SOIL SURVEY

of

CUMBERLAND COUNTY

NOVA SCOTIA

by

G. B. WHITESIDE
Dominion Department of Agriculture,
Experimental Farms Service

and

R. E. WICKLUND and G. R. SMITH
Nova Scotia Department of Agriculture

REPORT No. 2—NOVA SCOTIA SOIL SURVEY
TRURO, N.S., OCTOBER, 1945

Experimental Farms Service
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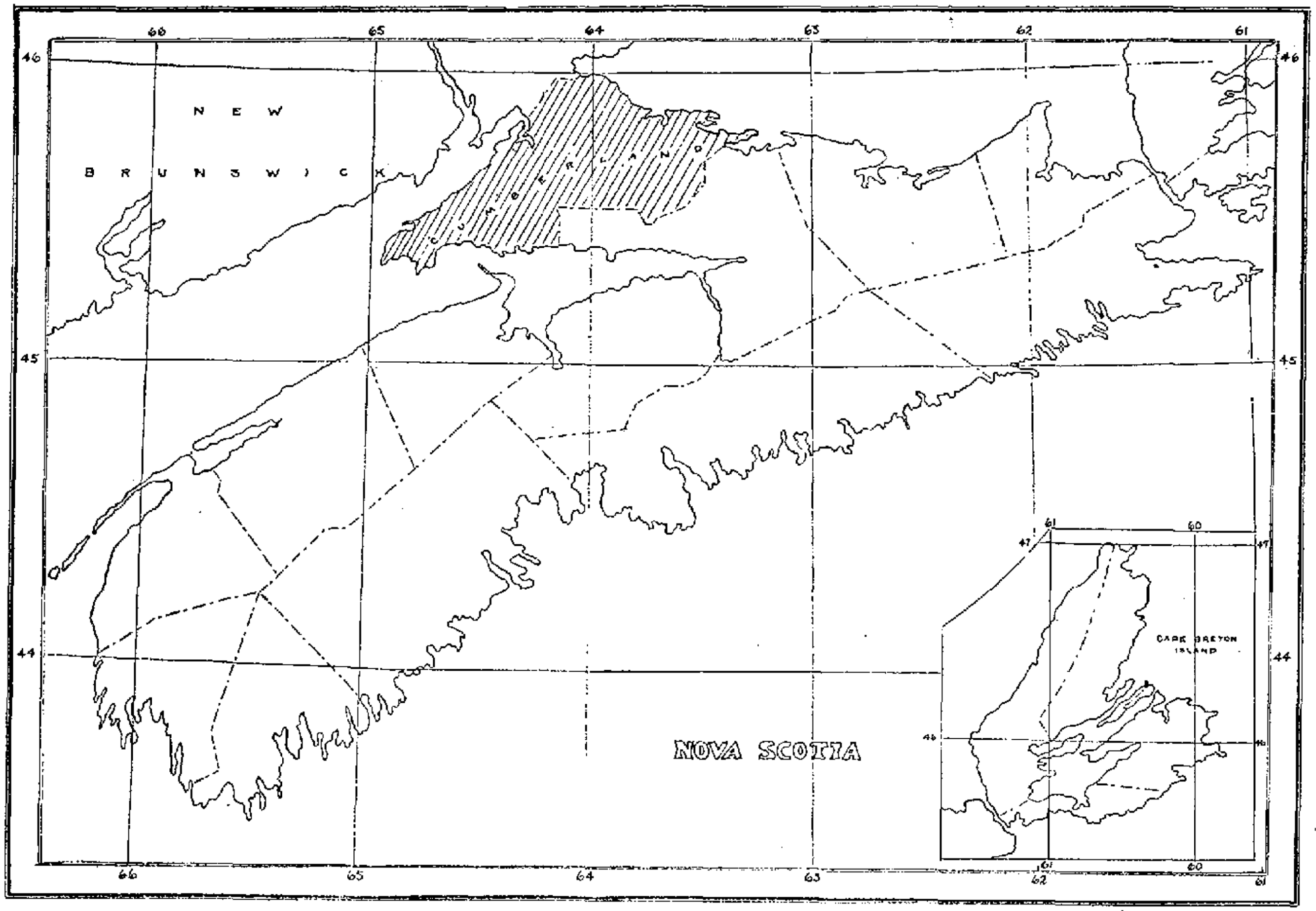

FIGURE 1. Sketch map showing location of Cumberland County, N.S.

INTRODUCTION

The effect which the variation in productive capacity of different soils has on the success and prosperity of an agricultural community has long been recognized. Problems of increasing concern are soil deterioration, uneconomic use of land and the need for soil conservation practices.

In order to obtain, as rapidly as possible, information concerning the nature of the soils of Cumberland county, their inherent characteristics and the relationship of these characteristics to crop production and land use, a soil survey was started in 1938 and continued in 1940. The results of this survey are presented in this report and the accompanying map. The report and map are designed to meet the needs of farmers, landowners, technical agricultural workers and others who may be interested in some particular area of land or district.

The report consists, primarily, of detailed descriptions of each soil mapped. Each description gives specific information by which the soil can be identified, such as colour, depth, texture, and nature of the rock material from which it has been derived. Topography, drainage, and amount of stone are also discussed as these factors are of practical significance in their effect upon the agricultural use of the soil. The relationship between the soil and crop production is also discussed, to indicate the type of farming practised, and what fertilizers and other soil management methods are needed to obtain the best results. As forest products are an important source of income to the farmers of the county, emphasis has been placed upon the suitability of certain soils for forest rather than for agricultural crops. For readers unfamiliar with the area a general description of the county is given in the first part of the report. The physiography, geology, regional drainage, climate and vegetation are discussed. A discussion of its history and population is also presented.

The soil map, which is an important feature of the report, shows the approximate location and extent of the different soils. In addition to the soil boundaries; roads, railroads, rivers, towns and most of the farm houses, which may serve as points of location, are shown. Each soil has been given a geographic name by which it may be identified either on the map or in the report.

The section on land use and soil rating gives a tentative land use classification and a comparison of the different soil types from the standpoint of their suitability for the main crops grown in the county.

For research workers and other technical men, detailed physical and chemical data are given in the appendix. The interpretation of these data is included in the general discussion of each soil type.

The information contained in this report and map will enable the farmer to compare his soil management practices and the productivity of his land with those of other farmers on land classified the same as his own. It will assist in the more widespread utilization of the information obtained from experimental work which has been conducted, by indicating, with reasonable assurance, where similar results can be expected. The information obtained in this survey should also be a valuable guide for further research and investigation which might be undertaken, in order to increase the productivity of the land, for the planning of efficient and economic land use and study of many soil problems.

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of

CUMBERLAND COUNTY, NOVA SCOTIA

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G. B. WHITESIDE[1], R. E. WICKLUND[2] AND G. R. SMITH[3]

GENERAL DESCRIPTION OF THE AREA

Location and Extent

Cumberland county, Nova Scotia, covers an area of approximately 1,683 square miles or 1,077,120 acres. It occupies the northwestern part of the province, lying between 63°10′ and 65°00′ west longitude, and between 45°15′ and 46°00′ north latitude.

Roughly triangular in shape, Cumberland county has approximately 150 miles of coast line. The coast line forms part of the northern boundary in the Northumberland Strait area, part of the southern boundary, along the Minas Basin and Minas Channel, and the western boundary, along the Chignecto Bay. The provincial boundary between Nova Scotia and New Brunswick, which extends across the Isthmus of Chignecto, also forms part of the county's northern boundary. In the east and for about 36 miles along the southern boundary Cumberland and Colchester counties meet.

Physiography and Geology

Cumberland county is characterized by three physiographic divisions: the range of uplands known as the Cobequid Mountains; the lowlands surrounding the Cobequid range, which to the north and west of the range are known as the Cumberland plain, and to the south forms part of the Minas Basin lowlands; and the tidal flats or salt marsh occurring around the coast and in river estuaries.

The Cobequid Mountains comprise a long, narrow range of highland, 8 or 10 miles wide, stretching for approximately 80 miles across the southern part of the county, from the head of the Bay of Fundy, in the west, to Folleigh or Folly in the east. This range, a remnant of the Atlantic upland, when viewed from the surrounding lowlands appears to be mountainous having bold steep sided flanks and a rugged uneven top. The ruggedness of the Cobequids is more apparent than real. While the flanks are fairly steep and in places precipitous the summits of the hills, which range from 850 to 1,000 feet in height are broad and rounded, forming a gently rolling surface of a more or less narrow dissected plateau. The highest peak in the county is Sugar Loaf Mountain, 1,020 feet high. The Cobequid range is composed mainly of crystalline rocks—granite, syenite, felsite and diorite—which are more resistant to weathering processes than are the softer rocks of the surrounding lowlands. The north and south flanks of this upland range are broken by numerous steep-sided ravines and passes. Two of the largest and most important of these passes are Folly Pass near Wentworth, and Halfway Lake or Parrsboro Pass, north of the town of Parrsboro.

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These passes are two of the outstanding physiographic features of the county. Parrsboro Pass is much larger than Folly Pass, being deeper and wider. While the original floors and sides of both passes are now covered by a heavy mantle of glacial drift in the form of kames and outwash gravels, it is interesting to note their floors are as wide at the summit as at both ends.[1] As a result of the blocking of the Folly gap by these thick masses of glacial gravels the floor of this pass, at its highest point, is occupied by a lake, some 200 acres in extent.[1]

Except for the two passes or valleys, which are covered by a deep surface mantle of water-deposited sands and gravels, the Cobequid Mountain area is covered by a relatively shallow deposit of glacial till or broken down rock material which is the product of the grinding and transporting action of ice. The till is usually stony throughout with many boulders over the surface and frequent rock outcrops. Since the till has not, as a rule, been moved very far from its source of origin the influence of the underlying rocks is often so marked as to suggest residual material rather than glacial till. Material such as this, which has been but feebly glaciated might well be classed "Glacio-residual".

The lowlands of Cumberland county occupy approximately 75 per cent of the total area. The topography of the Cumberland plain section is undulating to gently rolling, with an average elevation of about 200 feet. It is not however one uniform plain. Because of differential erosion of the original rock and to some extent the disturbances due to uplift, particularly in the area bordering the Cobequids, there is a noticeable variation in form and height. A close examination of the relief shows the area to consist of several broad valleys or depressions resembling what might be termed local plains, which are separated by long, flattened ridges. Towards the Northumberland Strait and Cumberland Basin the topography is fairly smooth, the ridges are lower and usually broader, with more gentle slopes than is the case closer to the Cobequids. Here the ridges are much higher, have steeper slopes and fairly narrow tops giving to this area a low hill type of topography. Some of the ridges are: Springhill, 610 feet and the Salem hills, 390 to 450 feet. The theory has been advanced that these ridges may have been the sites of local ice sheets during the Pleistocene period.[2]

The rock formations underlying and responsible for the formation of the lowland area are sedimentary, consisting of soft reddish sandstones and shales of the Permo-Carboniferous period, occurring mainly along the shores of the Northumberland Strait and Cumberland Basin; and the numerous sandstone, shale, conglomerate, limestone and gypsum beds of the Carboniferous periods which underlie the greater part of the area. These rocks are not all equally resistant to weathering, those of the Permo-Carboniferous and the rocks of the Upper and Lower Carboniferous periods are relatively soft and more easily eroded than the stronger millstone grit sandstone and its interbedded conglomerates of the middle Carboniferous. The core of many of the more prominent ridges is formed from the millstone grit sandstones, and as a general rule, has an east-west trend, corresponding to the trend or strike of the underlying strata.

In the southeastern corner of the county, between the Cobequid Mountains and Minas Basin, lies a narrow belt of lowland extending from Harrington River, where it forms part of the Minas Basin lowlands, to the vicinity of Parrsboro, where it merges with the Cumberland plain. The topography is rolling to hilly, consisting of strongly rolling slopes abutting the southern border of the Cobequids, and a series of fairly steep sided ridges or low hills along the Minas Basin shore. A level, gravelly outwash plain extends intermittently through the centre of the area.

Part of this section has been developed on Triassic sandstones and shales which occur now only as small patches along the shore. Sandstones and shales, presumably of the Lower Carboniferous period, also form part of the rock formations underlying this area. Some of the latter rocks have a close resemblance to similar rocks of the Devonian period.

The surface mantle covering the lowland areas is relatively thin, although on the whole thicker than is general for the Cobequid Mountain area. It consists of ground moraine till, some small areas of terminal moraine till, kame, esker and other outwash deposits, and recent stream alluvium. The glacial till ranges in texture from stony or sandy till to a fairly heavy clay, and in varying degree reflects the influence of the local bedrock. For instance, in the Amherst-Tidnish area the red colour of the Permo-Carboniferous rocks has been imparted to the soil mass. Whereas in the Port Greville-Kirkhill-Moose River region the relationship of the till to the bedrock is such as to suggest a glacio-residual soil. The till in the Joggins area exhibits some interesting features, such as, two distinct tills which are different in colour, one being grey-brown and the other brownish-red depending upon the kind of rock material associated with it. Boulders of coarse grained, igneous rocks resembling granodiorite or diorite were found embedded in the till. Several erratics of coarse grained, granitic rocks and some crystalline limestone have also been noted on the surface in this area. These features would suggest that the till has been partly influenced by rock material foreign to the region and that it may have been transported some considerable distance. Carbonaceous material or coal is frequently found in the lower subsoil and parent material of many of the soils. It occurs as a thin film on the face of the soil aggregates or as small particles ranging in size from a pin-head to a grain of wheat.

The terminal moraine deposits are not very prominent and occupy but a comparatively small area. The till is usually stony and porous, the stone consisting in a large measure of the local rock material. Even the water-laid deposits such as the kames, eskers and outwash gravels are poorly sorted. The materials composing them also are largely of local origin. This is very plainly seen in one of the remarkable topographical features of the county, namely, the gravel ridge or more correctly, the series of gravel ridges along the River Hebert, known as the "Boar's Back". The material forming these ridges ranges from some fairly fine textured, compact material resembling boulder clay to very coarse cobbles and boulders, practically all of which is of local Carboniferous sandstone origin, with a small admixture of rock material from other sources, such as the Cobequid Mountains.

Along many of the larger water courses alluvial deposits or "Intervales" occur. They are the result of seasonal floods or freshets which transport large volumes of sediment depositing it along the stream and river beds.

One of the most important of the physiographic divisions in the county, is the salt marsh or marine deposits. These marine deposits are found in the estuaries of some of the larger rivers and around the coast, particularly at the head of Cumberland Basin. Their development is due, in the Cumberland Basin area, to the extraordinary tides of the Bay of Fundy which carry in large volumes of sediment. This sediment was derived, mainly, from the disintegration of the Carboniferous and Triassic rocks of the surrounding uplands and underlying the Bay of Fundy region. In the Northumberland Strait sector the marsh lands are due to the wear and wastage of the adjacent land surface and rock formations which material has been transported mainly by rivers. Tidal action in this region is not so strong as in the Bay of Fundy. The relationship between geological formations and the soils of the county will be shown more fully in the discussion of the individual soils which follow later in the report.

Drainage

A fairly comprehensive network of rivers, streams and lakes has provided reasonably good external drainage facilities throughout the county. The general pattern of the drainage system shows a rough parallelism in the distribution of the larger rivers over the county. This has been influenced by the character of the topography and to some extent by the underlying rock strata. Owing to the nature of the topography the larger rivers flow either directly north or directly south. Those flowing north empty into the Northumberland Strait or into the Cumberland Basin, while the rivers flowing south have their outlets in the Minas Basin and Minas Channel.

Practically all the larger rivers of the county and most of the smaller ones draining the Cumberland Plain are tidal rivers. The effects of the tides carry as far as 5 to 10 miles up stream in the case of the four largest rivers but not extending much beyond the estuaries of the smaller rivers and those flowing into the Minas outlet.

The four largest rivers in the county flow northward across the Cumberland plain, and are the Maccan, Hebert, Wallace and Philip rivers. All have their headwaters in the Cobequid Mountains, some 10 to 30 miles south of their outlets. The drainage basin of the Maccan River, which is the largest of all, also includes the high ground around Springhill and Leicester. Another interesting feature of the Maccan River, especially at the spring tides, is the tidal "bore".

Owing to the comparatively smooth gradient across the Cumberland Plain practically all of the rivers and streams draining this area are relatively shallow and sluggish, except at the time of the spring freshets, and during seasonal floods following heavy rains. At such times they become rapid flowing and carry large quantities of sediment which when deposited along the streams and rivers goes to form the alluvial flats so important in the agriculture of the county.

The rivers flowing into the Minas Basin and Minas Channel traverse more rugged topography where the gradients are steeper and the distance from their headwaters to their outlets is shorter. Consequently they are faster flowing and have little or no alluvial sediments, along their beds. While there are numerous lakes throughout the county, especially in the Cobequid Mountain area, they do not contribute in any large measure to the general drainage of the county. Exception may be made perhaps to the two largest lakes, namely, Halfway Lake, which is associated with the Hebert and Maccan river systems, and Folly Lake at the headwaters of the Wallace River.

The natural drainage conditions of the soils of the county are largely influenced by three local factors; topography, depth to bedrock and texture of the parent material. Soils situated on undulating to rolling topography, particularly in the southern section of the county, are, as a rule, well drained. In some cases drainage may be excessive. However where clay till is present drainage, even on rolling topography, may be restricted. While surface drainage may be adequate the compacted clay subsoils tend to restrict the downward movement of water causing lateral seepage and temporary poor internal drainage conditions. Soils developed over the lighter textured parent material, even on the smoother topography in the northern part of the county, are usually well drained. Frequently however drainage conditions on the flatter land tend to be imperfect to poor, especially where the underlying till consists of compacted clay.

In some sections of the county where the bedrock lies close to the surface drainage conditions are often unsatisfactory. The bedrock influences internal drainage in much the same manner as the compacted clay till. It often restricts the downward movement causing seepage places and a springy condition of the soil.

Numerous swamps, muck and peat deposits occur on the flat topography and in many of the depressions associated with the rolling topography, where there are apparently no free drainage outlets.

Climate

The climate of Cumberland county is humid-temperate, with short cool summers and long moderately cold winters. Extremes in temperature seldom occur. The highest and lowest monthly means recorded (Table 2) for the area are 84·5°F, at Springhill and —16·4°F, at Nappan. Even on the hottest days of summer the temperature invariably drops towards evening so that the nights as a rule are cool. Wind movement is moderate, gales sometimes occur but the average wind velocity is around 6 m.p.h. in summer and 10 m.p.h. in winter. The prevailing winds are westerly and northwesterly in the winter months and south to southwesterly during the summer months.

The occurrence in some years of cold water currents and floating ice late in the spring, in the Northumberland Strait, particularly, tends to make the seasons later in the adjacent areas than the mean monthly temperatures would indicate.

Humidity is relatively high with an abundance of moisture most of the time, the climate generally being largely influenced by the precipitation. Fogs are not uncommon around the coast in the spring and autumn. They are more prevalent over the southwestern area, bordering the Minas Channel coast.

Tables 1 to 3 give the meteorological data for three stations in the area surveyed, namely, Nappan, Springhill and Parrsboro, and one station just outside the area, at Sackville, New Brunswick. These data were compiled and supplied by the Dominion Meteorological Branch.

TABLE 1.—PRECIPITATION DATA

Month	Sackville, N.B.		Nappan, N.S.		Springhill, N.S.		Parrsboro, N.S.	
	Total Precipitation	Snowfall	Total Precipitation	Snowfall	Total Precipitation	Snowfall	Total Precipitation	Snowfall
	inches	inches	inches	inches	inches	inches	inches	inches
December	3·53	15·0	3·90	17·8	3·78	15·4	3·75	14·5
January	2·56	14·3	3·32	16·9	3·65	14·9	3·92	16·2
February	2·57	20·2	2·74	17·9	2·30	14·1	2·98	17·4
Winter	8·66	49·5	9·96	52·6	9·73	44·4	10·65	48·1
March	2·36	13·2	3·84	12·5	3·20	9·8	3·55	11·6
April	2·43	6·4	2·64	5·8	2·89	6·0	3·13	4·6
May	3·12	Trace	2·30	0·2	2·71	0·2	2·51	0·1
Spring	7·91	19·6	8·78	18·5	8·80	16·0	9·19	16·3
June	3·36	....	3·02	....	2·70	....	3·35	....
July	2·18	....	2·70	....	2·56	....	2·78	....
August	2·62	....	3·18	....	4·23	....	3·56	....
Summer	8·16	....	8·90	....	9·49	....	9·69	....
September	3·95	Trace	3·18	....	3·88	....	3·23	....
October	3·91	0·1	3·95	Trace	4·11	0·1	4·11	0·3
November	4·37	5·6	3·59	5·6	3·74	6·5	3·88	4·0
Autumn	12·23	5·7	10·72	5·6	11·73	6·6	11·22	4·3
Year	39·96	74·8	38·36	76·7	39·75	67·0	40·75	68·7

Unfortunately there are no records available for the Cobequid Mountain area so that it is not possible to compare the local conditions of the lowland areas with those of the upland area. While the records at Springhill give some indication of the effects of elevation and location on local climate it is interesting to note that the variations generally are progressive from north (Nappan) to south (Parrsboro).

TABLE 2.—TEMPERATURE DATA

Month	1934–1939 Sackville, N.B.					1913–1938 Nappan, N.S.					1918–1929 Springhill, N.S.					1897–1938 Parrsboro, N.S.				
	Mean	Mean daily Maximum	Mean daily Minimum	Mean monthly Maximum	Mean monthly Minimum	Mean	Mean daily Maximum	Mean daily Minimum	Mean monthly Maximum	Mean monthly Minimum	Mean	Mean daily Maximum	Mean daily Minimum	Mean monthly Maximum	Mean monthly Minimum	Mean	Mean daily Maximum	Mean daily Minimum	Mean monthly Maximum	Mean monthly Minimum
December	22·8	30·3	15·4	51·5	− 7·0	22·7	29·6	15·9	51·0	− 7·0	21·8	29·2	14·5	50·7	− 5·5	23·6	32·4	14·8	52·3	− 7·6
January	18·8	27·3	10·4	47·8	− 9·8	17·6	26·1	·1	48·1	−15·9	16·7	26·5	6·9	47·7	−14·9	19·0	29·3	8·7	48·8	−15·4
February	17·8	26·0	9·6	44·8	−11·8	18·8	29·6	8·0	44·3	−16·4	16·4	24·7	9·1	42·5	− 8·0	18·1	28·2	8·1	43·8	−14·9
Winter	19·8	27·9	11·8	......	......	19·7	28·4	11·0	......	......	18·3	26·8	10·2	......	......	20·2	29·9	10·5	......	......
March	26·6	34·2	19·0	48·8	23·7	26·7	35·1	18·4	52·3	− 5·3	27·5	36·0	19·0	52·6	− 0·2	27·4	35·9	18·9	49·9	− 3·6
April	38·2	45·9	30·6	64·3	17·2	37·8	45·8	29·8	63·6	15·7	37·0	45·2	28·8	62·7	14·4	37·8	46·7	29·0	62·4	14·7
May	48·8	58·5	39·2	73·8	28·5	48·5	58·7	38·4	75·2	25·9	49·1	59·3	39·0	76·1	27·7	47·4	58·4	36·5	73·1	23·6
Spring	37·5	46·2	29·6	......	......	37·6	46·5	29·2	......	......	37·8	48·8	28·9	......	......	37·5	47·0	28·1	......	......
June	59·0	69·1	48·9	81·5	37·2	58·4	68·9	47·9	81·4	33·9	58·4	68·9	47·9	81·3	36·5	56·5	67·4	45·6	78·9	32·0
July	64·6	74·6	54·6	83·3	45·8	64·3	74·6	54·0	83·6	40·3	64·9	74·5	55·4	84·5	44·2	63·0	73·9	52·0	83·2	39·1
August	65·2	75·4	55·0	86·0	42·0	63·3	73·8	52·9	83·8	39·3	62·7	72·1	53·3	82·3	44·0	61·5	72·1	51·0	81·2	38·1
Summer	62·9	73·0	52·8	......	......	62·0	72·4	51·6	......	......	62·0	71·8	52·2	......	......	60·3	71·1	49·5	......	......
September	57·2	66·6	47·9	77·3	34·3	56·2	66·2	46·3	78·8	30·9	56·2	65·4	47·1	77·9	33·4	55·6	65·9	45·1	76·4	30·2
October	46·2	54·9	37·6	67·2	23·3	46·9	55·7	38·2	71·5	22·7	47·8	56·0	39·2	71·0	24·2	46·0	56·1	35·9	68·6	21·7
November	36·0	43·7	28·3	60·3	12·8	35·4	42·4	28·5	60·7	9·3	34·3	41·4	27·2	61·4	9·5	35·8	44·2	27·4	60·7	10·6
Autumn	46·5	55·1	37·9	......	......	46·2	54·7	37·6	......	......	46·0	54·3	37·8	......	......	45·8	55·4	36·1	......	......
Year	41·7	50·5	33·0	86·0	−11·8	41·4	50·5	32·3	83·8	−16·4	41·0	49·9	32·3	84·5	−14·9	40·9	50·8	31·0	83·2	−15·4

The mean annual precipitation for the county, as indicated by the records of the three stations, is around 39·4 inches, of which approximately 7 inches is supplied in the form of snowfall. It is fairly evenly distributed throughout the year, the average monthly total precipitation is about 3·3 inches, ranging from 2·5 inches in May to 4·1 inches in October; the autumn months having the highest amount of precipitation, about 11 inches, which is mainly rainfall.

During the winter months snowfall is responsible for about 50 per cent of the total precipitation. The average snowfall for the three months, December to February, is 48·7 inches. Variations in the distribution of the precipitation over the area surveyed are relatively small as shown in Table 1. The highest annual amount is recorded at Parrsboro, 40·7 inches. This may be explained by the fact that Parrsboro is situated in a fairly narrow belt of lowland between the Cobequid Mountains and Minas Basin where the increased precipitation is probably due to condensation of the warm, moist air off the Bay of Fundy meeting the cooler air currents off the Cobequids. But it should be noted that the wettest month has been recorded in August at Springhill, with a rainfall of 4·2 inches. It will also be seen that while Springhill is situated at an elevation of 600 feet and at about the centre of the county, it has a lower annual snowfall, 67·0 inches, than has Nappan, which is situated near the head of Cumberland Basin at an altitude of 100 feet. Here the snowfall is about 77 inches.

In Table 2 the daily, monthly, seasonal and yearly temperature records are given. These data show the mean annual temperature to be about 41°F. Although there is a fairly wide seasonal range in temperature from 19·4°F. during the winter months to 61·4°F. for the summer months extreme temperatures are seldom severe. The highest and lowest are 84·5°F. in July and —16·4°F. in January.

The small variations in temperature at the three stations, as shown by the yearly means of 41·4°F. at Nappan, 41·0°F. at Springhill, and 40·9°F. at Parrsboro would indicate a fairly uniform temperature for the county, but rapid fluctuations of 25 to 30 degrees within 24 or 48 hours do occur.

Various factors will tend to modify the length of actual growing season in an area. One of these factors is the length of the frost-free period, which as shown in Table 3 varies for the different sections of the county. Springhill has the longest average frost-free period, 140 days and Parrsboro the shortest, 109 days. It will be noted that while the frost-free period at Nappan is only

TABLE 3.—FROST DATA

Station		Late Frost			Early Frost			Number of Days	
		Month	Day	Day of Year	Month	Day	Day of Year	Frost	Free Period
Nappan, N.S.— 1913–1940	Average	May	28	148	Sept.	21	264	116	Average
	Earliest	May	8	128	Aug.	28	240	68	Shortest
	Latest	June	21	172	Oct.	17	290	162	Longest
Springhill, N.S.— 1918–1929	Average	May	21	141	Oct.	8	281	140	Average
	Earliest	May	10	130	Sept.	21	264	114	Shortest
	Latest	May	30	150	Oct.	31	304	174	Longest
Parrsboro, N.S.— 1897–1940	Average	June	2	153	Sept.	19	262	109	Average
	Earliest	May	13	133	Aug.	2	214	42	Shortest
	Latest	June	21	172	Oct.	21	294	161	Longest
Sackville, N.B.— 1934–1940	Average	May	18	138	Oct.	2	275	137	Average
	Earliest	May	6	126	Sept.	24	267	118	Shortest
	Latest	May	29	149	Oct.	7	280	154	Longest

7 days longer than at Parrsboro it is considerably shorter than at Sackville, New Brunswick, where it is 137 days.

The data of the latest spring frost and the earliest fall frost recorded are, June 21 at Nappan and August 2 at Parrsboro, respectively.

Vegetation

It is well recognized that climate is the principal agent responsible for the type of natural vegetation dominant in a given region. The climate of Cumberland county, and of Nova Scotia generally, favours a forest type of vegetation, particularly conifers.

Owing to the unregulated activities of man there is very little, if any, of the original tree growth standing. The indiscriminate clearing of the land by the early settlers and the exploitation of the forest by the lumbering industry have destroyed the virgin forest so that the present stands consist of second growth and younger aged trees.

Approximately 70 to 75 per cent of the county is still covered by natural vegetation which can be roughly divided into five classes:—mixed conifer—hardwood association, about 40 per cent; conifer around 10 per cent; pure hardwoods about 3 per cent; barrens or burned over areas approximately 20 per cent;[10] and treeless bogs and swamps, of which there are about 5,000 acres.[11]

The local distribution of individual species and combinations of species is largely influenced by the local geological formations; drainage conditions; the soil, its texture and depth; and by the activities of man.

While it was noted that certain species of trees are more or less prevalent on certain types of soil and in certain areas, it would be difficult to assign any definite species or species combination boundaries. It was noted that as a rule the more luxuriant stands of hardwoods were most frequently found on the well drained soils associated with the igneous rocks of the Cobequid Mountain area. Further observations indicated that the hardwoods were more prevalent on the northern slopes where the soils are gravelly and fairly deep. They form a large proportion of the mixed woods of the lower slopes. These mixed wood associations usually consist of yellow birch, red spruce, hard or sugar maple, hemlock, wire birch, also some balsam fir and red maple. Higher up the slopes the hardwoods predominate, in some cases forming comparatively pure stands of yellow birch, sugar maple and beech. In the narrow valleys, depressions and basins the conifers predominate.

On the southern slope, where the soils tend to be shallower, the mixed associations are similar to those on the north side in the species comprising them but the conifers appear to predominate, especially in the wider valleys. On the crests of the lower ridges, especially on the deeper, porous soils the hardwood are dominant. At the western end of the Cobequids, north of Advocate, red spruce is the dominant species.

On the well drained soils associated with the Carboniferous sandstones and shales, of the lowland area, the forest growth is mainly coniferous. While there are some small blocks of almost pure hardwood stands and some fairly large areas of mixed woods, red spruce, hemlock and some larch predominate, particularly where drainage tends to be imperfect. Stands of red pine and jack pine are found on the more gravelly and porous soils of the outwash terraces or associated with the coarser conglomerate rocks.

Where the soils are poorly drained, black spruce, tamarack or larch and white birch are the dominant species although some red spruce, also some red maple have been found in such places. In the lowland section north of the Cobequids there are some extensive tracts of more or less barrens. These barrens are largely the results of large forest fires which have apparently not only burned deeply into the soil, destroying all the original organic matter, and sterilizing the soil but have also practically denuded these burned areas of seed trees, hence the slow regeneration and barrens condition. Unfavourable soil conditions, such as very poor drainage, or on the other hand excessive drainage may result in barrens.

The two largest areas of barrens occur in the western and central sections of the county. One extends in a northeasterly direction from Harrison Settlement to the Springhill-Black River area and the second runs from the vicinity of Oxford, in a southwesterly direction to Greenville. There are a number of smaller areas around Joggins, north of Warren and in the Leicester-Shinimicas area.

These barrens, on the well drained, sandy soils, are mainly covered with a scattered and scrubby growth of white birch, aspen, wire birch and some jack pine, with a ground cover of blueberries, sweet-fern, bracken fern, sheep laurel, labrador tea, and haircap moss. On the heavy clay soils where drainage conditions are unfavourable, such as around Joggins, the old fire barrens are populated by poplar, alder, paper birch, red maple with some red spruce and fir.

The length of time required before the barrens become productive forest areas again will depend upon the severity of the burning, whether all seed trees in the area have been destroyed and upon the soil conditions.

Throughout the area there are a number of treeless and near treeless bogs and swamps. The natural vegetation of these areas is principally sphagnum mosses, carex, labrador tea, pitcher plant, and rhodora. Occasionally some stunted black spruce, tamarack and white birch may occur in small numbers.

While the climax vegetation for the county as a whole is forest there is one important exception, namely the salt marsh or dykeland areas. Here the natural vegetation is grass. The most common species of natural grass on the marsh areas is *Spartina stricta* or *Alterni flora*, commonly known as "broadleaf". Other natural species are *Spartina juncea* (fox grass), and *Juncus gerardii* (black grass). When drained and brought under cultivation these natural grasses are replaced by what is known as English hay, namely, timothy, alsike and red clover.

The type of vegetative cover occupying an area is often used as an indicator of the kind of soil that may be found in such areas. This may be of value in regions where the forest is composed of virgin stands, but in an area such as Cumberland county, where extensive lumbering operations, long-time agricultural settlement and forest fires have all taken their toll through severe culling or complete destruction, too much emphasis on vegetative covering as a guide to soil conditions may prove very misleading. This is well illustrated by conditions observed in many abandoned agricultural or cleared areas that are now reverting to forest growth. It was noted for instance, in an area south of Williamsdale, that an area of open fields (old pasture area) was surrounded by a young or second growth of sugar maple, beech and yellow birch which was itself surrounded by a dense growth of red spruce and other conifers. Whereas in some other areas of abandoned clearings white spruce was the dominant growth and in other places alder and even larch were rapidly invading these former grasslands, even though the natural drainage was well established.

History and Population

Cumberland county is one of the leading agricultural and lumbering counties in the Province of Nova Scotia. It has varied natural resources with which to encourage settlement; fisheries, forest, mineral and a relatively large area of potential agricultural land. Like most counties in the Province it has experienced fluctuating periods of prosperity and depression which have been influenced by the historical background and economic trends.

The county capital, Amherst, has a population of about 8,500 people. It is situated in one of the best agricultural districts of the Province, and is located on the headwaters of the Bay of Fundy about 5 miles from the provincial boundary. Amherst is on the main line of the Canadian National Railway; it is also the focal point where provincial highways Nos. 2, 4 and 6 meet to join the inter-provincial highway running to New Brunswick.

Two other important centres in the county are Springhill, a coal mining town of about 7,000 population, and Oxford, with a population of around 1,300. Oxford is one of the main centres of the important lumbering industry in the county.

The earliest white settlers were French adventurers and pioneers. In 1605, and later, they followed the French fishermen and traders who for some years previous had been familiar with the shores of Nova Scotia. The first organized white settlement in what is now Cumberland county was established at Beau Basin in the year 1696.

By the year 1746 many French families were established in the Beau Basin district, the total white population of all Acadia, at that time, numbered about 10,000 people. The population continued to be largely French until 1755 when the historic expulsion of the Acadians took place. For the next five or six years (1755-1760) the territory was practically without a white population except for the British garrisons at Forts Cumberland and Lawrence. About the year 1760 civil settlement of the county was renewed by the arrival of colonists from the New England States, to settle in the Chignecto Isthmus area.

In the year 1759 the township of Cumberland was formed, and by 1763 the Chignecto settlements consisted of three townships, Amherst, Cumberland and Sackville. Census figures for 1763 show 35 families at Fort Lawrence and 30 families at Fort Cumberland, with a total white population in the whole Province of 13,000 people. Settlements were established at Pugwash, Wallace and Fox Harbour in 1812, and the settlement of Parrsboro, which formerly formed part of King's county, was added to Cumberland county in 1840. The Parrsboro or Partridge Island settlement, as it was then called, was established in 1775. Parrsboro, even in those early days, was an important settlement as it was situated on the only road between Fort Cumberland and Halifax; it was also the northern terminus for the ferry across the Bay of Fundy to Windsor, Hants county, opened 1776. New England emigrants made up about two-thirds of the population by 1775. Settlement was slow, land speculation by favoured parties had been a damper on progress. With the improvement of settlement and land tenure laws emigration from the New England Colonies and the British Isles increased. The influx of United Empire Loyalists gave a marked impetus to settlement. By the year 1871 the population of the county had increased to 23,818. The numbers increased steadily until 1921 when there were 41,191 persons in the county. During the past twenty years the population has shown some fluctuation, decreasing between 1921 and 1931, due largely to the migration of young people, after World War I to the industrial centres of Central Canada and the United States. The depression of the 1930's and the resulting lack of industrial employment caused the rate of migration to slacken and the last ten years has seen a tendency for the population to increase, as shown by the 1941 census of 38,872.

The early settlers were located along the shores and river estuaries where the relatively large areas of level, treeless alluvial soils occurred and because the waterways offered the only means of transportation and communication. There were no carriage roads in the county until late in the 18th century.

Very little attempt was made at clearing and farming the forested, interior upland. Fishing and a self-sufficient type of farming was the source of livelihood of the early French settlers, and surplus products were traded to the garrisons at the forts. Although the accessibility of the alluvial flats made the establishing of farmsteads easier than if the pioneers had been compelled to clear the forest land, life was hard, the standards of living, until after the Revolution at least, were precarious and low. It was not until after the re-settlement by British stock from New England and the British Isles that much progress was made in the development of the county. While the cultivation of the land formed an essential background for such a development the fishery and forest resources were developed more rapidly than the agricultural resources. Even to-day agriculture in many sections of the county is only a part-time occupation.

TABLE 4.—POPULATION DATA FOR CUMBERLAND COUNTY(1)

—	1871	1881	1891	1901	1911	1921	1931	1941
Total Population	23,508	27,368	34,529	36,168	40,543	41,191	36,366	38,872
Urban Population	....	2,274	10,503	12,846	18,934	21,561	17,857	19,944
Rural Population	23,518	25,094	24,026	23,322	21,609	19,630	18,509	18,928
Population on Farms(*)	....	....	....	....	....	....	12,150	....
Percent of Rural Population(*)	....	....	....	....	....	....	33·4	....
Number of Farms (2)	3,223	3,894	4,248	3,820	3,784	3,339	2,806	2,596

(1) Dominion of Canada Census 1941.
(2) Includes lots under 5 acres.
(*) Data not available except for 1931.

The forests of Cumberland county have contributed in a large measure to its development and wealth. The first important use of the forest resources was in connection with supplies for the navies of France and Britain and later for shipbuilding generally—first, materials for British shipyards and then for the growing new industry in Nova Scotia; Nappan and Parrsboro were two important shipbuilding centres in the county around 1860. By the year 1871 the supplying of shipbuilding material had given place to the production of boards, deals and logs for the wider lumbering trade. Many millions of board feet of lumber have been taken from the forests of the county. With the unrestricted exploitations of the virgin forest the stands of white and red spruce, red pine, yellow birch and maple have been depleted in many sections. Fir and spruce have taken their place and the forest products in many of these areas consist of pit props and pulpwood. Where a reasonable system of management was observed the forest remains a source of potential wealth.

Among its mineral resources Cumberland county has counted iron, copper and coal. Copper was mined by the Acadians, the largest deposits were mined at Cape D'or. The outstanding mineral resource has been coal. This was first noted in the county in 1764 but the first mention of mining it was in 1866 in the Joggins area. Two years later $1,438 was invested in exploring coal deposits at Springhill. Both of these areas have been important factors in the economic development of the county and are still in production. Other coal mines were located at River Hebert and Maccan.

The quarrying of building stone and millstone, was for many years a thriving industry. This industry was operating as early as 1776 and the quarries at Wallace still provide occasional employment to a limited number of men.

In the Malagash Peninsular area, salt in the form of rock salt and in solution, has been mined for a good many years. About the middle of the 19th century Amherst, the county town, and Oxford began to develop as industrial and manufacturing centres. Lumber mills, foundries, engineering works, car shops, and boot and shoe factory are among the major industries that were located in Amherst. At Oxford are a foundry, furniture factory and a woollen mill, the latter having been in operation since 1867.

Transportation facilities over most of the county are fairly good; with the exception of the extreme western section and in the Cobequid Mountain region there is a network of well kept roads, many miles of which are hard-surfaced. Most of the main agricultural section is within 10 to 20 miles of a shipping point, either on the main line of the Canadian National Railroad, which was first laid down as the Intercolonial Railroad about 1868, or on a branch line running from Oxford Junction, through Oxford and Wallace to Pictou in Pictou county. In 1873 the building of a company railroad was started, by the mining company, from Springhill to Parrsboro to facilitate the export of coal by water. Harbours are maintained at Pugwash, Sand River, Advocate and Parrsboro providing the lumber industry with excellent water transportation facilities. A company dock at Malagash is maintained by the salt mining company.

Agriculture

Agriculture in Cumberland county is diversified, varying in character from a part-time lumbering-farming type to those farms specializing in the production of fluid milk. It is on the whole based on a mixed-farming type of business. The average size of farm is about 153 acres with approximately 42 acres or 28 per cent of improved land, 85 acres or 62 per cent in woodland and around 19 acres in rough pasture[1]. Table 8 gives the acreage and condition of the land in the county in 1931, and shows the acreage under all field crops on 2,806 farms to be 79,983 acres. The 1941 census figures show a decrease in both the number of farms, 2,596, and the acres under all field crops, 75,706.

The early history of agriculture in the county shows that up to the year 1755 it was centred mainly around the marshlands. It was of a primitive subsistence type concerned chiefly with the growing of such crops as wheat, rye, beans, pumpkins and potatoes for home consumption.

The outstanding contribution of the Acadian settlers to the agricultural development of the county was the reclamation of marshland and the legacy of the knowledge of dyke building, and repairing, and marshland management.

With the re-settlement of the area by the New England and British colonists, after 1760, more attention was given to the clearing and farming of the forested uplands. This was probably due to the natural tendency of the settlers to follow the practices common to the territories from which they emigrated, and in part, to the fact the marshlands were in disrepair due to damage by severe storms in 1759 also to the new settlers' lack of knowledge and skill in repairing and building the dykes; a task that was not accomplished until after the return of some of the Acadians around 1761.

During the next sixty years farming was of a subsistence type providing food for the farm family and seasonal occupation in the slack periods of fishing and lumbering. The acreage under cultivation was small; figures for 1762 give the total acreage for the Province as around 14,000 acres. It was not until about 1818-1820 that much improvement in farm practices occurred. About this time agricultural societies were formed; Cumberland Agricultural Society 1818 and Parrsboro Farming Society, 1819, being among the first.[8] With the forming of agricultural societies new methods and farm practices were introduced. It is recorded that[9] summerfallowing was coming into general practice in 1819, that the iron and double mould board ploughs were introduced in 1821, and that the practice of liming the soil was being followed on some of the more progressive farms. Ploughing matches were first held in the county in 1819 and 1820 at Amherst, River Phillip and Remsheg or Wallace

[1] Dominion Census 1931.

as it is now called. The writings of "Agricola", about this time, also had a marked influence on the trend in agricultural development. A period of rapid improvement in agriculture set in and the years 1820-1845 marked one of the most prosperous periods in the county's agricultural history.

The opening of markets in the United States about the middle of the 19th century, in large part due to the heavy demands for supplies for the Union forces during the Civil War; the development of industry and commerce in the county and the building of the railroad all stimulated the agricultural industry. Throughout the early years the type of farming had been basically mixed-farming associated with the production of fat cattle, except in the Amherst marshland area where hay production was practically the sole source of revenue. About the end of the 19th century the trend was towards dairying. This was due, in part, to the increased demand for dairy products by the growing urban population and to the competition of the more cheaply produced western beef cattle.

Within the last 20 years the wheat acreage has decreased rapidly while the acreage of oats and barley has increased. The main cereal crop grown to-day is oats. The average yield for the county is 32·3 bushels per acre, while yields of 73 bushels have been obtained on some upland soils and as high as 100 bushels on the dykeland soils. It is interesting to note that in 1820 yields of 73 bushels of oats and 45 to 60 bushels of wheat per acre were obtained.[9] Tables 5 and 6 give the acreage devoted to the principal crops grown in the county, over a period of years and the average yields in 1931.

The acreage of hay has always exceeded that of any other crop; until comparatively recent years the dykelands of the Amherst region were used almost solely for the production of hay.

With the replacement of horses by the automobile, truck and tractor, the market for hay has been greatly reduced which necessitated a readjustment in the utilization of the marsh area. An increasing acreage of the dykelands is used for the production of grain and roots, as well as hay. Unfortunately a considerable acreage has been neglected and is reverting to the original marsh vegetation, largely Broad Leaf.

A considerable acreage in the county, 53,885 acres, of the cleared land is under natural grasses which are either cut for hay or used as permanent pastures. As a rule the quality of the herbage is only mediocre, and the yields and carrying capacity are low.

Buckwheat is grown in some sections for livestock feed, domestic use and in some cases as a green manuring crop. Potatoes, strawberries and vegetables are profitable side-lines in some areas. The market for these crops is largely the local urban centres such as Amherst and Springhill.

Table 7 gives the livestock population of the county, from 1871 to 1941, as reported by the Dominion Census. Although there has been a definite increase in the number of dairy cattle, the Dominion Census reports 11,132 milch cows and heifers over 2 years old, the beef breeds of cattle continue to provide a significant part of the farm revenue on many farms. The sheep population has declined steadily, with a sharp decrease since 1921, largely as a result of the trend to dairying and low prices for sheep products. While the number of swine has decreased since 1911, because of the relatively high cost of feed grain, the quality of carcass has improved and they are recognized as being an economic side-line to the dairy industry.

During the last 20 years the poultry industry has increased rapidly, small farm flocks are disappearing and the large specialized commercial flocks are increasing. This trend has been largely influenced by the introduction of the commercial chick hatching industry into the Province.

The knowledge of commercial fertilizers and how to use them is growing. While much of the fertilizer is bought as mixed goods, single ingredients are also purchased, to be mixed on the farm or used alone. Superphosphate alone is used on many of the dairy farms where there is a reasonably good supply of barnyard manure. The mixtures most generally used are 2-12-6, and 4-8-10 with some 5-10-5, and the rates of application are around 300 to 500 lb per acre for grain and 400 to 600 lb per acre for root crops.

The use of agricultural limestone is also increasing. In 1942 approximately 3,582 tons of limestone were used in the county. It is sown broadcast or with a drill, the rate of application is around 2 to 3 tons per acre.

TABLE 5.—ACREAGE OF PRINCIPAL CROPS IN CUMBERLAND COUNTY

—	1871	1881	1891	1901	1911	1921	1931	1941
All Field Crops	....	....	....	....	87,670	90,834	79,983	75,706
Wheat	3,863	6,576	3,044	3,585	2,891	3,504	954	375
Barley	....	....	8,556	8,660	10,508	14,737	15,164	11,730
Oats	....	....	8,556	8,660	10,508	14,737	15,164	11,730
Fall Rye	....	....	....	....	2	15	15	18
Buckwheat	....	....	....	....	2,937	2,495	2,528	822
Mixed Grains	....	....	....	....	442	297	848	1,274
Cultivated Hay(1)	39,680	51,451	58,650	64,802	65,188	65,170	54,369	55,729
Potatoes	3,835	4,635	3,317	2,873	2,399	2,971	2,012	1,467
Field Roots (2)	....	....	621	757	921	965	1,025	1,265

(1) Includes Alfalfa, Clovers, and all Grasses.
(2) Includes Turnips, Swedes, Mangolds, and Sugar Mangolds.

TABLE 6.—AVERAGE YIELDS PER ACRE FOR NOVA SCOTIA AND CUMBERLAND COUNTY

—	Nova Scotia(1) Bushels per Acre	Cumberland County(2) Bushels per Acre
Wheat	18·0	17·9
Barley	27·6	27·8
Oats	33·9	32·3
Rye	18·7	38·2
Peas	19·6	17·1
Buckwheat	22·2	19·8
Potatoes	166·8	217·2
Field Roots	483·6	511·0
All Cultivated Hay	1·62 (tons per acre)	1·1

(1) Average For 15 year period (1922-1936)—Data by Provincial Agronomist.
(2) Dominion Census—1931.

TABLE 7.—LIVESTOCK POPULATION—CUMBERLAND COUNTY[1]

—	1871	1881	1891	1901	1911	1921	1931	1941
Horses	4,639	7,259	7,256	7,243	7,539	6,432	5,133	4,635
Dairy Cattle, Other Cattle[2]	22,239	26,035	24,969	28,910	27,758	24,398	23,322	21,188
Sheep	31,828	28,631	23,970	22,133	12,542	11,297	7,415	3,957
Swine	3,977	2,934	3,406	3,422	6,273	4,424	4,491	3,888
Poultry (All Classes)	....	....	80,813	73,266	84,315	89,017	117,924	107,459

(1) Dominion Census.
(2) Includes working oxen of which there were—2,806 in 1871.
2,283 in 1881.
1,105 in 1891.

TABLE 8.—ACREAGE AND CONDITION OF LAND IN CUMBERLAND COUNTY

—	1931	1941
Total Land Area	1,077,120	
Area Occupied by Farms	429,990	
Area of Improved Land	118,408	
Pasture	29,757	
All Field Crops	79,983	75,706
Other Crops	8,688	
Area of Unimproved Land	311,582	
Woodland	342,864	
Natural Pasture	53,885	
Marsh and Wasteland	14,833	
Total Number of Farms	2,806	2,596
Average Size of Farm	153·2	
Improved Land per Farm	42·2	
Unimproved Pasture per Farm	19·2	
Average Area Woodland per Farm	86·5	

SOIL SURVEY METHODS

The type of soil survey conducted in Cumberland county is known as a reconnaissance survey. That is, it provides a broad picture of the soil pattern of the area, and as such it cannot take into consideration the detailed variations that occur on the individual farm.

All the roads in the county were traversed by car, frequent stops were made for the purpose of examining the soil depending upon the topography and the nature of the landscape, whether it was agricultural land or forest area. The interval between stops varied from $\frac{1}{4}$ to 1 mile, in some cases $\frac{1}{10}$ of a mile where the complexity of the conditions required closer observations.

The road pattern in Cumberland county is very irregular, in some sections the roads are close together and in other sections they are widely separated. While this complex road system adds to the charm of the rural setting it does not facilitate systematic surveying with regularly spaced traverses. Since large sections of the county are inaccessible by car, foot traverses were made along the main bush trails and logging roads as well as at frequent intervals across the open farmlands. The foot traverses extended at least ½ mile into the territory and often from one road to another. Distances were measured by pacing and locations obtained from prominent landmarks or by compass bearings.

Holes or test pits were dug, roadside exposures studied and auger borings made to a depth of 2 feet or more. The method used and the depth to which the soil was studied depended upon what was the most suitable for the particular situation. From these exposures the soil characteristics were studied, such external features as relief, drainage, natural vegetation and stoniness were also noted. The soil boundaries were plotted on base maps, between points of examination the boundary lines were drawn arbitrarily according to the lay of the land.

The base maps used were supplied by the Topographical Branch of the Dominion Department of Mines and Resources. They are on the scale of 1 mile to 1 inch for part of the area and ½ mile to 1 inch for other sections. The maps show all the roads, railroads, main trails, watercourses and most of the buildings in the county.

During the last season aerial photographs were used to advantage. These were especially useful in the more densely wooded areas. These photographs were prepared by the Royal Canadian Air Force and loaned to the survey party through the courtesy of the Nova Scotia Economic Council.

Soil samples, representing the different soil associations mapped, were taken for physical and chemical analysis. Wherever possible an undisturbed profile in a virgin or nearly virgin forest area was selected. Composite surface soil samples from cultivated fields adjacent to the profiles were also taken if possible. Fields that had not received fertilizer treatment during the previous three or four years are preferable when taking such surface samples.

The soil map accompanying this report is printed on a scale of 2 miles to 1 inch and is an important part of the report. It shows the location and the approximate extent of the different soil associations and miscellaneous land classes, identified in the course of the field work, in relation to the roads, railroads, rivers, streams and buildings.

SOIL FORMATION

It is generally agreed that soil is the product of a number of factors of environment acting together and one upon the other. These factors are:—parent material, its origin and mode of deposition; climate under which the soil has been developed; biological agencies or plants and animals, particularly plants, which act upon and modify the mineral or rock material; topography, which influences drainage, soil temperature, and susceptibility to erosion; and the length of time the climatic and biological agencies have been acting upon the rock material.

As a result of the interaction of all these soil-forming agencies each soil or group of soils possess certain characteristics which distinguish it from another soil or soil group. These characteristics are observed in what is known as the soil profile, that is, a vertical section extending from the surface down to the unmodified mineral material or to the bedrock.

The climate and biological conditions prevailing in Nova Scotia, namely, high precipitation; long, cold winters; short, cool summers and largely coniferous forest growth, favour strong leaching processes. Soils developed under such conditions are known as Podsols.

The outstanding characteristics of a Podsol profile, under natural and undisturbed conditions are: a surface layer of raw organic matter, a light grey or white layer immediately below the surface, followed by a reddish or brown layer that may be strongly cemented to form a hardpan layer, and a strongly acid reaction.

The degree of podsolization, as this type of soil development is called, will under local conditions, such as obtained in Cumberland county for instance, be influenced by the plant species making up the vegetation and by the kind of parent material.

The forest litter, which is the source of organic matter in the soil, plays an important part in the degree of leaching that occurs in a soil. In Cumberland county litter from deciduous trees is, as a rule, richer in bases than litter from coniferous trees, consequently leaching will not be so strong under deciduous forest cover as under coniferous forest. The organic matter from coniferous forest which, owing to its origin is relatively low in bases, decomposes slowly, and organic acids as well as numerous other decomposition products, are released. The large amount of water passing downward through the soil, combined with the organic acids, causes strong leaching to occur. The soluble bases, calcium, magnesium and potassium, also iron and aluminium are carried out of the upper layers or horizons down to lower levels leaving the grey layer, which is low in plant food elements, near the surface. The iron and aluminium, some organic compounds and fine clay particles, which may also be carried down, and some of the bases accumulate in the lower layers to form new horizons. The new horizons, or subsoil, are usually dark in colour, relatively higher in plant food elements and may be compacted to the extent of creating physical conditions unfavourable to plant growth. This hardpan condition, or Ortstein as it is called, of the "B" horizon is not common to all the soils of Cumberland county. There is, however, a compaction of the parent material or till of many of the soils which is generally referred to as hardpan. This compaction of the till, which probably is due to the original character of the till and its mode of deposition, should not be confused with the hardpan of the "B" horizon, which is developed as a result of leaching and accumulation processes.

The texture and mode of deposition of the parent material, its chemical composition and ease of weathering of the minerals contained in it are important factors influencing the degree to which podsolization processes have affected soil development. Texture, physical condition and mode of deposition will influence the movement of water through the soil which in turn will affect the amount of leaching that will take place. As a rule sandy textured, waterlaid soils are more strongly leached than well drained clay till soils. The chemical analysis results obtained for Cumberland county soils however show that textural variations do not appear to have had any appreciable influence on the degree of podsolization. The poorly drained, clay till soils in the county frequently have a thicker A2 or leached ashy grey layer indicating they are more strongly podsolized than many of the better drained soils. Soils developed from mineral material relatively high in bases, making possible a greater circulation of bases through the soil, are, as a rule more resistant to podsolization processes.

The character of the surface relief materially affects soil development, particularly of local soils within a broad climatic belt. It influences the moisture relationships or drainage conditions prevailing in a particular soil. The amount of water absorbed by soils, from equal rainfall, will be greater on level or depressional topography than on slopes, consequently leaching or podsolization processes will be more active, generally, on the smoother topography.

The amount of surface run-off is regulated to a large extent by the nature of the surface relief. Other conditions being equal the steeper the slope the greater will be the amount of surface run-off. The effects of this on soil development are manifest in two ways, its influence on surface erosion and on the effective moisture conditions in the soil. Where the percentage of run-off is great and erosion active the depth of the solum or upper layers of the profile decreases, the differentiation of the individual horizons is less distinct and the soil moisture conditions approach those of arid soils. On the other hand with soils developed on flat topography or in depressions where surface run-off is negligible, the solum will be deep, horizon separation is usually more distinct and the soil has more of the characteristics of one developed under humid climatic conditions.

The drainage conditions prevailing in a soil affect the soil temperature and aeration. These in turn greatly influence the number, kind and activity of soil micro-organisms. In poorly drained soils micro-biological activity is restricted, organic matter decomposition is slow and the organic matter tends to accumulate on the surface.

The degree to which the soil-forming processes affect the development of the soil in any region depends upon the length of time the parent materials have been subjected to the activities of climate, vegetation and topography.

Soils like the intervales or stream alluvium, which are subject to annual flooding, therefore constant renewal by deposits of new material, show little or no profile development and are considered to be immature. Soils subject to severe and continuous erosion damage are also in a stage of immaturity whereas on undulating topography, where climate and vegetation have had ample time to influence soil development, normal mature soils occur.

A detailed description of a hypothetical profile of a normal, well drained Cumberland county soil under undisturbed condition (virgin) is as follows:—

A0. Layer of forest litter, largely decomposed.

A1. A comparatively thin, dark coloured layer of mineral soil intimately mixed with a fairly high percentage of organic matter.

A2. A bleached or ashy grey mineral layer. Horizon of maximum leaching.

B1. Yellowish-brown to light brown. Usually loose and open.

B2. Dark coloured layer, usually some shade of brown or red. More compacted than B1.

C. Parent material. Partially modified unconsolidated rock material.

D. Underlying strata. Usually bedrock or clay. Geological material unrelated to the parent material, may or may not influence the overlying soil.

Individual profiles do not necessarily have the same sequence of horizons. One or more may be absent or further sub-division may occur. In poorly drained soils a layer referred to as the "Glei" horizon (G) may be present. It is developed under conditions of fluctuating ground-water levels.

SOIL CLASSIFICATION

In the previous section it has been stated that soils possess certain characteristics expressed in the soil profile. It is upon the basis of those profile characteristics that the soils of Cumberland county have been classified and mapped.

The classification scheme followed in the survey covered by this report takes into consideration the climatic and vegetative features; the origin, in so far as possible, and the mode of deposition of the parent material; surface relief; drainage and other external features.

The mapping unit used in this survey is the "Soil Association." The "Soil Association" consists of a group of soils developed from similar parent materials and having certain common characteristics but differing in drainage conditions. Wherever possible broad differences in drainage conditions have been indicated on the map. The separation of the different drainage conditions forms the basis for dividing the soil association into "Associates."

Twenty-three soil associations, including organic and miscellaneous soils, have been mapped in Cumberland county. Of these twenty-three soils seventeen are zonal soils, that is to say, they are soils having well developed profiles typical of the podsol type of development and reflecting the influence of the major soil-forming processes—climate, vegetation and time. The soil associations included in the zonal soil group are:—Queens, Diligence, Nappan, Joggins, Pugwash, Tormentine, Southampton, Shulie, West Brook, Rodney, Spencer, Hansford, Cobequid, Wyvern, Kirkhill, Hebert and Parrsboro.

Within the county there are three soils upon the development of which the influence of local drainage conditions has been of greater significance than the normal effect of climate and vegetation. These soils are mapped as peat, muck and swamp, all of which are distinguished by reason of having a highly organic surface layer.

There are three distinct soils in the county in which the profiles show little or none of the morphological characteristics of the type of soil development typical of the zone in which they occur. These soils are the Cumberland, and Acadia associations and salt marsh. All of them are water-laid soils which have been or still are subject to periodic renewal by flooding, consequently the materials of which they are formed have not been exposed long enough to soil-forming processes for them to develop normal soil characteristics. Such soils are known as azonal soils.

For purposes of convenient identification each soil association has been given a name. The names were selected from some geographical location with which the soil was originally associated.

CLASSIFICATION SCHEME USED IN CUMBERLAND COUNTY

A_1 Zone—Podzol—Leached acid soils.

B_1 Soils on glacial till.

C_1 Clay to clay loam parent material. Compact and slowly permeable.

1. Queens Association.........Grey brown surface soil over reddish-brown subsoil. Dark reddish-brown or chocolate brown clay parent material derived from soft dark grey Carboniferous sandstone.

2. Diligence Association.......Grey brown surface soil over yellowish-brown subsoil. Mixed grey and red clay parent material derived from grey carboniferous shale.

3. Nappan Association........Light brown surface soil over brownish-red subsoil. Brownish-red clay parent material derived from brown and red Carboniferous and Permo-Carboniferous sandstone.

4. Joggins Association.........Dark greyish-brown surface soil over drab subsoil. Grey brown and dull reddish-brown clay parent material derived from fine textured grey and red Carboniferous sandstone (coal measure series) with some coarse grained igneous rocks.

C_2 Sandy loam to sandy clay loam parent material. Slightly compact and permeable.

1. Pugwash Association....... Brown surface soil over reddish-brown subsoil. Reddish-brown sandy clay loam parent material derived from mixed brown and grey carboniferous sandstone.

C_3 Sandy loam parent material. Slightly compact and easily permeable.

1. Tormentine Association..... Light brown surface soil over red subsoil. Red and brownish-red sandy loam parent material derived from red Permo-Carboniferous sandstone.

C_4 Gravelly sandy loam to gravelly loam parent material.

1. Southampton Association... Greyish-brown surface soil over brown subsoil. Brownish-grey gravelly loam parent material derived from grey Carboniferous sandstone and conglomerate.

2. Shulie Association.......... Greyish-brown surface soil over light brown subsoil. Greyish-brown gravelly sandy loam parent material derived from grey Carboniferous sandstone.

3. West Brook Association..... Brown surface soil over reddish-brown subsoil. Purplish-red gravelly loam parent material, derived from purplish-red Carboniferous conglomerate.

4. Rodney Association........ Brown surface soil over light brown subsoil. Greyish-brown gravelly loam parent material derived from mixed Carboniferous grey sandstone and purplish-red conglomerate.

5. Spencer Association......... Brown surface soil over yellow brown subsoil. Brown gravelly sandy loam parent material derived from grey Carboniferous sandstone and Triassic trap rock.

6. Hansford Association....... Grey brown surface soil over light brown subsoil. Light brown gravelly sandy loam parent material derived from mixed brown and grey Carboniferous sandstone.

7. Cobequid Association....... Dark brown surface soil over coffee brown subsoil. Light grey gravelly sandy loam parent material derived from felsite, syenite, diorite and granite.

8. Wyvern Association........Dark brown surface soils over light coffee brown subsoil. Greyish-brown gravelly sandy loam parent material derived from granite.

9. Kirkhill Association........Grey brown surface soils over yellow brown subsoil. Olive brown shaly sandy loam parent material derived from olive grey Carboniferous shale.

B_2 Soils on water deposited parent material.

C_1 Soils on kames, eskers, river terrace and outwash deposits.

1. Hebert Association.........Brown surface soil over light brown subsoil. Parent material, gravel, sand and cobblestone occurring as kames, eskers and river terraces.

2. Parrsboro Association.......Grey surface soil over light reddish-brown subsoil. Parent material, cobblestone and gravel occurring as delta and shore line deposits.

C_2 Alluvial soils. Gravel and sand deposits in stream and river channels. Immature soils.

1. Cumberland Association....Sandy textured surface and subsoils. Rock material variable in composition being composed of the rocks of the area through which the stream is flowing.

C_3 Marine deposits, immature azonal soils. Clay to silty clay loam parent material.

1. Acadia Association........ Brown surface soils over brown subsoils. Bluish-grey clay parent material.

B_3 Organic soils (Bog).

C_1 Accumulated organic material 12 inches or more in depth.

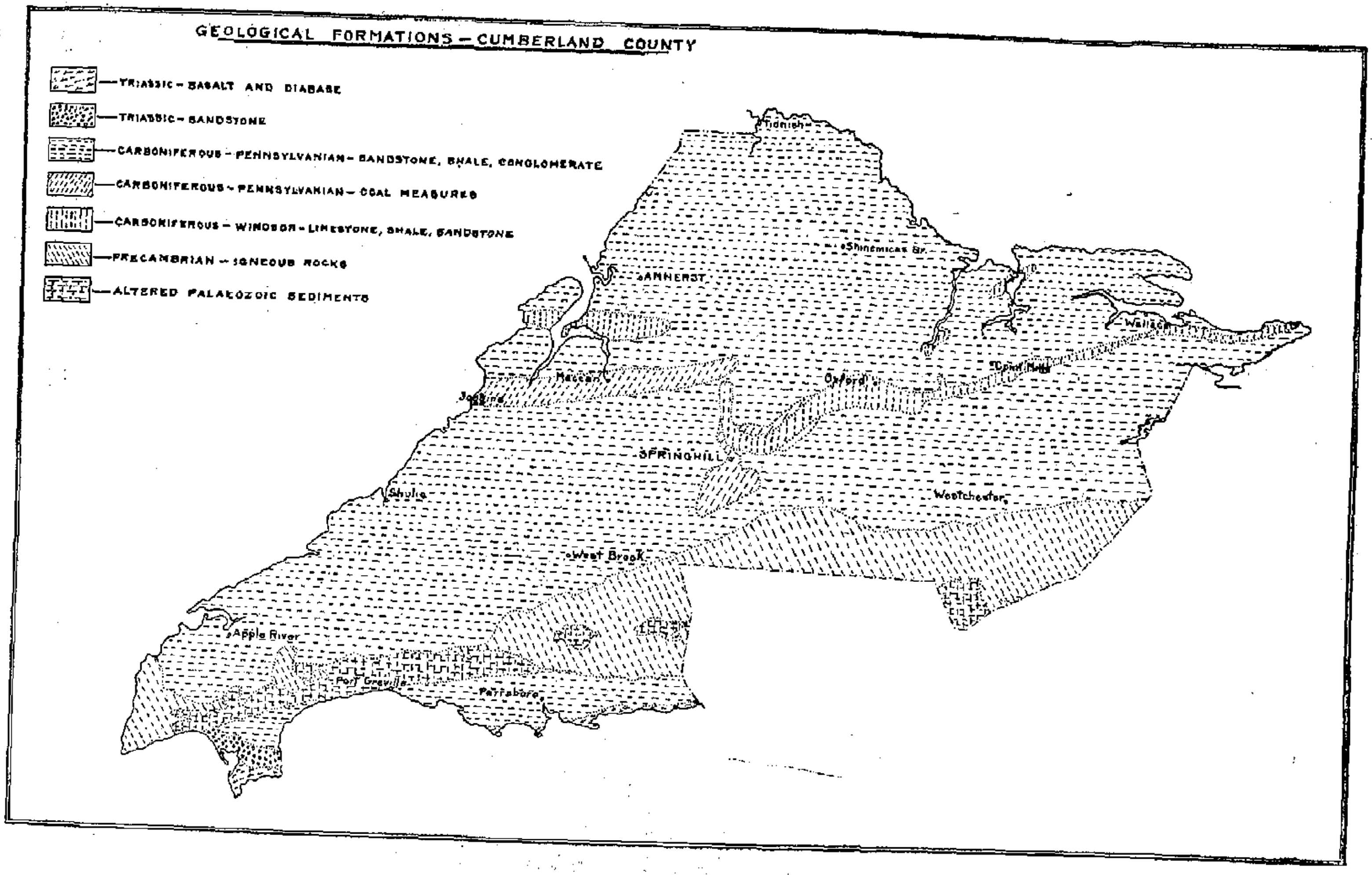
1. Peat—Fibrous organic material consisting chiefly of undecomposed sphagnum moss.
2. Muck—Dark brown to black well decomposed organic material.

B_4 Miscellaneous soils.

1. Swamp—Mineral soils continually saturated with water, with shallow muck or peat-like surface.
2. Salt Marsh—Recent marine deposits, reworked by daily tides.
3. Eroded slopes—Steep eroded slopes along stream and river channels.

TABLE 9.—APPROXIMATE ACREAGE OCCUPIED BY THE DIFFERENT SOIL ASSOCIATIONS, AND PERCENTAGE OF TOTAL AREA

Soil Association or Class	Total Acres	Percent	Drainage Conditions	Acres	Percent of Association
Acadia	16,045	1·6	Fair	8,237	51·3
Acadia	....	....	Poor	7,808	48·7
Cobequid	64,083	6·3	Good	63,891	99·7
Cobequid	....	....	Poor	192	0·03
Cumberland	24,096	2·4	....	....	....
Sandy Loam	....	....	Good	10,706	44·3
Cumberland Gravelly Sandy Loam	....	....	Good	7,360	30·5
Cumberland Silt Loam	....	....	Good	6,030	25·2
Diligence	17,562	1·8	Imperfect	14,253	81·1
Diligence	....	....	Poor	3,309	18·9
Spencer	2,528	0·2	Good	2,528	100·0
Hansford	42,618	4·2	Good	39,706	94·1
			Poor	2,912	5·9
Hebert Sandy Loam	25,767	2·5	Good	....	....
	....	....	Good	11,763	45·6
Hebert Gravelly Sandy Loam	....	....	Good	10,605	41·2
Hebert Cobbly Sandy Loam	....	....	Good	3,399	13·2
Joggins	8,096	0·8	Poor	8,096	100·0
Kirkhill	29,933	2·9	Good	29,933	100·0
Rodney	53,267	5·3	Good	48,664	91·4
Rodney	....	5·3	Poor	4,602	8·6
Nappan	55,854	5·5	Imperfect-Fair	43,169	77·3
Nappan	....	....	Poor	12,685	22·7
Parrsboro	8,401	0·8	Good	8,401	100·0
Pugwash	100,448	9·9	Good	69,453	69·1
Pugwash	....	....	Poor	30,995	30·9
Queens	80,617	8·0	Imperfect-Fair	74,761	92·8
Queens	....	....	Poor	5,856	7·2
Shulie	163,872	16·1	Good	115,590	70·5
Shulie	....	....	Poor	48,282	29·5
Southampton	47,763	4·7	Good	46,995	98·4
Southampton	....	....	Poor	768	1·6
Tormentine	124,218	12·3	Good	55,930	45·0
Tormentine	....	....	Poor	66,288	55·0
West Brook	74,758	7·3	Good	73,267	98·0
West Brook	....	....	Poor	1,491	2·0
Wyvern	43,891	4·2	Good	43,891	100·0
Peat	5,453	0·5	....	....	....
Muck	640	0·1	....	....	....
Swamp	21,017	2·1	....	....	....
Salt Marsh	3,226	0·3	....	....	....
Eroded	1,850	0·1	....	....	....
Total	1,016,002	100·0	....	....	....


GEOLOGICAL FORMATIONS — CUMBERLAND COUNTY
TRIASSIC — BASALT AND DIABASE
TRIASSIC — SANDSTONE
CARBONIFEROUS — PENNSYLVANIAN — SANDSTONE, SHALE, CONGLOMERATE
CARBONIFEROUS — PENNSYLVANIAN — COAL MEASURES
CARBONIFEROUS — WINDSOR — LIMESTONE, SHALE, SANDSTONE
PRECAMBRIAN — IGNEOUS ROCKS
ALTERED PALAEOZOIC SEDIMENTS
Tidnish
Shinemicas Br.
AMHERST
Maccan
Oxford
SPRINGHILL
Shulie
Westchester
West Brook
Apple River
Port Greville
Parrsboro

SOIL DESCRIPTIONS

Glacial Till Soils

The glacial till soils occupy the largest total area, approximately 908,608 acres or 89·5 per cent of the total land area. Practically all the upland consists of glacial till material, consequently includes the variations corresponding to the variations in geological material. These variations in rock material have given rise to a wide range in soil textures, the range being from gravelly sandy loam to heavy clay loam and clay.

Podsolization is well developed and the general profile characteristics of the podsol predominates regardless of the nature of the parent material. The surface and subsoil of the glacial till soils all have a strongly acid reaction. Two of the heavy textured soils, namely Queens and Nappan, have parent materials that tend to be slightly acid to neutral in reaction. This may be due to the presence of lime carbonate in the rock material from which they have been derived. Fifteen soil associations have been mapped on glacial till, Queens, Joggins, Diligence, Pugwash, West Brook, Southampton, Shulie, Hansford, Tormentine, Nappan, Spencer, Cobequid, Wyvern, Kirkhill and Rodney.

Queens Association

The Queens Association includes some of the heaviest textured soils in the county. Although not the most extensive, they are among the most important agricultural soils of the area, and occupy approximately 80,617 acres or 8·0 per cent of the area. They are glacial till soils developed on heavy clay loam to clay parent material derived largely from Carboniferous rock material. The rock material consists of dark grey, brownish-grey, greenish-grey, and dark, brownish-red sandstone with some conglomerate and possibly some limestone.

Queens soils occur mainly in the northeastern section of the county, forming an almost continuous belt extending from around Springhill, through Oxford, Street Ridge and Wallace to Malagash Mines. Another smaller area is found around Pugwash Junction and small isolated blocks are scattered throughout the area.

The general topography over most of the area is undulating to gently rolling, consisting for the most part of long, smooth ridges, the long axis of which have an east-west trend. Over most of the area the ridges are low, broad and smoothly oval while the Springhill-Claremont Hill ridges and parts of the Wallace ridge, particularly in the vicinity of Malagash Mines, are high, relatively narrow topped with steeply sloping flanks. Some of the slopes are a mile or more in length with only slight undulations breaking an otherwise smooth surface relief.

While the surface relief, in general, allows for moderately good surface run-off, the compaction and plasticity of the lower subsoil and the parent material restricts the downward movement of water. As a result the natural drainage of these soils, as a whole, can only be classed as imperfect. There are, however, some small areas of moderately well drained soils, usually along some of the narrow crests of the steeper slopes where drainage is better than average. This is also true, generally, of the area of Queens soils mapped around Pugwash Junction; there the soil is of somewhat lighter texture, and more permeable throughout the profile than normal, hence has fairly free internal drainage as well as good surface drainage. On some of the flatter topography and in some depressed areas both surface and internal drainage are restricted giving rise to a poorly drained soil. While the ground-water level does not remain near the surface permanently in all cases, it does remain sufficiently late in the season to materially affect the agricultural value of these areas. Seepage areas are fairly common on the longer slopes, the compact till restricting the downward movement of excess ground-water which moves along the top of the substratum and the soil remains soggy, particularly where the solum is thin over the compact till.

Surface stone and boulders are not a serious problem although frequently encountered. In the past most of the larger stones have been removed from the cleared land, as shown by the stone piles in and around the fields. The majority of the stone consists of various types of sandstone which weather fairly readily. An occasional conglomerate boulder occurs and some of the igneous pebbles composing it, as well as pieces of sandstone, are found in the profile.

The cultivated surface soil varies from brownish-grey or dark grey to dark brown in colour and from 3 to 8 inches in thickness. The surface soil of the better managed grasslands has a fairly well developed crumb structure; but under general practice this structure has been destroyed, and the surface tends to become baked and cracked when dry and puddled and sticky when wet, making it difficult to work.

Immediately below the surface layer a subsurface layer occurs; it is occasionally light grey to white in colour but more often it is a yellowish-grey. It is invariably lighter in texture than the surface soil and has a tendency to a weak, platy structure.

The subsoil which is usually friable and porous in the upper part with a semblance of a platy structure, and light brown in colour, becomes quite firm to compact with depth, has a weak, nut-like structure and the colour darkens to a dark reddish-brown. At about 20 to 24 inches it grades into the compact, tenacious chocolate brown or deep reddish-brown clay till.

One of the more noticeable characteristics of the Queens profile is its mass colour, which might be termed a dull chocolate brown or purplish-brown with a dull greyish cast, especially in the upper solum.

Surface soil textures include sandy loam, loam, sandy loam and clay loam with the clay loam apparently being the dominant texture. A description of a representative clay loam profile is as follows:—

Horizon	*Depth*	*Description*
A_0	0″–1″	Dark brown to black organic layer, partially decomposed tree and moss debris.
A_1	1″–3″	Brown to dark brown clay loam, having a weak crumb-like structure. Loose, soft and porous. Fairly good root distribution. Not always present. pH 5·4.
A_2	3″–8″	Pale yellowish-grey or brownish-yellow clay loam, tendency to a weak platy structure. Porous. pH 5·0.
B_1	8″–13″	Brown heavy clay loam, having a feebly developed granular structure, loose and porous. pH 5·1.
B_2	13″–24″	Dark reddish-brown heavy clay loam, compacted, tendency to a weak nut-like structure. Hard when dry, plastic when wet. pH 5·0.
C	below 24″	Dark reddish-brown (chocolate brown) with a purplish coat, heavy clay loam. Compact, slowly permeable. Contains fragments of carboniferous sandstone. pH 6·6.

The Queens soils as mapped in Cumberland county are not uniform throughout the area. Beside the normal differences in degree of leaching in the different textural classes or types, broader variations were noted, which appear to be closely related to the dominance or proportion of one or more of the varied rock materials responsible for their development. On the south side of the Wallace Ridge, extending from just east of Stake Road to Dewar Lake is a narrow belt of soil differing from the average Queens soil in its general greyish-brown colour, well developed coarse nut structure and much heavier clay texture and more cheesy consistency. Most of this land is under forest although some is included in the cultivated area east of Stake Road and produces good crops of hay and grain in seasons of relatively low rainfall. As most of this soil is comparatively stone free no satisfactory evidence of its origin has been noted. On the top of some of the sharper ridges, such as the Wallace Ridge and just west of Oxford, small areas or long narrow strips of a fairly bright red soil occur which appears to carry more of the influences of the reddish conglomerate and sandstones. Where the conglomerate is more pronounced the profile is usually shallow and stony. In the Springhill area the soil is browner and somewhat more friable than usual, a fairly fine textured brown sandstone appears to dominate the rock mixture here. As previously stated the soil around Pugwash junction is somewhat lighter textured and more permeable than most soils of the Queens association. This may be related to the prevalence of the brownish, slightly carbonaceous sandstone in this region, giving the soil the appearance of a transition soil between the Pugwash association and the more typical Queens.

The differences due to type or textural class are to be noted pricipally in the degree of leaching as shown by the development and colour of the A_2 or subsurface layer and of the B_1 or upper subsoil layer. In the sandy loam profile the A_2 is usually light grey to nearly white in colour and has only a weakly developed structure, if any. The B_1 is yellowish-brown to light brown in colour, loose and porous. In the loam and more particularly the clay loam the A_2 is often feebly developed, yellowish-grey to olive grey in colour or else dull purplish-grey and has a tendency to a weak platy structure, while the B_1 is a dull light brown, not quite so well developed or so loose. On the heavy clay loam till the surface soil usually has a better developed crumb structure than is found on the lighter textured, redder till, and the subsoils frequently have a much better structural development.

Owing to the fine texture of the surface soils, low permeability of the subsoils and the nature of the surface relief, surface run-off may cause sheet erosion unless proper precautions are taken to offset such losses.

The poorly drained associate is found on the flatter topography and in depressions at the bottom of the long slopes and on the top of the broader ridges. Owing to the nature of the surface relief and drainage conditions the organic-matter content on and in the surface layer is invariably higher than in the normal Queens soil. It is usually dark grey to black in colour and in some cases may be slightly mucky. Below this is a dull light grey to yellowish-grey or olive-grey layer, which has a weak platy structure and is strongly mottled, especially in the lower part (A_3). When wet this layer is puddled, and smeary but tends to be baked and hard when dry although it crumbles to a powdery condition when crushed. The subsoil is very compact and practically impervious, with only a weak horizon development, if any, and grades into the parent material at a depth of 16 to 24 inches.

Agriculture

Queens soils are tricky to work, they must be worked at the right stage of moisture content and once ready should be seeded as quickly as possible. The earlier this is done the better in order to obtain the maximum benefit of the soil moisture, to preserve a good tilth, and to get maximum efficiency of applied soil amendments. If cultivated when too wet the soil particles coalesce and the soil becomes puddled, especially where the organic-matter content is low. If, on the other hand, the soil is allowed to become too dry it is apt to bake and be crusted requiring more power to work it with the result that the seed-bed, as was quite frequently observed, will be shallow and cloddy.

Drainage is an important factor in the management of Queens soils. While tile underdrains may present a problem, due to the fine texture and compactness of the subsoil restricting lateral movement, the removal of excess surface water can and should be accelerated. This can be done satisfactorily by ploughing the fields in narrow lands having high crowns and fairly deep dead furroughs which can act as temporary drainage channels.

At the present time a large proportion of the area of Queens soil is under bush or neglected grassland, which in many cases is reverting to young bush growth. The tree growth is mixed hardwood and softwood with spruce predominating, and mosses forming a considerable part of the ground cover,

In the grasslands the herbage is thin and weedy, wild oat grass (*Danthonia Spicata*), poverty grass (*Panicum Depangeratum*), paintbrush sorrel (*Rumex Spicata*), ox-eye daisy, yellow weed or narrow-leafed golden rod, as well as other weeds form the greater part of the vegetation on the old neglected pasture fields. The surface soil is often crusted when dry and rough from having been badly trampled when wet. Such conditions facilitate surface or sheet erosion.

The Queens soils are well suited for mixed farming and the topography generally will permit the use of practically all types of farm machinery. At the present time the acreage under cultivation is relatively small. The larger percentage of the cleared land is used for pasture and hay. The main grain crops are oats, barley and buckwheat.

The natural fertility of the Queens soil is not very high, the average yield of oats being about 30 bushels per acre with barley slightly less, but under good management yields of 40 to 60 bushels of oats per acre have been obtained. The chemical analysis of this soil substantiates the field observations. Table 13, which shows the available nutrients in pounds per acre, indicates that the soil is low in available plant food, the only exception being in the parent material which has a satisfactory level, particularly of calcium and phosphorus. Since this material is not within reach of plant roots, the addition of fertilizers and manure is necessary for satisfactory crop production. For grain crops alone an application of 300 to 500 pounds of 2-12-6 is generally recommended. As previously stated the herbage of the pasture fields is usually thin and weedy. To produce good permanent pasture periodic top dressings with a mixed fertilizer and lime are necessary. A somewhat higher rate of application of fertilizer is required for pastures than for grain, an application of 500 to 700 pounds per acre of 2-12-6 is usually found satisfactory. For potatoes and garden crops a mixed fertilizer, such as 4-8-10, at the rate of 1,200 to 2,000 pounds per acre give good results.

The chemical analysis further indicates that the Queens soil is quite acid, having a pH of about 5·0. This acidity can be corrected by the application of limestone, preferably dolomitic limestone to make up the deficiency in magnesium as well as calcium. While the lime requirement figures indicate that as high as 6 tons of limestone per acre will be necessary to correct the acidity of Queens soils it is recommended that regular applications of 2 tons of limestone per acre be made in each rotation. The limestone should be applied before seeding down.

The organic-matter content of the Queens soil is very low, patricularly in the cultivated soil. A satisfactory organic-matter content not only improves the fertility but also the physical condition of the soil. Regular application of barnyard manure is the most desirable way to build up the organic-matter content, but as herds of cattle on most farms are small the supply of barnyard manure will need to be supplemented by the use of a green manuring crop such as buckwheat or preferably clover. It is generally recognized that the most productive soils in Nova Scotia are those containing eight per cent or more of organic matter. The figures given in Table 12 as loss on ignition show the surface layers to contain 7·4, 2·9 and 3·5 per cent of organic matter.

Under good management the Queens soils will give a good response. This involves the maintenance of the organic-matter content and adequate drainage, and the regular application of barnyard manure, lime and the necessary commercial fertilizers. It is most suitable for hay, grain and pasture crops.

Potatoes and vegetable crops are produced in limited quantities but this soil is not suitable for their commercial production.

The poorly drained soil is practically all under forest, for which it is best suited. Some small areas are cleared and used for rough pasture.

Diligence Association

Occupying an area of approximately 17,562 acres or 1·8 per cent of the total area the soils of the Diligence association comprise one of the minor groups of soil in the county, agriculturally, and in extent. They occur on the roughly undulating to gently rolling topography southwest of Spencer Island; between Diligence River and Parrsboro, also in the area between and just north of Greenhill and Two Islands.

The soils of this group are strongly influenced by material derived from Lower Carboniferous or Upper Devonian rocks such as light olive grey sandstone and shales, some fine textured brown sandstone and possibly some limestone. Drainage, generally, is imperfect to fair. Surface drainage ranges from fair to good over most of the area, but internal drainage tends to be slow. The presence of the slowly pervious clay till and in the places of bedrock, close to the surface, restricts the downward movement of water, keeping the upper part of the profile moist late in the spring and during rainy periods. On the flat or gently undulating topography the drainage conditions are even more restricted, giving rise to areas of poorly drained soil that may be swampy in wet seasons.

Scattered over the surface and through the profile and increasing in quantity with depth, are rounded, flat and angular fragments of stone or rock material. Grey sandstone boulders occur on the surface but are not a serious factor in clearing the land. Outcrops of the sandstone are occasionally noted.

Only a small percentage of the land is cleared, most of the area being covered with a young growth of spruce. The poorly drained areas are all under a fairly dense scrubby growth of black spruce, alder and wire birch. The cleared areas border the roads and are used chiefly for pasture. Many of these areas are reverting to spruce or alder.

The surface soil, in the cleared area, consists of a friable yellowish-brown loam to clay loam which is relatively low in organic matter and has little or no structure. The surface layer is underlain by a yellow brown friable subsoil, having a weakly developed granular to fine nut-like structure. It is soft and firm, may have yellow or brownish mottles and in places tends to be sticky when wet. The parent material is a brown or grey brown clay loam, firm to compacted. The A_2 or leached layer is not strongly developed; where it does occur it is a light ashy grey colour with a pinkish tinge.

In the poorly drained member the surface soil is more of a dark grey or dull brownish-grey colour and is usually sticky and structureless or amorphous. The subsoil is a drab colour, very slowly pervious, grading in to a more impervious parent material of much the same colour.

The surface soils, which are predominantly clay loam in texture, have a decided gray colour when dry, frequently are crusted and liable to be cloddy if ploughed or worked when wet and sticky, making it a difficult soil to work.

A profile description of a representative Diligence clay loam under forest vegetation is as follows:—

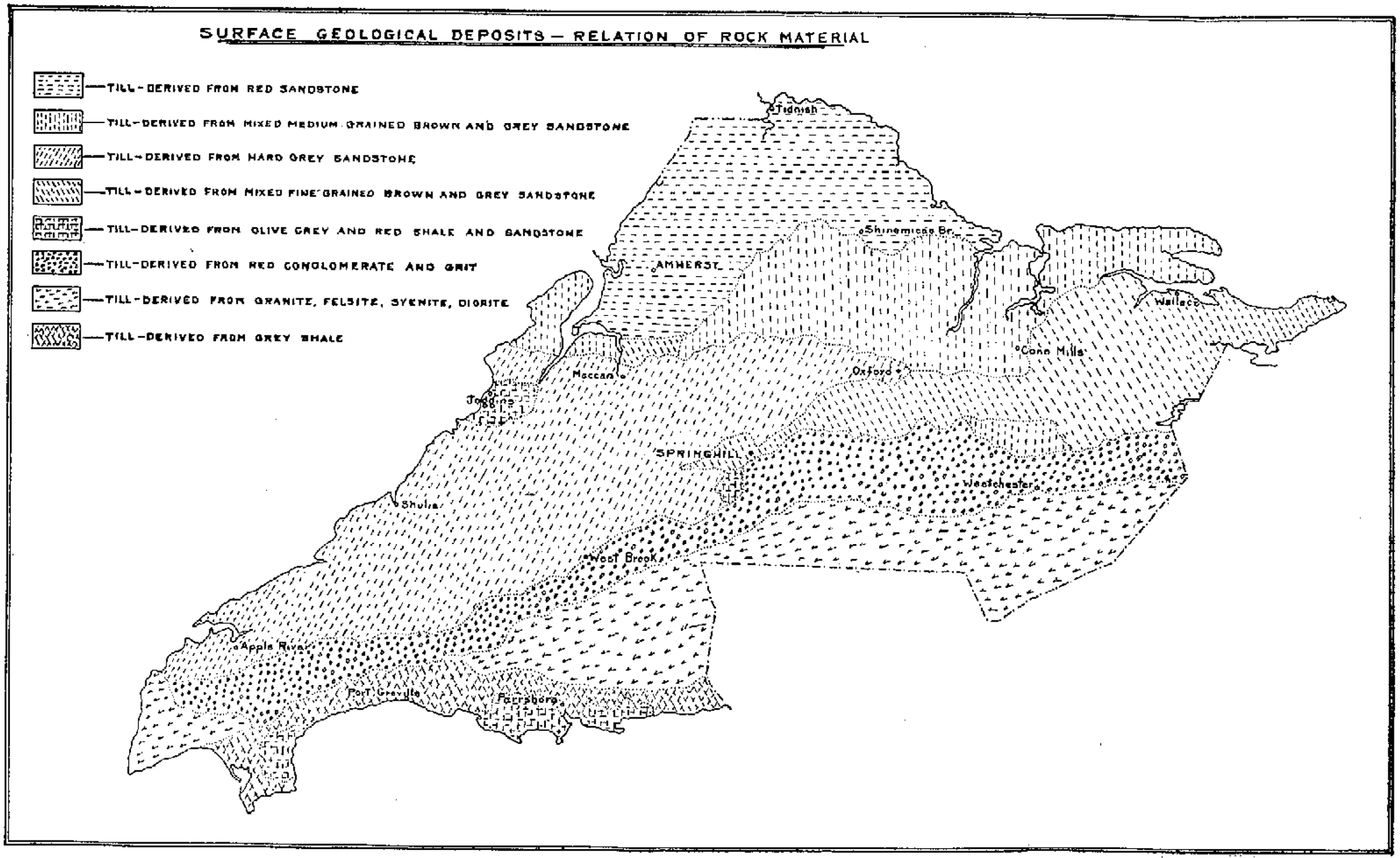
Horizon	Depth	Description
A_0	0″ – 1″	Black organic matter, fairly well decomposed, mainly spruce needles and moss-mold. pH 4·0.
A_2	1″ – 3″	Ashy grey heavy clay loam, having a faint pinkish cast. Weak platy structure which crumbles readily to fine granular structure. Likely to be smeary or greasy when wet. pH 3·8.
B_1	3″ – 7″	Light orange brown or deep yellow brown clay loam, fine granular strucure, porous and loose. pH 4·2.
B_2	7″ –16″	Yellowish-brown or light brown clay loam, has a coarse crumb or weakly developed fine nut structure which crushes easily to granular structure. Soft, firm, may show some yellow mottling. Contains grey sandstone and bluish-grey or light olive grey shale chips. pH 4·2.
C	below 16″	Light brown shaly clay loam till. Compacted, slowly pervious. Has a greyish cast to the mass colour, also weakly streaked with red and olive. pH 4·4.

Diligence soils, although relatively shallow, vary somewhat in depth, in texture of the subsoil and in drainage conditions. These variations are small in range and occur within narrow limits. Where the area borders the Kirkhill soils those of the Diligence association are usually shallow and better drained; in the Parrsboro area where the grey sandstone appears to predominate the profile is somewhat deeper, and not so permeable. Closeness of rock to the surface and the undulations of its surface largely influence the variability in drainage conditions. The acreage of Diligence soils under cultivation is small, consisting mainly of small farmsteads that provide part-time employment and a place of residence for a population engaged mainly in lumbering and fishing. Since there are very few large tracts of land having sufficiently smooth surface relief to permit the use of the heavier types of machinery the agricultural value of Diligence soils is limited. As they are well suited to tree growth, forest would appear to be the most satisfactory use. A more intensive cultivation of the farm holdings than is the common practice would no doubt result in better yields; careful attention being given to the organic-matter content to improve the tilth and the quality of the pastures. The use of lime will also be necessary for the improvement of the herbage of the pasture and hay fields.

Nappan Association

Occupying approximately 55,853 acres or 5·5 per cent of the land area, Nappan soils comprise one of the four most important soils of the county, not so much because of their extent but on account of their potential agricultural value. They are moderately heavy textured soils developed on clay till derived mainly from brown, brownish-red and brownish-grey carboniferous sandstones that are relatively fine textured and fairly soft. In some areas there is also a marked influence of the soft, micaceous Permo-Carboniferous sandstones. The topography on which Nappan soils occur is gently undulating to gently rolling. It consists of wide stretches of nearly level land with gentle swells, as in the Beckwith, Henderson Settlement, North Wallace and Nappan areas, and long low ridges having long gentle slopes and nearly level tops, as around Wallace Highlands and Wallace Grant.

The surface relief over most of the area permits moderate to good surface drainage. But the heavy texture and compactness of the lower subsoil and parent material retard the downward percolation of ground-water thus making the natural drainage, as a whole, imperfect. After heavy rains a moisture belt is formed on top of the compact layer and the material above remains temporarily moist and cold, whereas the parent material itself is comparatively dry. These drainage conditions, however, are not sufficient to prevent or seriously restrict the utilization of the land although they are reflected in slowness in drying in the spring and after heavy rains, thereby delaying farm operations.


SURFACE GEOLOGICAL DEPOSITS — RELATION OF ROCK MATERIAL
TILL-DERIVED FROM RED SANDSTONE
TILL-DERIVED FROM MIXED MEDIUM GRAINED BROWN AND GREY SANDSTONE
TILL-DERIVED FROM HARD GREY SANDSTONE
TILL-DERIVED FROM MIXED FINE GRAINED BROWN AND GREY SANDSTONE
TILL-DERIVED FROM OLIVE GREY AND RED SHALE AND SANDSTONE
TILL-DERIVED FROM RED CONGLOMERATE AND GRIT
TILL-DERIVED FROM GRANITE, FELSITE, SYENITE, DIORITE
TILL-DERIVED FROM GREY SHALE
Tidnish
Shinemicas Br.
AMHERST
Maccan
Oxford
Wallace
SPRINGHILL
Westchester
Shulie
West Brook
Apple River
Port Greville
Parrsboro

During prolonged wet seasons, crops on these soils return low yields, but in dry seasons the soils have all the appearance of being well drained, the surface soil may even bake and become crusty, but crops will withstand the dry weather better than on some of the lighter soils, because of the greater moisture-holding capacity. In the depressions and on some of the flatter land there are areas of poorly drained soil where the water-table continues close to the surface until late in the season.

The Nappan soils have but few rocks or boulders on the surface or stone through the profile. Most of the stone fragments, mainly sandstones, are held in the compact, firm mass of the till or parent material. Some pebbles and small stones are found in the surface soil.

The cultivated surface generally, is light brown to greyish-brown in colour. It has a weakly developed pulverulent to crumb-like structure and is fairly loose and friable when dry although it has a tendency to bake, especially where the organic-matter content is low. When wet it may become cohesive or sticky. In general, the surface soil, on drying, tends to have a greyish hue, in some localities it may have a reddish cast, particularly where part of the surface soil has been removed by erosion. Below this an ashy-grey subsurface layer occurs intermittently. This is loose and porous and may show some faint mottling with yellow limonite.

The subsoil generally consists of 4 to 8 inches of yellow brown sandy clay loam to clay, which is loose, porous and has only a weak crumb-like structure. This overlies 8 to 12 inches of brownish-red or reddish-brown clay loam that is quite firm to compact and has a small nut-like to weak fragmental structure.

The underlying parent material occurs at about 20 to 24 inches below the surface. It is a deep brownish-red or dark red in colour, stiff and compact, practically impervious to root penetration and contains fragments of sandstone embedded in it. In some localities, as at the Nappan Experimental Farm, in the Gulf Shore area and around Mattatal's Lake, the subsoil and parent material have a brighter red colour and a more cheesy consistency than normal. This variation appears to be associated with the presence of a red soft micaceous sandstone similar to that associated with the Tormentine soils.

Surface textures include loam, sandy clay loam and clay loam with some small areas approaching a sandy loam. The texture of the till ranges from a sandy clay loam to a heavy clay loam. The clay loam dominates in the areas mapped. An undisturbed profile of Nappan sandy clay loam under forest conditions is as follows:—

Horizon	*Depth*	*Description*
A_0	0″ –1½″	Dark grey sandy loam to loam, loose and crumbly. High in organic matter. pH 4·1.
A_2	1½″– 5″	Light ashy grey sandy loam to loam, platy structure. Held together by numerous grass roots. Slight mottling at the bottom of this layer. pH 4·3.
B_1	5″ – 8″	Yellow brown loam, well developed thin platy structure, brittle, moderately cohesive, crushes readily to fine platy-like segments. Slightly mottled, contains a few fine roots. pH 4·9.
B_2	8″ – 23″	Light brownish-red clay, cloddy-like macro-structure which breaks down to a fine nut-like structure. Compact, stiff, almost impervious. Numerous stains or coating of black carbonaceous material. Contains some fine roots, also some gravel or stone. pH 6·7.
C	below 23″	Brownish-red clay till, slightly darker in colour than B_2. Compact stiff, contains grey and red fine grained, soft sandstone; also some red sandstone having the appearance of ochre. Some of the sandstone pebbles are highly carbonaceous. pH 6·8.

Because of the fine texture of the surface soil and the compactness of the subsoil absorption and percolation of rainfall is slow, consequently surface run-off will be greater. As a result, Nappan soils are subject to damage by erosion, especially on the more sloping topography.

The profile of the poorly drained associate differs from that of the better drained soil in having a deeper surface soil which is dark grey to black in colour and owing to higher moisture conditions, has a higher organic matter content. The subsurface is dull grey to yellowish-grey in colour, strongly mottled and frequently has a weak platy structure.

The subsoil does not show a clear differentiation, it is a duller hue and grades slowly into the compact, impervious parent material. The profile is, usually, somewhat shallower than under better drainage conditions—about 18 to 20 inches to the parent material.

Agriculture

The soils of the Nappan association are well suited to general farming, dairying and livestock production, as good yields may be obtained from most of the field crops common to the region. There are very few stones and the topography is satisfactory for the use of all types of farm machinery. They are heavy textured soils and consequently satisfactory drainage is a problem, particularly where the topography is level or slightly undulating. Well drained and poorly drained soils occur continuously within the same cultivated field. The poorly drained areas can easily be distinguished by their ashy grey colour.

These poorly drained soils are not always in isolated depressions, but occur at the base of most slopes and as such, may form a large portion of a cultivated field. Some method of artificial drainage will be necessary to remedy this condition. Although tile drainage is satisfactory, shallow surface ditches would help to prevent accumulation of water, especially at the base of the slope.

The natural fertility of the Nappan soils is fairly good as compared with other soil associations of similar texture. This condition is only relative and is not to be considered as satisfactory. Although they are well adapted to the production of field crops and to a less extent garden crops, regular liming and fertilizer applications are necessary to ensure the best results. The chemical data in Table 13 indicate that the surface soil is low in available plant nutrients. The subsoil and parent material, however, are much more satisfactory in this respect, so that where deep rooted crops such as legumes are used, some of this reserve may be available once the plants have become established. Lime application is particularly important in these soils in order to correct the highly acid condition of the surface soil. This will require regular applications of limestone at the rate of two tons per acre, being spread on the ploughed land and harrowed into the soil.

In the management of Nappan soils emphasis should be given to increasing the organic-matter content. In the vicinity of Fox Harbour and Pugwash, these soils have been cultivated for a considerable length of time and are very low in organic matter. As a result, the soils show evidence of poor tilth with shallow and cloddy seed-bed. Where insufficient barnyard manure is available the ploughing down of green manuring corps will be necessary.

Hay and pasture land comprises a large portion of the farm acreage wherever these soils occur. Application of lime and fertilizer on these areas will do much to improve their carrying capacity. Fertilization of hay and pasture fields should be done preferably the second year after they were seeded down, but may be applied on any field which has a satisfactory stand of grass. Ill placed expenditure on fertilizer is often incurred in adding it to fields on which the growth of grass is thin and weedy. For Nappan soils the application of fertilizers for grain and fields roots should be, 2-12-6 at the rate of 300 to 500 lb. per acre and 400 to 600 lb. per acre respectively, and 1,200 to 2,000 lb. per acre of 4-8-10 for potatoes and garden crops.

The largest area of cleared land on most farms of these soils is generally in hay and pasture. Hay cuts on the average, about 1 to 1½ tons per acre, largely timothy, and the pasture fields have a comparatively low carrying capacity.

The herbage, on the whole is only poor when left down any length of time. It consists largely of the natural grasses indigenous to the region, namely, brown top, wild oat grass and poverty grass along with such weeds as evening-primrose, yellow weed or narrow-leafed goldenrod, the hawkweeds and sorrel. The principal field crops grown are typical of those grown throughout the county; oats, barley, timothy or mixed timothy and clover hay, turnips or mangolds and in some cases some corn, fed as a fodder crop. Buckwheat is also grown to a limited extent, mainly for the grain but in some cases as a green manuring crop. The average yield of oats is around 30 to 35 bushels per acre with barley slightly less, buckwheat yields about 22 bushels per acre and field roots approximately 400 bushels per acre.

That Nappan soils will produce much higher yields if good management practices are followed, including the use of lime, manure incorporated in the soil and the application of the necessary commercial fertilizers, is clearly shown by results obtained at the Dominion Experimental Farm, Nappan, where 60 to 70 bushels of oats, 47 bushels of barley, 920 bushels of roots (swedes) per acre have been obtained and mixed timothy and clover hay cuts 2 to 3 tons per acre.

Approximately 50 per cent of the Nappan association is still covered with forest, mainly young growth trees consisting of red spruce, balsam fir, hemlock, birch, poplar, some maple, beech, with black spruce, red maple, tamarack and alders on the poorly drained positions. Most of the bushland consists of farm woodlots that have been closely culled. A considerable acreage of the Nappan soils that has been cleared and formerly farmed is now reverting to bush and much good land is being taken out of production.

Fertility and drainage are the chief problems to be considered in the management of Nappan soils. Damage from erosion is at present more or less local, but if these soils are subject to more intensive cultivation this factor may be expected to become serious. In general, Nappan soils are good agricultural soils and will respond to good management practices.

Joggins Association

Joggins association is one of the minor groups of soil in the county, occupying approximately 8,096 acres or 0.8 per cent of the land area. This association comprises heavy clay till soils derived largely from relatively fine textured grey and red carboniferous sandstones associated with the coal measures series, and possibly some material foreign to the area, such as coarse grained igneous rocks.

Joggins soils are comparatively shallow, and on the whole, poorly drained soils, found mainly on the nearly level to gently undulating topography between Joggins and River Hebert, also north of Leamington Settlement. Surface boulders and stone in the profile are not common. The surface soil in the cleared or cultivated areas is brownish-grey to dark grey in colour, being darker as the organic-matter content increases. When dry it has a characteristic grey hue, tends to become hard, baked and cracked. Below this is a mottled pale yellowish-grey to light grey layer that is sticky when wet but crumbles to a powdery condition when dry. This grey colour of the upper part of the soil is a distinguishing feature of Joggins soils.

The subsoil is grey brown or drab coloured, may show a tendency to a weak nut-like structure, is slowly permeable and stiff and frequently mottled. At about 16 to 20 inches the subsoil grades into a massive compact heavy clay till, grey brown to dull reddish-brown in colour depending upon the type of sandstone predominant in the till. A light grey, silvery sheen was often noted along the face of blocks of the soil or on the face around stones. Numerous specks of black carbonaceous material or coal are also prevalent in the parent material.

Where the redder coloured till occurs the drainage conditions are slightly better than where the till is grey brown, the upper part of the profile is yellow rather than grey in colour and the profile tends to be a little deeper. These variations may occur within a few feet.

Owing to the character of the subsoil, water seeps away slowly and the soil remains wet for a considerable length of time. A moisture belt occurs at the top of this very slowly permeable layer the effects of which have been to give rise to the development of a strongly mottled or Glei-like horizon in which root development is poor, due to lack of proper aeration. Because of the high content of clay the surface soils tend to run and coalesce when wet, becoming puddled, sticky and plastic. Upon drying out during the summer the soil bakes, contracts and has marked cracks across the surface.

Surface soil textures are usually heavy, such as clay loam to heavy clay loam, although some small, local variations of a heavy loam occasionally occur on the knolls, particularly where underlain by the redder till.

A detailed profile description of a clay loam soil in a young growth bush area is as follows:—

Horizon	*Depth*	*Description*
A_0	½″ – 1″	Dark brown to black organic matter consisting of partly decomposed litter from birch, fir, alders, and sphagnum moss.
A_1	1″ – 2″	Black heavy clay loam, containing a high percentage of organic matter, has a weak granular structure and a soft moderately friable consistency. Numerous roots interwoven throughout the layer. pH 4·2.
A_2	2″ – 6″	Ashy grey clay loam having a weak, thin platy structure, a soft consistency and a smooth silty feel. Slight mottling. pH 4·4.
A_3	6″ –11″	Strongly mottled clay loam. Has a weak platy structure; smeary when wet, upon drying is quite firm but crumbles readily. pH 4·5.
B	11″–20″	Brownish-grey or drab heavy clay loam, mottled with grey and yellow. Exhibits a weak nut-like structure; very slowly permeable. pH 4·6.
C	below 20″	Greyish-brown heavy clay loam, massive, compact and impervious. Contains numerous small black specks of carbonaceous material. pH 5·4.

In some of the wetter spots a thin mucky layer of decaying organic matter covers the surface and the soil is almost swampy, with water-loving plants, sedges and blue flag included in the vegetation.

Except for areas in and around Joggins and River Hebert very little of the Joggins association is cultivated. Practically all of the land is covered by a somewhat scrubby second growth mixed-woods vegetation consisting largely of wire birch, white birch, ferns, alders, red maple, spruce and some larch. Among the ground cover are rhodora, labrador tea, glyceria and other moisture-tolerant species. The principal crops grown are oats and hay; yields are low and the quality of the hay is poor. In some newly seeded fields fair stands of clover were noted but due to unfavourable soil reaction and the tendency of the soil to "heave" clovers do not persist and the herbage of the grasslands soon detiorates and has low carrying capacity.

At the present time Joggins clay loam has a low agricultural value. It could be measurably improved by the provision of drainage facilities such as ploughing the land in narrow, high crowned ridges with deep dead furrows to carry away the excess surface water and following good cultural practices as recommended for the other heavy soils such as the Nappan and Queens associations.

Joggins soils are better suited to forest or permanent pasture than for cultivated crops.

Pugwash Association

The Pugwash association comprises one of the four most important agricultural soils of the county. They occupy approximately 100,448 acres or 9.9 per cent of the soils of the area and are found on the undulating to gently rolling topography extending across the central section of the Cumberland plain from the Minudie area to Wallace Bay. The largest areas occur around Minudie, the Mansfield-Leicester Road area north of Oxford and the Pugwash-Fox Harbour area. Other smaller blocks are scattered across the Cumberland plain region.

Pugwash soils are developed from glacial till derived mainly from moderately fine textured, brownish-grey, brown, reddish-brown and greenish-grey Carboniferous sandstones and red Permo-Carboniferous sandstone. Occasionally some influence of Carboniferous conglomerate is present. Some of these rocks are highly carbonaceous and where such rocks are abundant the soil usually has a darker brown colour and is permeated with small chips of the carbonaceous material or coal. The undulations or ridges are relatively low, with long smooth or gentle slopes; very little, if any, of the land is too rough for agricultural use. The surface relief over most of the area is sufficiently variable to provide satisfactory surface drainage and the texture and structure of the surface soil and subsoil is such as to permit satisfactory internal drainage. Imperfectly to poorly drained soils are found on some of the smoother topography. While there are numerous brooks and streams running through the area, providing a natural framework of drainage outlets, many of them are shallow and clogged with vegetation and the streams are sluggish except after heavy rains.

The stoniness of the land presents little difficulty for clearing and cultivating. Cobbles and boulders of sandstones occur on the surface but can be cleared readily. Some gravel occurs throughout the profile and rock fragments are found in the parent material. The gravel content is not enough to interfere with cultivation and adds friability to the soil mass.

The cultivated surface soils on well drained positions are on the whole, low in organic matter. The soil has a pale brown colour and when dry has a greyish cast. Structural development under the best conditions is only a weak fine crumb, and the surface material tends to run together and to form a thin crust when dry. This crust is easily pulverized by cultivation and many of the freshly ploughed fields have a fine cloddy appearance suggesting a heavy soil. Where drainage conditions are unfavourable the surface soil is darker in colour and is often soggy and swampy. The subsurface is either light ashy grey or a dull yellowish grey, according to moisture conditions. Under poor drainage the layer is frequently very strongly mottled.

The subsoil is usually a yellowish-brown to light brown permeable horizon, that is subdivided into a loose upper part having a weak crumb to granular structure and grading into a firmer layer which has a weak platy structure. This horizon is not so well differentiated in the poorly drained associate and may be indurated. Except for the increased quantity of rock material, the change from subsoil to parent material is gradual. The degree of compaction increases with depth from the B_2 down; the colour tends to be darker, especially in the area east of the Pugwash River where the higher content of carbonaceous material has a marked influence on the mass colour of the soil. This carbonaceous material occurs as a thin film on the faces of the soil aggregates or as small fragments about the size of a pea. The core of many sandstone cobbles is composed of this material. West of the Pugwash River, in the Shinimicas-Mansfield area, the subsoils are brighter in colour, have a somewhat smoother consistency and often have a silvery-grey lustre to the mass colour. This variation appears to be related to the rock material occurring most commonly in this sector. This rock material is a soft, fine textured brown sandstone, containing little or none of the black, organic matter, and frequently has a fair amount of micaceous material present. In some places the soil resembles the Tormentine soils and where the two associations intermingle separation of the two is often difficult.

Sandy loam is the dominant textural class of the surface soil, with loam and sandy clay loam also having been noted. A profile description of a well drained Pugwash sandy loam profile, under forest conditions is as follows:—

Horizon	*Depth*	*Description*
A_0	0" – 3½"	Brown to brownish-black organic matter; felty, partially decomposed. pH 4.4.
A_2	3½" – 9"	Light grey sandy loam, having a pinkish cast. Tendency to a platy structure, firm but porous. pH 4.8.
B_1	9" – 15"	Light brown clay loam. Granular to fine crumb structure, soft and crumbly. Contains some coarse gravel. Good root penetration. pH 4.8.
B_2	15" – 23"	Light brown sandy clay loam, tendency to a platy structure. Firm to compacted, but breaks readily into sharp angular fragments. Has a greyish cast. pH 5.1.
C	below 23"	Weak reddish-brown sandy clay loam. Firm to compacted, but permeable. Contains a moderate amount of rounded and subangular grey and red sandstone fragments, varying in size from 2" to over 8" in diameter; black carbonaceous material also present. pH 5.9.

Agriculture

Much of the land occupied by the Pugwash association is still under forest vegetation, consisting mainly of second or younger growth red spruce and birch, with some red maple, poplar, tamarack and pine on the well drained soil. In the poorly drained positions it is largely scrubby black spruce, tamarack, wire birch and alders. The forest has in the past supplied considerable wealth to the area and still continues to provide a large part of the income on many of the farms. While there are blocks of forest from which logs suitable for lumber can be obtained, severe culling has depleted the supply so that pulpwood forms a large part of the revenue from forest products.

Mixed farming in association with dairying constitutes the major agricultural activity and in addition some farmers grow a limited acreage of early potatoes. Good quality Irish Cobblers are produced in the vicinity of Shinimicas.

The potential agricultural value of the Pugwash soils is fairly high, having about the same natural fertility as the Queens soil, but being superior to it in having better internal drainage. Drainage is an important factor in the area in which these soils occur as excess moisture in the soil delays the time of seeding. In general, the heavier the texture of the parent material the less satisfactory will be the internal drainage. The percentage of total clay given in Table 12 indicates that the Pugwash soil is intermediate between the heavy textured soils such as Queens and Nappan, and the light textured soil such as Tormentine.

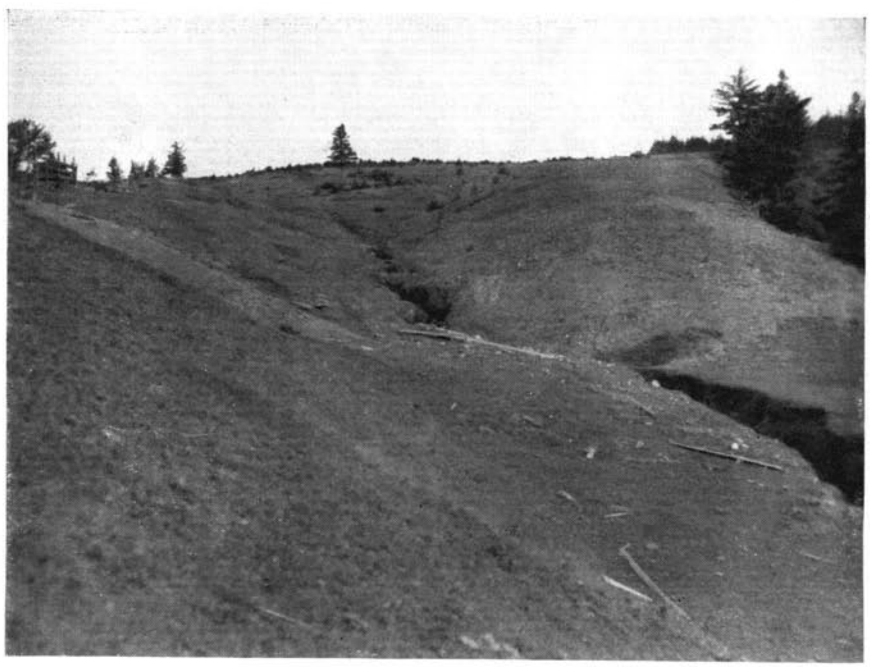
For successful crop production attention will need to be given to improving the fertility of these soils. They are low in available plant food and are very acid, particularly in the surface soil. The recommendation made with regard to the application of lime and fertilizers for the Queens soil applies equally as well to the Pugwash soils. The lime requirements figures given in Table 12 indicate that regular applications of limestone, of two tons per acre, will be necessary to alleviate the acid condition of the soil.

Most of the cultivated land is in hay and pasture, much of which is of poor quality because of thin stand and weedy condition. Abandoned land quickly shows the effects of deterioration and reverts to relatively dense growth of alder and spruce. The maintenance of suitable hay and pasture land will require first, liming to promote the growth of clovers, followed by applications of manure or commercial fertilizers to furnish other plant nutrients. Deteriorating effects in the soil tend to be cumulative so that if even small applications

Stony areas. Used for sheep pasture. Cobequid Association.

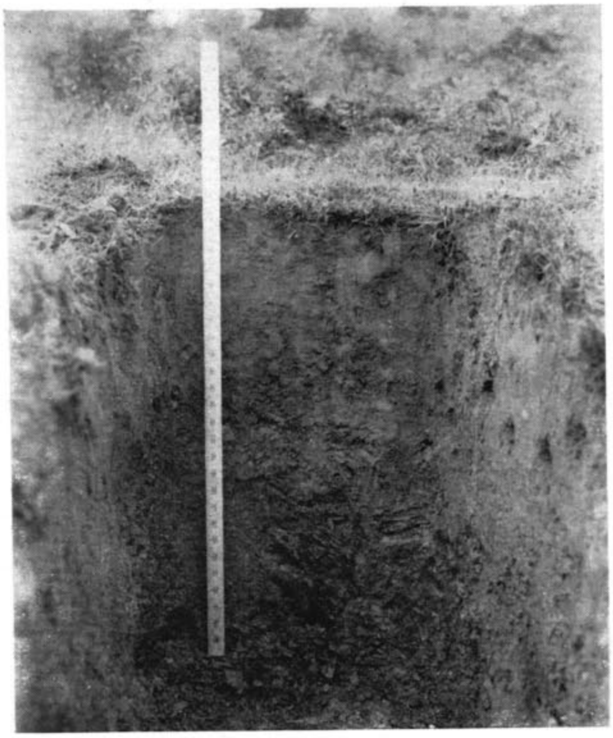
Vegetable crops growing on Tormentine sandy loam.

Haying operations on Acadia soil near Amherst.

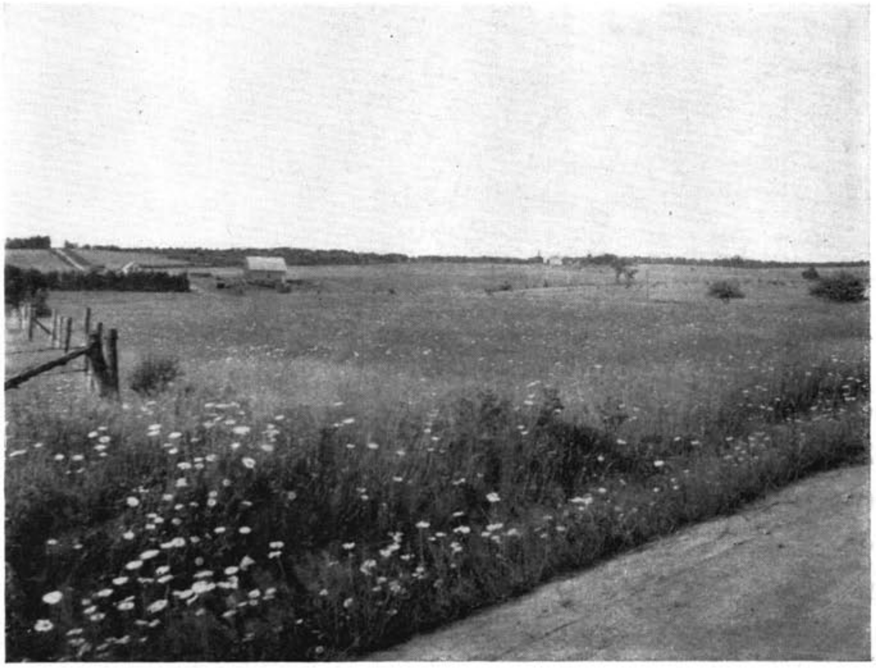


Effects of improper use of land. Neglected farm, note spruce invasion, thin grass cover and the resulting sheet and gully erosion.

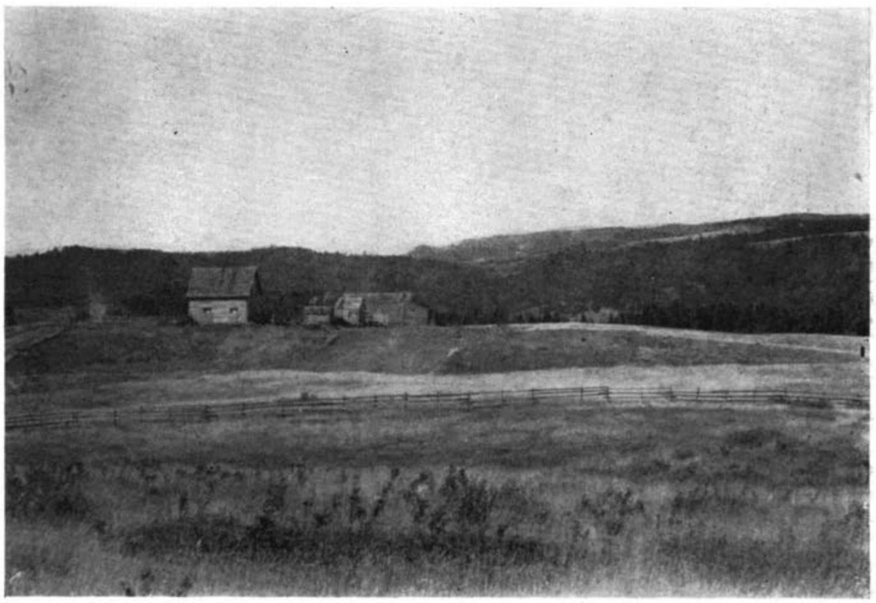
(*a*) Profile of Queens clay loam. Imperfect natural drainage.



(*b*) Shallow soil over shaly bedrock. Kirkhill Association.



Undulating topography characteristic of Queens Association.



Abandoned farm on Kirkhill Association. Note the sparse grassland vegetation and the hilly topography.

of lime or fertilizer were added to pastures they would help to maintain a moderate level of fertility.

Average yields of oats and barley, the two main grain crops, are 30 bushels and 25 bushels per acre respectively, while hay averages around one ton per acre. Under a good system of management, such as the turning under of a good aftermath and the use of manure, lime and some commercial fertilizer, yields of 50 bushels or more of oats, 40 bushels of barley and two tons of hay per acre, have been obtained.

Pugwash soils generally are easy to work under proper moisture conditions. Because of the lateness of the season they are often worked when they are too wet, which produces a shallow cloddy seed-bed. Consequently the seed will be exposed on the surface, germination will be poor, droughtiness increased and the efficiency of applied fertilizers will be reduced.

Owing to the comparatively fine texture of the surface soil, erosion may occur either as sheet erosion or wind erosion. The maintenance of a higher organic-matter content in the soil will help to solve this problem.

Tormentine Association

Soils of the Tormentine association cover approximately 124,218 acres or 12·3 per cent of the county. Developed mainly from the comparatively soft, micaceous red sandstone of the Permo-Carboniferous period these soils are amongst the most important agricultural soils of the county.

The general topography is broadly undulating to nearly level. On the more undulating topography the surface relief provides moderately good surface drainage and the permeable character of the subsoil provides good internal drainage. On the flatter topography, of which there is a considerable area comprising approximately 55 per cent of the association, the natural drainage is imperfect to poor. Surface drainage is relatively slow even though there are numerous water-courses running through the area. Most of them are comparatively shallow and sluggish, except at the time of heavy rains, consequently their efficiency as drainage outlets is much reduced. Dredging and cleaning out of many of these water-courses, particularly the larger ones, such as the La Planche River would probably increase the acreage of potential agricultural land. The somewhat compact nature of the subsoil of the poorly drained associate which in some cases is indurated to form hardpan, retards internal drainage, causing the upper part of the soil to remain wet until quite late in the season.

Few reddish sandstones and boulders occur on the surface of Tormentine soils. Variable amounts of small sandstone fragments and smoothly rounded pebbles are found in the profile, in some places the latter give the soil the appearance of having been modified by water action. Stones in the profile however are not abundant enough to interfere with cultivation.

A vertical exposure through a cultivated soil shows several distinct layers. The surface layer consists of a fine textured, friable, mellow soil, brown to light brown in colour which dries with a greyish cast. The structure of the surface soil is, on the whole, only weakly developed, but the soil has a characteristic small cloddy appearance when cultivated, giving it the appearance of a heavier soil than is actually the case. Below plough depth a light grey or white sub-surface layer may occur depending to some extent upon the length of time the soil has been under cultivation and how deep it has been ploughed and mixed with the subsoil. The upper part of the subsoil is a bright coloured, orange or reddish-yellow, loose, friable sandy loam. It grades into a light brownish-red to bright red, firmer sub-horizon that has a feebly developed thin platy structure. Below 24 inches or more the parent material is a dull brick red, slightly compacted sandy loam to sandy clay loam till, that is friable and porous.

In the poorly drained position the surface soil is greyish-brown in colour and frequently has a weak fine crumb structure. The subsurface layer is dull grey in colour, frequently thicker than the A_2 of the well drained associate, and is often underlain by a strongly mottled yellow-grey layer, the zone of fluctuating ground-water levels. The subsoil and parent material are dull brownish-red and quite compacted; the change from one to the other often being very gradual making it difficult to separate them.

The prominent features of the Tormentine soils are: the characteristically bright red colour of the parent material and the mellow friable consistency of the soil profile.

Two textural classes have been noted in this association, sandy loam and loam. The sandy loam is the dominant texture. The following description is representative of a virgin sandy loam profile:—

Horizon	*Depth*	*Description*
B_2	15″ – 27″	Light brownish-red to brick red sandy loam. Firmer than B_1 decomposed. pH 4·2.
A_2	1½″ – 9″	Light ashy grey to white sandy loam, has a pinkish cast. Practically structureless, loose an dporous. pH 4·4.
B_1	9″ – 15″	Light yellow, to reddish-yellow, loose, mellow sandy loam. Has feeble fine granular structure, contains variable amount of small sandstone pebbles. Good root penetration. pH 4·9.
B_2	15″ – 27″	Light brownish-red to brick red sandy loam. Firmer than B1 but porous. Has a weak thin platy structure, contains sandstone pebbles and chips of soft red sandstone. Good root distribution. pH 5·0.
C	below 27″	Brownish-red or dull brick red sandy loam, firm to slightly compacted but porous. Crushes readily upon fracturing, tends to break with a flaky fracture, brittle and grittier than B_2. Some root penetration also some red and brownish sandstone gravel. Much of the sandstone is soft and micaceous. The mica appears to impart a slight greyish sheen. pH 4·7.

In the vicinity of Linden and north of Lake Killarney the soil is heavier throughout than normal, the surface texture is loam and the sub-soil ranges to a sandy clay loam or heavier. This appears to be a transition area between Tormentine and Nappan soils and the principal rock material is a fine textured brown sandstone. The profile has a somewhat more silty or more cheesy-like consistency. In the Shinimicas Bridge-Head or Amherst area where the Tormentine and Pugwash soils merge the profile is a little browner in colour and shows slightly more compaction in the subsoil than is generally noted.

Agriculture

Practically all of the well drained soil of the Tormentine association is cleared and under cultivation and has a high agricultural value. The types of agriculture prevailing over most of the area are mixed farming and dairying. Around Amherst some of the farmers specialize in fluid milk for the local retail market or for shipping to outside markets. Over most of the area, however, cream is the chief dairy product, and is sold to local creameries for butter production. Strawberries, potatoes and vegetables, mainly for the local markets, are also grown on many farms around Amherst where the soil is predominantly sandy loam and well suited to such crops.

The principal field crops grown for livestock feed are oats, barley, timothy and clover hay, turnips and mangolds. Some buckwheat is grown and threshed and occasionally some spring wheat is grown for domestic consumption.

Under the cultural practices prevailing generally throughout the region yields are relatively low, grain about 30 to 35 bushels per acre, hay 1½ tons per acre and field roots around 450 bushels per acre. Although the natural fertility of Tormentine soils is not high they will respond to good management, as indicated by yields of oats as high as 75 bushels per acre and hay over 2 tons per acre.

The poorly drained areas are either used for rough permanent pasture or bush, forming the woodlots on most farms. The tree growth consists of young spruce, fir, red maple, alder and wire birch. The lay of the land is suited to the use of practically all modern farm machinery. In general the surface soils, are easy to work and absorb moisture readily; cultivation is possible soon after rains owing to the openness of the surface soil and the permeability of the subsoil. Because of the light texture and porosity of the profile the moisture-holding capacity of Tormentine soils, except in the Linden area where the texture is heavier, is only fair. In dry seasons crop growth may be retarded because of an insufficient water supply, particularly on the older cultivated areas where, as a result of unsound soil management, the organic-matter content is low. Careful attention to the maintenance of an adequate supply of organic matter is essential for improvement of the moisture-holding capacity and preventing, to some extent, the droughty condition of the soil as well as for ensuring good tilth and the maximum efficiency of applied fertilizers and the plant food elements in the soil. The barnyard manure should be worked into the soil and where the supply is insufficient, as is generally the case, it can be supplemented by ploughing down a green manuring crop or a good clover aftermath. In many cases the stable manure is applied as a top dressing, either just after seeding or on the aftermath of the first cut of hay. As mentioned above it should be worked in wherever possible because the organic matter is needed in the soil not on the surface. At the time of seeding, oats usually receive 200 to 400 lb., and field roots 400 to 600 lb. per acre of commercial fertilizer. The kinds in common use are 2-12-6 for grain and 4-8-10 for roots and potatoes.

Liming is essential on these soils if clovers are to be successfully grown and if quality and yields, of not only the hay crop, but of pastures also, are to be increased. Where the practice of liming has been followed, particularly in conjunction with the use of manure or commercial fertilizers, excellent results have been obtained and the practice should be encouraged.

On many farms in the past the farm practice has been to intensively cultivate the fields close to the buildings, giving them all the barnyard manure and leaving the fields at the far end of the farm in grass, occasionally breaking the land and giving it an application of commercial fertilizer. This practice is now being changed on many farms, all the fields being brought under a relatively short, regular rotation (3 to 5 years) with a more uniform distribution of the manure, the ploughing down of a good aftermath and the use of soil amendments. Where this has been done it has resulted in a considerable improvement in crop yields and quality of the grasslands.

The agricultural value of many poorly drained areas could be increased by some system of drainage and by following the same general practices of soil management as are used on the better drained member. The pasture areas, on the whole, have a poor quality herbage which is very often weedy. Under good management more desirable species of grasses and clovers are encouraged and the carrying capacity of the pastures increased. With the improvement of the drainage some of the less well drained fields could be brought under cultivation. Owing to the fine texture of the surface soil Tormentine soils on the well drained position, are exposed to losses as a result of soil drifting, and to sheet erosion caused by water action.

Southampton Association

The soils of the Southampton association are medium textured till soils derived from a mixture of purplish conglomerate, grey sandstone and grey conglomerate rock material. Depth to bedrock is variable with outcrops frequently occurring. The soil appears in many places to be a transition soil between the

West Brook, Rodney and Shulie soils. The texture and porosity of the till and the general appearance of the profile is somewhat variable depending on the kind of rock material predominating and the proximity of the soil to that of the other associations. In the Indian Reserve area, west of the Boar's Back road the soil mass is sandier than normal and contains more of the grey sandstone. South of Athol the profile is also sandy and open but has a slightly higher clay content and the parent material has a darker grey colour than in the Reserve area, while south of Southampton the subsoil has a sufficiently high clay content to classify it as a sandy clay loam and shows more compaction. In the West Brook area where the conglomerate rock predominates the profile is shallow and some conglomerate rock outcrops occur. The topography is rolling to hilly; drainage generally, is adequate and the quantity of stone on the surface and in the soil is variable but not as plentiful as in the West Brook and Rodney soils.

Only a small proportion of Southampton soils are cleared and under cultivation. The greater part is still covered with a young growth forest vegetation consisting, largely, of spruce, birch, maple, and fir.

The cultivated soil has a pale brown or greyish-brown surface layer which is loose and porous but may become crusty when the organic matter is low. It is underlain by a bright brownish-yellow or deep yellow, loose, mellow B_1 which in turn is underlain by a medium brown, slightly firmer B_2 that may have a weakly developed coarse granular to fine nut-like structure. Below 18 inches the parent material is grey or brownish-grey in colour, often compacted although friable and permeable.

Sandy loam textures predominate in the surface and subsoil horizons. A detailed description of a virgin sandy loam profile is as follows:—

Horizon	*Depth*	*Description*
A_0	0″– 1″	Dark brown raw humus, partially decomposed mixed woods and moss debris.
A_1	1″– 3″	Greyish-brown sandy loam, little or no structure. Loose and porous. pH 4·0.
A_2	3″– 5″	Ashy grey to white sandy loam, loose and practically structureless. pH 4·2.
B_1	5″–10″	Brownish-yellow sandy loam, fine crumb structure to structureless. Loose and porous. Contains some gravel. pH 4·6.
B_2	10″–20″	Brownish sandy loam, may have a greyish or purplish cast. Firmer than B_1 but readily permeable. Weak crumb or small nut-like structure. Some gravel. pH 4·8.
C	below 20″	Brownish-grey sandy loam. Firm to compacted but permeable. Contains grey sandstone and conglomerate rock material. pH 4·6.

Agriculture

As only the smoother topography along the roads is cleared the amount of land farmed is small, the type of agriculture is a mixed lumbering-farming combination, with lumbering providing most of the income. Oats and timothy hay are the principal crops grown. Applications of lime are necessary for clover. Yields under average treatment are in line with those of most soils of the county under similar conditions, namely, about 25 to 30 bushels per acre for oats and about 1 ton of hay per acre. In the Apple River district some excellent kitchen gardens were noted indicating these soils will respond well to good cultural practice.

Topography and quantity of stone on the surface rather than soil conditions limit the agricultural value of these soils.

Shulie Association

Shulie soils comprise the most extensive association mapped in Cumberland county and for this reason, rather than their agricultural value these soils are among the most important in the economy of the county. Extending across the

Cumberland plain area from Salt Springs to Chignecto Bay Coast, they are found around Springhill, in the vicinity of Maccan, south of River Hebert, and between Two Rivers and Apple River, with some smaller blocks in other parts. In all, the area covered by the Shulie association is approximately 163,872 acres or 16·1 per cent of the total land area of the county.

These are fairly coarse textured soils developed on glacial till that owes its origin to the weathering of hard, moderately coarse grained Carboniferous sandstones, light grey, greenish-grey and greyish-yellow in colour. In the western section, between Shulie and Apple River, some grey conglomerate occurs.

The topography of the Shulie soils is undulating as in the Shulie-Apple River area; strongly undulating, as south of Two Rivers; or rolling, as around Springhill Junction.

Both surface and internal drainage is adequate over the greater part of the area and on the more rolling areas is inclined to be excessive. Owing to the sandy texture and the stony, porous character of the soil percolating waters pass rapidly through the soil, and the profile, as a rule, shows evidence of considerable leaching. In the depressions and on the smoother topography drainage is imperfect to poor, with numerous swampy spots being scattered throughout the area. The unfavourable drainage conditions may be due to any one or all of a number of factors, such as, inadequate natural drainage outlets; shallow soil over bedrock or clay substrata, both of which conditions were noted, or to the formation of compact or indurated subsoils. These compacted layers restrict the downward movement of water and hold the excess water at a high level as shown by the strong mottling of the bottom part of the comparatively deep leached horizon.

Shulie soils are characterized by the high percentage of grey sandstone boulders and slabs on the surface and throughout the profile. The slabs of sandstone are usually flat, sharply angular in shape and vary in size up to 8 inches or more in length. The bedrock in many places is close to the surface, within 18 inches, and frequently outcrops, especially in the Shulie-Apple River area.

Surface soils in the cleared and occasional cultivated fields are usually brownish-grey or a weak brown in colour, low in organic matter, loose and structureless. The subsoil generally is a loose, stony sandy loam, bright yellow or yellow-brown to greyish-brown in colour, occasionally it is weakly cemented. At about 24 inches the subsoil grades into a brownish-grey parent material that changes little in texture or compaction.

Surface textures throughout the association are quite uniform being predominantly sandy loam. On some of the knolls or higher ridges, where drifting or erosion has removed some of the surface soil the texture is a loamy sand. Under normal forest conditions an undisturbed soil has the following profile:—

Horizon	*Depth*	*Description*
A_0	0″–2″	Raw humus, mainly coniferous tree debris, slightly decomposed. pH 4·4.
A_2	2″–7″	Ashy-grey to white sandy loam. Practically structureless, very porous, contains fragments of grey sandstone. pH 4·8.
B_1	7″–14″	Deep yellow to orange yellow sandy loam. Loose and porous; little or no structure; has a harsh, gritty feel. Contains angular fragments of grey sandstone. pH 5·4.
B_2	14″–24″	Grey to brownish-grey sandy loam. Firmer than B_1 but quite permeable. Has a tendency to a feebly developed fine platy structure. pH 5·4.
C	below 24″	Grey to grey brown sandy loam. Firm, permeable and stony. pH 4·7.

Agriculture

The soils of the Shulie association are not used to any extent for agricultural purposes; they are essentially forest soils. This is not because they will produce better trees than other soils in the county, but because the quantity of stone on the surface and in the soil mass, generally, is sufficient to limit, and in places, prohibit the clearing of the land and the economical use of farm machinery. Because of the stony, porous nature of the profile the moisture-holding capacity of these soils will be low, and moisture conditions in dry seasons will limit crop production. Due to their sandy nature Shulie soils are strongly podsolized and the natural fertility level is relatively low which will make it difficult to maintain a satisfactory level of productivity.

These soils formerly supported a fairly good forest growth consisting of a mixed softwood-hardwood association, some of the tree species being spruce, birch, red maple and pine on the better drained land with black spruce and tamarack on the wetter areas. Practically all of the land has been cut over, so that the better stands of timber to-day are second or younger growth trees consisting of spruce, poplar, wire birch, pine and some larch. The open spaces are usually grown up to blueberries, bracken, sweet fern, such grasses as wild oat-grass (*D. Spicata*) and poverty grass (*P. Depauperatum*). Severe culling and forest fires have reduced a considerable acreage of Shulie soils to the state of barrens, on which the vegetative covering is mainly wire birch, a scattering of Jack pine and a dense growth of blueberry, sweet fern, bracken, sheep-laurel and haircap moss. In the wetter areas black spruce, alder, purple laurel, labrador tea and rhodora form the natural vegetation.

Forest fires not only destroy the standing timber, they also destroy the organic matter in the soil and in cases of severe fires also sterilize the surface layer. As a result it takes a considerable number of years for nature to repair the damage because the vegetation re-establishes itself very slowly.

The average accumulation of forest litter and humus on Shulie soils is comparatively thin and care should be taken to preserve it if Shulie soils are to produce a good crop of timber, for which they are best suited.

West Brook Association

The West Brook association consists of a medium to coarse textured glacial till soil occurring along the northern boundary of the Cobequid range. The area covers approximately 74,259 acres or 7·3 per cent of the county. It extends from Apple River to West Brook and occurs also in the vicinity of Windham Hill, Westchester, Greenville and Wentworth. These soils are developed from gravelly parent material derived mainly from Carboniferous conglomerate rock material, presumably of the Pennsylvanian series, and some grey sandstone rock material.

The colour of the soil, particularly of the subsoil and parent material, is one of the striking characteristics of this association. It is a deep red or purplish red. This colour appears to be intimately associated with this particular kind of conglomerate rock.

West Brook soils are usually well drained. Being situated on the undulating to gently rolling topography of the lower slopes of the Cobequids, surface drainage is rapid and on some slopes erosion may be serious. Although the clay content of the subsoils has given them some degree of compaction they are sufficiently pervious to permit free internal drainage. Narrow, ill-drained depressions occur at the bottom of some of the steeper slopes, on the more rugged topography around Westchester. Ill-drained areas are also encountered on the nearly level to gently undulating topography in the western section of the county. The poorer drainage conditions in this area may be due to a higher clay content in the parent material than is usual or to the soil being shallower over the rock.

An appreciable amount of large stones and boulders occurs on the surface and occasionally outcroppings of the conglomerate rock are found. There is considerable gravel in the subsoil and parent material, ranging as high as 50 per cent. The gravel consists principally of rounded igneous material which is characteristic of the pebbles forming the conglomerate rock. Due to the presence of this gravel the soil in many places has the appearance of outwash material.

In general the cultivated surface soil is low in organic matter, as indicated by the light or yellowish-brown colour. Structural development is weak or lacking altogether, and the soil is loose and porous. In some places the soil has a reddish cast, which suggests that surface soil is being lost through erosion. The A_2 horizon is light ashy-grey to white in colour, with a pinkish or purplish cast. It is a loose, porous layer with little or no structure. Below this is a yellowish-brown to light reddish-brown friable subsoil having a weak structural development ranging from fine granular, in the upper part, to fine nut in the lower section. Although quite gravelly the subsoil has a sufficiently high clay content to give it a fair amount of body and a fair moisture-holding capacity. At about 20 to 24 inches the subsoil grades into a dark reddish or purplish-red gravelly parent material which is compacted but porous.

The area around Eatonville, New Salem and the western area generally, is browner in colour than normal and the profile contains more coarse rock material. West of Westchester and near Lower Greenville the subsoil and parent material contain enough clay to classify them as gravelly clay loam. This may be due, in part, to the influence of the reddish-brown shales of the Boss Point formation which is present in this region.

In the imperfectly drained soils of the West Brook association the A_2 layer is frequently bluish-grey in colour, somewhat cohesive and has a tendency to a weak platy structure. The subsoil is mottled at the top and not clearly subdivided as in the well drained soil.

Surface textures are variable consisting of coarse sandy loam, sandy loam, gravelly loam and loam. A detailed profile description of a virgin loam is as follows:—

Horizon	*Depth*	*Description*
A_0	0″ –2″	Dark brown to black raw humus, composed of mixed-woods debris. Partially decomposed. pH. 4·6.
A_2	2″– 5″	Ashy grey loam, has a pinkish cast. Structureless and loose. Soft, friable. pH 4·6.
B_1	5″–11″	Deep yellow to light yellow brown gravelly loam, fine granular structure, soft and loose. Good root penetration. pH 4·7.
B_2	11″–20″	Brownish-red or light brown gravelly loam. Firm, crushes readily, has a weak granular to small nut-like structure. Permeable. pH 4·8.
C	below 20″	Purplish-red gravelly loam. Firm to compacted but permeable. Contains smooth, rounded conglomerate gravel. Fair root penetration. pH 4·9.

Agriculture

West Brook soils are largely covered by forest consisting mainly of young growth of red spruce, yellow birch and wire birch. A large part of the cleared areas are used for rough pasture which in general furnishes only fair grazing. The natural grass herbage, mainly brown top and wild oat grass, is thin and spindly. A large proportion of these soils are too stony and rough for the use of most agricultural machinery and it is only on the smoother topography along the lower slopes, adjacent to the roads, that they are under regular cultivation.

General farming, with cream production as the main source of income, is the type of agriculture practised on West Brook soils. The principal crops grown are oats, timothy, or timothy and clover hay, and some barley for the feeding of livestock. Moderately good crops of grain can be grown where sound cultural practices are followed. West Brook soils, as a whole, need more organic matter. The addition of organic matter will help to retain moisture and also add to the plant food supply. Hay and pasture yields will also be materially increased by attention to the organic matter supply. As a rule hay and pasture yields are low on these soils. In the West Brook and Pettigrew Settlement strawberries are grown successfully, largely for the local markets in Amherst and Springhill. The soil is suited to this crop and also to potatoes.

Rodney Association

In general the texture, origin, and character of the land surface of the Rodney soils are similar to those of the West Brook association. They are developed from a gravelly or stony glacial till which is apparently derived from a mixture of Carboniferous sandstone and conglomerate rocks and material from the igneous rocks of the Cobequids, with the sandstone predominating. This mixture of rock materials has given rise to a soil that possesses many of the features of the West Brook soils but differing from them in having a browner coloured profile, a slightly lower clay and higher sand content and in general, a more open, porous profile.

Rodney soils occupy approximately 53,267 acres or 5·3 per cent of the total area. Two large areas have been mapped, one in the vicinities of Southampton, South Brook, East Mapleton and Rodney. A second area occupies the territory extending from just east of River Philip toward North Greenwood. These two main areas are linked by a narrow belt along the base of the Cobequids between Rodney and Collingwood.

The topography is strongly undulating to rolling. Numerous boulders, mainly greyish sandstone, are found on the surface and a considerable amount of coarse gravel and stone occurs throughout the profile. Drainage, on the whole, is well established. Due to the character of the general relief surface drainage is rapid and the stony, porous nature of the profile permits rapid percolation through the soil. On the lower stretches of the longer, smoother slopes and in some of the depressions or gullies associated with the steeper topography there are some small scattered areas of imperfectly to poorly drained soil resulting from seepage from the higher ground. These areas however are not very numerous. Between Windham Hill and Rodney, also to some extent in the New Canaan area the profile is more open and porous than in the South Brook or the Collingwood and Williamsdale area. Consequently the soil is less drought resistant in the former areas, where the dominant rock material is a moderately coarse textured sandstone, than in the other areas where conglomerate rock or a reddish-brown fine textured sandstone or shale are evident.

Under cultivation the surface soils are brownish-grey to moderately dark brown in colour. They possess little or no structural development and are only weakly cohesive. Occasionally in some of the older grassland soils where good management has allowed a fairly good sod to develop, a weak granular structure is noted.

The subsoil is light brown in colour, loose and practically structureless, usually not quite so firm as in the West Brook profile, and contains a considerable quantity of gravel. The underlying till is stony and permeable although in places there is a fair degree of compaction. It ranges in colour from a weak greyish-brown to a weak reddish-brown. The degree of compaction and colour is related to the kind of rock material that is prevalent in the parent material.

Surface texture varies within narrow limits, ranging from a sandy loam to loam, with the loam being more extensive. A detailed description of a virgin profile of the loam follows:

Horizon	Depth	Description
A_0	0" – ½"	Organic layer, consisting of partially decomposed forest litter.
A_1	½"–1½"	Dark grey loam, almost structureless. Gravelly and friable.
A_2	1½"–3"	White sandy loam to loam, may have a faint pinkish cast, practically structureless, loose and gravelly. Irregular development.
B_1	3" –9"	Deep yellow to brownish-yellow gravelly sandy loam to loam. Tendency to a small crumb structure, loose and soft.
B_2	9" –18"	Light brown gravelly sandy loam to loam, firmer than B_1 but permeable. Structure is feebly developed, weakly granular.
C below 18"		Greyish-brown gravelly loam. Firm but permeable.

The imperfectly drained member of this association differs from the well drained mainly in the restricted development of profile. As a rule the colour profile below the surface is fairly uniform making it difficult to differentiate between subsoil and parent material. It also has a duller lustre than the well drained member and except in the depressions or on the flatter topography, A_2 development is lacking. Where it does occur it is generally a dull grey colour and occasionally strongly mottled. Mottling as a general rule is not noticed in this soil.

Agriculture

Only a small percentage of the Rodney association is under cultivation, the cleared areas are small, usually located on the smoother topography along the roads, and they are to a large extent used for pasture. The rugged character of the topography and the stoniness of the soil generally are unsuited to the use of all types of modern machinery so will limit the extent to which Rodney soils are developed for agricultural purposes.

Approximately 80 per cent of the area mapped in this association is under a forest cover consisting mainly of pure stands of maple, beech and birch or mixed stands of maple, birch, spruce and fir. On most of the farms forest products provide a considerable part, if not the major part, of the farm income with dairying in the form of cream production playing a secondary role. Herds of cattle are small, the supply of barnyard manure inadequate with the result the organic-matter content of the cultivated soils is, on the whole, low.

The principal crops grown are oats and barley, some field roots, either turnips or mangolds, chiefly turnips, and timothy or timothy and clover hay.

Under prevailing conditions oats and barley yield around 30 to 35 bu. per acre, and hay about 1 to 1½ tons per acre.

Cultural practices to obtain maximum yields on Rodney soils will be the same as for those of West Brook association, namely attention to the organic-matter content, proper fertilizer treatment and attention to erosion control.

While erosion is not a serious problem with the Rodney association it is one that exists, especially on the steeper slopes. Evidence of erosion is to be seen in some sectors in the obvious increase in the amount of small stone on the surface resulting from the washing away of the finer soil particles. Even in the bush gullying is taking its toll. In many places old skidways or logging trails have been obliterated and have given place to gullies where the destructive action of surface run-off has been accelerated owing to the gouging out of furrows in the surface covering as a result of skidding operations.

Spencer Association

The Spencer association consists of stony till soils derived mainly from dark grey and brownish-grey Carboniferous sandstone, and from Triassic Trap rock material. They occupy 2,528 acres or 0·2 per cent of the land area, the least extensive of the upland soils of the county. They are found on the strongly undulating to rolling topography between Cape D'Or to Cape Spencer, at Black Rock, and Partridge Island.

The relief consists of steep sided ridges with narrow tops. External drainage on the whole, is free to excessive, and the open, porous character of the soil mass allows free downward movement of water. There are however some seepage spots on some of the lower slopes, invariably where the soil is shallow to bedrock. The quantity of stone on the surface and in the profile is sufficient to restrict and limit the clearing and agricultural development of Spencer soils. Numerous boulders and angular slabs of sandstone and trap are found on the surface while as much as 40 per cent of the subsoil and till consists of stone and gravel, and outcrops of trap rock are not uncommon.

The surface soil usually consists of about 6 inches of light brown gravelly sandy loam which has little or no definite structure, is loose, quite porous and readily absorbs rainfall. The upper subsoil is a yellow brown or orange coloured gravelly sandy loam, structureless, loose and porous. Below this the lower subsoil is a browner gravelly to stony sandy loam, sharper and grittier than the upper part but like it, also loose, porous and lacking in structural development. At a depth of 16 to 24 inches is a light grey brown to brown gravelly or stony sandy till, which is firm but quite permeable. The gravel or rock material consists of smooth, flat, rounded and subangular particles, mainly sandstone and trap with an admixture of other igneous rock material from the Cobequids.

Spencer gravelly sandy loam, the predominant textural class, has a relatively low agricultural value, because of the nature of the topography, which is, on the whole, too rough for the use of modern farm machinery, and because of the stoniness of the soil. Very little of this soil is cleared and under crop. It supports a young mixed-wood growth, common to most of the soils south of the Cobequids; namely, spruce, maple and beech. The cleared areas are largely used for pasture. The herbage appears to be of relatively good quality which indicates that on the smoother slopes Spencer soils have an agricultural value as potential grasslands.

Hansford Association

The soils of this association are, as a rule, fairly coarse textured although somewhat variable. They are developed on mixed till or parent material which ranges from stony sandy loam to a sandy clay loam, derived principally from brown, brownish-grey and grey Carboniferous sandstone. The soil is gritty and contains a relatively large proportion of sand. The parent material may show some indications of weak stratification in the till. In places it has a fairly open substratum and in others it is relatively shallow and slightly compacted but permeable. The largest areas of Hansford soils occur north of Oxford; between Hansford and Conn's Mills; also east of Thompson to New Jersey. Other, smaller areas are found north of Mansfield, east of Nappan and east of Blairs Lake.

These soils occur on strongly undulating to gently rolling topography associated with terminal moraine country and on broad-topped, fairly steep sided ridge terrain and on knolls. They occupy approximately 42,618 acres or 4·2 per cent of the total land area.

The surface relief, on the whole, is sufficiently rolling to give good drainage and the porosity of the subsoil allows free internal drainage. In depressions and on some of the lower slopes and flatter relief the soil is slightly heavier and natural drainage is restricted. The quantity of stone on the surface and through the soil will adversely affect the agricultural development of these soils.

The surface soil in the cleared areas is a light grey brown sandy loam, moderately low in organic matter, loose and quite porous. Under this is a yellow brown subsoil, gravelly and loose which grades at 20 inches into a firm to slightly compacted, but permeable light brown gravelly sandy loam which has a slight greyish cast. In many places the soil is similar to the Pugwash soils except that it has a much higher percentage of greyish sandstone slabs in the profile and the till is not as uniform in texture.

Agriculture

Hansford soils are not used to any extent for agricultural purposes. All of the land has been cut over, some of it has been cleared and brought under cultivation. At the present time however the acreage under crops is small, and occurs mainly around the buildings on farmsteads occupied for the most part by part-time farmers, largely farmer-woodsmen. The cleared areas away from buildings are usually in grass, which is of poor quality, principally red top, and generally thin and weedy.

Due to the prevailing light texture and the porous character of the profile, Hansford soils have a low moisture-holding capacity, probably one of the lowest of any soil in the county and the organic-matter content is also low. The land under crops produces fair yields of small grains, vegetables and potatoes but constant care is needed to maintain fertility.

Under present economic conditions Hansford soils are marginal agricultural land and would be better left under forest. At the present time the tree growth consists largely of young birch and spruce. In the Leicester Road area where the soil has a little more body, maple and beech also occur. Many of the burned over areas now consist of birch-blueberry barrens.

Cobequid Association

Occupying approximately 64,083 acres or 6·3 per cent of the total area the Cobequid association consists of soils developed on comparatively shallow till, which has been derived from igneous rock materials such as felsite, syenite, diorite and granite. This soil is well distributed across the top of the Cobequid mountain range, from the vicinity of Lakelands, on the Parrsboro Pass, to the county boundary east of Wentworth. Another smaller area occurs west of New Yarmouth and Eatonville.

The general topography is rolling to hilly, in some places mountainous, with the tops of the larger hills being gently undulating. When considered as a whole it has the character of a dissected plateau, many deep, steep-sided gorges and ravines accentuate the apparent ruggedness of the topography. Drainage on the whole is adequate, the surface relief is sufficiently undulating, over most of the area, to provide moderately good surface run-off and the porosity of the soil mass is favourable to the free movement of percolating water. Seepage spots occur, due to the nature of the local surface relief or to the movement of excess ground-water over the surface of the bedrock.

Varying amounts of stone and boulders occur on the surface and throughout the profile. Numerous large stone piles in the fields and along the fence rows are testimonials to the amount of labour spent in clearing the land. Depth to bedrock probably does not average more than 2 feet and rock outcrops occur frequently. Surface soils in the cleared areas are dark brown to dark grey brown in colour and where there is a fairly good supply of organic matter have a granular structure. In seepage spots the surface soil is much thicker, almost black in colour and becomes quite soggy. The subsoil which is dark yellow brown to rust brown in the upper part and brownish-grey in the lower section contains a large amount of angular gravel, in some cases as high as 45 to 50 per cent. At about 14 to 18 inches it grades into a grey, compact stony till.

The A_2 or subsurface layer is not always present in the cleared areas. However under forest vegetation and good drainage conditions it is light ashy grey in colour, mellow and porous, but under poor drainage, such as in seepage spots, it tends to be bluish-grey.

Surface soils range between sandy loam and loam in texture, while the sandy loam is probably the more extensive. The loam occurs most frequently on the smoother topography hence is of greater agricultural importance. The profile of a representative loam soil consists of:—

Horizon	*Depth*	*Description*
A_0	0"– ½"	Dark brown to black raw humus, composed of partially decomposed tree, grass and sphagnum moss debris. Strongly acid reaction. Good root mat.
A_1	½"– 2"	Dark grey to dark brown of black loam having a feebly developed granular structure. Soft and easily crumbled. Strongly acid.
A_2	2"– 5"	Light ashy grey gravelly clay loam. Has a feeble granular structure; soft, mellow consistency and is strongly acid.
B_1	5"–11"	Dark yellow-brown to dark rust or bronzy-brown, porous, gravelly sandy loam. Fine soil particles are soft, mellow and have weak cohesion. There is good root distribution through this layer. Reaction is strongly acid.
B_2	11"–19"	Light brownish-grey gravelly loam, having a weak granular structure, which readily crumbles. It is firmer than B_1 but permeable. Stone content increases, many roots permeate the soil and the reaction is strongly acid.
C	below 19"	Light grey gravelly or stony clay loam till. Quite compact and brittle, shatters readily. Practically no roots present. Reaction medium acid.

The characteristic colour of the B_1 or upper part of the subsoil is probably due to the infiltration of organic colloids from the surface layer. Occasionally the texture of the parent material is much lighter, light loam to sandy loam. This occurs frequently in the shallower profiles. The quantity of rock material also is usually greater in the shallower profiles, hence moisture capacity will be lower than in the deeper, better textured soil.

Agriculture

Nearly all of the Cobequid soil is under forest vegetation. The main species are spruce, yellow birch, wire birch, maple, with some beech and fir. Some stands consist of almost pure spruce and others are the maple, yellow birch and beech, but the mixed stands predominate. In the poorly drained soils black spruce and alder predominate.

Very little of the land is used for farming; many of the cleared areas that were under cultivation at one time, are now reverting to young forest growth—mainly spruce or alder.

Character of the topography, stone content and variability in depth of soil over rock are factors adversely affecting the agricultural value of Cobequid soils. On the whole the majority of the area is better adapted to forest, which is its main crop at the present time. The soil on the smoother relief tends to have the deeper profile, consequently better moisture conditions than the shallower soils. It offers possibilities for pasture lands that with reasonable attention should give very satisfactory results. Two factors however may limit the use of the land for this purpose, difficulty of access and the problem of water supply for the livestock.

Wyvern Association

This is a group of stony till soils extending along the northern boundary of the Cobequid range, from the vicinity of New Canaan to Wentworth. They are derived principally from igneous material in which granite is prominent, with some small amounts of grey sandstone.

The surface relief ranges from undulating to hilly. The smoother topography is characterized by long smooth slopes, while that of the more rugged sections frequently consists of short, steep-sided ridges having narrow tops.

External drainage is rapid to excessive, especially on the more strongly sloping relief and the gravelly, porous character of the soil mass allows rapid percolation of ground-water. In areas of more rolling topography semi-swampy spots are to be found; these are seepage spots on the lower slope or in the depressions between the steeper slopes. On the steeper slopes erosion has to some extent modified the profile, both by removal and deposition, as shown by the redder cast of the surface soil on these slopes and the thicker darker coloured surface soil at the bottom of the slopes.

Boulders of granitic origin are plentiful on the surface, over most of the area. Gravel and stone are also plentiful through the soil being as high as 60 to 70 per cent in the parent material.

Wyvern soils comprise about 4·2 per cent of the land area in the county, or approximately 43,891 acres. Of this area 75 per cent or more is still covered by woods, largely a mixed hardwood-coniferous association. Some of the more luxuriant stands of hardwoods are encountered on these soils, either as the predominant species in the mixed-woods association or as pure stands. Sugar maple, beech, yellow birch and red spruce are the main tree species.

A cross-section of the soil in old pasture areas consists of 6 inches of brown to dark brown loam permeated with fine roots and having a fairly high organic-matter content. It is loose, soft and friable and has a weakly developed crumb structure. Under the prevailing cultural practice the organic matter becomes depleted and the surface is usually lighter brown in colour and loses its structure. Below this is a loose, mellow layer, variable in thickness and development, which is dark yellow brown or light bronzy-brown in colour. At about 9 inches it grades into a brown gravelly sandy loam that has much the same general characteristics but is frequently firmer than B_1. The parent material, which is reached at around 20 inches, is a firm but permeable gravelly or stony till, brown or greyish-brown in colour.

Wyvern soils do not appear to have been as strongly podsolized as some of the other soils of the county, especially those of the Carboniferous region. While the ashy grey subsurface or A_2 horizon occurs in the wooded areas it is not, as a rule, as well developed or as persistent as in other soils.

Loam is the dominant textural class, although sandy loam and gravelly phases are encountered. A profile description of a loam profile, taken in a second growth woods area is as follows:—

Horizon	*Depth*	*Description*
A_0	0″– ½″	Very thin layer of leaf litter, mainly deciduous leaves.
A_1	½″– 4″	Brown loam; moderately well developed crumb structure; soft mellow consistency, loose and absorbent. Good root development. pH 4·0.
A_2	4″– 6″	Intermittent pockets of ashy grey or white sandy loam, has a purplish hue, loose and porous.

Horizon	*Depth*	*Description*
B_1	6″–11″	Dark yellow brown or light bronzy brown gravelly sandy loam. Tendency to a weak small crumb structure; loose and porous; contains a considerable amount of smoothly rounded and flattened granitic and other igneous gravel. Good root penetration. pH 4·4.
B_2	11″–20″	Brown gravelly sandy loam, slightly firmer than B_1, otherwise much the same as B_1. pH 4·6.
C	below 20″	Greyish-brown gravelly sandy loam till. Firm to compacted but crushes readily and is permeable. Large proportion of the gravel granitic in origin. pH 4·6.

Wyvern soils differ from Cobequid soils in that they are somewhat sandier throughout, usually have a deeper profile and the rock material present is gravel rather than angular stone. Roots of most common plants easily penetrate the soil down to and into the parent material. Erosion has in some places modified the profile by removal and deposition of part of the surface soil. The deeper profile is found on the smoother or gently undulating topography on the top of the Cobequids or on the lower section of the northern slope. On the steeper slopes the profile is shallower and stonier.

Agriculture

The economic value of Wyvern association lies mainly in the forest cover for which it is, on the whole, well suited, as the vigorous tree growth well proves. While the physical characteristics of the soil have much to recommend it as a potential agricultural soil the prevalence of stone, the character of the topography over a large part of the area, and its general location and inaccessibility will be limiting factors to be considered in its utilization.

At the present time most of the land utilized for agricultural purposes occurs along the northern slopes of the Cobequid where it is used largely for pasture land. Fields that are within easy reach of the farm buildings and are located on the lower, smoother slopes are used for field crops and in seasons of favourable moisture conditions fair yields of grain, mainly oats, and hay, are obtained. In years past a considerable acreage of land along the roads going south over the Cobequid range had been cleared and farmed as noted by the old grasslands reverting to bush and the stone fences now well hidden by the dense growth of young trees.

The type of agriculture that was practised on these abandoned farms and largely prevails today is a part time lumbering-mixed farming type. Herds are small in size; three or four milch cows, and some cattle for fattening. The cream is usually sold to local creameries.

The main crops grown are oats, barley, buckwheat and timothy hay with some fairly good crops of clover in newly seeded fields. Under the normal cultural practices prevailing, grain yields around 25 to 30 bushels per acre, and hay cuts 1 to 1½ tons per acre.

The area of Wyvern soils having a surface relief suitable for farming is relatively small and the parcels of such land are widely scattered so that its value as an agricultural soil is limited and it would be better left in forest.

Kirkhill Association

Kirkhill association occupies 29,933 acres or 2·9 per cent of the county. It consists of a shallow shaly till soil derived from a bluish-grey or medium grey shale, presumably Pre-Carboniferous material. This soil occurs in the southern part of the county, extending almost continuously from West Advocate to the eastern boundary of the county, along the Harrington River. The area forms a belt 2 miles wide and is only broken by stretches of alluvial soils along the various rivers,

The topography is rugged or hilly and has the appearance of an undulating plateau strongly dissected by numerous deep ravines and stream courses.

Because of the nature of the surface relief, the abundance of natural drainage outlets, and the shaly porous character of the soil, Kirkhill soils are predominantly well drained, having good surface drainage and fairly rapid internal drainage. Occasional seepage spots occur on some of the smoother slopes where the bedrock is near the surface and breaks the slope.

In some of the small depressions, the soil consists of 20 to 30 inches of fairly well decomposed peat.

Surface stone is plentiful, in places sufficient to interfere with the clearing of the land, and the subsoil is gravelly or shingly. The rock material is composed, principally, of thin flakes or chips of shale which are comparatively soft and easily broken. Bedrock outcrops are frequently encountered.

The profile of this soil is variable in depth ranging from 12 to 24 inches. It is not so severely leached as soils developed from sandstone material and the subsoil has a characteristic yellow colour.

Under cultivation or old pasture land conditions the profile usually consists of, a grey brown or a light brown, loose, mellow surface soil, sandy loam to loam in texture and having only weak structural development, pulverulent to fine crumb. Below this is a bright brownish-yellow or strong yellowish-brown subsoil, which is loose, porous, almost structureless and only weakly cohesive. It contains 50 per cent or more of fine shale. This layer dries with a pale yellow colour.

The parent material in the deeper profile is an olive grey or olive brown, loose, porous shaly till, containing 70 per cent or more of shale chips. In the shallow profile the parent material is frequently composed of partially weathered shale chips with little or no fine soil material. In many places the soil has the appearance of being a semi-residual soil. There is however sufficient evidence to indicate feeble glaciation so that Kirkhill soils might properly be designated as "Glacio-residual."

The surface texture is loam to clay loam, with some small areas of slightly lighter texture on some of the sharper knolls. A detailed description of a representative profile of the deeper soil taken under as nearly virgin conditions as possible in a second growth forest area, is as follows:—

Horizon	Depth	Description
A_0	0" – 3"	Dark grey brown to black moss or organic layer consisting of partially decomposed mixed woods litter. pH 4·2.
A_2	3" – 7"	Light ashy grey shaly heavy clay loam. Very feeble structure, loose and porous. Contains a high percentage of shale chips. ph 4·0.
B_1	7" –12"	Deep yellow-brown shaly sandy loam; structureless, loose with only weak cohesion. Fairly good root distribution. pH 4·5.
B_2	12"–24"	Darker yellow brown shaly sandy loam, with a slight olive cast. Similar to B_1 in structure and consistency, but contains more shale chips. Fairly good root penetration. pH 4·9.
C below 24"		Olive grey or olive brown shaly sandy loam till, largely composed of finely divided bluish-grey shale fragments; loose and porous. pH 5·0.

Agriculture

Owing to the ruggedness of the topography and the variability of the depth of the profile Kirkhill soils can only be classed as marginal agricultural soils. While a fairly large proportion of the land has, in the past, been logged and cleared and brought under cultivation most of it is now in bush or neglected grassland that is reverting to woods. Areas suitable for farming are small in extent and widely scattered, where the soil is being cultivated the type of agriculture practised is largely a part time lumbering-farming proposition, providing a place of residence and seasonable employment when lumbering operations are slack.

The crops grown are mainly oats and hay, the latter largely composed of native grasses or timothy. Grain crops are only fair and hay stands light although the condition of the turf on many old grasslands is superior to that on the sandstone formations. Some very good vegetable gardens are grown indicating that Kirkhill soils will respond to intensive cultivation and proper soil management.

Soils on Water-laid Parent Materials

The soils on water-laid parent materials include the Hebert, Parrsboro, Cumberland and Acadia associations. They are found on kame and esker formations; as outwash deposits and terraces along the rivers and streams, and around the coasts.

While they are not very extensive, covering approximately 74,309 acres or 7·3 per cent of the area, the water-laid soils are important because they include the marine deposits or dykelands (Acadia association) and the intervale lands (Cumberland association).

Soil textures cover a wide range, from cobbly loamy sands to silty clay loam and clay loam. Textures are largely influenced by the geological origin of the material and the effects of water action.

The Hebert and Parrsboro associations are coarse textured, porous, well drained soils of the kames, eskers, older river terraces and deltas. Surface soils absorb the rainfall readily and dry out rapidly. The porous nature of the subsoils facilitates rapid leaching and as the original base content of such water-worked soils is not very high they will require sound management practices if good yields are to be obtained. Gravel pits are found on these two associations and the gravel is of variable quality.

The Cumberland association consists of bottom-land or intervale soils. These soils are immature, subject to flooding and renewal, and drainage is seasonal. Agricultural value depends largely upon depth of the deposit, texture of the soil and gravel content.

Acadia soils are found around the coast and in some of the river estuaries. They are heavy textured, and probably the most fertile soils in the county. Natural drainage is variable.

Hebert Association

The soils of the Hebert association are in many respects similar to the Parrsboro soils; but they usually occur on the more irregular topography of the kame and esker formations; as ridges or remnants of old terraces along the slopes bordering drainage channels, and as outwash on the adjacent smoother topography. Formed from water deposits they consist of sands and gravels derived mainly from sandstone and conglomerates of the Carboniferous period and igneous rock material of the Pre-Carboniferous period. The more stony and cobbly soils are associated with the steeper slopes and ridges, while the sands are formed on the smoother topography along the bottom of the slopes and along the drainage channels.

Occurring as they do along most of the larger drainage channels and along many of the smaller ones, Hebert soils, are well distributed throughout the county, having a total area of 25,767 acres or 2·5 per cent.

The largest and most important areas are along the Folly Pass and Wallace River, the Pugwash River, River Philip and the Boar's Back ridge along the Hebert River. With the exception of a few small isolated areas these soils are all well drained. The nature of the topography on which the greater proportion is found allows rapid run-off and the porosity of the soil mass permits free percolation. The stony nature of the surface soil, on the steeper slopes, has protected it to some extent from serious erosion damage.

Cultivated surface soils are brown in colour, varying in intensity from light to dark according to the organic-matter content, which generally is low. Immediately below this is a white or light ashy grey subsurface layer. Both the surface and and subsurface horizons are loose and porous, lacking structure and cohesion. The subsoil is loose and porous, yellowish-brown to light brown in colour, which at 20 inches or more grades into stratified parent material.

Three textural classes have been mapped; sandy loam, gravelly sandy loam and cobbly sandy loam. The sandy loam is the most extensive and is more frequently used for agriculture. A representative profile of a virgin loamy sand is described as follows:—

Horizon	*Depth*	*Description*
A_0	0″– 1″	Dark brown to black organic matter, fairly well decomposed needle and moss debris. pH 4·6.
A_2	1″– 5″	White sand, structureless, loose, open, has slight pinkish cast. No cohesion. pH 4·4.
B_1	5″–13″	Deep yellow brown loamy sand, structureless, loose and open. Scattered throughout are pebbles of weakly cemented material about 3″ in diameter. pH 4·6.
B_2	13″–24″	Light brown with reddish cast or light reddish-brown loamy sand; structureless, loose and porous. pH 4·8.
C	below 24″	Brownish-grey sand, stratified with lenses of reddish fine sandy loam to very fine sand. Stratified gravel 3 feet or more from surface. pH 4·6.

The sandy loam differs from the other two classes in its smaller quantity of gravel, and in being practically stone free.

The cobbly sandy loam is very open and porous which makes it a dry soil consequently unsuitable for agriculture.

Hebert soils are not important agricultural soils. They are largely covered with young growth of spruce, fir, pine and wire birch. The cleared land is confined mainly to the smoother topography along the drainage channels where the sandy loam is located. Like the Parrsboro soil their agricultural value will depend more on the cultural practices followed than on the character of the soils. Given good management, Hebert sandy loam could be used for early crops such as potatoes and strawberries; but is marginal as grassland soil. The grass stand is only fair in all but wet years and even then growth is inferior to that upon the stronger till soils.

Parrsboro Association

Parrsboro Soils occupy the nearly level to undulating outwash plains, river and delta-like terraces. They are light textured soils developed over shaly, gravelly and stony parent materials derived from greyish shales of the Lower Carboniferous or Upper Devonian, the igneous rocks of the Pre-Carboniferous and in some cases Carboniferous sandstone material may predominate.

The larger areas of these soils are to be found around Advocate, Diligence River and Parrsboro with some smaller areas scattered throughout the county. The total area is about 8,041 acres or 0·8 per cent.

While the general relief of the areas on which the Parrsboro soils occur does not allow rapid run-off, drainage generally is free to excessive. The porous character of the soil permits rapid internal drainage and it is only in the occasional trough-like depressions, such as occur between Parrsboro and Diligence River, that drainage may be restricted. In seasons of low rainfall the low moisture-holding capacity of these soils may result in drought injury to the common crop plants.

The cultivated surface soil is greyish-brown to dark grey in colour depending upon the organic-matter content. Where this tends to be high the tilth of the surface soil, as indicated by a small crumb-like or granular structure, is moderately good. Below this is a yellowish-brown to light brown or weak reddish-brown subsoil. It is usually loose and porous with little or no definite structure. Occasionaly however, a tendency to a weak cementation in the upper part of the subsoil occurs. At a depth of about 20 inches the material grades into a grey brown to olive brown gravelly to stony parent material which is stratified to a greater or lesser degree. The character of the parent material depends to a large extent upon the area through which the stream courses traversed. In the Diligence River-Port Greville area it usually consists of small, flat, smoothly angular fragments of shale whereas in the Parrsboro area it is more rounded and mainly igneous gravel or stone.

As a rule there are very few large boulders on the surface but the whole profile is gravelly to stony, running as high as 88 per cent gravel in the parent material.

The surface texture varies from sandy loam to gravelly loam with the gravelly loam being the dominant texture.

A detailed description of a representative profile of Parrsboro gravelly loam is as follows:—

Horizon	*Depth*	*Description*
A_0	0″– 1″	Black semi-decomposed, felty organic matter consisting principally of needle and moss mould.
A_1	1″– 5″	Grey brown gravelly loam having a weakly developed fine granular structure. It is soft, loose and powdery, and only weakly cohesive. Traces of a light ashy grey layer are present, mainly as small, isolated pockets. pH 5·0
B_1	5″–13″	Light brownish-yellow gravelly loam, loose and porous with only a very weak development of a fine granular structure. Root development is fair. pH 5·0.
B_2	13″–16″	Light brown gravelly, coarse sandy loam, similar structure to the upper part but slightly firmer although quite porous. There is a marked increase in the amount of gravel or stone. pH 4·6.
C	below 16″	Greyish coarse gravel and cobblestones, mainly rounded igneous rock material. Loose and very porous. pH 5·0.

In the Port Greville-Diligence River area the profile is shallower, not so well developed and has a little more body throughout than is general for Parrsboro soils. Surface boulders are more numerous in this locality and poorly drained areas are more frequent.

Agriculture.

Owing to the open, porous nature of the soil, and to its low moisture-holding capacity, Parrsboro soils can only be considered as marginal agricultural soils. Their agricultural use will be largely determined by the cultural practices followed. In seasons of high precipitation and under good management, which includes the building up of the organic-matter content and liming, as well as the use of commercial fertilizer, moderately good crops of hay and oats can be produced. Hay, mainly timothy and red top, yields about 1 ton per acre and oats, the main grain crop, about 25 to 30 bushels per acre.

While most of the area mapped as the Parrsboro association is cleared, only a small percentage is cultivated. The majority is grassland of poor quality, the herbage consisting mainly of red top or brown top. Spruce, alder and some birch vegetation is encroaching and claiming a considerable part of this land.

Cumberland Association

Cumberland association consists of soil materials carried and deposited along the bottoms of stream courses and lying at and below flood level. The materials are largely of local origin and the soil mass, will in the main, reflect the influence of the rock materials of the area through which the stream flows. Being associated with practically all the streams of any size, Cumberland soils are widely scattered throughout the county, and they are, in some sections, of considerable importance in the agricultural economy of the area, although not very extensive in acreage. They comprise 2·4 per cent of the county area or approximately 24,096 acres.

The surface relief is nearly level, with small undulations and hummocks, Natural drainage is variable and is largely influenced by seasonal fluctuations in the level of the individual streams. In the spring and after heavy seasonal rains the drainage conditions temporarily may be poor, but once the water-table is lowered the soil is moderately well drained.

Cumberland soils are variable in texture, ranging from gravelly material to fine sand, silt or clay. They are immature soils, having little or no profile development and are periodically made over by fresh soil material deposited at the time of flooding. Variations in the texture of the subsoils are as wide as those of the surface soil, although they are as a rule composed of coarser material than are the surface soils.

Three textural classes have been mapped in the Cumberland association; gravelly sandy loam, sandy loam and silt loam. While the sandy loam is the most extensive, 10,707 acres, the silty loam is perhaps the more important agriculturally.

A representative profile of Cumberland silty loam has the following description:—

Horizon	*Depth*	*Description*
Surface Soil:	0″– 8″	Dark reddish-brown or light chocolate brown loam to silt loam. It is soft and mellow, has a fine crumb structure, tends to be sticky when wet. Good root distribution. pH 5·0.
Subsoil:	8″–28″	Lighter brown loam to silt loam. Finely granular structure, soft, mellow consistency. pH 5·2.
	Below 28″	Similar to the subsoil, faintly laminated with thin layers or lenses varying in hue and texture. These lenses are due to mode of deposition. Below 42″ the soil tends to become coarser in texture. pH 5·0.

The depth of the profile of Cumberland soils varies from 10 to 36 inches. Most of the soils are underlain by coarse sand or gravel and the coarseness and character of the gravel frequently varies with the distance from the Cobequid Mountains.

The profile of the silt loam is usually free from any appreciable amount of gravel; the sandy loam is more open, usually contains a fair amount of fine gravel throughout the soil, and coarse gravelly material is frequently reached within 36 inches of the surface. The gravelly sandy loam usually consists of 6 to 12 inches of dark brown gravelly sandy loam over coarse gravel or cobbles.

Occasionally small depressions are poorly drained and may even be mucky, such spots however are not numerous.

Soils of the Cumberland association, especially the sandy loam and silt loam, are important because in some sections they provide most of, and in some cases, practically all of the arable land on the farm. They are all more or less cleared, but in some of the more neglected sections alder and willow are encroaching. Owing to the periodic flooding or silting the soils of the Cumberland association are comparatively fertile and have continued to produce relatively good crops, particularly grass.

The extent to which these soils are cultivated depends largely upon their stoniness, depth of soil and the frequency and length of time they are flooded. As a general rule the gravelly sandy loam class provides only poor rough pasture. Such soils occur mainly close to the Cobequid Mountain range and are shallow to the cobbly substratum.

The sandy loam class is also largely used as meadow or hay land, although in some sections grain is occasionally grown. The wider variety of crops is grown on the silt loam; in the vicinity of Oxford and River Philip Station some very good crops are obtained. The turf of the grasslands is fairly thick, with a relatively high percentage of white or alsike clover. Where lime is used good stands of red clover have been obtained on the new seeding, with hay yielding 2 to $2\frac{1}{2}$ tons per acre.

The principal grain crops grown are oats and barley, in favourable years and under good management 35 to 40 bushels of grain per acre are obtained.

Acadia Association

One of the most important soils in the Cumberland county area consists of the marine deposits or "dykeland" as it is locally called. These dykelands comprise one of the most unique features of the landscape of the Maritime Provinces of Canada and have been made famous by Longfellow in his poem "Evangeline". They have had an important place in the history and agricultural development of the Maritimes since the very earliest settlement by the French or Acadians, in 1605. Because of this association with the early life of the region it was considered appropriate to designate them the Acadia association.

Acadia soils are found around the coast and in the estuaries of many of the rivers. The largest area occurs at the head of the Bay of Fundy forming a prairie-like stretch of land along the boundary of Nova Scotia and New Brunswick. The area with which this report is concerned consists of what is known as the Amherst Marshes, which are situated between the Missaquash River and Amherst, the Elysian Fields or Minudie Marsh at the head of the Minudie Peninsula, the dykeland along the Hebert, Maccan and Nappan Rivers and other smaller areas in the vicinity of Advocate and along the Northumberland Strait. The total area of Acadia soils covers approximately 16,045 acres or 1·6 per cent of the land area of Cumberland county.

These marine deposits are quite uniform in their profile characteristics. With the exception of the comparatively small area in the Northumberland Strait section the Acadia soils are developed from sediments laid down by the Bay of Fundy tides and are derived from the disintegration of the Carboniferous and Triassic rock material of the surrounding uplands and underlying rocks of the Bay of Fundy region. In the Northumberland Strait section a very large part of the material has been transported by the larger rivers as the result of erosion and wastage of the adjacent rock formations and land surface.

The topography is nearly level to gently undulating, a striking feature of the relief is that the elevation along the inner boundary bordering the uplands is usually lower than it is along the outer or seaward boundary. Surface stone and boulders are absent and the profile is stone free.

The natural drainage ranges from poor to moderately good, depending upon the level of the water-table, which in turn is influenced by the micro-topography, condition of the dykes and drainage ditches.

Mode of deposition and drainage conditions are the two factors that have influenced what might be termed profile differentiation. The effects of weathering expressed in true profile development characteristic of a normal upland profile are not, as a rule, found in the Acadia soils. Occasionally slight evidence was noted suggesting a tendency to true profile formation.

Variations in the soil profile occur within relatively short distances. The principal differences observed in the Acadia soils generally are depth to the grey or bluish-grey subsoils; the degree of mottling in the subsoil and the type of vegetation growing on them. On the basis of these variations the dykelands have been separated into two groups, the moderately well drained, comprising about 8,237 acres, and the poorly drained, of which there are approximately 7,808 acres.

The better drained areas are characterized by having light coloured surface soil, greyish-brown to brown, with a general structure that is pulverulent in character and a tendency to a weak crumb structure where the organic-matter content is higher than the average. It is cohesive when wet but crumbles readily in the dry condition; it has a soft, friable consistency and is moderately porous with a good root development permeating the layer. Below this is a second layer of light (chocolate) brown to brown clay loam, having in some cases a reddish cast. It exhibits a tendency to a platy-like structure, although this is not definite or consistent. When wet it is sticky and cohesive but crumbles readily when dry. This layer grades into a light greyish-brown to light brown clay loam, having a weaker structural development. Greyish and yellow mottling may occur and the soil becomes more plastic. Only a few roots occur in this layer.

The underlying substratum, below 35 inches from the surface, is a grey, bluish-grey or dark blue silty clay loam which is plastic and impermeable. It is usually waterlogged.

The surface layer of the poorly drained soil is, as a rule, darker in colour although it ranges from a greyish-brown to dark brown to black. The darker coloured soils usually are permeated with fibrous roots and have a higher organic-matter content. They are, however, invariably puddled and sticky, with little or no structure and are frequently mottled at the junction with the second layer, with rusty staining along old root channels.

The subsoil is light grey, occasionally greyish-brown in colour, structureless, sticky and plastic, very often strongly mottled indicating poor aeration owing to drainage conditions; therefore unfavourable for root development. This is shown by the abundance of rusty brown staining along the old root channels and the paucity of live roots. Occasionally the upper part of the subsoil will be quite crumbly and have a tendency to a feeble nut-like structure while the lower part is amorphous or structureless. It would appear that this condition is more in evidence where there has previously been a fairly good root development, because where this crumbly condition occurs there is usually found more of the rusty-brown staining and evidence of root channels.

The underlying substratum is bluish-grey or grey, sticky, plastic, impermeable and usually water logged.

Surface textures include loam, silty clay loam, clay loam and clay. A profile description is given of a moderately well drained Acadia silty clay loam taken on the Amherst Marsh area:—

Horizon	*Depth*	*Description*
Surface Layer:	0″– 7″	Greyish-brown silty clay loam. Has a good small crumb structure; soft, friable and porous. Good root distribution. pH 5·0.
Upper Subsoil:	7″–22″	Brown clay, fair nut structure, permeable, has a smooth silty feel. pH 6·4.
Lower Subsoil:	22″–44″	Brown clay, weaker structural development, otherwise similar to the previous layer. Plastic, stained with brown along root channels. pH 6·8.
Substratum:	Below 44″	Dark bluish-grey clay. Sticky, plastic, impermeable and wet. pH 7·0.

The dykelands of the Northumberland Strait section are not of as high quality as the better drained areas of the Cumberland Strait region although similar in general development. They tend to be somewhat sandier and in places gravel may be at the lower depths. In the Advocate area the dykeland is largely of a better drained class and consists of a dark brown surface over brown clay to a depth of 30 inches or more.

Agriculture

The Acadia soils have a high potential agricultural value, but are not utilized to the best advantage. Although they have long been noted for their relatively high agricultural value their productive capacity, in general, has deteriorated owing to continuous cropping, improper management and neglect of the dykes and adequate drainage facilities.

The natural vegetation is a grass climax consisting of salt marsh grasses, mostly *Spartina*. Probably the most prominent species is *Spartina stricta* or *Alterniflora*, commonly known as "Broad Leaf", which is a tall, rank growing grass. Other species are fox grass, salt marsh grass and black grass.

Field observation shows that given proper management the productive capacity of the Acadia soils can be materially increased. As previously stated, the differences in the soil profile are related to the level of the water-table and the micro-topography. The better drained and more productive areas occupy the slightly higher topography, consequently have an advantage in greater depth above the high-water mark of daily tidal fluctuations, hence greater depth of well aerated soil, permitting deeper root penetration and feeding range for plant roots. This is reflected in the wider range of better quality herbage of the grasslands which consist of what is locally known as "English hay", namely, a mixture of the cultivated hay plants; timothy, alsike clover and red clover. This English hay along with oats and field roots are the principal crops grown on the Acadia soils.

The productive capacity of these soils is to be noted in yields of oats of around 50 to 60 bushels per acre, with 110 bushels having been obtained where liberal applications of commercial fertilizer have been used. Hay yields of 2 to 4 tons per acre are not uncommon. Alfalfa has been grown fairly successfully on the dykeland area at the Dominion Experimental Farm, Nappan, N.S.

Though the general texture of the Acadia soils is naturally well suited to grass, experience has shown they are also suited to most general farm crops when given good management, and they will provide excellent pasture lands after the removal of the field crops.

There are a number of sections of the dykeland areas that show very clearly what can be done with these soils if they are given proper treatment. The need for maintaining the organic-matter content is emphasized in order to bring about a desirable structure or tilth of the surface soil, and to protect it from excessive drying out and cracking. The ploughing down of barnyard manure or in its absence, a good clover sod will materially aid in attaining this objective. Applications of agricultural limestone and where necessary commercial fertilizers are also recommended. The practice of short rotation cropping should also be included in a good soil management program for Acadia soils. A fundamental problem, that will influence the success or otherwise of such a program as above suggested, is the provision of adequate drainage facilities and attention to the repair of the dykes.

The serious damage to bodies of dykeland with a resulting loss in agricultural value, due to poor drainage facilities and neglect of repair to dykes, is well illustrated on such bodies as Upper Missaquash, East Amherst and along the Eddy road and sections of the Minudie Marsh. Where these areas should be producing good crops of hay and grain similar to those on the better managed bodies they are, invariably, covered with flood waters until late in the spring and summer and produce only "Broad Leaf" and bushes.

To provide the necessary drainage facilities it will not only be essential to deepen, clean out and keep clear the main natural drainage channels but will also require a systematic drainage scheme on the individual bodies of dykeland. This can be accomplished by a system of open ditches at regular intervals. The dykeland area at the Nappan Experimental Farm is a clear demonstration of what can be accomplished along this line.

Organic Soils

Throughout the county there are approximately 6,093 acres of organic soils, about 0·6 per cent of the total area. These deposits are composed of plants and plant residues in varying stages of decomposition which have accumulated under poor drainage conditions in depressions, sites of old ponds and lakes.

The natural vegetation consists of typical bog plants such as, sphagnum, sedges, cotton grasses, pitcher plants, heath, stunted black spruce and larch.

The larger areas of organic soils, particularly southwest of River Hebert, consist of treeless, sphagnum peat. Along the upper reaches of the Missaquash and La Planche Rivers lies a considerable area described by Leverin (12) as floating bog. Many of the smaller areas are covered by a stunted vegetation, mainly black spruce, larch and alder, with various heath plants and a mat of sphagnum.

The organic soils vary in depth from 12 inches to 10 feet or more and are of two classes: Peat and muck, depending upon the percentage of organic matter and the stage of decomposition.

Peat.—(5,453 acres—0·5 per cent)

The largest areas of peat occur southwest of River Hebert, between the Hancock brook and Patton creek; along the road between Athol and Millar's Corner and south of the highway between Diligence River and Fox River. Many smaller blocks are scattered across the county.

The peat in these areas is of the fibrous, sphagnum moss type, particularly the blocks south of River Hebert and along the Athol Road, where they form treeless bogs or muskeg. The character of the peat varies from raw sphagnum moss 3 to 4 feet or more in depth to fairly well decomposed, black material, almost rubbery in consistency. The whole profile is saturated with water. In the Diligence River area and most of the smaller blocks, where there is some tree growth, largely scrubby alder, tamarack (larch) and black spruce, the peat is somewhat different, approaching more of the woody-peat type. It usually consists of 2 feet or more of raw sphagnum moss over dark brown fibrous, felty peat to 3 or 4 feet below which the material is more highly decomposed and spongy with the water level below the sphagnum moss layer.

Muck.—(640 acres—0·06 per cent)

The muck deposits occur as small, isolated parcels throughout the county. The organic material composing these is more thoroughly decomposed than in the case of peat, the plant remains having lost their identity.

The surface layer is 12 to 20 inches thick, black or very dark brown in colour, well decomposed and has an oozy consistency. Below this is a dark brown layer, not so well decomposed as the surface layer. This is frequently underlain, at 3 feet or more, by a strongly mottled, compact soil similar to the surrounding mineral soils.

Agriculture

Only very small acreages of the organic soils of the county have been utilized for agricultural purposes. They are of the woody-peat type or muck, small areas of which are used, on the farms where they occur, for the production of hay or pasture and in some cases for garden crops. In the vicinity of West Brook 10 acres of these organic soils have been planted to cranberries.

When considering the suitability of organic soils for agricultural purposes a number of factors will neeed to be considered, namely, the character and depth of the material, the possibility of drainage, the degree of acidity, cost of clearing and the availability of markets.

Muck soils are very satisfactory for garden and truck crops provided the right fertilizers for each kind of crop are used to overcome the deficiencies in plant food elements. Woody peat is also suited to agricultural purposes where properly treated. The moss types of peat, because of their raw, fibrous character are not suited to the growing of crops.

Owing to their high organic-matter content, 20 to 95 per cent, these soils have a high moisture-holding capacity and high shrinkage upon drying. Organic soils, generally, are characterized by a comparatively high total nitrogen content and a low available nitrogen content; potash, lime and phosphoric acid are low although the lime and phosphoric acid are more variable than potash. The soil reaction is generally strongly acid.

Organic soils could be used to good advantage for the improvement of many of the mineral soils with a low organic-matter content. They will increase the absorptive and moisture-holding capacity, aid in building up the humus content, and have a beneficial effect on the tilth of many soils. Because of their fibrous nature moss peats are less desirable than the woody-peat or muck soils.

When organic deposits are used as soil amendments it will be desirable to apply lime to offset the acid reaction of the organic matter added.

Miscellaneous Soils

Swamp

The soils classed as swamp occupy approximately 21,017 acres or 2·1 per cent of the area. They are widely scattered throughout the county and consist of very poorly drained mineral soils that may have a more or less mucky surface soil less than 12 inches thick.

These soils occur in depressions or on flat, low-lying topography that has but poor, if any, drainage outlet. They have a more or less permanently high water-table, with the surface being quite often covered with water. At the best they are waterlogged for such a considerable period of the growing season as to adversely affect their development for agricultural purposes.

Scattered as they are throughout the county the swamp soils, as mapped, vary considerably in texture and to some extent profile development. They all have dark coloured surface layers usually strongly mottled subsurface layers and compacted subsoils and substrata.

While it is recognized that these soils will have some features in common with the adjacent better drained soils it was considered that in view of the general resemblance of the profile; the difficulty of making a proper profile examination, because of the high water-table; the limited extent of the individual parcels of land, and the low agricultural value, these soils could, for the purposes of a reconnaissance survey, be grouped together in one soil class.

They are practically all covered by natural vegetation, either a dense growth of scrubby black spruce, wire birch, tamarack, fir and red maple or else sedges, reeds and other semi-aquatic plants.

Largely because of the difficulty of draining these areas the reclamation of the swamp soils is at present not an economical proposition and they are better left under their natural vegetation.

Salt Marsh

Associated with the Acadia soils are marine deposits more recently built up outside the protecting dykes. These are known as "salt marsh", they occupy about 0·6 per cent of the area or approximately 3,229 acres.

Salt marsh consists of reddish coloured very fine sand, silty sand and silty clay which are being constantly reworked by the daily tides. As yet they are of minor agricultural importance, the only product being a certain amount of marsh hay that may be cut during the ebb tide. The salt marsh vegetation is largely marsh grass, glasswort, sea-blite and spurry.

Eroded Land

Some narrow belts of very steep, non-agricultural land have been mapped, approximately 1,850 acres or 0·1 per cent. These areas are not necessarily damaged by sheet erosion although the steepness of the slopes greatly increases the erodibility of such areas. The soils are, as a rule, thin and stony which combined with the steepness and roughness of the relief makes them unsuitable for anything other than woods.

Land Use Classification and Soil Rating

Field observations have shown that although the farmers of Cumberland county, generally, are growing the kind of crops suited to the soils of the county, the prevailing use of the land is not always the soundest in the best interest of the country, nor is the productivity of the arable land all that could be desired.

While it is not possible from a reconnaissance survey, to definitely assess land use suitability, or to give detailed recommendations for its proper utilization a tentative and broad land-use classification for the soils of Cumberland county is given in Table 10.

The character of the topography and the degree of stoniness, on and in the soil, are important factors in determining its use as agricultural land. Topography and stoniness influence the use of farm machinery, the types and size of machines used, the power needed to operate them and the cost of maintenance. Topography and stoniness also affect the erodibility of the soil and the suitability of the land for different crops, grasses or trees.

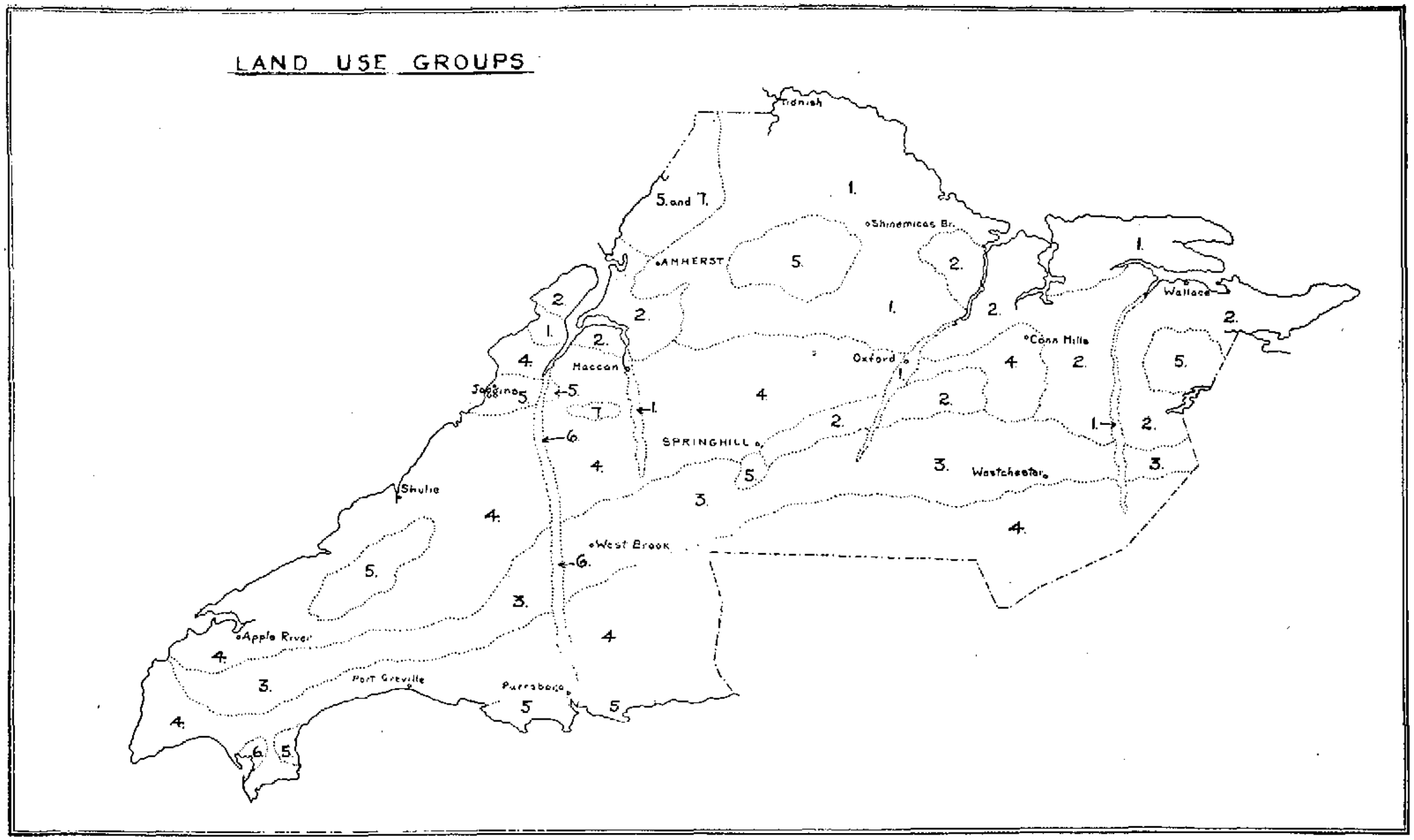
Drainage, closely linked with topography, is another important factor because of the effect upon soil moisture relationships which in turn influence the ability of plants to maintain themselves, as well as influencing the kind of plants grown and soil management practices.

General texture of the soil mass must also be considered, because of its influence on the tilth of the soil, its permeability and erodibility. Largely on the basis of the above mentioned factors and with due consideration given to other observations eight land-use groups are suggested for Cumberland county soils. The approximate distribution of the larger areas of the different land-use groups is shown in Fig. 3.

TABLE 10.—APPROXIMATE ACREAGE AND PER CENT OF EACH SOIL ASSOCIATION IN THE DIFFERENT LAND USE GROUPS

LAND USE GROUP 1

Soil Association	Acres	Per cent of Total
Tormentine	55,930	5·5
Pugwash	69,453	6·8
Cumberland Silt Loam	6,030	0·6
Cumberland Sandy Loam	10,706	1·0
	142,119	13·9


LAND USE GROUPS
Tidnish
5. and 7.
Shinemicas Br.
AMHERST
Wallace
Conn Mills
Oxford
Maccan
Joggins
SPRINGHILL
Westchester
Shulie
West Brook
Apple River
Port Greville
Parrsboro

Good arable and potential arable land, well drained. Good physical characteristics. Capable of producing good yields of the farm crops generally grown in the county. Surface relief gently to moderately undulating, permits the use of all types of farm machinery. Surface erosion not likely to be a serious factor under good management. Stone not a limiting factor. At present either under cultivation or forest cover.

LAND USE GROUP 2

Soil Association	Acres	Per cent of Total
Nappan	43,169	4·2
Queens	74,761	7·3
Acadia	8,237	0·8
	126,167	12·3

Good to fair arable and potential arable land, could be improved by some drainage. Imperfect to fair natural drainage. Not so easy to work as the soils of Group 1 but capable of producing good yields of the crops common to the county. Surface relief and stoniness similar to Group 1. Susceptible to erosion unless well managed. Considerable acreage under cultivation, larger proportion utilized for pasture or under forest vegetation.

LAND USE GROUP 3

Soil Association	Acres	Per cent of Total
West Brook	73,267	7·2
Rodney	48,664	4·7
Southampton	46,995	4·6
	168,926	16·5

Marginal arable land due to rough topography and to moisture relationships. Well drained, may prove excessively drained when cleared. Will not produce as high yields of general farm crops as soils of Groups 1 and 2. Relief undulating to rolling, restricts the use of farm machinery to the lighter types of implements. Quantity of stone variable, not a serious factor generally. Surface erosion likely to occur where the vegetative cover is neglected. Mainly under forest growth, for which these soils are well suited, although a considerable acreage has been cleared and brought under cultivation or grassland.

LAND USE GROUP 4

Soil Association	Acres	Per cent of Total
Wyvern	43,891	4·3
Cobequid	63,891	6·3
Shulie	115,590	11·4
Kirkhill	29,933	2·9
Spencer	2,528	0·2
Hansford	39,706	3·8
	295,539	28·9

Marginal agricultural land. Topography, stoniness, porosity and shallowness of profile are limiting factors in crop growth and land use. Well drained soils, moisture may prove a limiting factor for satisfactory crop growth. Crop yields, generally, are low. Relief undulating to strongly rolling; stone a serious handicap to cultivation. Limited areas of arable and pasture land. Mainly under forest cover for which these soils are well suited.

Land Use Group 5

Soil Association	Acres	Per cent of Total
Joggins	8,096	0·8
Diligence	17,562	1·7
Tormentine (poorly drained associate)	68,288	6·8
Pugwash (poorly drained associate)	30,995	3·0
Nappan (poorly drained associate)	12,685	1·2
Queens (poorly drained associate)	5,856	0·6
Acadia (poorly drained associate)	7,808	0·7
West Brook (poorly drained associate)	1,491	0·1
Rodney (poorly drained associate)	4,602	0·4
Southampton (poorly drained associate)	768	0·1
Cobequid (poorly drained associate)	192	
Shulie (poorly drained associate)	48,282	4·8
Hansford (poorly drained associate)	2,912	0·2
	209,537	20·4

Poorly drained soils. Poor crop land, crop yields low. Moderately good grassland. Considerable acreage of potential arable land but systematic drainage essential. Topography level to undulating, stone not a serious factor, generally. Mainly under grass and forest cover.

Land Use Group 6

Soil Association	Acres	Per cent of Total
Hebert	25,767	2·5
Parrsboro	8,401	0·8
Cumberland Gravelly, Sandy Loam	7,360	0·7
	41,528	4·0

Marginal arable soils although they cannot be considered as wholly non-agricultural land. Crop yields even under the best management are only fair to poor. Natural fertility low. Surface relief nearly level to undulating. Well drained to excessive. Coarse textured droughty soils that produce only poor natural grass and would be better utilized for forest.

Land Use Group 7

Soil Association	Acres	Per cent of Total
Peat	5,453	0·5
Muck	640	0·1
Swamp	21,017	2·1
Salt Marsh	3,226	0·3
	30,336	3·0

Very poorly drained soils, sub-marginal arable land. Water-table high most of the year, drainage conditions difficult and costly to improve. Surface relief nearly level to depressional. Practically all under natural vegetation.

Land Use Group 8

Soil Association	Acres	Per cent of Total
Eroded land	1,850	0·2

Non-agricultural land. Rough topography—steep slopes and ravines. Natural drainage excessive. Stoniness variable. Such areas should remain under forest cover.

Table 10 gives the different soil associations included in the various land use groups and their approximate acreage. This grouping is of necessity only tentative and as such is subject to revision. It does however indicate the soil associations, hence the general location and approximate extent of land suitable for consideration in a land settlement or rehabilitation program.

TABLE 11.—SOIL RATING FOR THE PRINCIPAL CROPS GROWN IN THE COUNTY

Soil Association or Class	Oats	Hay or Grass	Turnips	Truck Crops	Land Utilization Group	Natural Drainage Condition
Good Crop Land—						
Tormentine	HF	HF	HF	HF	1	Good
Pugwash	HF	HF	HF	F	1	"
Cumberland silt loam	HF	HF	HF	F	1	"
Cumberland sandy loam	F	F	F	F	1	"
Nappan	HF	HF	F	M	2	Fair to imperfect
Queens	F	HF	F	M	2	"
Acadia	HF	HF	F	U	2	Fair
Fair to Marginal Crop Land—						
West Brook	F	F	M	F	3	Good
Rodney	F	F	M	M	3	"
Southampton	F	F	M	M	3	"
Wyvern	M	F	U	M	4	"
Cobequid	M	F	M	U	4	"
Marginal Crop Land—						
Shulie	U	M	U	U	4	"
Kirkhill	M-F	M	M	U	4	"
Spencer	U	F	U	U	4	"
Hansford	U	M-F	U	U	4	"
Hebert Sandy loam	M-F	M-F	M	F	6	"
Sub-Marginal Crop Land—						
Joggins	M	F	M	U	5	Poor
Diligence	M	F	M	U	5	Imperfect to poor
Tormentine	M	F	M	M-U	5	"
Pugwash	M	F	M-U	U	5	"
Nappan	U	F	U	U	5	Poor
Queens	U	F	U	U	5	"
Acadia	M	F	U	U	5	"
West Brook	U	F	U	U	5	"
Rodney	U	F	U	U	5	"
Southampton	U	F	U	U	5	"
Cobequid	U	M	U	M	5	"
Shulie	U	U	U	U	5	"
Hansford	U	U	U	U	5	"
Hebert gravelly sandy loan	M	M-F	U	U	6	Good to excessive
Hebert cobbly sandy loam	U	M	U	U	6	"
Parrsboro	M	M-F	U	M	6	"
Cumberland gravelly sandy loam	M	M	U	U	6	Variable

Symbols: HF—Highly favourable. F—Favourable. M—Marginal. U—Unsuitable.

The figures in Table 10 further suggest that approximately 26·4 per cent of the total land area, which includes Groups 1 and 2, is the most suitable for cultivation therefore is the land having the highest agricultural value. Soils of Groups 3 and 5 consisting of marginal agricultural soils, which will require some special management to bring them into satisfactory production, comprise approximately 37·2 per cent of the county. The remaining 36·3 per cent of the land can only be considered as being better suited to forest. This does not mean the soils forming Groups 4, 6, 7 and 8 will produce better forest growth than the soils of other Groups. But rather that they are better capable of producing their natural vegetation than they are agricultural crops.

Although about 63 per cent of the county is indicated as arable and potential arable land many factors other than those recognized in making this classification will have to be considered when formulating a land settlement and rehabilitation policy; factors such as, economic and social conditions, accessibility of the areas, problems concerned with drainage engineering and of course the type of agriculture desired for the county. As about 80 per cent of the county is covered by forest and at least 36 per cent of this should remain under forest it would seem that greater emphasis should be placed on forest management than at present prevails. Effort spent in caring for and improving the forest areas should prove just as profitable, if not more so, than would the time and energy given to clearing and farming many of the areas.

The most reliable measure of the suitability of a soil for a given crop, also for the productive capacity of the soil, is the actual crop yield. Unfortunately authentic crop yield data for the individual soil associations are not available so that it has not been possible to give a soil rating based on productivity. The estimated rating given in Table 11 is based upon the soil characteristics, as observed in the field; on the habits and requirements of the different crops and on such crops yield data as are available. In presenting this soil rating it is assumed that a reasonably good soil management program is followed. The soil management practices on the individual farm will greatly influence the productivity of the soil; a soil rated as highly favourable for a given crop may under poor management not produce any better yields than a soil rated as favourable or marginal for the same crop. For instance, Tormentine sandy loam, under sound cultural practices has produced 73 bushels of oats per acre, but under poor farm practices only 30 bushels per acre are obtained. On the other hand the agricultural value of a marginal soil may be greatly improved by good management.

It will be noted from Table 11 that although the different soil associations differ in their rating there is a fair uniformity in the rating of the individual soil association for the main crops grown in the county, namely, oats, hay and roots. In the case of truck crops, potatoes, vegetables and small fruits, to be grown commercially, there is a more rigid selection. Thus the table demonstrates that the type of farming which is to be practiced successfully, depends, to a large extent, upon the nature of the soil. A comparison of the soil rating with the land-use grouping shows the soils rating highly favourable or favourable for the main crops belong to the soil associations having the largest percentage of their area classed in Groups 1 and 2.

Soil Management

In the section on "Land Use Classification and Soil Rating" suggestions have been made as to the most suitable utilization of the different soils. A broad relationship between the land-use class of a soil and its general suitability for the main crops grown in the county has also been shown. Soil management however will, in a large measure, influence the actual agricultural and economic value of the different soils.

As stated earlier in the report the soils of Cumberland county, generally, belong to the Podsol Group; they are leached, acid soils and as such have a comparatively low natural fertility level. Consequently the basic consideration in a soil management program should be concerned with establishing a long term management system designed to build up and maintain a comparatively high and uniform level of fertility.

Observations and tests made in the field and in the laboratory show the soils of Cumberland county to be acid in reaction, requiring lime for the best production of most crops. Practice has shown that 2 or 3 tons of limestone per acre, applied in the rotation before seeding down has given excellent results. In the case of legumes it has been found that ploughing the limestone under has given the best results. There is a general deficiency of organic matter in practically all of the cultivated soils and the available supply of the essential plant food elements, especially phosphorous, is low. The survey has also shown the productivity of a considerable acreage of the soils best suited to agriculture to be low, due in a large measure to unsatisfactory drainage conditions. To overcome these deficiencies, wholly or in part, it will be necessary for the landowner to develop a definite and sound program of crop rotation and soil improvement, which includes the conservation and use of manure, the use of green manuring crops, lime and fertilizers, and the installation, where necessary, of a drainage system.

As the character of the individual soils largely determines crop adaptations and management practices to be followed, this brief discussion of soil management will be based upon the soil type characteristics. While specific management practices for each soil association will be different, and have been discussed in the individual soil descriptions, soil associations having similar physical and land features will be discussed together. That a broad relationship between "Land Use Grouping" and soil management exists will be noted.

The soil associations having similar management problems, in general, are:

A. Tormentine and Pugwash associations.
B. Nappan, Queens, Joggins and Diligence associations.
C. Westbrook, Rodney, Southampton, Wyvern, Cobequid, Kirkhill, and Spencer associations.
D. Shulie, Hansford, Hebert and Parrsboro associations, also Cumberland gravelly sandy loam.
E. Acadia association, Cumberland silt loam and Cumberland sandy loam.
F. The poorly drained soils and the non-agricultural land of "Land Use Groups" 7 and 8.

The relatively, deep, medium textured, well drained soils of the Tormentine and Pugwash associations are among the most intensively farmed soils of the county. They are well suited to mixed farming and are capable of producing good yields of all the common farm crops grown in the county, with the Tormentine soils also being suited to vegetables and small fruits. In general a four- or five-year rotation is suggested as a basis for a sound management program, this may have to be modified on the Tormentine soils where vegetables and truck crops are grown. Pasture lands should not be over-grazed or allowed to remain down too long without receiving some treatment. Top dressing with lime and manure or fertilizers or both have proved beneficial. While erosion is not severe on these soils it is active, and its prevention and control are largely a matter of proper land use and sound cultural practice. When cleared the imperfectly to poorly drained associates of these two soils are capable of producing fairly good pastures. Care should be exercised to prevent overgrazing and pasturing when wet. As drainage of such areas presents a rather difficult engineering problem they are probably better left as woodland for which they are well suited.

Drainage is a fundamental problem on such heavy textured soils as the Nappan, Queens, Diligence and Joggins associations. While the surface relief of the Nappan and Queens soils is, in the main, sufficiently undulating to allow moderately good surface drainage, surface relief, however, of the Diligence and Joggins soils tends to accentuate the unfavourable drainage conditions so that clearing and draining of these soils would not appear advisable. Although the Nappan and Queens soils are characterized by slow drainage they produce good yields where properly managed. One of the essential factors in their management is some system of surface drainage, at least. While they are perhaps better grassland soils than the Tormentine and Pugwash soils attention should be given to the renewal and treatment of pastures. A four- or five-year rotation would be desirable on these soils, where the grasslands are left longer a top dressing of manure or fertilizer will prove beneficial. Lime is necessary, preferably dolomitic limestone in the case of the Queens soil. Legumes may suffer from heaving resulting from frost action. Maintenance of a good physical condition is essential to satisfactory crop production. This can be accomplished by providing a plentiful supply of organic matter and working the soils only when the moisture conditions are most favourable otherwise the surface becomes puddled and "dead", as it is often expressed, furnishing a poor seed-bed. Fall ploughing will benefit these heavier textured soils, if ploughed in narrow lands with high crowns and deep dead furrows it will assist in surface drainage and the effect of frost action in pulverizing the clods is of material aid in working up a desirable seed-bed.

While the sandy loams and gravelly sandy loams of the West Brook, Rodney, Southampton and Wyvern associations and the stony and shaly loams of the Cobequid and Kirkhill associations produce a variety of crops similar to those on the heavier textured soils the yields are, as a rule, much lower. Only comparatively small percentages of these soils, on the smoother topography, are suitable for cultivation. The greater proportion of the land is too rugged and stony and is therefore better adapted to forest, producing some excellent stands of timber. The soils of the cultivated areas are low in essential plant food elements and deficient in organic-matter content. As a result of the low organic-matter content the physical condition of the surface soils generally is poor. Owing to the lack of organic matter and the relatively open and in some cases shallow nature of these soils they dry out rapidly and crops suffer from lack of moisture. Native pastures are of poor quality and overgrazing early in the spring and during dry periods results in bare pastures which accentuates the leaching out of plant food, and in erosion of the surface soil so that not only do the grasslands become thin and poor but the natural fertility of the soil is lowered. When properly managed these soils will give good response as observed on the West Brook soils where good crops of potatoes and strawberries have been grown. In order to maintain a satisfactory level of production the cultural practices followed should be designed not only to provide the necessary plant food but also to build up the organic-matter content, conserve moisture and prevent erosion, which is severe in some sections. For this purpose a definite rotation system of farming, similar to that suggested for the heavier soils, is desirable. Should the farm business require a longer rotation, manuring or fertilizing and liming of the pastures is recommended in order to improve and maintain the quality of the vegetation and develop a good sod so as to reduce erosion. Rotation grazing will also benefit the quality of the grasslands and will reduce the danger of overgrazing.

The porous, gravelly and stony soils of the Shulie, Hansford, Hebert and Parrsboro associations, also the Cumberland gravelly sandy loam, are better adapted to forest than to cultivation. Where under cultivation their management should be similar to that of the West Brook soils.

Acadia clay loam, Cumberland silt loam and Cumberland sandy loam due to their origin and in the case of the latter two soils, seasonal flooding, are possessed of a higher natural fertility than the upland soils. Owing however to the continued cultivation of these soils the productivity is deteriorating, particularly in the case of the Acadia clay loam. While they are largely used, under prevailing conditions, for hay they are capable of producing good crops of oats, barley and field roots. In general their management should be similar to that of the medium to heavy textured upland soils. They have, however, a problem peculiar to themselves, namely that of seasonal flooding, the control of which is essential to the most efficient use of these lowland soils. This has been effected in a large measure on the Acadia soils by the system of dykes and aboiteaux, it could be greatly improved by a system of open ditches. It is also possible that the use of open ditches might prove beneficial in controlling excess surface water on the Cumberland soils.

Because of the engineering difficulties involved in draining the swamp areas or dyking the salt marsh and the expense involved, it would appear that such areas should remain under their natural vegetation. Except where the swamp areas are very shallow or have been severely culled and burned over they produce trees of marketable value, they also serve as natural reservoirs for the conservation of water. Regulated culling of the trees would probably be more profitable than clearing the land and increasing the acreage of submarginal agricultural land. The management of the muck and peat areas will depend upon the markets available for their products and the crops grown on them.

As the non-agricultural lands along the stream gullies and ravines are mainly under forest vegetation, the management of these areas resolves itself into a problem of good woodland management and protection of the areas against the ravages of erosion.

Summary

Cumberland county is situated in the northwestern section of Nova Scotia and covers an area of approximately 1,683 square miles or 1,077,120 acres. The physiography of the county is characterized by the nearly level plain comprising the marsh or dykelands, the broad undulating to strongly rolling lowlands of the Cumberland plain and the range of uplands known as the Cobequid mountains. The elevation ranges from a few feet above sea level along the coasts to 1,020 feet at Sugar Loaf mountain, the highest point of the Cobequid range.

The climate is largely influenced by precipitation. It is characterized by an average rainfall of 38·3 inches, an annual average snowfall of 76·7 inches, a mean annual temperature of 41·4° F. and an average frost-free period of 116 days.

The underlying bedrock consists of sandstone, shales and conglomerates in the lowland areas and igneous rocks and unaltered sediments of the upland range. The county, except for the dykelands was originally covered with a dense forest growth; largely coniferous in the lowlands and hardwoods on the Cobequid Mountain range. Approximately 70 to 75 per cent of the county area is still covered with natural vegetation.

The soils of the county have developed under the influence of a humid-temperate climate and a heavy forest vegetation. The mature soils possess a grey surface layer and belong to the Podsol group of soils. The greater part of the soil parent materials consist of glacial till having wide textural variations. The glacial till deposit is relatively thin, varying from 2 feet or less to 20 or 30 feet, consequently it bears a close relation to the underlying rock material. Along many of the river valleys and stream channels are alluvial deposits which comprise some of the important agricultural soils of the county.

Twenty-three soil associations or groups, including organic and miscellaneous soils, have been identified. Approximately 29 per cent of the land is suitable for arable land, another 26 per cent is potential agricultural land provided proper management practices are followed, while at least 45 per cent is better suited to forest.

Among the glacial till soils the most important agriculturally are the Tormentine sandy loam, Pugwash sandy loam, Nappan clay loam and Queens clay loam, all of which occur on the smoother relief adjacent to the Northumberland Strait. The remaining glacial till soils have their agricultural value reduced by either one or more of the following: gravelly texture, stone, rough topography, or shallow deposit over bedrock and unfavourable drainage conditions.

The largest area of Acadia clay, or dykeland soils, occurs in the border area between Nova Scotia and New Brunswick. These are highly productive soils wherever they occur and are chiefly used for the production of hay and small grains. Their use is dependent upon the satisfactory maintenance of dykes and of drainage, an improvement of which is necessary to increase the potential acreage.

Mixed farming is the main type of farming practised at the present time. Lumbering forms a complementary enterprise, particularly in the interior part of the county, and where the topography is too rough to be used as arable land. In some of the more advanced agricultural sections dairying and the growing of specialized crops are well developed. In the coastal regions fishing forms an important industry for a certain part of the year.

The principal crops grown in the county are hay, oats, barley and turnips. Some intensive vegetable and small fruit production is carried on in the vicinity of urban areas. Cultivated hay occupies the largest area in field crops, while oats and barley are the leading grain crops with approximately equal acreages.

Approximately 28 per cent of the land occupied by farms is improved, the remaining 72 per cent being in woodlots or natural grass. The condition of much of the grassland, both natural and cultivated, is only fair to poor owing to lack of proper management.

The chief soil problems are concerned with fertility and drainage. All of the soils in the county with the exception of Acadia clay, Cumberland sandy loam and Cumberland silt loam, are low in natural fertility. The use of barnyard manure, green manuring crops, lime and commercial fertilizers is necessary to obtain satisfactory crop production. Drainage is a problem in many of the main agricultural soils, it is related to the character of the surface relief and to the texture and compaction of the till. Queens clay loam and Nappan clay loam are typical examples.

The gravelly and stony textured soils, namely, Shulie sandy loam, West Brook loam, Southampton sandy loam, Hansford sandy loam and Hebert sandy loam, have limited acreages of arable and potential arable land. Because of stoniness, coarse textures and rough topography the larger proportion of these soils is better suited to forest.

The soils of the Cobequid range such as, Cobequid loam, Wyvern sandy loam and Kirkhill shaly clay loam are essentially forest soils and their utilization for any other purpose is questionable.

The peat and muck soils are not being utilized at present. The use of the muck soils may well be considered as a source of organic matter to be applied to the mineral soils. Salt marsh, swamp and eroded land are not used for agriculture.

The information given in this report is necessarily general, the kind of survey and the scale of the map do not permit detailed delineation; it does not mean that for every field or even farm any soil boundary will show the detailed characteristics as indicated in the report. But it will serve as a guide to the soils of the county and their possible utilization and management, therefore, in practice, every farm and field should be studied by the owner, in the light of the information given. For more detailed information concerning individual soil problems it is recommended that farmers consult with the staffs at the Nova Scotia Department of Agriculture, Truro, N.S., and the Dominion Experimental Farm, Nappan, N.S.

APPENDIX

Glossary of Terms Used in Description

Surface soil—The upper horizon or surface layer. The term as generally used includes part or all of what is known as the A horizon. In cultivated soils it usually refers to that portion that is modified or stirred by tillage operations. Usually the darkest coloured layer.

Subsoil—The horizon or layer of soil beneath the surface horizons. The B horizon or horizons.

Parent material—The unweathered or only slightly altered material below the subsoil. The C horizon from which the surface and subsoil has been developed.

Solum—The A and B horizons. The portion of the profile that has been weathered or altered by soil forming processes.

Soil horizon—A layer or section of the soil profile, more or less well defined, and occupying a position parallel to the soil surface.

Soil profile—A vertical column of the soil from the surface down to and including the unconsolidated or unmodified material from which the soil has been formed. It shows the arrangement, thickness, colour, texture, structure, etc. of the different soil horizons.

Texture—Refers to the relative size of the individual soil particles or grains, or the fineness or coarseness of the soil mass.

Soil structure—A term expressing the arrangement of the individual soil particles and aggregates that make up the soil mass.

Mature soil—A soil in which the profile shows a full development of the A and B horizons in equilibrium with the environmental factors.

Ortstein—Hard, irregularly cemented material, usually found in the B horizon. It may exist as small pebble-like concretions, as large irregular lumps or as a thick solid layer.

Arable—Refers to land that is suitable for, or under regular cultivation, in contrast with land used for permanent grassland or under forest vegetation.

Till—Unconsolidated mass of rock debris, boulders, gravel, sand and clay; the unsorted material left behind by glaciers and glacial action.

Topography—*Level*—Practically uniform elevation, only very slight, if any, swells or waves.

Undulating—Uniform, low swells or waves. Easily cultivated.

Gently rolling—Landscape consists of long, smooth slopes and low ridges. Slopes around 5 to 8 per cent, permits the use of most farm machinery.

Rolling—Changes in elevation more frequent, steeper slopes. Use of farm machinery restricted to the lighter types.

Hilly—Broken landscape. Changes in elevation fairly frequent and relatively high. Slopes variable in length, smoothness and degree of steepness, usually 10 per cent or more.

Methods of Analysis

The soil sample was prepared by air drying, passing through 2 m.m. and 1 m.m. sieves. The latter was used for analysis.

Hydrogen-ion concentration by method given in circular 56, United States Department of Agriculture, using the quinhydrone electrode.

Moisture, Loss on ignition, Total Nitrogen and Phosphorous by methods according to A.O.A.C., Fourth edition, 1935.

Mechanical Analysis, by Bouyoucos method in Soil Science, Vol. 42, 1936.

Total Silica, Iron and Aluminum, by methods according to A.O.A.C., Fourth edition, 1935.

Lime Requirement by Jones method. Journal A.O.A.C., Vol. 1, page 43.

Readily available phosphorous. Method by Truog, Journal American Society of Agronomy, Vol. 22, page 874.

Total Carbon. By reduction of chromic acid; method by Allison in Soil Science, Vol. 40, page 311.

Base Exchange. Determined by leaching with ammonium acetate and obtaining exchange capacity, total exchangeable bases, exchangeable calcium magnesium and potash by methods developed in our laboratory in 1935 and appearing practically the same in the A.O.A.C. methods. Fifth edition, 1940.

Soil Classes

Soils are composed of particles of different sizes, as follows:—

Soil Fraction or Particle	*Size of Particle*
Sand	1·0–0·05 millimetre
Silt	0·05–0·005 "
Clay	0·005 millimetre and less
Fine Clay	0·002 " " "

Proportion of different soil particles comprising soil classes:—

1. Soils with less than 20 per cent of clay and silt and 80 per cent or more of sand.
   (*a*) *Sand*—More than 85 per cent sand and less than 15 per cent clay and silt.
   (*b*) *Loamy sand*—More than 80 per cent sand, and 15 to 20 per cent silt and clay.
   (*c*) *Sandy loam*—50 to 80 per cent sand; 20 to 50 per cent silt and clay combined, less than 20 per cent clay.
   (*d*) *Loam*—From 30 to 50 per cent sand; more than 50 per cent silt and clay combined, but not more than 20 per cent clay.

2. Soils with more than 20 per cent clay.
   (*a*) *Sandy clay loam*—Over 50 per cent sand; up to 50 per cent silt and clay combined, with 20 to 30 per cent of clay.
   (*b*) *Clay loam*—More than 50 per cent silt and clay combined but less than 50 per cent silt and between 20 to 30 per cent clay.
   (*c*) *Clays*—More than 50 per cent silt and clay, over 30 per cent clay.

TABLE 13.—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES

Soil Associations	Queens Sandy Loam					Nappan Sandy Clay Loam					Diligence Clay Loam				
Horizon of Profile Depth in Inches	A 0″–3″	A2 3″–8″	B1 8″–13″	B2 13″–24″	C	A0 0″–1″	A2 1″–5″	B1 5″–8″	B2 8″–23″	C	A0 0″–1″	A2 1″–3″	B1 3″–7″	B2 7″–16″	C
% Coarse and Fine Gravel	7	9	13	22	13	....	0	0	12	17	....	23	28	23	37
% Total Sand (1) (1·0–0·05 m.m.)	52	61	47	29	36	....	61	69	34	42	....	29	35	30	44
% Silt (1) (0·05–0·005 m.m.)	28	23	29	34	31	....	14	20	31	27	....	37	41	42	34
% Total Clay (1) (0·005 m.m. and less)	20	16	24	37	33	....	25	11	35	31	....	34	24	28	22
% Fine Clay (0·002 m.m. and less)	17	15	22	32	30	....	21	10	31	27	....	26	18	20	18
% Loss on Ignition	7·4	2·9	3·5	3·4	2·8	55·0	5·0	2·0	3·0	3·0	74·5	5·5	12·0	9·0	3·5
p.H.	5·4	5·0	5·1	5·0	6·6	4·1	4·3	4·9	6·7	6·8	4·0	3·8	4·2	4·2	4·4
Lime Requirement (tons CaC03 per acre)	7·0	3·0	4·0	3·0	0·3	30·0	7·0	1·0	2·0	1·0	62·0	9·8	12·0	6·7	2·8
Available P205 (lbs. per acre)	21	9	9	9	664	160	41	27	7·0	126	356	29	22	20	2·0
% Total P205	0·14	0·11	0·11	0·10	0·15	0·29	0·06	0·03	0·04	0·11	0·16	0·03	0·09	0·10	0·04
% Total Nitrogen	0·19	0·07	0·05	0·03	0·005	1·20	0·05	0·05	0·02	0·03	1·5	0·13	0·21	0·15	0·08
% Organic Carbon	3·04	0·81	0·79	0·42	0·13	39·9	2·6	0·24	0·07	0·07	52·7	3·1	3·8	2·1	0·42
M. E. Exch. H.	12·6	6·3	7·1	5·5	7·5	12·3	7·9	1·7	0·13	1·3	75·0	13·5	21·3	11·0	3·6
M. E. Exch. Ca.	1·8	0·88	0·62	1·3	7·0	13·9	2·1	0·72	6·9	4·8	11·0	1·1	0·52	0·34	0·20
M. E. Exch. Mg.	0·12	0·05	0·04	0·10	0·26	0·15	0·06	0	0·1	0·22	0·01	0	0	0·37	0·31
M. E. Exch. K.	0·25	0·25	0·22	0·20	0·20	2·8	0·59	0·33	0·63	0·59	2·7	0·31	0·34	0·33	0·32
% Base Saturation	14·6	15·7	11·0	22·5	51·5	57·8	25·8	38·1	98·5	81·1	15·4	9·4	3·8	8·6	18·9
% Total Si 02	77·6	85·3	80·6	75·8	74·6	24·0	76·3	88·0	72·2	73·8	4·2	78·0	63·6	67·3	74·7
% Total Fe 2 03	3·6	2·3	3·7	4·8	5·8	2·5	2·5	2·7	5·9	5·0	0·73	2·3	6·6	5·9	5·2
% Total A1 2 03	10·3	10·6	11·5	14·7	17·5	5·8	12·6	9·3	15·2	14·6	1·0	11·6	14·2	15·1	13·3
Si 02/R2 03	10·5	12·9	10·3	7·4	6·2	6·6	10·9	14·0	7·0	7·0	5·8	10·8	6·2	6·5	7·7

(1) Calculated on the basis of 100 percent.

TABLE 13.—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*Continued*

Soil Associations	Joggins Clay					Pugwash Sandy Loam					Tormentine Sandy Loam				
Horizon of Profile / Depth in Inches	A 0″–2″	A^2 2″–6″	A^3 6″–11″	B 11″–20″	C	A^0 0″–3″	A^2 3″–9″	B^1 9″–15″	B^2 15″–23″	C	A^0 0″–1″	A^2 1″–9″	B^1 9″–15″	B^2 15″–27″	C
% Coarse and Fine Gravel	20	10	5	11	8	....	0·5	21	10	13	....	0	10	7	7
% Total Sand (1) (1·0–0·05 m.m.)	35	39	43	33	28	....	60	46	59	55	....	52	60	62	62
% Silt (1) (0·05–0·005 m.m.)	31	30	13	30	35	....	26	29	20	25	....	35	26	24	18
% Total Clay (1) (0·005 m.m. or less)	34	31	44	37	37	....	14	25	21	20	....	13	14	14	20
% Fine Clay (0·002 m.m. or less)	32	34	30	30	32	....	12	20	18	17	....	7	9	10	15
% Loss on Ignition	16·8	7·2	4·4	4·7	4·4	37·5	3·0	7·0	2·5	2·0	64·7	1·3	8·4	4·4	1·8
p.H.	4·2	4·4	4·5	4·6	5·4	4·4	4·8	4·8	5·1	5·9	4·2	4·4	4·9	5·0	4·7
Lime Requirement (tons CaCo3 per acre)	21·6	11·3	4·2	4·2	1·0	20·0	3·0	4·0	2·0	2·0	39·2	2·8	4·9	3·5	2·1
Available P205 (lbs. per acre)	30	30	14	12	295	160	18	22	48	57	224	16	13	11	160
% Total P205	0·22	0·10	0·08	0·0[illegible]	0·14	0·11	0·02	0·07	0·06	0·09	0·19	0·04	0·06	0·06	0·08
% Total Nitrogen	0·44	0·15	0·05	0·[illegible]5	0·05	0·53	0·007	0·03	0·006	0·007	0·41	0·01	0·10	0·04	0·01
% Organic Carbon	7·7	3·1	0·84	0·86	0·70	26·1	0·24	1·2	0·12	0·07	39·9	0·22	2·2	1·0	0·09
M.E. Exch. H.	31·7	14·7	7·2	7·8	2·8	47·5	2·6	5·7	2·7	2·4	....	....	9·4	5·4	1·6
M.E. Exch. Ca.	1·6	0·78	0·46	1·4	8·5	7·6	0·48	1·2	1·3	2·6	....	....	0·52	0·30	0·36
M.E. Exch. Mg.	0·13	0·06	0·04	0·09	0·42	0·18	0·06	0·02	0	0·35	....	....	0·02	0·03	0·03
M.E. Exch. K.	0·40	0·22	0·18	0·56	0·[illegible]2	0·27	0·27	0·29	0·34	0·55	....	....	0·52	0·63	0·65
% Base Saturation	6·3	6·7	8·6	20·8	76·5	14·4	23·7	20·9	37·8	59·3	....	....	10·1	15·0	39·2
% Total Si02	59·8	76·3	73·8	72·0	72·1	47·3	90·5	68·6	74·1	75·0	23·7	83·3	76·1	78·1	79·5
% Total Fe203	2·9	2·2	5·7	5·6	6·2	1·3	1·5	5·8	4·5	4·8	1·5	1·7	2·7	3·6	4·6
% Total A1203	20·7	13·7	16·8	14·3	16·0	8·0	6·6	15·6	14·0	14·0	5·0	12·5	12·8	12·3	11·4
Si02/R203	4·5	9·0	6·4	7·0	6·4	10·	21·7	5·7	8·0	7·5	7·9	10·6	9·0	9·3	10·1

(1) Calculated on the basis of 100 per cent.

TABLE 13.—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*Continued*

Soil Associations	Southampton Sandy Loam					Shulie Sandy Loam					West Brook Loam				
Horizon of Profiles Depth in Inches	A^1 0″–3″	A^2 3″–5″	B^1 5″–10″	B^2 10″–20″	C	A^0 0″–2″	A^2 2″–7″	B^1 7″–14″	B^2 14″–24″	C	A^0 0″–2″	A^2 2″–5″	B^1 5″–10″	B^2 10″–24″	C
% Coarse and Fine Gravel	16	13	28	18	38	....	6	26	24	13	....	20	29	25	31
% Total Sand (1) (1·0–0·05 m.m.)	56	66	54	58	59	....	67	61	60	59	....	38	41	38	37
% Silt (1) (0·05–0·005 m.m.)	29	25	30	27	27	....	26	26	28	31	....	43	38	45	44
% Total Clay (1) (0·005 m.m. and less)	15	9	16	15	14	....	7	13	12	10	....	19	21	17	19
% Fine Clay (0·002 m.m. and less)	12	7	12	9	11	....	3	12	9	7	....	10	16	10	17
% Loss on Ignition	5·0	2·5	5·2	2·6	1·7	63·6	0·85	5·7	1·7	1·6	67·8	3·1	6·7	5·1	2·6
p.H.	4·0	4·2	4·6	4·8	4·6	4·4	4·8	5·4	5·4	4·7	4·6	4·6	4·7	4·8	4·9
Lime Requirement (tons CaCo3 per acre)	4·2	3·1	2·8	1·4	2·4	47·0	1·0	2·1	0·7	0·7	46·0	4·2	7·1	3·1	2·1
Available P205 (lbs. per acre)	32	30	18	27	....	76	5	5	12	37	302	30	23	25	20
% Total P205	0·08	0·04	0·10	0·02	0·07	0·11	0·02	0·07	0·04	0·07	0·23	0·03	0·10	0·06	0·04
% Total Nitrogen	0·07	0·03	0·04	0·02	0·01	0·69	0·01	0·05	0·01	0·01	1·16	0·05	0·11	0·08	0·04
% Organic Carbon	1·6	0·82	1·3	0·21	0·13	36·2	0·22	1·0	0·16	0·16	40·6	1·4	1·9	0·99	0·28
M.E. Exch. H.	7·9	2·8	5·4	1·3	2·1	68·7	0·79	3·5	0·85	1·3	22·1	4·4	12·9	6·2	2·6
M.E. Exch. Ca.	0·54	0·46	0·62	0·44	0·66	10·8	0·54	0·62	0·36	0·38	3·4	0·48	0·42	0·40	0·42
M.E. Exch. Mg.	0·20	0·52	0·16	0·12	0·40	0·88	0·04	0·02	0·02	0·06	2·8	0·24	0·16	0·08	0
M.E. Exch. K.	0·43	0·53	0·61	0·55	0·56	3·8	0·33	0·50	0·47	0·45	4·6	0·53	0·61	0·59	0·60
% Base Saturation	12·8	35·0	20·4	46·0	43·5	18·3	53·5	24·5	50·0	40·6	32·8	22·1	8·4	14·7	28·1
% Total Si02	83·3	93·1	78·8	84·3	84·0	25·6	97·8	76·3	86·8	88·3	19·3	87·6	73·1	76·1	77·6
% Total Fe203	3·8	1·7	4·2	4·2	4·2	0·92	1·0	7·0	4·6	3·2	1·5	2·5	6·0	4·9	4·8
% A1203	8·1	3·5	11·7	9·3	17·7	0·68	1·2	10·5	11·3	7·7	2·7	13·1	11·3	12·0	12·1
Si02/R203	13·8	37·5	10·0	12·7	7·4	38·1	94·7	8·5	10·7	15·5	11·0	9·9	8·6	9·2	9·9

(1) Calculated on the basis of 100 per cent.

TABLE 13.—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*Continued*

Soil Associations	Hansford Sandy Loam					Cobequid Loam					Wyvern Sandy Loam			
Horizon of Profile	A^0	A^2	B^1	B^2	C	A^0	A^2	B^1	B^2	C	A	B^1	B^2	C
Depth in Inches	0″–3″	3″–7″	7″–11″	11″–20″		0″–2″	2″–5″	5″–11″	11″–19″		0″–4″	4″–11″	11″–20″	
% Coarse and Fine Gravel	....	13	30	24	27	....	49	46	59	52	26	41	46	57
% Total Sand (1) (1·0–0·05 m.m.)	....	68	64	62	68	....	38	51	49	45	45	58	57	55
% Silt (1) (0·05–0·005 m.m.)	....	23	25	25	19	....	42	39	35	28	41	34	34	35
% Total Clay (1) (0·005 m.m. and less)	....	9	11	13	13	....	20	10	16	27	14	8	9	10
% Fine Clay (0·002 m.m. and less)	....	6	10	9	9	....	16	10	16	21	7	7	7	7
% Loss on Ignition	29·5	2·0	7·0	2·5	1·5	67·3	3·5	10·2	4·7	2·7	10·9	23·2	8·6	5·0
p.H.	4·3	4·3	4·6	4·9	5·1	4·4	4·4	4·6	4·8	4·2	4·0	4·4	4·6	4·6
Lime Requirement (tons $CaCO_3$ per acre)	30·8	1·7	5·3	1·7	1·0	49·0	7·8	10·2	4·9	3·1	8·8	10·6	6·0	4·2
Available P_2O_5 (lbs. per acre)	140	29	50	20	41	178	22	20	52	167	41	13	50	103
% Total P_2O_5	0·09	0·01	0·13	0·04	0·03	0·23	0·05	0·13	0·12	0·12	0·15	0·33	0·27	0·19
% Total Nitrogen	0·87	0·03	0·10	0·02	0·02	1·5	0·11	0·23	0·09	0·03	0·36	0·05	0·19	0·10
% Organic Carbon	19·6	0·55	1·9	0·50	0·06	43·7	1·6	4·9	1·5	0·29	5·8	7·7	3·4	1·7
M.E. Exch. H	46·9	2·4	6·1	1·3	0·81	54·4	6·5	17·8	5·9	3·6	12·4	23·5	12·0	6·8
M.E. Exch. Ca	8·0	0·54	0·30	0·12	0·16	10·8	0·50	0·36	0·30	1·04	2·5	1·0	0·58	0·86
M.E. Exch. Mg	0·27	0·03	0·04	0	0	0·84	0·13	0·12	0·18	0·17	1·9	1·2	0·32	0·20
M.E. Exch. K	2·4	0·27	0·29	0·64	0·63	2·2	0·42	0·41	0·43	0·42	1·5	1·2	0·67	0·52
% Base Saturation	18·5	25·9	9·3	36·8	49·3	20·0	13·9	4·7	4·7	31·1	32·2	12·6	12·8	18·8
% Total SiO_2	53·6	96·3	76·7	85·0	88·4	....	77·6	69·1	70·2	74·1	67·1	48·5	59·3	65·5
% Total Fe_2O_3	1·4	0·99	3·6	3·4	2·9	....	4·3	8·0	6·3	6·8	5·8	7·9	7·7	7·1
% Total Al_2O_3	2·5	2·1	9·6	8·7	6·6	....	7·6	11·5	11·9	13·5	9·7	19·0	18·5	17·1
SiO_2/R_2O_3	27·8	61·5	11·5	14·0	21·0	....	14·3	6·8	7·8	7·2	9·1	3·6	4·4	5·4

(1) Calvulated on the basis of 100 per cent.

TABLE 13.—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*Continued*

Soil Associations	Kirkhill Shaly Clay Loam					Hebert Sandy Loam					Parrsboro Gravelly Loam			
Horizon of Profile	A^0	A^2	B^1	B^2	C	A^0	A^2	B^1	B^2	C	A	B^1	B^2	C
Depth in Inches	0″–3″	3″–7″	7″–12″	12″–24″		0″–1″	1″–5″	5″–13″	13″–24″		0″–5″	5″–13″	13″–16″	
% Coarse and Fine Gravel	....	55	63	64	73	7	10	10	5	4	18	32	67	87
% Total Sand (1) (1·0–0·05 m.m.	....	34	62	64	60	72	85	84	88	83	45	46	51	74
% Silt (1) (0·05–0·005 m.m.)	....	33	27	21	27	16	7	6	5	8	41	38	35	14
% Total Clay (1) (0·005 m.m. and less)	....	33	11	15	13	12	8	10	7	9	14	16	14	12
% Fine Clay (0·002 m.m. and less)	....	31	11	13	11	8	5	7	6	7	12	14	13	8
% Loss on Ignition	52·0	6·5	21·0	10·8	8·3	7·7	0·5	3·0	1·8	1·0	12·1	9·7	5·7	4·1
p.H.	4·2	4·0	4·5	4·9	5·0	4·6	4·4	4·6	4·8	4·6	5·0	5·0	4·6	5·0
Lime Requirement (tons CaCO3 per acre)	32·0	9·5	13·1	4·2	3·1	5·6	1·0	2·0	1·0	1·0	7·1	5·6	3·5	3·9
Available P205 (lbs. per acre)	73	20	11	13	20	12·4	18	98	32	13	25	11	22	55
% Total P205	0·23	0·03	0·14	0·11	0·08	0·08	0·02	0·11	0·04	0·03	0·14	0·15	0·10	0·14
% Total Nitrogen	1·3	0·15	0·29	0·15	0·14	0·13	0·02	0·05	0·03	0·01	0·26	0·17	0·11	0·05
% Organic Carbon	34·6	3·2	3·3	2·3	1·5	5·2	0·16	1·0	0·11	0·02	6·7	3·6	1·9	1·1
M.E. Exch. H.	52·7	27·9	9·4	8·5	4·2	7·1	0·16	4·1	1·0	0·53	10·8	10·9	5·8	3·4
M.E. Exch. Ca.	5·3	0·50	0·34	0·24	0·32	1·7	0·64	0·42	0·50	0·80	1·0	0·20	0·36	0·44
M.E. Exch. Mg.	0·26	0·05	0·14	0	0·03	0·20	0·10	0·04	0·06	0·06	0·17	0·10	0·08	0·14
M.E. Exch. K.	2·5	0·32	0·66	0·59	0·62	1·1	0·22	0·07	0·20	0·11	1·4	0·39	0·30	0·17
% Base Saturation	13·2	3·0	10·8	8·8	18·7	29·7	85·7	11·4	43·2	64·6	19·2	5·9	11·3	18·0
% Total Si02	38·3	74·0	42·2	56·9	61·9	....	94·6	84·3	85·9	87·9	66·4	64·5	67·6	69·3
% Total Fe203	3·4	4·3	7·6	8·5	8·2	....	1·7	2·8	3·2	3·2	5·7	5·5	5·7	7·1
% Total A1203	7·9	19·0	14·2	20·3	18·3	....	1·7	6·9	6·4	6·1	10·4	13·8	14·1	13·1
Si02/R203	7·0	6·0	4·1	3·7	4·4	....	78·5	16·6	17·8	18·2	8·4	6·7	6·8	7·2

(1) Calculated on the basis of 100 per cent.

TABLE 13.—PHYSICAL AND CHEMICAL ANALYSIS OF REPRESENTATIVE SOIL PROFILES—*Concluded*

Soil Associations	Cumberland Loam			Acadia (Dykeland-well drained)				Acadia (Dykeland—poorly drained)		
Horizon of Profile	1.	2.	3.	1.	2.	3.	4.	1.	2.	3.
Depth in Inches	0″–8″	8″–28″	28″	0″–7″	7″–22″	22″–44″	44″	0″–5″	5″–20″	20″–36″
% Coarse and Fine Gravel	0	0	0	0	0	0	0	0	0	0
% Total Sand (1) (1·0–0·05 m.m.)	42	34	68	14	16	18	35	34	22	11
% Silt (1) (0·05–0·005 m.m.)	39	49	19	37	49	41	31	47	40	46
% Total Clay (1) (0·005 m.m. and less)	19	17	13	49	35	41	34	19	38	43
% Fine Clay (0·002 m.m. and less)	14	13	10	25	30	35	33	12	36	39
% Loss on Ignition	5·2	3·3	2·3	7·3	4·5	3·9	3·4	42·1	18·7	6·6
p.H.	5·0	5·2	5·0	5·0	6·4	6·8	7·0	5·2	5·0	4·2
Lime Requirement (tons CaC03 per acre)	2·4	2·1	1·7	2·8	0	0	0	15·	9·5	6·3
Available P205 (lbs. per acre)	110	137	82	55	420	430	490	32	25	57
% Total P205	0·11	0·11	0·08	0·13	0·12	0·17	0·12	0·38	0·23	0·15
% Total Nitrogen	0·15	0·08	0·06	0·19	0·05	0·04	0·04	1·3	0·08	0·06
% Organic Carbon	1·7	0·78	0·53	1·8	0·70	0·44	0·49	25·7	9·3	1·0
M.E. Exch. H	3·9	3·1	2·8	7·6	5·6	9·1	6·6	18·4	17·1	10·7
M.E. Exch. Ca	3·5	6·4	2·4	3·6	3·9	1·4	1·5	3·9	1·7	1·1
M.E. Exch. Mg	0·20	0·18	0·07	4·3	4·8	3·1	2·8	6·4	4·0	3·1
M.E. Exch. K	0·24	0·25	0·20	0·88	0·96	1·6	1·6	2·8	1·3	0·99
% Base Saturation	50·0	68·7	48·8	53·6	63·3	40·1	47·2	41·5	29·0	32·6
% Total Si02	77·1	81·4	79·6	68·8	67·8	72·3	70·0	32·8	54·6	65·1
% Total Fe203	2·8	4·6	3·9	6·0	6·5	7·1	6·2	6·3	4·9	6·4
% Total A1203	11·7	11·1	9·6	17·3	20·0	17·8	17·1	24·6	28·3	17·8
Si02/R203	10·6	11·2	11·8	5·7	4·9	5·7	5·8	1·9	2·9	5·1

(1) Calculated on the basis of 100 per cent.

TABLE 14.—AVAILABLE NUTRIENTS IN POUNDS PER ACRE(1)

Soil Association	Horizon	Available			
		CaO	MgO	K_2O	P_2O_5
Queens Sandy Loam	A	1,008	48	470	21
	A^2	492	20	470	9
	B^1	347	16	413	9
	B^2	728	40	376	9
	C	3,920	104	376	664
Nappan Sandy Clay Loam	Ao (2)	750	5	507	15
	A^2	1,176	24	1,109	41
	B^1	403	0	620	27
	B^2	3,864	40	1,184	710
	C	2,688	88	1,109	136
Diligence Clay Loam	A^1	594	0	489	34
	A^2	616	0	582	29
	B^1	291	0	639	22
	B^2	190	148	620	20
	C	112	124	601	20
Joggins Clay	A^1	896	52	752	30
	A^2	436	24	413	30
	A^3	257	16	336	14
	B	784	36	1,052	12
	C	4,760	168	413	295
Pugwash Sandy Loam	Ao (2)	410	72	48	15
	A^2	268	24	507	18
	B^1	672	8	545	22
	B^2	728	0	639	48
	C	1,456	140	1,034	57
Tormentine Sandy Loam	Ao (2)	....	....	....	21
	A^2	....	....	....	16
	B^1	291	8	977	13
	B^2	168	12	1,184	11
	C	201	12	1,222	160
Southampton Sandy Loam	A^1	302	80	808	32
	A^2	257	208	996	30
	B^1	347	64	1,146	18
	B^2	246	48	1,034	27
	C	369	160	1,052	....
Shulie Sandy Loam	Ao (2)	583	33	689	7
	A^2	302	16	620	5
	B^1	347	8	940	5
	B^2	201	8	883	12
	C	212	24	846	27
West Brook Loam	Ao (2)	183	10	834	29
	A^2	268	96	996	30
	B^1	235	64	1,146	23
	B^2	224	32	1,109	25
	C	235	0	1,123	20
Hansford Sandy Loam	Ao (2)	432	10	435	13
	A^2	302	12	507	29
	B^1	168	16	545	50
	B^2	67	0	1,203	20
	C	89	0	1,184	41
Cobequid Loam	Ao (2)	583	32	399	17
	A^2	280	52	789	22
	B^1	201	48	770	20
	B^2	168	72	808	52
	C	532	68	789	167
Wyvern Sandy Loam	A	1,400	760	2,820	41
	B^1	560	480	2,256	13
	B^2	324	208	1,259	50
	C	481	80	977	103

(1) Calculations for CaO, MgO and K20 derived from exchangeable bases by conversion from milligram equivalent to percentage weight.
(2) Calculated on the basis of 193,000 lb. soil per acre.

TABLE 14.—AVAILABLE NUTRIENTS IN POUNDS PER ACRE(1)—*Concluded*

Soil Association	Horizon	Available			
		CaO	MgO	K_2O	P_2O_5
Kirkhill Shaly Clay Loam	Ao (2)	286	10	453	7
	A^2	280	20	601	20
	B^1	190	64	1,284	11
	B^2	134	0	1,109	13
	C	179	12	1,165	20
Hebert Sandy Loam	Ao (2)	91	7	199	11
	A^2	358	40	413	18
	B^1	235	16	122	98
	B^2	280	24	376	32
	C	448	24	206	13
Parrsboro Gravelly Loam	A (2)	54	68	253	25
	B^1	112	40	733	11
	B^2	201	32	564	22
	C	246	64	319	55
Cumberland Loam	1	1,960	80	451	110
	2	3,584	72	470	137
	3	1,344	28	376	82
Acadia (dykeland—well drained)	1	2,016	1,720	1,632	55
	2	2,184	1,920	1,804	420
	3	784	1,240	3,008	480
	4	840	1,120	3,008	490
Acadia (dykeland—poorly drained)	1	2,184	2,560	5,264	32
	2	952	1,600	2,444	25
	3	616	1,240	1,861	57

(1) Calculation for CaO, MgO and K20 derived from exchangeable bases by conversion from milligram equivalents to percentage weight.
(2) Calculated on the basis of 193,000 lb. soil per acre.

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