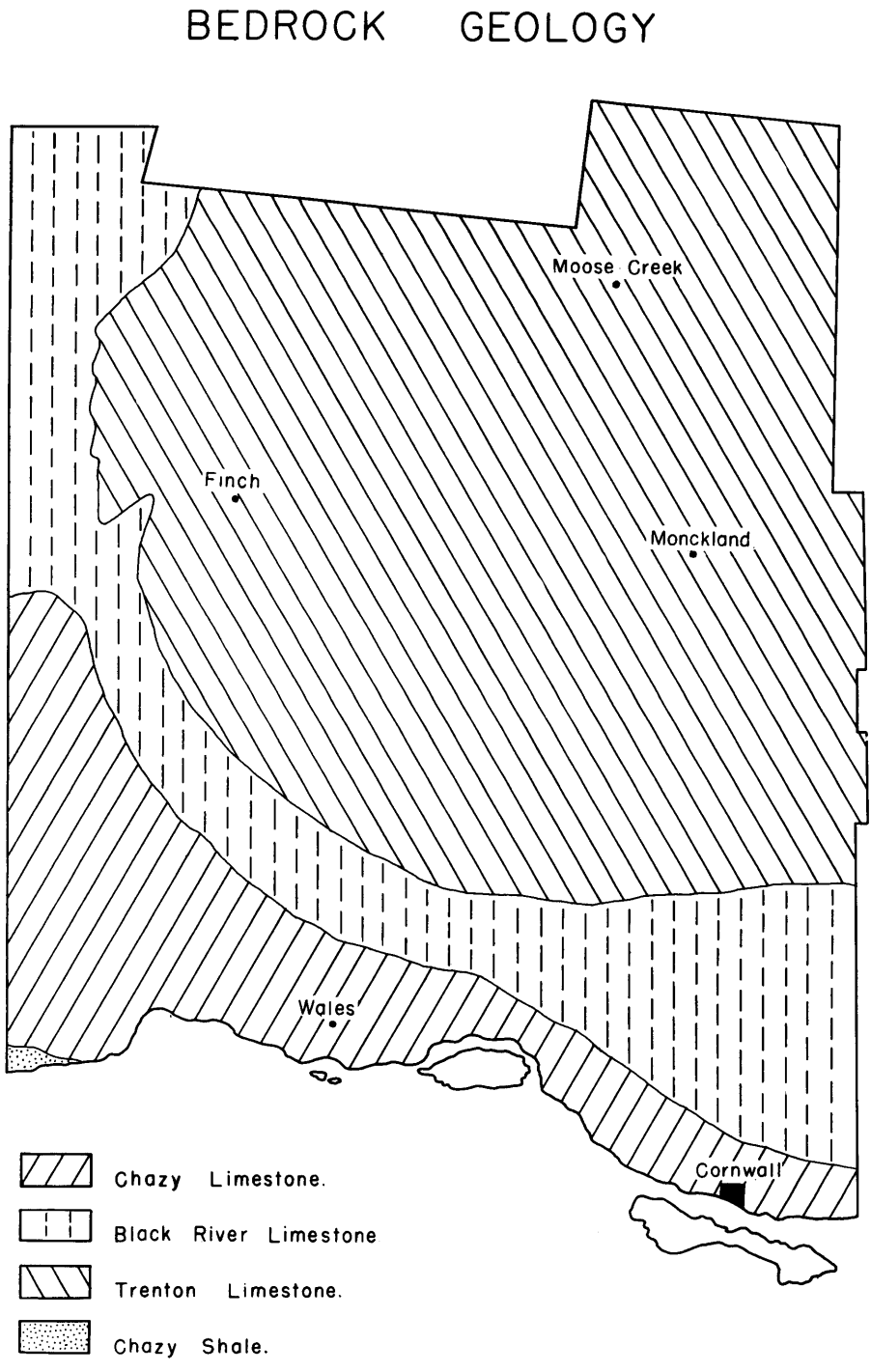


FIG. 7—Bedrock Geology of Stormont County.

After the ice sheet disappeared from the area a deposit of till of varying depth remained over the Trenton limestone bedrock. Much of the till was left arranged in the form of long oval shaped hills (drumlins) whose long axis is roughly parallel to the direction of movement of the glacier. Soils developed on till are generally good agricultural soils characterized by rolling topography, with some stones throughout the profile.

TABLE 4

ANALYSIS OF TRENTON LIMESTONE**

Insoluble mineral matter	6.41%
Ferric oxide	0.56%
Alumina	0.24%
Calcium carbonate	89.59%
Magnesium carbonate	3.80%
TOTAL	100.60%

(Sample taken from old quarry 2 miles south of Apple Hill, Glengarry County.)

A large portion of the area consists of water-laid material, an indirect result of glaciation. During the recession of the ice, meltwaters rushed in streams through crevasses in the ice and deposited coarse gravel and sand that remain today as long narrow ridges called "eskers". These ridges provide a good source of road gravel.

Extensive areas of medium sand materials also occur. Such material was deposited by moving water as it slowed down and flowed out over the area in front of the glacier. The topography is usually level to slightly undulating. As the ice receded and the waters of Gilbert Gulf and Champlain Sea covered the area much sediment was formed in the depths of these post-glacial waters. The sediment is fine textured, stonefree, and calcareous. It is less alkaline than the till and generally is inadequately drained, partly because of its level topography.

I. Till Deposits

The till deposits are made up of stones, dominantly limestone with some sandstone and Precambrain rocks, ranging in size from very fine grit to large boulders scattered throughout a matrix of sand, silt, and clay in varying proportions. The till area is characterized by drumlins particularly in the southeastern portion of the County where the topography is strongly undulating to rolling. The southern part of Stormont County lies in a lowland that was submerged by the glacial Champlain Sea. The stony crests of the drumlins and ridges are a result of the removal of fine materials from the crests to the valleys during the submergence. The water-laid materials among the till deposits range in texture from clay to very fine sand with a few deposits of gravel in close association with the till areas.

II. Gravelly Deposits

The gravelly ridges are located for the most part on the height of land that separates the South Nation River watershed from that of the Raisin River. The ridges consist of rough sorted gravel and coarse sand dominated by limestone fragments with some rocks of Precambrian origin.

III. Deposits of Water-laid Sediments

Water-laid sediments range in texture from sand to clay and are typically stonefree.

**Preliminary Report on the Limestones of Quebec and Ontario, Goudge, M. F. Canada, Department of Mines and Resources.

PHYSIOGRAPHIC DIVISIONS

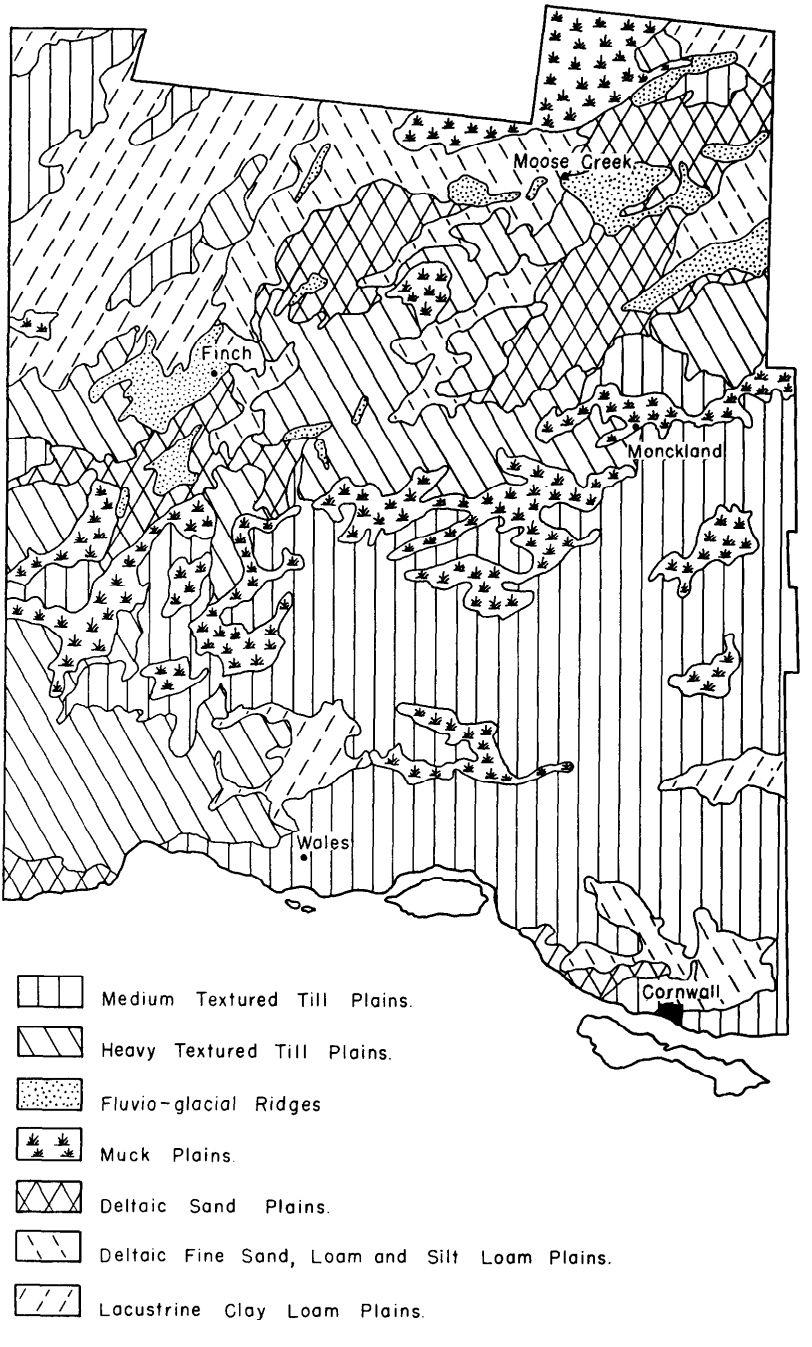


FIG. 8—Physiographic Divisions of Stormont County.

(a) Coarse textured material

There is only a limited area of sand plains in Stormont County and they are associated with the gravelly ridges. The topography is level to strongly undulating. Stones are found occasionally on the surface but do not occur within the profile. The parent material is coarse sand that is often water-logged because of a compacted subsoil or underlying heavy textured materials. The lime content and general fertility of the sand plains are low.

(b) Medium textured materials

Plains of medium textured materials occur in close association with the till plains. These water-laid materials apparently have been washed down from the till areas and have a variable composition indicating that they have been derived from several different kinds of rocks.

The topography of these plains is level but is broken by the till deposits that give an undulating effect to the general relief.

(c) Fine textured materials

The largest area of clay materials is situated along the South Nation River in the northwest portion of the County. It represents an extension of the much larger clay plain in Dundas County. The subsoil is a grey and rusty mottled clay or silty clay that requires artificial drainage for maximum crop production. There are local areas in the clay plain west of Moose Creek in which the parent materials are banded pink and grey clay similar to the Bearbrook series mapped in Russell County.

IV. Muck Deposits

The surface layer of the muck deposits is largely of organic origin, the material being in various stages of decomposition. In most instances, the muck is supporting a scrub willow vegetation. The material underlying the muck deposits is commonly clay although grey sand or loamy till may be found in some areas.

Relief

The relief of Stormont County is variable. The southeastern part is strongly undulating to rolling. The western portion is undulating to level while the north-eastern sandy areas are moderately undulating.

There is a height of land running in a northeasterly direction through the central part of the County. Land to the north of this divide is drained by the South Nation River and its tributaries. Immediately south of the divide, the Raisin River has its source near Newington in Osnabruck Township. This river flows in an easterly direction approximately parallel to the St. Lawrence River. The extreme southern portion of the County is drained into the St. Lawrence River by small creeks that have their source within five miles of the river.

The elevation is seldom higher than 325 feet above sea-level and the average is about 225 feet. The channel of the South Nation River is shallow and, hence, there is some danger of spring flooding. The Raisin River on the other hand has a relatively deep channel and floods only a limited area of lowland during periods of high rainfall.

There are numerous depressional areas in which muck has accumulated, and, indeed, is still accumulating.

The surface drainage is facilitated by the large number of streams and creeks throughout the area. The internal drainage is influenced by relief and also texture and structure. Hence movement of water within the heavy soils is usually slow.

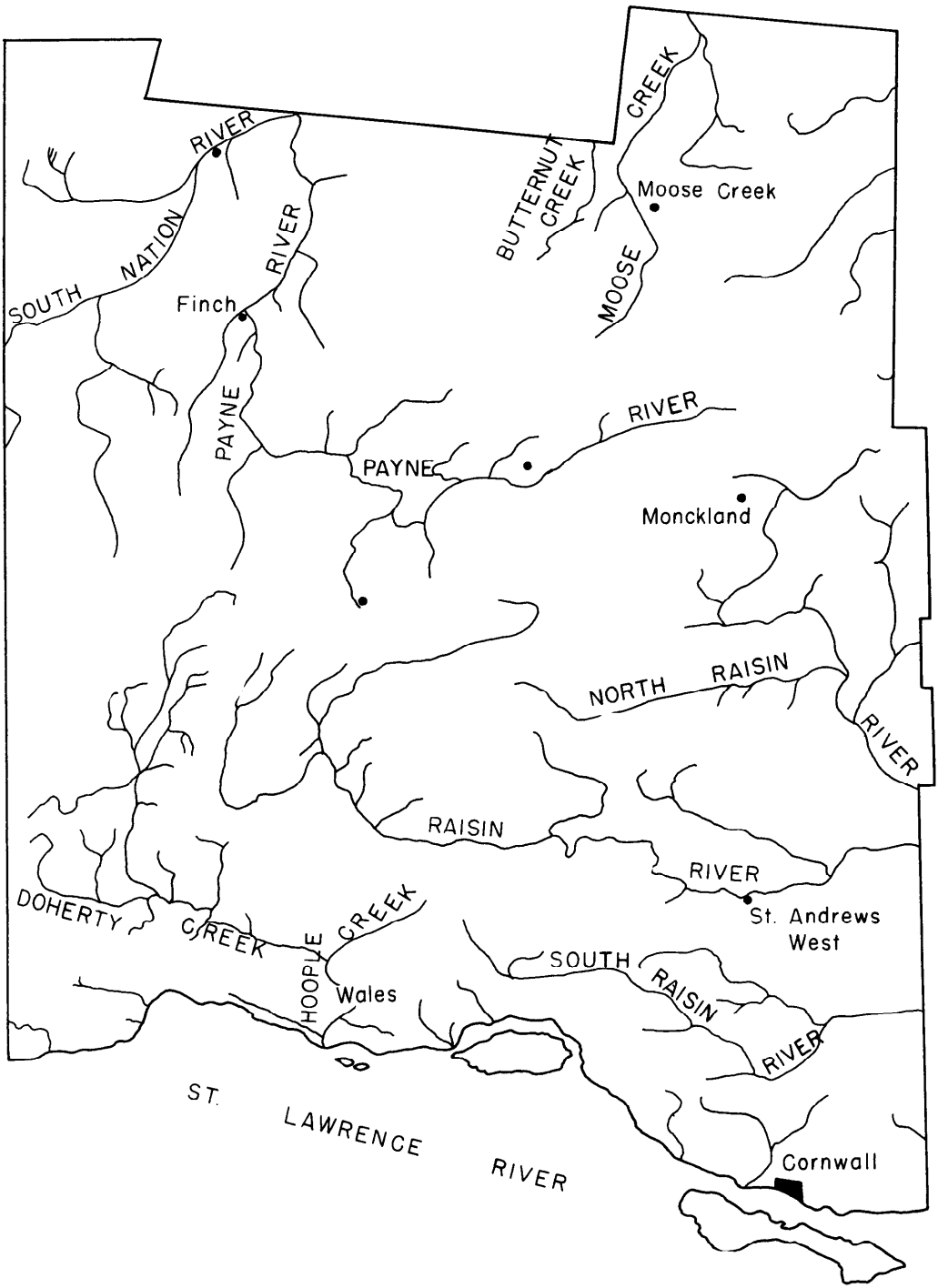


FIG. 9—Natural drainage courses in Stormont County.

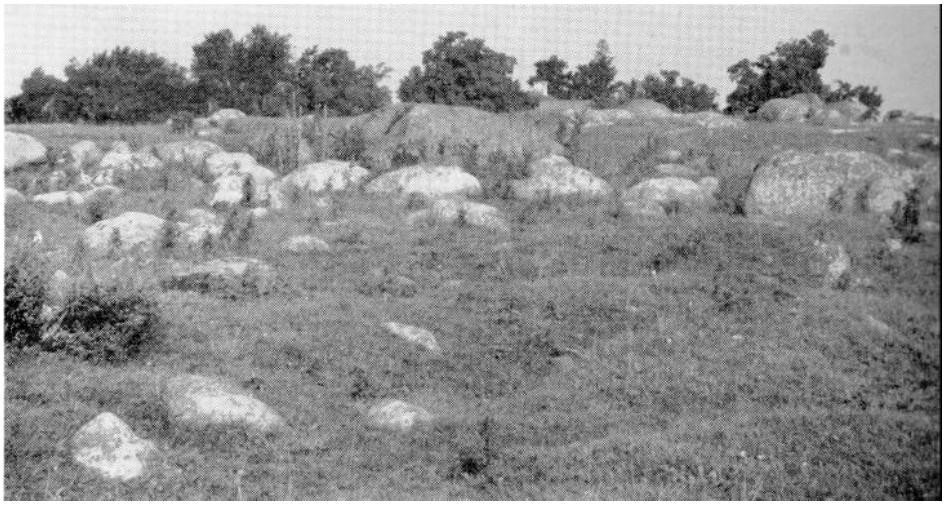
The medium textured soils that are strongly undulating to rolling have good internal and external drainage.

Climate

Stormont County is in the Eastern Ontario climatic region of Southern Ontario as classified by Putnam and Chapman.* The mean annual temperature is 42° as compared with 44º at Guelph, 45.3° at Rrantford and 32º at Kapuskasing. The extreme low temperature recorded for the area is -44° while the extreme high is 104° giving a range of 144°. The average date of the last frost in the spring is May 11-24 with 130 to 140 days in the frost-free period. The average length of the growing season is 191 to 197 days.

The precipitation varies from 34-40 inches annually. About 17-18 inches of rain fall during June, July and August, an amount, which is usually adequate fol most, farm crops. Drought frequency is low.

*Putnam, D.F. and Chapman, L.J., The Climate of Southern Ontario, Sci. ,Agr. 18:8, April 1938.



Post-glacial lake waters have removed the finer particles from the tops of some ridges leaving a large number of boulders on the surface.

TABLE 5

MEAN MONTHLY TEMPERATURE FOR SELECTED POINTS
(Temperature in degrees Fahrenheit)

	Period of Record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Ottawa	52	11.8	12.7	24.7	41.4	54.9	64.6	68.9	66.3	58.5	46.2	32.4	17.3	41.6
Brockville	22	18	18	30	43	56	65	70	68	60	49	36	22	45
Morrisburg	24	15.6	15.2	26.8	40.0	52.8	62.4	67.2	64.9	62.7	46.6	34.3	19.9	42.4
Pembroke	44	12	14	26	41	54	64	69	66	57	46	33	17	42
Guelph	55	20	19	28	42	53	63	68	66	59	47	36	24	44

TABLE 6

MEAN MONTHLY RAINFALL IN INCHES FOR SELECTED POINTS

	Period of Record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Ottawa	52	2.98	2.40	2.65	2.32	2.74	3.39	3.67	3.00	2.94	2.68	2.63	2.84	34.24
Morrisburg	24	3.69	2.97	3.09	3.28	3.22	3.20	3.12	3.34	2.85	3.42	3.35	3.09	38.60
Pembroke	44	2.31	1.96	2.25	2.19	2.92	3.26	3.50	2.86	3.52	2.96	3.15	2.53	33.41
Guelph	55	2.35	1.79	1.88	2.30	2.80	2.89	3.24	2.87	2.67	2.39	2.48	1.99	29.65

Natural Vegetation

During the time that it is becoming established, vegetation is dependent on climate and soil conditions. However, when it is established, vegetation exerts a strong influence on the type of soil developed. The types of litter found under coniferous and deciduous forests are quite different in chemical composition, consistency, and ease of decomposition.

It is impossible to determine which features of the soils of Stormont County have been influenced by vegetation only, because all the other soil forming factors have been operating simultaneously. Indeed, it is difficult to determine the native vegetation on certain soil types because only about eight per cent of the area is wooded under present land use. Certain associations of trees, however, have been observed to occur on certain soil areas more often than others.

The Upper St. Lawrence Section of the Great Lakes-St. Lawrence Forest Region as described by Halliday* includes the County of Stormont.

The general character of the tree cover is broad leaved but there is a fair representation of coniferous growth. The dominant association on well drained sites is sugar maple and beech with small numbers of birch, ash, and elm. Hemlock, white spruce and pine occur on the light soils. In poorly drained areas elm dominates along with tamarack, white cedar and black ash. Clumps of cedar are characteristic of stony sites.

Age

The number of features that are developed in a soil and their intensity depend to some extent on the length of time that the soil forming factors have been active. Hence, time itself becomes a soil forming factor.

Stormont County is in the area that was covered by ice during the glacial period. When the ice retreated the Champlain Sea submerged the area with marine waters. According to Antevs* the Champlain Sea receded about 6-10,000 years ago. Since that time, the soils of today have been developed.

*Halliday, W. E. D., A Forest Classification of Canada, Forest Service Bulletin, No. 89.

*Antevs, E. Late Quaternary Upwarpings of Northeastern North America, Jour. of Geol. 47, 1930.

PART III

CLASSIFICATION AND DESCRIPTION OF STORMONT COUNTY SOILS

Although knowledge of the factors that have affected the development of the soils of Stormont County is interesting, it is of little help in planning the efficient use of the soils as they exist to-day. It is the purpose of this part of the report to present a detailed description of each soil type with regard to its profile features as well as to other features of significance to the agricultural use of the soil.

A summary key of soils of Stormont County is presented below along with the map symbol and total acreage of each soil type.

Summary of the Classification of the Soils of Stormont County

	Map Symbol	Acreage	% Total
A. Soils Developed on Till			
1. Soils formed from loamy calcareous till			
(a) Brown Forest Soil Group			
(1) Well drained			
a. Grenville Series			
(i) Grenville loam	Gl	47,700	18.1
(ii) Grenville loam—bouldery phase	Gl-b	1,800	.7
b. Eamer Series			
(i) Eamer loam	El	26,400	10.0
(2) Imperfectly drained			
a. Matilda Series			
(i) Matilda loam	Ml	4,600	1.7
(b) Dark Grey Gleisolic Soil Group			
(1) Poorly drained			
a. Lyons Series			
(i) Lyons loam	Ll	1,300	.5
2. Soils formed from fine textured calcareous till			
(a) Brown Forest Soil Group			
(1) Well drained			
a. Wolford Series			
(i) Wolford clay loam	Wcl	13,000	5.0
(2) Imperfectly drained			
a. Morrisburg Series			
(i) Morrisburg clay loam	Mcl	20,500	7.7
(b) Dark Grey Gleisolic Soil Group			
(1) Poorly drained			
a. Osnabruck Series			
(i) Osnabruck clay loam	Obcl	3,400	1.3
B. Soils Developed on Roughly Stratified Sand and Gravel			
(a) Grey-Brown Podzolic Soil Group			
(1) Well drained			
a. Kars Series			
(i) Kars gravelly sandy loam	Kg	19,100	7.2
C. Soils Developed on Deltaic or Outwash Materials			
1. Soils formed from deltaic sands			
(a) Podzol Soil Group			
(1) Well drained			
a. Uplands Series			
(i) Uplands sand	Us	2,400	.9
(ii) Uplands sandy loam	Usl	1,200	.4
(b) Ground Water Podzol Soil Group			
(1) Imperfectly drained			

a. Rubicon Series			
(i) Rubicon sand	Rs	7,300	2.8
(ii) Rubicon sandy loam	Rsl	4,200	1.6
(c) Dark Grey Gleisolic Soil Group			
(1) Poorly drained			
a. Granby Series			
(i) Granby sand	Gs	4,900	1.9
(ii) Granby sandy loam	Gsl	3,700	1.4
D. Soils Developed on Lacustrine Materials			
1. Soils formed from limey lacustrine loams and silt loams			
(a) Dark Grey Gleisolic Soil Group			
(1) Poorly drained			
a. Osgoode Series			
(i) Osgoode loam	Ol	5,300	2.0
(ii) Osgoode silt loam	Osl	900	.4
2. Soils formed from neutral to slightly alkaline lacustrine clays			
(a) Grey-Brown Podzolic Soil Group			
(1) Imperfectly drained			
a. Carp Series			
(i) Carp clay loam	Ccl	2,400	0.9
(b) Dark Grey Gleisolic Soil Group			
(1) Poorly drained			
a. North Gower Series			
(i) North Gower clay loam	NGcl	26,600	10.0
(c) Half Bog Soil Group			
(1) Very poorly drained			
a. Belmeade Series			
(i) Belmeade muck	Bm	1,500	0.6
E. Soils Developed on Outwash Material Underlain by Lacustrine Material			
1. Soils formed from Sands over Clay low in lime			
(a) Brown Podzolic Soil Group			
(1) Well drained			
a. Manotick Series			
(i) Manotick sandy loam	Masl	600	.2
(2) Imperfectly drained			
a. Mountain Series			
(i) Mountain sandy loam	Msl	4,900	1.9
(b) Dark Grey Gleisolic Soil Group			
(1) Poorly drained			
a. Allendale Series			
(i) Allendale sandy loam	Asl	8,200	3.1
2. Soils formed from fine sands and silts over clay low in lime			
(a) Dark Grey Gleisolic			
(1) Poorly drained			
a. Marionville Series			
(i) Marionville fine sandy loam	Mfsl	500	.2
F. Soils Developed on Shallow Drift over Bedrock			
(a) Brown Forest Soil Group			
(1) Drainage variable			
a. Farmington Series			
(i) Farminton loam	F	500	.2
G. Soils Developed on Flood Lands along Stream Courses			
(a) Azonal Alluvial Soil Group			
(1) Bottom Land	B.L.	15,700	6.0
H. Soils Developed on Organic Materials			
(a) Bog Soil Group			
(1) Well decomposed			
a. Muck	M	35,100	13.3

Those who need to become familiar with all of the soil types in this County will find it helpful to understand the relations between the different soil types. Table 7 will help to make these relations clear. Soil types that appear in the same vertical column and between two horizontal double lines generally present similar problems in land use.

TABLE 7

STORMONT COUNTY SOILS GROUPED ACCORDING TO TEXTURE, PARENT MATERIAL AND DRAINAGE*

Texture of Surface Soil	Parent Material	Drainage		
		Well Drained	Imperfectly	Poorly Drained
Coarse Textured	gravel, medium lime	Kars gravelly sandy loam		
	sand, low lime	Uplands sand Uplands sandy loam	Rubicon sand Rubicon sandy loam	Granby sand Granby sandy loam
	sand over clay at three feet or less	Manotick sandy loam	Mountain sandy loam	Allendale sandy loam
Medium Textured	glacial till, high in lime	Grenville loam Grenville loam-bouldery	Matilda loam	Lyons loam
	shallow over limestone bed-rock	Farmington loam		
	glacial till, very high in lime	Eamer loam		
	stonefree water-laid loams and silts			Osgoode loam Osgoode silt loam
Fine Textured	glacial till, high in lime	Wolford clay loam	Morrisburg clay loam	Osnabruck clay loam
	stonefree water-laid silt and clay		Carp clay loam	North Gower clay loam
	silt over clay at less than 20 inches			Marionville fine sandy loam
Organic Soil	Shallow organic layer over clay			Belmeade
	Deep organic			Muck

*Bottom land soils are not included in the table. Differences among Bottom Land soils are presumably due to differences in parent materials.

DESCRIPTION OF STORMONT COUNTY SOILS

A. SOILS DEVELOPED ON TILL

1. Soils formed from loamy calcareous till

The loam textured till materials found in Stormont County may be divided into two groups on the basis of the carbonate content. The moderately calcareous till is derived from Black River limestone predominantly, while the highly calcareous till is underlain by Trenton limestone. An analysis of the Trenton limestone formation is presented in Table 3.

The Grenville catena includes the medium textured soils developed on those sections of the till plain underlain by Black River formation. The Grenville catena consists of the well drained Grenville series, the imperfectly drained Matilda series and the poorly drained Lyons series. The well drained soils developed on Trenton limestone materials are classified as the Eamer series. The imperfectly and poorly drained associates of the Eamer series have not been separated from the corresponding members of the Grenville catena.

Grenville Series (49,500 acres)

The Grenville series is developed from morainic material that, in Stormont County, is underlain predominantly by limestone of the Black River formation. The topography on which the series developed is undulating to slightly rolling. On the gentler slopes, areas of imperfect drainage having soil similar to Matilda loam may occur as a result of seepage from adjacent areas of higher elevation. The Grenville series belongs to the Brown Forest Great Soil Group.

Grenville loam (47,700 acres)

Grenville loam—bouldery phase (1,800 acres)

The following is a description of the Grenville loam as commonly found in uncultivated woodlots in Stormont County:

A_0 — ½-0 inch of matted leaves and twigs.

A_1 — 0-4 inches of very dark grey-brown (10YR 3/2)* loam; friable consistency; medium crumb structure; medium in organic matter; few stones; no free carbonates; pH—7.0.

B_1 — 4-7 inches of light brown (10YR 6/3) loam; friable consistency; weak small nuciform structure; very indistinct horizon; pH—6.8.

B_2 — 7-16 inches of dark grey-brown (10YR 4/2) loam; friable consistency; medium nuciform structure; few stones; no free carbonates; pH—7.0.

C_1 — 16-26 inches of dark grey-brown (10YR 4/2) loam; stony; free carbonates; not compacted; pH—7.6.

C_2 — Grey (10YR 5/1) or grey-brown (10YR 5/2) loamy till; stony; slightly compacted; calcareous; pH—7.8.

The parent material consists of unsorted till dominated by limestone with some sandstone fragments.

Stones occur throughout the profile and, in some areas, boulders occur on the surface in sufficient numbers to interfere with cultivation. Such areas are mapped as the bouldery phase of the Grenville loam.

When cultivated, the surface soil becomes a grey-brown loam of medium organic

*Colour code numbers as taken from Munsell Colour Chart.

matter content. The natural vegetation includes sugar maple, beech, ash, and some elm.

Agriculture

Most of the Grenville loam is now cleared and used for agricultural purposes. General farming and dairying are carried on to advantage as, corn, alfalfa, clover, and small grains thrive on this soil type.

The supply of plant nutrients and lime is medium. The type of agriculture that stresses dairying provides a good supply of barnyard manure for return to the soil. For the production of clovers and alfalfa, applications of potash and phosphorous prove profitable; nitrogen should also be added for cereals and corn.

The fertility of the Grenville loam-bouldery phase is similar to the normal type but the stoniness hinders cultivation. If the boulders are not too numerous, it may be economical to remove them but, in most instances, the bouldery phase is used for pasture production.

In a few areas where drumlins are common, erosion may be a problem especially if row crops are grown. Normal good management practices, however, usually suffice to control erosion on the Grenville soil type.

Eamer Series (26,400 acres)

Another group of soils developed on loamy till in Stormont County is the Eamer series. The soils of this series are well drained and are developed on till that, being derived from Trenton limestone, is higher in lime than the till of the Grenville series. The topography is strongly undulating to rolling resulting in greater susceptibility to erosion than on the latter series.

The series includes only one type, Eamer loam (26,400 acres). The profile characteristics exhibited are those of the Brown Forest Great Soil Group. A description of a virgin profile of Eamer loam is presented below:

A_0 — ½-0 inch of matted leaf litter.

A_1 — 0-5 inches of very dark grey (10YR 3/1) loam; friable consistency; medium crumb structure; medium to high in organic matter; few stones; free carbonates may be present; pH—7.0.

B_1 — 5-10 inches of dark grey-brown (10YR 4/2) loam; friable consistency; fine nuciform structure; few stones; free carbonates; pH—7.0.

B_2 — 10-18 inches of very dark grey-brown (10YR 3/2) loam; friable consistency; medium nuciform structure; stones and boulders; free carbonates; pH—7.2.

C_1 — 18-23 inches of grey-brown (10YR 5/2) loam; slightly compacted; very weak fine nuciform structure; stony; calcareous; pH—7.6.

C_2 — Grey (10YR 5/1) loamy calcareous till; stony; somewhat compacted; pH—8.0.

The parent material is characteristically stony but in some areas where eskeroid deposits are present it becomes excessively stony. The parent material has some tendency to be compacted but no hardpan layer is developed in this soil.

A number of boulders chiefly limestone with some granite erratics are scattered about the surface often in sufficient numbers to hinder normal cultivation.

The natural vegetation includes sugar maple, elm, and basswood. The internal and external drainage is good. When cultivated, the surface soil consists of a dark grey-brown loam of medium organic matter content.

Natural vegetation on well drained soils consisted of maple, beech, ash, association.

Agriculture

The Earner loam is well adapted to general farm crops provided that the boulders are not too numerous. It is well supplied with lime and is fairly well supplied with other available plant nutrients. Cereals, hay, especially alfalfa and clovers, and pasture thrive on this soil. Addition of phosphatic fertilizers may give profitable increases in yields.

Because the topography is strongly undulating to rolling, there are many slopes on which erosion is a problem. On certain slopes, it may be advisable to break up the sod only about once in five years to renew the hay and pasture.

Matilda Series (4,600 acres)

The Matilda series represents the imperfectly drained member of both the Grenville and the Earner catenas. It was not possible to differentiate between the inadequately drained members of the two catenas. Matilda loam, the only type in the series, is an imperfectly drained Brown Forest Soil. The profile horizons are less distinct than in the well drained soils due chiefly to the imperfect drainage. The type occurs on undulating topography and on the lower slopes of drumlins.

The following is a description of a Matilda loam profile under cultivation:

A_c—0-8 inches of greyish brown (10YR 5/2) loam; friable consistency; medium crumb structure; few stones; medium organic matter content; no free carbonates; pH—7.0.

B_1—8-15 inches of brown (10YR 5/3) loam; slightly mottled; friable consistency; fine crumb structure; pH—6.8.

B_2—15-22 inches of brown (10YR 5/3) loam; mottled; friable consistency; weak nuciform structure; horizon

is relatively indistinct and not always present; pH—7.0.

C — Grey (10YR 6/1) loamy calcareous till; stony; free carbonates; pH—7.4.

The parent material varies in pH from 7.2 to 8.0. It tends to become compacted and to hinder the natural internal drainage. The relatively smooth relief contributes to inadequate external drainage.

In some areas, considerable water washing has mixed some lacustrine material with the till materials. Such profiles are irregular in occurrence in areas that are too small to delineate.

The natural vegetation consists of elm with some maple on the better drained sites.

When cultivated, the surface soil is a grey-brown loam of medium organic matter content.

Agriculture

In general, the Matilda loam is used for semi-permanent pasture and hay production. It is fairly well supplied with nutrients and lime. Where local drainage conditions are improved, it compares favourably with the Grenville loam as an agricultural soil.

Artificial drainage is of value in this soil provided that the number of stones does not make tile drainage impractical. Buckwheat is well adapted to this type and, with favourable weather at seeding time, some spring grains can be grown even without improved drainage.

Lyons Series (1,300 acres)

The Lyons series, which is the poorly drained member of the Grenville and Eamer catenas, is represented in Stormont County by the Lyons loam. It belongs to the Dark Grey Gleisolic Group of soils. It exhibits the characteristics of that Great Group as evidenced by the profile description below:

With the exception of the Ac, the profile horizons are poorly defined.

A_c — 0-10 inches of very dark brown (10YR 2/2) stony loam; high in organic matter; sometimes free carbonates are present; pH—7.2.

G — 10-24 inches of mottled grey (10YR 5/1) stony loam that grades into the parent material; pH—7.5.

C — Grey calcareous stony till; pII—7.8.

The entire profile is usually stony and makes artificial drainage impractical. The topography is depressional; hence there is often considerable seepage from adjoining uplands. As the amount of organic matter in the surface layer increases, the type grades into areas of muck.

Most of the soil of this type is supporting its natural vegetation of cedar, poplar, and elm.

Agriculture

The surface soil is fairly well supplied with plant nutrients but the poor drainage limits the type chiefly to the production of permanent pasture.

2. Soils formed from fine textured calcareous till

The bedrock formations of the southwestern portion of Stormont County are Chazy shale and Black River limestone. The morainic material developed on these formations is high in lime and has a clay loam texture. Hence, the soils developed

are highly calcareous and the parent materials tend to be compacted producing a hardpan layer at depths varying from 18 to 36 inches below the surface.

Only one catena, the Wolford cantena, has been recognized on these materials in Stormont County. All three members of the catena occur in the southwestern part adjoining Dundas County. The catenary members are the well drained Wolford series, the imperfectly drained Morrisburg series and the poorly drained Osnabruck series.

Wolford Series (13,000 acres)

The Wolford series is developed from fine textured high lime till on undulating to very gently rolling topography. The Wolford clay loam is the only type mapped in Stormont County and it represents the well drained member of the Wolford catena. The profile is typical of the Brown Forest soils. Brown is the dominant colour throughout the profile as evidenced by the description below:

A_0 — ½-0 inch of matted leaf litter and dead grass.

A_1 — 0-5 inches of very dark brown (10YR 2/2) clay loam; friable consistency; medium crumb structure; numerous fibrous roots; medium in organic matter; occasional stones; free carbonates present; pH—7.2.

B_1 — 5-8 inches of dark brown (10YR 4/3) clay loam; friable consistency; medium nuciform structure; few stones; free carbonates; pH—7.3.

B_2 — 8-11 inches of very dark greyish brown (10YR 3/2) clay loam; friable consistency; fine blocky structure; several stones; free carbonates; pH—7.3.

B_3 — 11-15 inches of dark brown (10YR 4/3) clay loam; friable consistency; coarse blocky structure; several stones; free carbonates; pH—7.4.

C_1 — 15-20 inches of light brownish grey (10YR 6/2) clay loam till; stony; somewhat compacted; free carbonates; pH—7.8.

C_2 — Grey (10YR 6/1) clay loam till; calcareous; quite compacted; stony; pH—8.0.

The parent material is usually more or less compacted. The weathered profile varies between 20 and 30 inches in depth. In some places, the type is found in close association with eskeroid material and the presence of some gravel is evident in the profile.

The Wolford clay loam usually occurs in small areas within large areas of the inadequately drained members of the catena. The natural vegetation is elm, maple and basswood.

The cultivated surface soil is a dark brown clay loam with a medium supply of organic matter and plant nutrients. Lime is present throughout the profile.

Agriculture

When cleared, the Wolford clay loam is used to produce hay, corn, and small grains. It is especially well suited to alfalfa growing.

The soil is of medium fertility well supplied with lime. Because of the high lime content, crops probably will respond well to applications of phosphorus as commercial fertilizer to this soil. The greatest hindrance to crop production, however, is the presence of the compacted subsoil. The undulating to gently rolling topography results in some erosion on the steeper slopes. Ordinary good farm practices will keep erosion in check in most instances.

Morrisburg Series (20,500 acres)

The most extensive series found on the fine textured morainic till deposits is the Morrisburg series. It is the imperfectly drained member of the Wolford catena. Morrisburg clay loam developed on undulating topography is the only type in the series to be recognized in Stormont County. The imperfectly drained Brown Forest Group profile of the Morrisburg soil is described as follows:

A_0—½-0 inch of dark matted leaf litter.

A_1—0-6 inches of dark brown (10YR 4/3) clay loam; friable consistency; medium crumb structure; few stones; free carbonates; pH—7.2.

B_1—6-10 inches of dark yellowish brown (10YR 4/4) clay loam; friable consistency; small nuciform structure; slightly mottled; free carbonates; (horizon may be mistaken for an indistinct A_2); pH—7.3.

B_2—10-15 inches of brown (10YR 4/3) clay loam; friable consistency; small nuciform structure; mottled; free carbonates; few stones; pH—7.4.

C—Grey (10YR 6/l) clay loam; compacted; stony; free carbonates; pH—8.0.

The profile may vary somewhat in depth but the average is about eighteen inches to the parent material where the compacted subsoil occurs. The stoniness of the profile increases in areas adjacent to eskeroid material. Appreciable amounts of sandstone, presumably originating from the Potsdam formation, are present within the profile while granite erratics may be scattered about the surface. The soil appears to be shallow; the shallowness, however, is not due to the proximity of the bedrock but rather to the compacted layer. This condition is reflected in the natural vegetation that consists of elm, soft maple and numerous cedars.

Legumes are efficient subsoil improvers and produce good forage as well.

Under cultivation, the surface soil becomes a grey-brown clay loam of medium organic matter content and is fairly well supplied with plant nutrients.

Agriculture

When cleared, the soil type is used for the production of cereal grains, and, even in wet seasons, it produces commendable crops of buckwheat. It is a fairly good soil for the production of alfalfa and clover which, in turn, tend to break up the compacted subsoil for improved drainage.

Artificial drainage would be of value but the cost of installation is probably prohibitive in many instances.

Osnabruck Series (3,400 acres)

Osnabruck clay loam, the only member of the Osnabruck series, is the poorly drained member of the Wolford catena. It is developed in fine textured calcareous till on level to depressional topography. It belongs to the Dark Grey Gleisolic Great Soil Group. The general description of the profile is as follows:

A_0 — thin layer of black leaf litter.

A_1 — 0-10 inches very dark brown (10YR 2/2) clay loam; friable consistency; coarse crumb structure; high organic matter content; few stones; free carbonates present; pH—7.4.

G — 10-16 inches light brownish grey (10YR 6/2) clay loam; plastic consistency; massive structure; heavily mottled; free carbonates present; pH—7.6.

C — Grey (10YR 6/1) clay loam till; very stony; calcareous; pH—8.0.

As a result of its topographic position, the profile often includes varying amounts of water-washed fine textured material deposited over the till.

Boulders often occur in considerable numbers on the surface. The organic matter content of the surface soil varies considerably and becomes greater nearer muck areas.

Agriculture

The lack of drainage, both internal and external, seriously limits the usefulness of the Osnabruck clay loam for production of general farm crops. The relatively large number of stones within the profile makes drainage improvement of doubtful economic value. Some areas have been cleared and are used for permanent pasture. One of the best uses for the type, however, is the production of its natural vegetation of elm, cedar and willow.

B. SOILS DEVELOPED ON ROUGHLY STRATIFIED SAND AND GRAVEL (GLACIO-FLUVIAL MATERIAL)

As the last great ice sheet melted, streams of meltwater made their way through great crevasses in the ice and finally flowed out in front of the glacier. Rock debris which was originally held by the ice was carried by the streams, and was deposited in their beds. When the ice finally melted from the area, the beds of the glacial streams remained as long narrow ridges of coarse sand and gravelly material. As a result of the above mode of deposition the relief is hilly, a condition that does not readily lend itself to general farming practices.

Kars Series (19,100 acres)

All of the glacio-fluvial material in Stormont County is classified in the Kars series. This series is well drained. The remaining catenary members were not recognized in areas large enough to delineate in Stormont County.

The Kars series is represented by one soil type, the Kars gravelly sandy loam. The usual topographic form is one of long narrow ridges whose long axes are roughly parallel to the direction of ice movement. The profile is well drained and, in some instances, excessively drained. The profile characteristics identify the Kars with the Grey-Brown Podzolic Group of soils.

A_0—½-0 inch layer of leaf litter.

A_1—0-4 inches of dark grey-brown (10YR 4/2) sandy loam; very friable consistency; very fine crumb to single grain structure; few stones; pH—6.8.

A_2—4-12 inches of yellow-brown (10YR 5/6) sandy loam; very friable consistency; single grain structure; few stones; pH—6.6.

B—12-17 inches of dark brown (10YR 4/3) loam or sandy loam ; friable consistency; small nuciform structure; few stones; pH—7.0.

C—Roughly sorted gravel and sand; some free carbonates; some boulders; pH—7.0, contains some shale fragments.

The above profile developed under well drained conditions. Wherever the drainage is excessive, the horizon development is less distinct.

The natural vegetation is maple with some beech and pine. Elm may occur in slight depressions.

There were many small cobble stones scattered about the surface, under natural conditions, but most of these have been removed from cultivated land and placed in stone piles. The cultivated surface soil is a light grey-brown sandy loam, low in organic matter. It is also low in essential plant nutrients: hence fertilization is necessary if the soil is used for general farm crops.

Agriculture

The suitability of the Kars series for general farming is limited by several factors.

The stones that occur in the upper horizons may hinder the use of farm machinery. The removal of the boulders from the surface increases the cost of bringing the

The parent materials of the Kars series are often used for road building. The coarse textured materials promote rapid drainage.

soil into production and as the inherent productivity of the soil is low, stone removal may not be economical.

For specialized early crops such as potatoes and small fruits, the type is well suited provided that commercial fertilizer is used.

The rolling topography is conducive to erosion. Hence, during cultivation, the control of erosion is a problem. In addition, the coarse open subsoil tends to cause the soil to be droughty although the B horizon, which is relatively heavy in texture, aids in retaining a favourable moisture relationship.

During wet seasons, the Kars gravelly sandy loam becomes one of the better soils in the County for general farm crops because of its good drainage.

C. SOILS DEVELOPED ON DELTAIC OR OUTWASH MATERIALS

The parent materials of this group of soils were deposited by water as it flowed out over the area in front of the glacier. As the rate of flow of the water decreased particles of sand and fine gravel settled out to form the outwash plains of to-day. The topography is undulating with some gullying along stream courses. The largest acreage of outwash material occurs in Roxborough Township.

All outwash material that is three feet or more in depth is classified in the Uplands catena which includes the well drained Uplands series, the imperfectly drained Rubicon series and the poorly drained Granby series.

Uplands Series (3,600 acres)

The Uplands series has developed on strongly undulating to rolling outwash materials of sand or sandy loam texture. The Uplands sand and Uplands sandy loam are members of the series developed under good to excessive drainage conditions. The open nature of the subsoil and the low lime content of the parent material favours the development of a Podzol type of profile. The Uplands sand profile described below belongs to the Podzol Great Soil Group:

Uplands sand (2,400 acres)
Uplands sandy loam (1,200 acres)

- A_c — 0-3 inches of very dark grey (10YR 3/1) sand; extremely friable consistency; single grain structure; medium to low in organic matter; pH—6.0.
- A_2 — 3-5 inches of grey (10YR 5/1) sand; very friable consistency; single grain structure; pH—5.8.
- B — 5-17 inches of brown (10YR 5/3) sand; friable consistency; single grain to weak nuciform structure; pH—6.4.
- C_1 — 17-24 inches of yellow-brown (10YR 5/6) sand; friable consistency; single grain structure; pH—6.4.
- C_2 — Grey (10YR 5/1) sand and gravel; non-calcareous; pH—6.6.

There are no boulders within the profile, although a very occasional one may be found on the surface. If the soil is unprotected, "blow out" spots tend to develop. Coniferous forest is the common natural vegetation. The cultivated surface soil is very low in organic matter. Chemical tests indicate that the available plant nutrients also are in short supply.

Agriculture

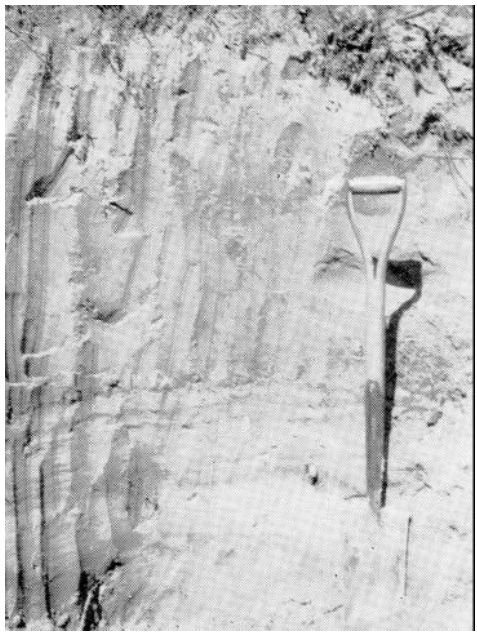
A large proportion of the Uplands soil has been cleared and cultivated but has now been returned to pasture. The soil is not well suited to general farming because

of low fertility and a tendency to be droughty. With adequate fertilization, grain and potatoes can be grown during seasons of favourable moisture supply.

The Uplands sandy loam is more useful than the Uplands sand because of its higher fertility level. Also during wet seasons, the sandy loam is very useful because the fine textured soils are hindered by excess moisture. Uplands sandy loam is well suited for specialized crops such as potatoes.

Rubicon Series (11,500 acres)

The imperfectly drained member of the Uplands catena is the Rubicon series. The two types, Rubicon sand and Rubicon sandy loam, are developed on undulating topography with numerous small knolls and depressions. The drainage conditions vary within very short distances ranging from good drainage on the knolls to poor drainage in the depressions. The Rubicon series is classified as a Ground Water Podzol although on the better drained knolls an Uplands podzol may develop and in the poorly drained depressions the Granby series may occur.



The Uplands sand profile has indistinct horizons. Low fertility and susceptibility to wind erosion limit the productivity of the soil.

Rubicon sand (7,300 acres)
Rubicon sandy loam (4,200 acres)

A description of an average profile under cultivation appears below:

A_c—0-5 inches of dark grey (10YR 4/l) sand or sandy loam; very friable consistency; single grain structure; pH—6.5.

A_2—5-10 inches of ashy grey (10YR 7/l) sand; very friable consistency; single grain structure; pH—6.0.

B—10-20 inches of dark brown (10YR 4/3) sand or

sandy loam; somewhat cemented; compact; pH—6.2; grades into mottled brown sand.

C — Grey (10YR 5/1) sand sometimes stratified with silt or gravel; pH—6.8.

There are practically no stones throughout the profile nor on the surface.

Under cultivation the surface soil is a yellow-brown on the knolls and dark grey in the depressions with streaks of ashy grey scattered throughout wherever the plow reaches the A_2 horizon. The soil in the depressions is often closely similar to the Granby as described later. The soil is moderately acid and low in plant nutrients.

Agriculture

The utility of this soil type is quite variable depending on the area of well drained knolls in proportion to the area of inadequately drained depressions. The open nature of the soil materials renders the retention of moisture poor where the water table is low. The depressions usually require drainage but this draining only accentuates the problem of moisture control on the knolls. In areas where clay occurs relatively close to the surface (3-6 feet) drainage is frequently difficult to improve.

Some farmers carry on a general type of farming on the Rubicon sandy loam where the topography is relatively level and where the subsoil is either calcareous gravel or clay. The sandy loam type is the more useful of the series and is valuable during wet seasons when finer textured soils fail to produce.

Granby Series (8,600 acres)

Depressional topography on sandy outwash material leads to the development of the poorly drained profile of the Granby series. The series includes the Granby sand and the Granby sandy loam.

Granby sand (4,900 acres)
Granby sandy loam (3,700 acres)

Both types belong to the Dark Grey Gleisolic Soil Group and have profile characteristics as described below:

A_0 — 1-0 inch of matted leaf litter.

A_1 — 0-5 inches of very dark brown (10YR 2/2) sand or sandy loam; very friable consistency; single grain structure; pH—6.8.

G_1 — 5-11 inches of grey (10YR 5/1) sand; very friable consistency; single grain structure; pH—6.8.

G_2 — 11-33 inches of grey (10YR 5/1) sand mottled with rusty brown; friable consistency; single grain structure; pH—6.9.

C — Grey (10YR 6/1) sand stratified with some clay and silt; no free carbonates; pH—7.0.

At a depth of three feet or more, clay may be present but it has no obvious effect on the profile developed nor on the productivity of the soil. The native vegetation is elm, soft maple, cedar, and spruce.

The natural surface soil is well supplied with organic matter that may be lost rapidly when the soil is drained and cultivated. The content of available plant nutrients is also low.

Agriculture

The native vegetation has been removed from much of the area but when the uselessness of the soil for farming was realized, the area was allowed to revert to

the production of scrub willow. The soil is one of the poorest types in the County and is probably serving its best purpose in producing trees. Fortunately there is only a small acreage of Granby in Stormont County.

If drainage and fertility are improved, good crops of hay and pasture can be produced. When drainage is improved, however, the soil tends to be droughty as a result of its coarse texture. The Granby sandy loam is somewhat better for agricultural purposes than the sand type although it possesses the same limitations to some degree.

D. SOILS DEVELOPED ON LACUSTRINE MATERIALS

Lacustrine materials are of medium to fine texture having been deposited by still or very slowly moving water. As the glacier receded, much of this eastern portion of Ontario was inundated by glacial Lake Champlain and Gilbert Gulf. The particles carried by the water flowing into the lake gradually settled to the lake bed. The farther retreat of the ice allowed the lakes to drain and so today only the beds of the lakes remain. The fine textured lacustrine plains represent the lake beds of late glacial times.

In general, lacustrine deposits are of fine texture ranging from a loam to clay, are stonefree, and usually are inadequately drained as a result of their level topography.

1. Soils formed from limy lacustrine loams and silt loams

The materials classified in this group are a mixture of clay sediments and coarser materials washed in from adjoining till and gravelly ridges. Great irregularity of layering of coarse and fine materials is found throughout the profile. This supports the belief that the mode of deposition had the dominating effect on the texture of the materials. Only one catena has been mapped on these materials and the Osgoode series is the only member of the catena to be recognized.

Osgoode Series (6,200 acres)

The Osgoode series commonly occurs as a transition between areas of lacustrine clay and areas of coarser materials (e.g. till and outwash). It appears to be a random mechanical mixture of sand and clay. The topography is level to depressional. Two types are included in the series that exhibits Dark Grey Gleisolic profile characteristics.

Osgoode loam (5,300 acres)
Osgoode silt loam (900 acres)

The following is a description of the loam profile under the original forest cover:

A_0 — ½-0 inch of matted leaf litter.

A_1 — 0-6 inches of dark grey (10YR 4/1) loam; friable consistency; fine granular structure; stonefree; no free carbonates; medium to high in organic matter; pH—7.0.

G_1 — 6-9 inches of light brownish grey (10YR 6/2) loam; friable consistency; weak medium nuciform structure; some weak mottling; no free carbonates; stonefree; pH—6.8.

G_2 — 9-21 inches of grey-brown (10YR 5/2) loam; weakly plastic consistency; massive structure; mottled; stonefree; no free carbonates; pH—7.0.

C_1 — Grey (10YR 5/1) loam; plastic consistency; massive structure; mottled; free carbonates may be present; pH—7.4.

The parent material may have lenses or layers of sandy material intermixed with layers of clay but no stones are present.

The natural vegetation consisted of soft maple, elm, and ash. Under natural conditions, the surface soil is fairly high in organic matter which it retains under cultivation if reasonably well managed.

Agriculture

For the most part the Osgoode loam is farmed intensively. The fertility level is medium but the restricted drainage is a limiting factor. The drainage problem can usually be overcome by installation of open ditches and tile drains. The type does not occur in large areas; hence any one farm is not likely to be all Osgoode loam. Hay (red clover and alsike), pasture, and cereal grains are crops commonly grown on this soil. Osgoode loam in association with a well drained soil type is an ideal combination for dairy farming.

Osgoode silt loam

This type has profile characteristics similar to those of the Osgoode loam except that the surface soil is a silt loam. The finer texture provides slightly high fertility but the same use is made of the two types. The fine texture may increase the problem of drainage but this can be overcome fairly economically.

2. Soils formed from neutral to slightly alkaline lacustrine clays

The Carp, North Gower, and Belmeade series have developed on grey clays and silts moderately high in lime. The largest area of such materials is found in Finch Township in the northwest part of the County along the South Nation River. In the remainder of the County, the poorly drained series occur in depressions between ridges of till or gravel.

The Carp catena includes all of the lacustrine clays in Stormont County. The Carp series is the imperfectly drained catenary member, the North Gower series the poorly drained, and the Belmeade series is the very poorly drained member.

Carp Series (2,400 acres)

The Carp series includes those soils that are developed on neutral to slightly alkaline, stonefree, lacustrine material under conditions of imperfect drainage. The areas of the Carp series are very limited and occurs close to stream courses. Some small areas of moderately well drained soils are included because such areas are too small to delineate. The Carp clay loam which is the only member of the series recognized is developed on gently undulating topography. It shows the profile characteristics of an imperfectly drained Grey-Brown Podzolic soil. The following is a description of the virgin profile of the Carp clay loam:

A_0 — ½-0 inch of matted leaf litter.

A_1 — 0-5 inches of dark grey-brown (10YR 4/2) clay loam; friable consistency; medium crumb structure; medium in organic matter; stonefree; no free carbonates; pH—7.2.

A_2 — 5-10 inches of light brownish grey (10YR 6/2) loam or clay loam; friable consistency; weak nuciform structure; stonefree; pH—7.0.

B_1 — 10-17 inches of brown (10YR 5/3) clay loam; very slightly mottled; hard consistency when dry; weak small blocky structure; stonefree; pH—7.0.

B_G — 17-29 inches of grey (10YR 5/1) clay loam; plastic

consistency; massive structure; mottled; stonefree: free carbonates sometimes present; pH—7.2.

C—Grey (10YR 6/l) silty clay loam; plastic consistency; massive structure; calcareous; pH—7.2.

The parent material is stonefree and fine in texture. The profile horizons are not well defined but as drainage improves the horizon definition improves.

The topography is undulating and may become rolling as a result of erosion by small streams that have developed gullies. The gullies facilitate external drainage although the internal drainage is imperfect. Although the Carp clay loam is a fine textured soil, its favourable structure greatly improves the internal drainage and the general productivity.

The natural vegetation was maple, elm and ash. The natural surface soil is fairly well supplied with organic matter which it retains under cultivation if the soil is reasonably well managed. The supply of most plant nutrients is medium to high.

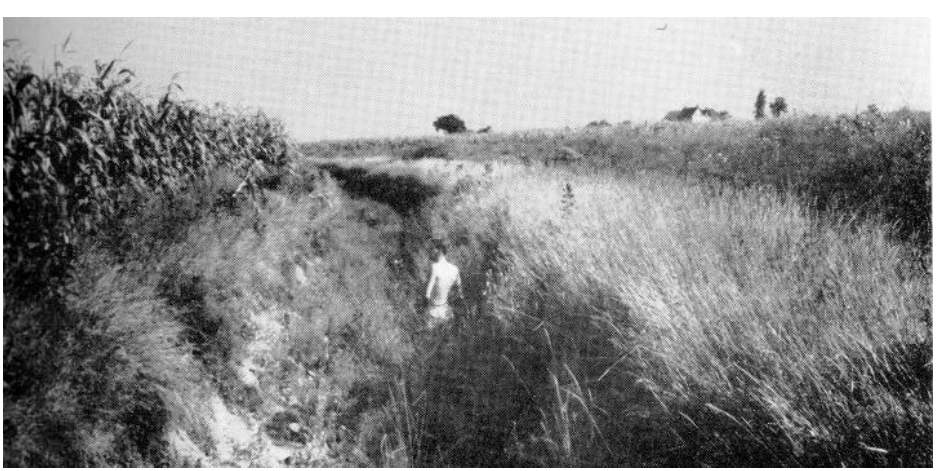
Agriculture

Most of the small acreage of Carp clay loam which occurs in Stormont County has been cleared. It is a good agricultural soil being well adapted to the growing of small grains, corn, alfalfa, hay and pasture. Artificial drainage is usually required for maximum production. The natural fertility is medium to high and may be maintained by ordinary good farm practices. The management problems are less serious on the Carp clay loam than on the poorly drained members of the catena.

North Gower Series (26,600 acres)

The North Gower series occurs on materials similar to those of the Carp series but is differentiated on the basis of drainage. The North Gower series includes fine textured soils of neutral to slightly alkaline reaction that are poorly drained.

Along the banks of the South Nation River in Finch Township, there are large areas of the North Crower series and smaller areas occur in other parts of the County. The level to depressional topography promotes poor drainage. The North Gower clay loam is the only member of the series mapped in the County. It belongs to



Installation of deep open ditches and tile drains is required on North Gower soils.

the Dark Grey Gleisolic Soil Group. A description of a virgin profile is presented below :

A_0—½-0 inch of matted leaf litter.

A_1—0-8 inches of very dark grey (10YR 3/l) clay loam ; friable consistency; medium crumb structure; stone-free; medium to high in organic matter; pH—7.0.

G_1—8-12 inches of grey (10YR 5/l) clay loam; plastic consistency; massive structure; mottled; stonefree; pH—7.0.

G_2—12-26 inches of grey (10YR 5/l) clay loam; plastic consistency ; massive structure ; intensely mottled ; stonefree; pH—7.2.

C—Grey (10YR 6/l) silty clay loam; plastic consistency; massive structure ; stonefree ; free carbonates present ; pH—7.4.

The parent material is usually stonefree although some grit may be present. The poor drainage results in horizons that are very indistinct and mottling often occurs immediately below the dark coloured A_1 horizon.

The natural vegetation consisted of elm, ash and soft maple. The organic matter content of the surface soil is medium to high and it is well incorporated with the mineral matter. The cultivated soil is very dark brown in colour with a medium to high fertility. The phosphorus and potash contents of the North Gower series are appreciably higher than those of comparable lacustrine deposits in Western Ontario.

Agriculture

A large percentage of this type in Stormont County has been cleared and is being used for permanent pasture prodution with no improvement in drainage. Cereal grains and some corn are grown, however, where ditches and tile drains have been installed.

Cereal grains grow well on poorly drained clay soils when drainage has been improved artificially.

General farming and dairying are common especially where well drained till areas occur in association with the lacustrine material. Cereal grains and alfalfa may be grown on the till soil while the poorly drained areas may be used for pasture and hay. The utilization of the North Gower clay loam varies greatly with the season. The soil is naturally poorly drained and, therefore, during a wet season its agricultural value is greatly decreased. Conversely, if the season is dry, the fine textured soil holds moisture better than the coarser soils and better crops result.

Belmeade Series (1,500 acres)

Soils developed on materials of the Carp catena under conditions of very poor

Belmeade muck is a very poorly drained soil. Note depth of muck over the grey clay.

drainage are included in the Belmeade series. The topography is depressional.

The Belmeade muck is the only member of the series and it exhibits the profile characteristics of a Half Bog Soil. The profile that obtains under virgin conditions is described below:

A_0 — 0-15 inches of black (10YR 2/1) layer of organic matter in varying stages of decomposition; pH—6.8.

G_1 — 15-20 inches of grey (10YR 5/1) clay; plastic consistency; massive structure; stonefree; pH—6.8.

G_2 — 20-36 inches of grey (10YR 6/1) clay; plastic consistency; massive structure; mottled with rusty brown; stonefree; pH—6.8.

C — Grey (10YR 6/1) clay or silty clay; plastic consistency; massive structure; stonefree; occasionally free carbonates are present; pH—7.0.

The surface horizon under cultivation is quite variable. In some areas, the native forest has been removed and the organic surface layer partially burned in an effort to reclaim the soil for general agriculture. The effort has been successful in some areas and the organic matter remaining has been incorporated with the mineral soil. The surface layer then becomes a very dark grey clay or clay loam about 6-8 inches deep very closely ressembling that of the North Gower series.

In many areas, however, the burning has been unsuccessful because the organic matter was completely burned and the grey subsoil low in organic matter has become the surface soil. This layer is difficult to handle because of poor aeration and low supply of available nutrients.

Agriculture

Fortunately, the acreage of Belmeade muck in Stormont County is very small. Much of the type is still in forest and natural pasture and probably is serving its best use in that state. Areas which have been cleared and prepared successfully for farming are used in the same manner as the areas of North Gower clay loam. Artificially improved drainage allows the production of hay, pasture, buckwheat, and cereals in relatively dry seasons.

E. SOILS DEVELOPED ON OUTWASH MATERIALS UNDERLAIN BY LACUSTRINE MATERIAL

1. Soils formed from sands and loams over clay

In some areas the lacustrine materials of the Carp catena are covered by a thin veneer of coarse textured material. The depth of the sandy overburden varies from six inches to three feet and in some places, the clay appears at the surface. In general, the profile is developed in the coarser materials although clay may occur in the B horizons and lower.

The Manotick catena includes all areas of this sand-over-clay complex. The Manotick series is found on undulating topography where the drainage is good. The Mountain series is imperfectly drained and the Allendale series and Marionville series are the poorly drained members of the catena.

Manotick Series (600 acres)

The soil developed on an undulating well drained plain of sand underlain by clay at three feet or less is called the Manotick series. The Manotick sandy loam is the only member of the series to be recognized.

The topography is moderately to strongly undulating. External drainage is

good. The internal drainage through the sandy materials is good but when the water reaches the clay layer it is impeded. Provided that other factors are constant, the deeper the sandy overburden the better the internal drainage. The soil type belongs to the Brown Podzolic Great Soil Group. The following is a description of a cultivated profile:

A_c — 0-4 inches of grey-brown (10YR 5/2) sandy loam; extremely friable consistency; fine crumb structure; stonefree; pH—6.6.

B_1 — 4-15 inches of yellowish brown (10YR 5/4) sandy loam; very friable consistency; single grain structure; pH—6.4.

B_2 — 15-27 inches of light yellowish brown (10YR 6/4) sandy loam or loam; friable consistency; granular structure; occasionally somewhat cemented; pH—6.7.

C — 27-32 inches of grey (10YR 6/1) sandy loam; friable consistency; single grain structure; pH—6.8.

D — Grey clay layer occurs at 20″ to 36″ below the surface; plastic consistency; massive structure; stonefree; pH—6.8.

The underlying clay is not the parent material of the profile. The profile is developed within the coarse textured materials.

The natural vegetation consisted of pine and maple forest. The cultivated surface soil is a grey-brown sandy loam or loam with a medium to low organic matter content. The supply of available plant nutrients in the sandy materials is medium. As the clay approaches the surface, however, more of the plant roots can obtain nutrients from the clay and better growth results.

Agriculture

There is only a small acreage of Manotick sandy loam in Stormont County. Most of it has been cleared and is used for general farming. The sand-over-clay type has an advantage in that the sandy surface allows early spring cultivation while the fine textured subsoil has larger reserves of plant food and aids in moisture retention during dry periods. The natural fertility is medium, but profitable crop response to applications of balanced fertilizer may be expected.

Mountain Series (4,900 acres)

About 2 per cent of the area of Stormont County consists of an imperfectly drained sand-over-clay complex mapped as the Mountain series. It is the imperfectly drained member of the Manotick catena developed on undulating topography similar to that of the Rubicon series. Hence, there are small areas of three to four feet of moderately well drained sand-over-clay as well as small areas of one to two feet of moderately poorly drained sand-over-clay included in the areas mapped as the Mountain series. The only member of the series recognized is Mountain sandy loam which is an imperfectly drained Brown Podzolic soil. The description of the cultivated profile is presented below:

A_c — 0-4 inches of dark brown (10YR 4/3) sandy loam; very friable consistency; fine crumb structure; medium organic matter content; pH—6.5.

A_2 — 4-6 inches of grey (10YR 6/1) sand or sandy loam; very friable consistency; single grain structure; pH—6.0. (This horizon is often indistinct).

B_2 — 6-9 inches of pale brown (10YR 6/3) sandy loam; sometimes weakly cemented; pH—6.2.

B_3 — 9-24 inches of pale yellow-brown (10YR 6/4) sand or sandy loam; slightly mottled; friable consistency; single grain structure; pH—6.6.

C — 24-32 inches of grey (10YR 6/1) sandy loam; friable consistency; mottled; single grain structure; pH—6.8.

D — Grey (10 YR 6/1) clay; plastic consistency; massive structure; stonefree; non-calcareous; pH—7.0.

The underlying clay is not the parent material of the profile although it has considerable influence on the moisture and fertility relationships of the soil.

The natural vegetation consisted of elm, pine and some poplar trees. The variability in the depth of the sandy overburden results in considerable variation in the fertility of the surface soil. In general, however, the surface soil is grey-brown in colour with a fair supply of organic matter.

Agriculture

The Mountain sandy loam is used largely for general farming. The combination of better drained knolls and more poorly drained depressions presents the same problem in utilization that was discussed for the Rubicon series. Within the area, there are soil conditions suitable for specialized crops such as small fruits and tree fruits adapted to the climate. Chemical tests indicate that the quantities of available plant nutrients are only fair, and use of commercial fertilizer will probably bring good returns. A good structure and plant nutrient level can be maintained fairly easily under good tillage and manurial practices.

Allendale Series (8,200 acres)

The Allendale series is the poorly drained member of the Manotick catena. The topography is level to slightly undulating. The Allendale sandy loam is the only type recognized. The depth of sandy overburden varies somewhat resulting in variations in the drainage conditions. The drainage is generally poor, both internal and external. The soil belongs to the Dark Grey Gleisolic Great Soil Group and exhibits profile characteristics described below:

A_1 — 0-6 inches of very dark brown (10YR 2/2) sandy loam; fine granular structure; very friable consistency; stonefree; high in organic matter; pH—6.4.

G_1 — 6-9 inches of grey (10YR 6/1) sand or sandy loam; very friable consistency; single grain structure; some mottling; pH—6.4.

G_2 — 9-25 inches of grey (10YR 6/1) sand; friable consistency; single grain structure; intensely mottled with rusty reddish brown; pH—6.5.

C — 25-36 inches of grey (10YR 6/1) sand; friable consistency; single grain structure; non-calcareous; pH—6.8.

D — Grey clay or clay loam; plastic; massive structure; pH—7.0.

In common with the other members of the catena, the profile of the Allendale sandy loam is developed within the sandy materials. The clay material may have some influence on the moisture relationships.

The natural vegetation consisted of elm, ash, and poplar. Much of the type is cleared, and remains as permanent pasture.

The organic matter is not well incorporated with the mineral fraction. In some areas, it has accumulated to such an extent that the soil is similar to shallow muck. Improved drainage and careful cultivation result in a grey-brown surface soil of medium to low fertility.

Agriculture

The common use for the soil type is the production of permanent pasture or trees. Some cereal grains, especially buckwheat, are grown to a limited extent.

Because of the proximity of the clay, the Allendale soil rates above the Granby series as far as crop production is concerned. The sand-clay complex makes artificial drainage improvement difficult and renders a uniform method of tillage and management impractical since the better drained knolls require a different treatment from that of the poorly drained depressions. Even if drainage were improved, the problems of fertility and organic matter retention would be serious.

Where small areas of Allendale sandy loam occur within areas of better drained soils it is useful for pasture production, alsike clover being one of the important pasture species.

Marionville Series (500 acres)

A very small acreage of the Marionville series occurs in the northwest corner of Stormont County. It is a complex of twenty inches or less of fine sandy loam and silt materials over clay under conditions of poor drainage. The Marionville fine sandy loam is the only type mapped. The topography is level to depressional. The Marionville soil does not have its profile developed entirely within the overlying deltaic material. It belongs to the Dark Grey Gleisolic Great Soil Group.

A_1 — 0-5 inches of very dark grey (10YR 3/1) fine sandy loam or silt loam; friable consistency; crumb structure; stonefree; medium in organic matter content; pH—7.0.

G_1 — 5-11 inches of grey (10YR 5/1) silt loam or very fine sandy loam; friable consistency; granular structure; pH—6.8.

G_2 — 11-19 inches of grey (10YR 6/1) silt loam; weakly plastic consistency; weak blocky structure; intensely mottled; pH—7.0.

G_3 — 19-36 inches of grey (10YR 6/1) clay loam; plastic consistency; massive structure; mottled with rusty brown (10YR 5/3); pH—7.0.

C — Grey (10YR 6/1) clay or clay loam; very plastic consistency; massive structure; non-calcareous; pH—7.2.

The C horizon is very similar to that of the North Gower series. It is difficult to determine the true parent material of this soil. The upper horizons are so coarse in texture (fine sandy loam) that it is unlikely that they were derived from the underlying C horizon material. The coarser material presumably is depositional overburden that is too shallow to allow a complete profile to develop within it. Hence, the profile extends through the overburden into the underlying lacustrine material. The lower part of the glei horizon is developed in the fine material. The C horizon then is the parent material of the lower horizons but not of the surface horizons.

The natural vegetation was elm, ash and soft maple.

The cultivated surface soil is a grey-brown fine sandy loam fairly well supplied with organic matter. In some areas, the A_2 horizon has become mixed with the A_1 resulting in a lighter colour in the surface layer.

Agriculture

Drainage is an important factor in the utilization of this soil type. The fine materials in the upper horizons hinder percolation and the clay at 12 to 20 inches practically prevents internal drainage. With the installation of deep ditches and tile drains, however, much of the area can be used for general farming.

The chief crops grown are hay and pasture with some acreage devoted to small grains.

F. SOILS DEVELOPED ON SHALLOW DRIFT OVER BEDROCK

In a few isolated areas throughout the County, limestone bedrock occurs within ten feet or less of the surface and indeed often is covered with less than three feet of soil.

Soils that are three feet or less in depth have been classified as the shallow phase of the series to which they are most closely related. The areas where the drift is one foot or less, however, have been mapped as Farmington series.

Farmington Series (500 acres)

The Farmington loam is the only member of the series recognized in Stormont County. The acreage of the type is very small. The topography is generally level and often broken by rocky outcrops. Natural drainage ranges from excessive in most places to poor where the bedrock restricts drainage. The natural vegetation consists of cedar and maple.

The following is a general description of the profile:

A_1 — 0-3 inches dark brown (10YR 4/3) loam; limestone fragments in the surface soil; pH—7.2.

B_2 — 3-9 inches grey-brown (10YR 5/2) stony loam grading into stony till immediately above the limestone bedrock; pH—7.8.

D — Limestone bedrock.

Agriculture

The most common use and, indeed, the best use for the type is as forest and grazing land. The relatively small acreage found in the County demands no special attention in planning the land use of the area.

G. SOILS DEVELOPED ON FLOOD LANDS ALONG STREAM COURSES

Bottom Land (12,600 acres)

The complex of soil conditions adjoining stream courses is called Bottom Land. Such land is subject to flooding and hence a great variety of alluvial material has been deposited. The reaction, texture, and profile characteristics are extremely variable.

Agriculture

The chief use of the soil is for the production of permanent pasture.

H. SOILS DEVELOPED ON ORGANIC MATERIALS

Muck (20,000 acres)

There is an appreciable acreage of organic soils in Stormont County, the largest area being in the northwest portion. All areas that have eighteen inches or more

of organic material overlying the mineral soil have been classed as muck. It belongs to the Bog Great Soil Group.

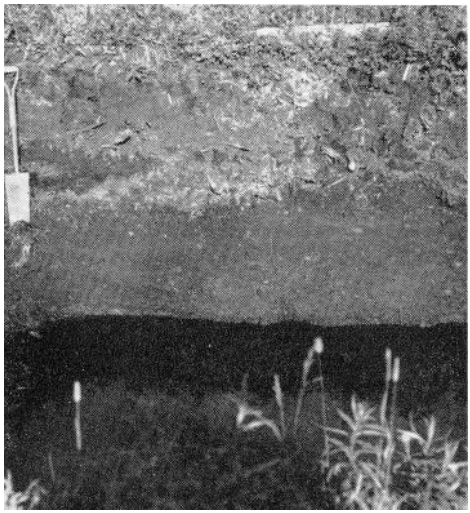
Description

10 inches or more of organic layer consisting of semi-decomposed vegetative material, usually neutral to alkaline on the surface.

Underlying material may be till, sand or clay.

Agriculture

Very little of the muck areas is used for general crops. The natural vegetation of elm, tamarack and cedar may be used for fuel but most of the area still remains in the wooded condition. For agricultural production, muck soils require clearing and drainage and it is doubtful if the returns would warrant the expenditure for development under present economy.



Muck is an organic soil. Vote the top three feet contains poorly decomposed material. Material below is well decomposed.

PART IV

AGRICULTURE AND LAND USE

Early Settlement and Agricultural Development

Stormont County was entered and, to a large extent, settled towards the close of the eighteenth century by United Empire Loyalists, who left New York and other States after the Revolution. The Town and Township of Cornwall were both entered in the year of the Declaration of Independence and are among the oldest settled portions of Ontario. Osnabruck township was entered in 1784 while the remaining townships of Finch and Roxborough were entered later. Settlement of the latter two townships was hindered by the lack of communication until a railway was built in 1860.

When the first settlers came to Stormont County, the country was an unbroken forest of trees and impassable swamp land. The lumbering industry flourished and much high grade timber found its way to Montreal for ship-building. Gradually the land was cleared for cultivation. By 1881, only 30 per cent of the area was still timbered. According to the 1941 Census only 8 per cent of the County remains in woodland.

Stock raising and dairying became important agricultural endeavours very soon after settlement. Excellent butter and cheese were produced and a ready market was found in Morrisburg and Montreal.

The need for improved drainage in some areas was noted but very little action was taken in those early days. Stone removal was necessary in some areas especially in Cornwall township. Stone fences and stone piles remain today as evidence of many hours of back-breaking labour.

The climate was too cold for production of fall wheat although tree fruits, especially apples, were produced in quantity.

Several cheese factories and creameries sprang up to serve the expanding dairy industry. Grist and saw mills as well as cotton and woollen mills began operating in Cornwall, a centre that rapidly increased in size. The industrial and agricultural progress of Stormont County has been closely linked with the development of the St. Lawrence River as a means of transportation to remunerative markets.

Present Agriculture and Land Use

Dairy cattle still provide the major part of the income of the farmers of the county. Much of the land is best suited for the pasture production that is so

Dairying is a favourite specialty of the farmers in Stormont County.

necessary for dairy farming. Many of the local cheese factories, however, have gone into disuse and the sale of fluid milk to condensories at Cornwall or to dairies at Montreal has become the important means of marketing.

There is some specialized farming. Some of the muck areas near Cornwall are used for market gardening. Orchard fruits, especially apples, are produced in the southern portion of the County along the St. Lawrence River.

Present Land Use (1951 Census)

	Acres	% Total
Total Land Area	263,680	100.0
Occupied Land	238,522	90.3
Improved cleared land	149,012	56.7
Unimproved cleared land	87,510	33.6
Including:		
Woodland	27,720	
Other	59,790	
No. of Farms	1,908	
Average Acres per farm	111	
Average Improved, Cleared Land Per Farm	70	

The utilization of the land in Stormont County is shown in Table 8 taken from 1941 Census.

TABLE 8

Utilization of Occupied Land According to Township (1941 Census)

Township	Improved Land				
	All Field Crops	Fallow	Orchard and Vineyard	Pasture	Total
Cornwall	24,071	52	2	4,880	29,889
Finch	28,014	166	...	12,856	42,115
Osnabruck	27,378	59	101	8,795	37,099
Roxborough	27,947	193	...	10,188	36,694
Indian Reserves	776	61	...	78	1,009
Total for County	108,186	531	103	36,797	149,806

Township	Unimproved Land			
	Woodland	Natural Pasture	Marsh and Wasteland	Total
Cornwall	7,090	19,418	3,162	29,670
Finch	1,908	4,825	1,123	7,856
Osnabruck	6,914	11,011	5,014	22,939
Roxborough	10,038	15,875	978	26,891
Indian Reserves	194	852	....	1,046
Total for County	26,144	51,981	10,277	88,402

The preceding tables indicate that dairy cattle and field crop production comprise the important agricultural endeavours of Stormont County.

Crop Adaptability Ratings and Land Use Management

Of the various factors that affect soil productivity, climate is one that cannot be altered. Fortunately, the climate of Stormont County is suitable for the production of a wide range of crops. In addition to such general farm crops as oats,

TABLE 9

ACREAGE OF DIFFERENT CROPS ACCORDING TO TOWNSHIP (1941 Census)

Township	Barley	Oats	Rye	Mixed or Other Grains	Cultivated Hay	Other Fodder Crops	Potatoes	Total
Cornwall	982	5,673	70	1,840	13,431	1,466	372	23,978
Finch	1,370	5,016	4	5,613	13,834	1,756	188	27,969
Osnabruck	728	4,942	19	5,147	14,471	1,619	241	27,312
Roxborough	1,205	9,009	31	1,588	14,317	1,328	237	27,879
Indian Reserves	13	95	—	11	605	27	23	776
Total for County	4,298	24,735	124	14,199	56,658	6,198	1,061	107,914

TABLE 10

NUMBER OF LIVESTOCK POPULATION ACCORDING TO TOWNSHIP (1941 Census)

Township	Horses	Cattle			Sheep	Swine	Poultry
		Total	Milch Cows	Beef Cows			(Hens and Chickens)
Cornwall	1,603	9,919	7,908	144	218	5,036	65,134
Finch	1,625	11,208	8,907	60	502	5,423	80,155
Osnabruck	1,455	9,129	7,172	43	515	4,886	122,441
Roxborough	1,642	10,863	8,860	36	384	4,343	79,957
Indian Reserves	84	360	237	—	39	125	857
Total for County	6,409	41,479	33,078	283	1,658	19,813	348,544

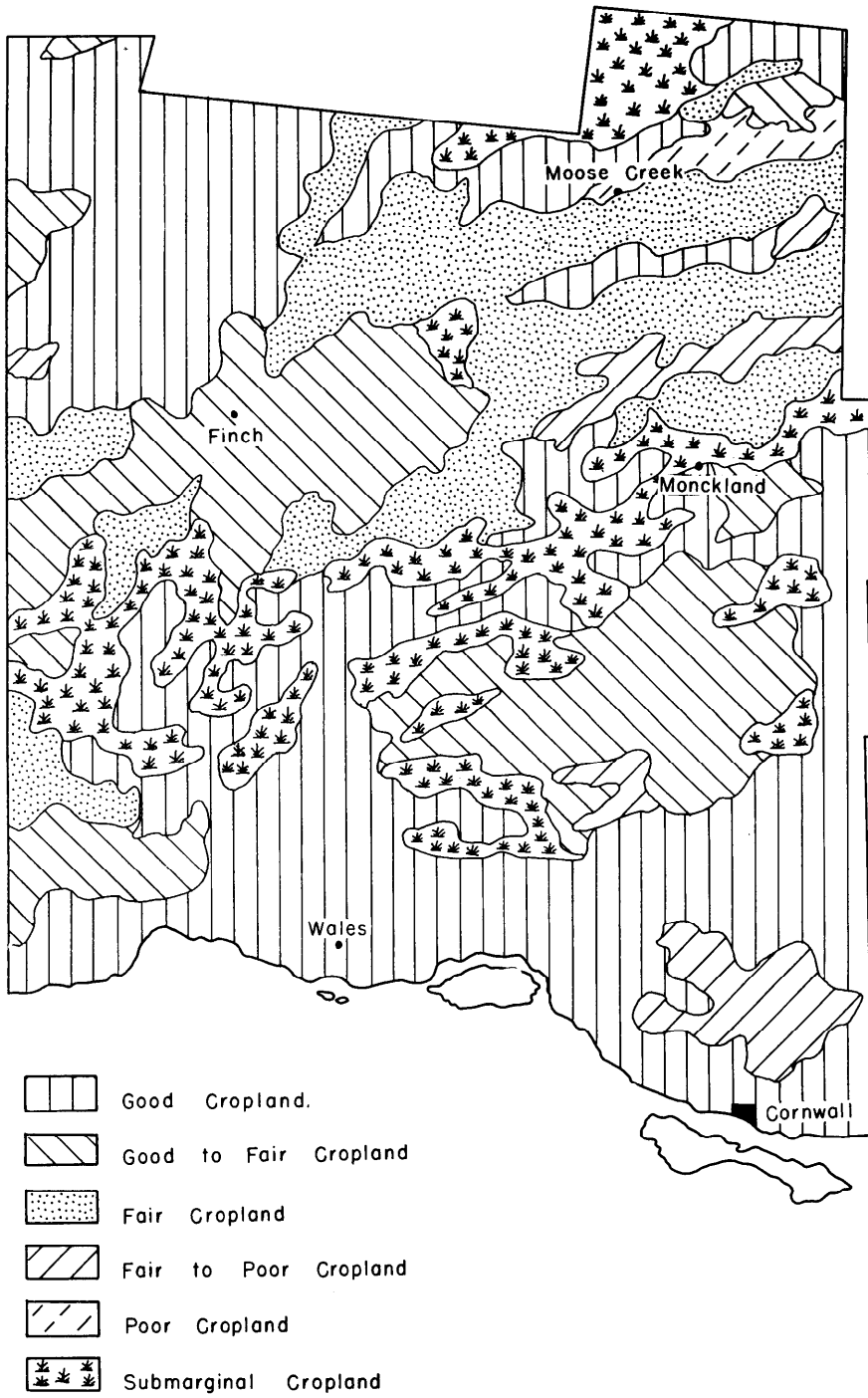


FIG. 10—Areas and distribution of soils of different crop adaptability groups in Stormont County.

barley, alfalfa, timothy, hay and pastures, specialized crops such as apples are produced in some areas. The successful production of any crop depends on the suitability of the soil to produce that crop. The simplest method of soil conservation and good land use management is the selection of crops that produce most efficiently and economically on the soil types available.

The potentialities and limitations of the soil types for crop production have been discussed in Part III. The comparative adaptability of individual soil types for selected crops grown in the area is a useful beginning for better land use management. The soil type is specific in character having more or less constant chemical and physical properties. Such features as topography, erodibility, and stoniness as well as organic matter content, texture, structure, reserve supply of nutrients and water are evaluated in determining the comparative adaptability of a soil for a certain type of crop production.

The limitations of such crop adaptability rating must be realized in the beginning. It is a theoretical rating based on a consideration of the natural fertility and productivity of the soil under the prevailing system of management in relation to the requirements of the crop concerned. The absolute rating of crop adaptability under specific management must be obtained from average yields over a significant number of years. The introduction of new varieties of crops, new management practices, market variations or other unforeseen factors may necessitate adjustments or changes in some of the ratings.

On the basis of the best information available from soil workers, agronomists, and farmers, as well as on observations made during the survey, the soils of the County have been arranged into six adaptability groups and rated for nine crops commonly grown in the area. Because of the marked influence that the amount of rainfall exerts on the adaptability of the soils of the area separate ratings are presented for a normal and a wet season.

Group I—Good Cropland

Soil Type	Acreage	% Total Acreage of County
Wolford clay loam	13,000	5.0
Carp clay loam	2,400	0.9
Eamer loam	26,400	10.0
Grenville loam	27,700	18.1
Osgoode loam	5,300	2.0
Osgoode silt loam	900	0.4
North Gower clay loam	26,600	10.0
Total	122,300	46.4

A large portion of Stormont County is classed as good cropland. The soils included in this group provide the most economical production of the common crops under the prevailing systems of management. The till soils of the group (Wolford, Eamer and Grenville) have a general disadvantage in that they are susceptible to erosion when brought under cultivation. The Eamer loam with its strongly undulating to gently rolling topography has the most serious erosion hazard. Normal good management, however, with adequate crop rotation on the steeper slopes suffices to stabilize the soil. Stones on the Eamer and Grenville loams may be so numerous that they must be removed to allow efficient cultivation.

The remainder of the soils of the group are stonefree, fine textured, and tend to be inadequately drained. The simple installation of open ditches and tile drains, however, allows good crop production in most seasons.

This group of soils has a naturally high fertility and organic matter content

TABLE 11

*CROP ADAPTABILITY RATINGS FOR GOOD CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Wolford clay loam	G	G-F	G	G-F	G	G-F	G	G-F	G	G	F	F-P	G	G	G	G-F	G	G
Carp clay loam	G	G-F	G	G-F	G	G-F	G	G-F	G	G	F	F-P	G	G	G-F	F	G	G
Eamer loam	G-F	G-F	G-F	G-F	G	G-F	G	G-F	G-F	G	F	F-P	G	G	G	G-F	G-F	G-F
Grenville loam	G-F	G-F	G-F	G-F	G-F	G-F	G	G-F	G-F	G	G-F	F	G	G	G	G-F	G-F	G-F
Osgoode loam	G	G-F	G	G-F	F	F-P	G-F	F	G	G	F	F-P	G	G-F	G-F	F	G	G
Osgoode silt loam	G	G-F	G	G-F	F	F-P	G-F	F	G	G	F	F-P	G	G-F	G-F	F	G	G
North Gower Clay loam	G	F	G	F	F-P	P	G-F	F	G	G	F-P	P	G-F	F	F	F-P	G	G

N.S.—Normal Season.

W.S.—Wet Season.

*Crop adaptability ratings for each soil type as follows:

G—Good; G-F—Good to Fair; F—Fair; F-P—Fair to Poor; P—Poor.

that can be easily maintained. Parcels of land that include both well drained and inadequately drained members of this group provide good returns for the operator who specializes in dairying.

Group II—Good to Fair Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Morrisburg clay loam	20,500	7.7	compacted subsoil
Manotick sandy loam	600	0.2	fertility
Matilda loam	4,600	1.7	drainage
Marionville fine sandy loam	500	0.2	drainage
Total	26,200	9.8	

The soils of Group II are lower in fertility than the soils of the previous group. The Manotick sandy loam, in particular, requires the addition of some commercial fertilizer and care in the conservation of organic matter for good crop production. Some attention must be paid to the compacted subsoil that tends to develop in the Morrisburg clay loam. The use of legumes and other deep rooted crops tends to break up the hardpan and thus to improve the moisture relationships of the soil. Improved drainage is necessary in the case of the last two soils of the group. In this respect, the Matilda loam has the disadvantage of being stony, a condition that makes drainage expensive and in some instances impractical.

The above limitations combine to increase the cost of crop production on the soils of the group thereby decreasing the net returns for the farmer.

Group III—Fair Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Kars gravelly sandy loam	19,100	7.2	fertility and erosion susceptibility
Mountain sandy loam	4,900	1.9	fertility and drainage
Uplands sandy loam	1,200	0.4	fertility
Rubicon sandy loam	4,200	1.6	fertility and drainage
Total	29,400	11.1	

The lack of fertility and adequate drainage is a rather serious hindrance to crop production. Hence, the soils of this group must be considered as only fair cropland.

All of these soils are coarse textured, generally of low fertility and lose organic matter rapidly under cultivation. The Kars soil type is developed on rolling topography and hence has an erosion problem on the slopes.

Special attention must be paid to organic matter maintenance on the soils of this group. Fortunately, the dairy type of farming in the area provides material for the above purpose. The Rubicon and Uplands soils often respond to applications of lime.

The soils are well suited to potato production and are useful for cereal grain production during wet seasons when the finer textured soils have too much moisture. On the average, the yields of general farm crops from this group of soils are only fair under the management practices in common use in the area.

TABLE 12

*CROP ADAPTABILITY RATINGS FOR GOOD TO FAIR CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Morrisburg clay loam	G-F	F	G-F	F	G-F	F	G-F	F	G	G	F-P	P	G-F	G-F	G-F	F	G	G
Manotick clay loam	G-F	F	F	F	G-F	F	F	F	G-F	G-F	G	G-F	F	F	G-F	F	G	G
Matilda loam	G-F	F	G-F	F	F	F	F-G	F	F-G	F-G	F	F-P	F	F	F	F-P	G	G-F
Marionville fine sandy loam	G-F	F	F	F	F	F-P	F	F-P	G	G-F	F-P	P	G-F	F	F	F-P	G	G

N.S.—Normal Season.
W.S.—Wet Season.
*Crop adaptability ratings for each soil type as follows:
G—Good; G-F—Good to Fair; F—Fair; F-P—Fair to Poor; P—Poor.

TABLE 13

*CROP ADAPTABILITY RATINGS FOR FAIR CROPLAND

Soil Type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Kars gravelly sandy loam	F	F	F	F	F	F	F-P	F-P	F	F	G-F	G-F	F-P	F-P	G-F	F-G	F-P	F-P
Mountain sandy loam	F	F	F	F	F	F-P	F	F-P	F	F	G-F	F	F	F	F	F	F	F
Uplands sandy loam	F-P	F	F-P	F	F-P	F	F-P	F	F	F	G	G-F	F-P	F	F	F-G	F-P	F
Rubicon sandy loam	F-P	F-P	F-P	F-P	P	P	P	P	F	F	F	F-P	F	F	F-P	P	F-P	F-P

N.S.—Normal Season.
W.S.—Wet Season.
*Crop adaptability ratings for each soil type as follows:
G—Good; G-F—Good to Fair; F—Fair; F-P—Fair to Poor; P—Poor.

Group IV—Fair to Poor Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Belmeade muck	1,500	0.6	drainage
Granby sandy loam	3,700	1.4	drainage and fertility
Rubicon sand	7,300	2.8	fertility and drainage
Lyons loam	1,300	0.5	drainage and fertility
Allendale sandy loam	8,200	3.1	drainage and fertility
Osnabruck clay loam	3,400	1.3	drainage
Total	25,400	9.7	

The soils of Group IV are moderately to poorly suited for the production of general farm crops. As a group, the lack of drainage is an important factor limiting the productivity of the soils. In the case of the lighter textured soils, when drainage has been improved, fertility becomes a limiting factor in production. The Lyons and Osnabruck soils have an added limitation—excessive stoniness that hinders attempts at artificial drainage as well as cultivation. The Belmeade muck soil has a deep organic layer that must be partially burned off and incorporated with the mineral soil for crop production. The above limitations and the cost of overcoming these limitations greatly increase the cost of production. Under the present system of management and at present agricultural prices, such soils must be classed as fair to poor cropland.

Group V—Poor Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Grenville loam (bouldery phase)	1,800	0.7	stoniness
Uplands sand	2,400	0.9	fertility and droughtiness
Farmington loam	500	0.2	shallowness
Granby sand	4,900	1.9	drainage and fertility
Total	9,600	3.7	

Fortunately, there is only a small acreage of poor cropland in Stormont County. Also, each unit area of such land is generally small and in association with better crop land. Wherever the soils of this group occur, however, they create a problem in land use.

The bouldery Grenville loam defies cultivation unless the stones are removed. This is an expensive procedure and so usually the soil is left for pasture production. The Uplands sand is low in fertility, and organic matter, and tends to be droughty. In many instances reforestation is a sound practice. The Farmington loam produces fair pasture but it tends to be droughty as a result of its shallowness. The Granby sand is limited by lack of drainage and fertility for general farm crops. It often approaches the submarginal class of cropland.

Group VI—Submarginal Cropland

Soil Type	Acreage	% Total Acreage of County	Chief Limitations
Bottom Land	15,700	6.0	drainage
Muck	35,100	13.3	drainage
Total	50,800	19.3	

TABLE 14

*CROP ADAPTABILITY RATINGS FOR FAIR TO POOR CROPLAND

Soil type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Belmeade muck	F	P	F	P	P	P	P	P	F	F-P	P	P	F-P	P	F-P	P	F	F
Granby sandy loam	F-P	P	P	P	P	P	P	P	F	F-P	P	P	F	F-P	F	F-P	F	F-P
Rubicon sand	P	P	P	P	P	P	P	P	F-P	F-P	F	F-P	F-P	F-P	F-P	P	F-P	F-P
Lyons loam	F-P	P	F-P	P	P	P	P	P	F-P	F-P	P	P	F-P	P	P	P	F-G	F
Allendale sandy loam	F-P	P	P	P	P	P	P	P	F	F	P	P	F	F-P	P	P	F	F
Osnabruck clay loam	P-F	P	P-F	P	P	P	P	P	P-F	P	P	P	P	P	P	P	F	F-P

N.S.—Normal Season.

W.S.—Wet Season.

*Crop adaptability ratings for each soil type as follows:

G—Good; G-F—Good to Fair; F—Fair; F-P—Fair to Poor; P—Poor.

TABLE 15

*CROP ADAPTABILITY RATINGS FOR POOR CROPLAND

Soil type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Grenville loam (bouldery phase)	P	P	P	P	F-P	F-P	F-P	F-P	F-P	F-P	P	P	P	P	P	P	F	F
Uplands sand	P	F-P	P	F-P	P	P	P	F-P	P	F-P	F	F	P	P	P	F-P	P	F-P
Farmington loam	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	F
Granby sand	P	P	P	P	P	P	P	P	P	P	P	P	F-P	P	P	P	F-P	P

N.S.—Normal Season.

W.S.—Wet Season

*Crop adaptability ratings for each soil type as follows:

G—Good; G-F—Good to Fair; F—Fair; F-P—Fair to Poor; P—Poor.

TABLE 16

*CROP ADAPTABILITY RATINGS FOR SUBMARGINAL CROPLAND

Soil type	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Fodder Corn		Permanent Pasture	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Bottom Land	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Muck	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

N.S.—Normal Season.

W.S.—Wet Season.

*Crop adaptability ratings for each soil type as follows:

G—Good; G-F—Good to Fair; F—Fair; F-P—Fair to Poor; P—Poor.

A relatively large proportion of Stormont County is classed as submarginal cropland. The large number of meandering streams have a large acreage of bottom land associated with them. This land is subject to flooding during periods of high rainfall. Hence, permanent pasture production is the best use that can be made of such land. The muck areas which make up 13.3 per cent of the area are not used for general farming. The cost of drainage improvement and provision of irrigation facilities for market gardening is so costly that commercial development of the muck soils will be confined to small and most favourably situated areas. The unimproved muck soils are of little agricultural value.

TABLE 17

SUMMARY OF CROP ADAPTABILITY GROUPS WITH ACREAGES AND CHIEF LIMITATIONS

	Acreage	% Total Acreage	Chief Limitations
Group I	122,300	46.4	
Group II	26,200	9.8	drainage compacted subsoil
Group III	29,400	11.1	fertility
Group IV	25,400	9.7	drainage, fertility
Group V	9,600	3.7	fertility, stoniness
Group VI	50,800	19.3	drainage
Total	263,700	100.0	

TABLE 18

*CROP ADAPTABILITY RATINGS FOR SELECTED CROPS FOR THE SOIL TYPES OF STORMONT COUNTY, ONTARIO

	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Corn Fodder		Permanent Pasture		General Suitability		Average Suitability	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Good Cropland:																						
Wolford clay loam	G	G-F	G	G-F	G	G-F	G	G-F	G	G	F	F-P	G	G	G	G-F	G	G	G	G-F	G	
Carp clay loam	G	G-F	G	G-F	G	G-F	G	G-F	G	G	F	F-P	G	G	G-F	F	G	G	G	G-F	G	
Eamer loam	G-F	G-F	G-F	G-F	G	G-F	G	G-F	G	G	F	F-P	G	G	F-G	F	G-F	G-F	G	G-F	G	
Grenville loam	G-F	G-F	G-F	G-F	G-F	G-F	G	G-F	G	G	G-F	F	G	G	G-F	F	G-F	G-F	G	G-F	G	
Osgoode loam	G	G-F	G	G-F	F	F-P	G-F	F	G	G	F	F-P	G	G-F	G-F	F	G	G	G	G-F	G	
Osgoode silt loam	G	G-F	G	G-F	F	F-P	G-F	F	G	G	F	F-P	G	G-F	G-F	F	G	G	G	G-F	G-F	
North Gower clay loam	G	F	G	F	F-P	P	G-F	F	G	G	F-P	P	G-F	F	F	F-P	G	G	G	G-F	G-F	
Good to Fair Cropland:																						
Morrisburg clay loam	G-F	F	G-F	F	G-F	F	G-F	F	G	G	F-P	P	G-F	G-F	G-F	F	G	G	G-F	F	G-F	
Manotick sandy loam	G-F	F	F	F	G-F	F	F	F	G-F	G-F	G	G-F	F	F	G-F	F	G	G	G-F	F	G-F	
Matilda loam	G-F	F	G-F	F	F	F	F-G	F	F-G	F-G	F	F-P	F	F	F	F-P	G	G-F	G-F	F	G-F	
Marionville fine sandy loam	G-F	F	F	F	F	F-P	F	F	G	G-F	F-P	P	G-F	F	F	F-P	G	G	G-F	F	G-F	
Fair Cropland:																						
Kars gravelly sandy loam	F	F	F	F	F	F	F-P	F-P	F	F	G-F	G-F	F-P	F-P	G-F	F-G	F-P	F	F	F	F	
Mountain sandy loam	F	F	F	F	F	F-P	F	F-P	F	F	G-F	F	F	F	F	F	F	F	F	F	F	
Uplands sandy loam	F-P	F	F-P	F	F-P	F	F-P	F	F	F	G	G-F	F-P	F	F	F-G	F-P	F	F-P	F	F	
Rubicon sandy loam	F-P	F-P	F-P	F-P	P	P	P	P	F	F	F	F-P	F	F	F-P	P	F-P	F-P	F-P	F-P	F-P	

	Oats		Barley		Alfalfa		Red Clover		Timothy		Potatoes		Buckwheat		Corn Fodder		Permanent Pasture		General Suitability		Average Suitability	
	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.	N.S.	W.S.
Fair to Poor Cropland:																						
Belmeade muck	F	P	F	P	P	P	P	P	F	F-P	P	P	F-P	P	F-P	P	F	F	F	F-P	F-P	
Granby sandy loam	F-P	P	P	P	P	P	P	P	F	F-P	P	P	F	F-P	F	F-P	F	F-P	F-P	P	F-P	
Rubicon sand	P	P	P	P	P	P	P	P	F-P	F-P	F	F-P	F-P	F-P	F-P	P	F-P	F-P	F-P	P	F-P	
Lyons loam	F-P	P	F-P	P	P	P	P	P	F-P	F-P	P	P	F-P	P	P	P	F-G	F	F-P	P	F-P	
Allendale sandy loam	F-P	P	P	P	P	P	P	P	F	F	P	P	F	F-P	P	P	F	F	F-P	P	F-P	
Osnabruck clay loam	P-F	P	P-F	P	P	P	P	P	P-F	P	P	P	P	P	P	P	F	F-P	P-F	P	P-F	
Poor Cropland:																						
Grenville loam (bouldery phase)	P	P	P	P	F-P	F-P	F-P	F-P	F-P	F-P	P	P	P	P	P	P	F	F	F-P	P	P-F	
Uplands sand	P	F-P	P	F-P	P	P	P	F-P	P	F-P	F	F	P	P	P	F-P	P	F-P	P	F-P	P-F	
Farmington loam	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	F	P	P	P	
Granby sand	P	P	P	P	P	P	P	P	P	P	P	P	F-P	P	P	P	F-P	P	P	P	P	
Submarginal Cropland:																						
Bottom Land	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
Muck	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	

N.S.—Normal Season.

W.S.—Wet Season.

*The Crop Adaptability rating for each soil type as follows:

Good—Good; G-F—Good to Fair; F—Fair; F-P—Fair to Poor; P—Poor.

APPENDIX TABLE 1

MECHANICAL ANALYSES, pH, CATION EXCHANGE CAPACITY AND ORGANIC MATTER CONTENT OF SURFACE SAMPLES FROM STORMONT COUNTY, ONTARIO (1)

Soil Type	Sample No.	Location			Sand	Silt	Clay	Reaction pH Glass Electrode	Cation Exchange Capacity m.e./100gms.	Organic Matter (2) % C x 1.724
					Bouyoucos Hydrometer					
		Township	Lot	Con.	Per Cent 1-.05mm.	Per Cent .05-.002mm.	Per Cent <.002mm.			
Allendale sandy loam	13	Finch	14	V	71.4	17.4	11.2	5.86	16.5	3.40
	18	Roxborough	35	VII	78.0	14.0	8.0	7.44	26.0	5.59
Carp clay loam	14	Finch	4	VI	28.2	43.0	28.8	5.28	23.0	3.83
Eamer loam	22	Cornwall	25	V	41.6	43.2	15.2	7.70	52.0	11.03
	23	Cornwall	31	IV	43.8	35.2	21.0	7.50	41.0	8.38
	25	Cornwall	9	VIII	36.8	43.0	20.2	6.51	52.6	11.30
	28	Cornwall	10	III	42.2	39.8	18.0	7.58	36.0	9.68
Grenville sandy loam	12	Roxborough	19	V	46.0	34.8	19.2	6.78	30.0	7.61
	21	Osnabruck	21	V	40.0	36.8	23.2	7.54	40.0	7.84
Grenville loam	24	Cornwall	24	VI	42.8	40.8	16.4	7.79	28.3	8.89
	29	Cornwall	33	VII	54.6	33.0	12.4	6.05	23.0	4.35
	30	Osnabruck	6	V	52.6	31.6	15.8	6.91	18.5	4.33
	31	Osnabruck	7	VI	56.4	30.0	13.6	6.36	20.2	4.14
	39	Cornwall	33	IX	41.6	36.2	22.2	6.81	36.0	8.88
Kars sandy loam	3	Osnabruck	16	VIII	44.0	36.0	20.0	7.53	30.5	5.86
	9	Roxborough	13	VII	65.6	20.8	13.6	5.34	25.0	5.21
	36	Roxborough	2	VI	74.4	14.8	10.8	5.48	13.2	3.55
Morrisburg clay loam	2	Osnabruck	18	III	29.0	37.0	34.0	6.71	40.0	7.98
	20	Osnabruck	33	II	41.0	36.2	22.8	7.86	36.0	6.27
	40	Roxborough	18	V	51.6	32.4	16.0	6.73	36.0	9.00
Mountain sandy loam	26	Cornwall	5	II	64.6	26.4	9.0	6.88	23.0	4.72

North Gower clay loam.....	6	Finch	7	IV	35.0	31.0	34.0	7.40	33.5	4.38
	15	Finch	6	VII	20.8	50.4	28.8	6.98	53.4	10.50
	17	Finch	18	IX	17.6	48.4	34.0	6.04	40.0	5.92
	27	Cornwall	2	III	18.0	57.6	34.4	6.12	38.0	6.70
	38	Osnabruck	8	II	31.6	34.4	34.0	5.35	31.4	7.52
Osgoode loam.....	4	Finch	10	I	57.6	23.4	19.0	7.73	54.0	8.22
Uplands sand.....	10	Roxborough	16	V	84.0	9.8	6.2	5.44	8.7	2.42
Uplands sandy loam.....	34	Cornwall	22	I	54.2	33.0	12.8	6.26	22.0	4.57
Wolford clay loam.....	7	Finch	24	III	46.2	34.2	19.6	7.10	36.0	5.08
	19	Osnabruck	27	II	43.2	35.6	21.2	7.68	33.0	5.78

(1) Samples were taken during the course of the Soil Survey in 1948. Old pastures representative of the type were selected whenever possible. The analyses were made by A. B. Olding.

(2) The organic carbon was determined by the chromic acid method described by Allison, L.E., "Organic Soil Carbon by Reduction of Chromic Acid"—Soil Science, Vol. 40, 1935, p. 311. The organic matter data was obtained by applying the factor 1.724 to the per cent of organic carbon.

APPENDIX TABLE 2

TOTAL ANALYSIS OF WOLFORD CLAY LOAM PROFILE A TYPICAL BROWN FOREST SOIL IN STORMONT COUNTY[1]

Horizon	Depth in Inches	pH	Nitrogen %	Loss on Ignition %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	CaO %	MgO %	K_2O %	Na_2O %	P_2O_5 %	$\frac{SiO_2}{Al_2O_3+Fe_2O_3}$
A_0	½– 0	6.6	0.77	22.43	53.86	10.37	4.25	3.05	1.31	1.60	1.76	0.27	7.0
A_1	0– 6	6.6	0.55	17.20	59.32	10.82	4.40	2.86	1.40	1.68	1.89	0.26	7.4
A_2	6– 9	6.8	0.16	6.26	66.76	13.53	5.18	2.32	1.64	1.88	1.98	0.23	6.7
B_1	9–16	7.5	0.13	7.00	64.80	14.35	5.34	4.19	1.80	1.84	1.66	0.35	6.2
B_2	16–19	7.7	0.13	9.90	58.36	12.27	4.59	9.22	1.68	2.00	1.93	0.35	6.5
C_1	19–22	7.8	0.08	9.97	56.58	12.16	4.26	10.81	1.52	1.96	2.30	0.28	6.5
C_2	22+	7.9	0.04	16.16	46.43	9.65	2.92	19.90	1.30	1.76	2.16	0.21	6.85

[1]Location of profile—Con. IX, Lot 4, Osnabruck Township, Stormont County