Series 1958, No. 27

Issued April 1964

SOIL SURVEY

Aroostook County, Maine

Northeastern Part

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
UNIVERSITY OF MAINE AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of northeastern Aroostook County will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, and other structures; aid foresters in managing woodlands; and add to the fund of knowledge about soils.

In making this survey, soil scientists dug holes and examined surface soils and subsoils; measured slopes with a hand level; noticed differences in the growth of crops, weeds, and grasses; and, in fact, recorded all the things that they thought might affect the suitability of the soils for farming, forestry, engineering, and related uses.

The scientists plotted the boundaries of the soils on aerial photographs. Then, cartographers prepared the detailed soil map shown in the back of this report. Cultivated fields, roads, creeks, and other landmarks are shown on the map.

Locating soils

Use the index to map sheets to locate areas on the large map. The index is a small map of the survey area on which numbered rectangles have been drawn to show where each sheet of the large map is located. When you find the correct sheet of the large map, note that the boundaries of the soils are outlined and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they appear on the map. The symbol will be inside the area if there is enough room; otherwise, it will be outside the area and a pointer will show where the symbol belongs. Suppose, for example, you find an area on your farm marked with the symbol CgB. The legend for the detailed map shows that this symbol identifies Caribou gravelly loam, 2 to 8 percent slopes. This soil and all others mapped in the survey area are described in the section "Soil Series and Mapping Units."

Finding information

This soil survey report has special sections for different groups of readers, as well as some sections of value to all. The section "General Nature of the Area" points out outstanding features of the survey area and will be of interest mainly to those not familiar with northeastern Aroostook County.

Farmers and those who work with farmers can learn about the soils in the section "Soil Series and Mapping Units" and then turn to the section "Use and Management of the Soils." In this way they first identify the soils on their farm and then learn how these soils can be managed and what yields can be expected. The soils are grouped by capability units; that is, groups of soils that need similar management and respond in about the same way. For example, in the section of soil descriptions, Caribou gravelly loam, 2 to 8 percent slopes, is shown to be in capability unit IIe-3. The management this soil needs, therefore, will be stated under the heading "Capability Unit IIe-3," in the section "Use and Management of the Soils."

Foresters and others interested in management of woodlands can refer mostly to the section "Forestry." In this section the kinds of forest trees are mentioned, the factors affecting their management are explained, and the soils in different woodland suitability groups are described.

Engineers will want to refer to the section "Engineering Applications." The tables in this section show characteristics of the soils that affect engineering.

Scientists and others will find information about how the soils were formed and how they were classified in the section "Soil Formation and Classification."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

* * *

Fieldwork for this survey was completed in 1958. Unless otherwise indicated, all statements in the report refer to conditions in the area at that time. This publication on the soil survey of northeastern Aroostook County is part of the technical assistance furnished to the Central Aroostook and St. John Valley Soil Conservation Districts.

Cover picture: Gently sloping Caribou soils along the Aroostook River

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SOIL SURVEY OF AROOSTOOK COUNTY, MAINE NORTHEASTERN PART

REPORT BY JOHN R. ARNO, SOIL CONSERVATION SERVICE

SOILS SURVEYED BY J. S. HARDESTY, JOHN R. ARNO, R. B. WILLEY, W. H. FARLEY, B. W. McEWEN, K. P. WILSON, A. D. BACKER, J. E. McCUEN, A. P. FAUST, SHELDON MICHAELS, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE UNIVERSITY OF MAINE AGRICULTURAL EXPERIMENT STATION

THIS SOIL SURVEY covers 1,517,316 acres in the northeastern part of Aroostook County, Maine (fig. 1). For convenience, the area is referred to as northeastern Aroostook County in this report. It is bordered on the north by the St. John River and on the east by Canada. The towns [1] of Blaine, TD–R2, T9–R3, T9–R4, T9–R5, and Oxbow are included in the survey area and form the southern boundary. The towns of St. Francis, St. John, Eagle Lake, Winterville, T14–R6, Portage Lake, Nashville, Garfield, T10–R6, and Oxbow, which also are within the survey area, form the western boundary.

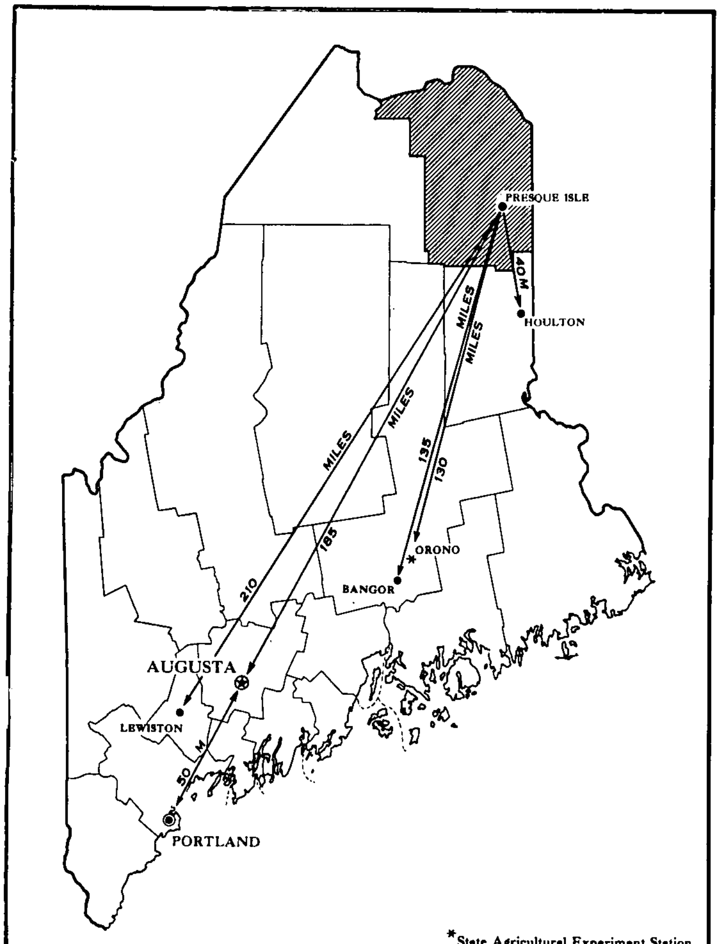

Figure 1.—**Northeastern part of Aroostook County, Maine.**

About 1,112,900 acres were mapped in detail. This included the cultivated area. A total of 404,416 acres were mapped in semidetail, or as a reconnaissance survey; most of this land is mainly in unorganized townships and is owned by lumber companies.

How Soils Are Named, Mapped, and Classified

Soil scientists made this survey to learn what kinds of soils are in northeastern Aroostook County, where they are located, and how they can be used.

They went into the area knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug or bored many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down to the rock material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are

[1] The term "towns" as used in this part of the country is synonymous with the term "townships."

similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Caribou and Howland, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in natural characteristics.

Many soil series contain soils that are alike except for texture of their surface layer. According to this difference in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Howland gravelly loam and Howland very stony loam are two soil types in the Howland series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into soil phases. The name of a soil phase indicates a feature that affects management. For example, Howland gravelly loam, 0 to 2 percent slopes, is one of several phases of Howland gravelly loam, a soil type that ranges from nearly level to moderately steep.

After a fairly detailed guide for classifying and naming the soils had been worked out, the soil scientists drew soil boundaries on aerial photographs. They used photos for their base map because they show woodlands, buildings, field borders, trees, and similar detail that greatly help in drawing boundaries accurately. The detailed soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing the detailed map, the soil scientists may group together some soils that are not regularly associated geographically. These mapping units are called undifferentiated groups, and Easton and Washburn silt loams, 0 to 2 percent slopes, is an example. Differences between these soils were not great enough to require separate mapping.

Also, in most mapping, there are areas to be shown that are so rocky, so shallow, or so frequently worked by wind and water that they cannot be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Mixed alluvial land or Riverwash, and are called land types rather than soils.

After the soil scientist had named and described the soil series and mapping units and had shown the location of the mapping units on the soil map, there was additional work to be done. The mass of detailed information he had recorded then needed to be presented in different ways for different groups of users, among them farmers, managers of woodlands, and engineers.

To do this efficiently, he had to consult with persons in other fields of work and jointly prepare with them groupings that would be of practical value to different users. Such groupings are the capability classes, subclasses, and units, designed primarily for those interested in producing the short-lived crops and tame pasture; woodland suitability groups, for those who need to manage wooded tracts; and the classifications used by engineers who build highways or structures to conserve soil and water.

General Soil Map

After study of the soils in a locality and the way they are arranged, it is possible to make a general map that shows several main patterns of soils, called soil associations. Such a map is the colored general soil map in the back of this report. Each association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic, although not strictly uniform.

The soils within any one association are likely to differ greatly among themselves in some properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general map does not show the kind of soil at any particular place, but different patterns of soils, each of which may consist of several different soils.

The associations are named for the major soil series in them, but as already noted, soils of other series may also be present. The major soil series of one soil association may also be present in other associations but in a different pattern and proportion.

The general map showing patterns of soils is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

1. Smoothly sloping soils on till derived chiefly from shale and limestone: Caribou-Conant association

This soil association consists mainly of broad, gently rolling ridges of till soils on the uplands. Each ridge, or hill, has a nearly level top and smoothly sloping sides. Only where the hills border streams are the slopes fairly steep.

In general, the broad ridges consist of deep, well-drained Caribou soils, which make up more than 50 percent of the association. Nearly three-fourths of the slopes are less than 8 percent, but a few slopes are as steep as 25 percent. The Caribou soils are used mainly for potatoes. A few small areas, mostly on steep slopes, are in forests of northern hardwoods.

The Caribou soils grade smoothly to the moderately wet Conant soils in slight depressions on the ridges. Because of the gently rolling to slightly undulating relief, there are large, easily farmed fields.

The Conant soils are mostly on slopes of less than 8 percent. They are used mainly for potatoes grown in a rotation that includes peas, small grains, and hay. Some areas are used for pasture, but the absence of fences is particularly noticeable throughout the area.

The ridges are separated by areas of narrow, low, very wet Easton and Washburn soils. These areas make up less than 25 percent of the association, but they are very distinct. The soils are usually too wet for the growing of potatoes. Most of the areas have been left in native spruce. Narrow bands of spruce trees, among the broad fields, indicate areas of Easton and Washburn soils. These soils are more extensive in association 6.

Association 1 comprises the area known as the limestone valley of Aroostook County. The city of Presque Isle is near its center and it includes some of the surrounding towns. This is the most highly specialized potato-producing area in the State. Most of the people depend on the potato crop for a living.

Most of the farms in this association are 100 to 120 acres in size, but the trend is toward large farms. Some farmers operate units of 400 to 1,000 acres. With the introduction of large, expensive, highly specialized equipment, it has been necessary to increase the number of acres farmed. Some of the farmers and their sons now operate their farms as corporations.

2. Smoothly sloping soils on till derived chiefly from acid rocks: Plaisted-Perham-Howland-Daigle association

Most of this association occurs on high ridges that extend in a northeast-southwest direction. The ridges have relatively level, long, narrow tops and moderately steep sides. Many of the ridgetops and less sloping sides are used for growing crops, but thousands of acres have never been cleared.

More than half of the acreage on the ridges consists of well-drained Perham (fig. 2) and Plaisted soils. In general, the slopes range from 8 to 15 percent, but slopes of less than 8 percent are common.

Depressions and low areas on the ridges consist of the moderately wet Howland and Daigle soils. These soils make up more than one-third of the acreage of this association. Some areas have been cleared, but large areas, particularly of the very stony Howland soils, are still forested. On most of the acreage of the Howland and Daigle soils, the slopes are less than 8 percent, but in places they are as steep as 25 percent.

The ridges are separated by very wet valleys occupied by Monarda and Burnham soils. These soils are nearly level and are usually too wet for row crops; in addition, much of the acreage is very stony and, therefore, has been left in forest. Spruce is the most common tree. The Monarda and Burnham soils occur in small areas in this association.

Figure 2.—**Smoothly sloping Perham and Daigle soils in the western part of the survey area.**

All the soils of this association, which have formed on glacial till in the uplands, have a firm horizon. This compact horizon is the predominant characteristic of the soils. Neither plant roots nor water can easily penetrate this layer. Internal drainage is so severely impeded that only the sloping soils are well drained. Since most of the area is strongly sloping, there are large individual areas of well-drained soils.

Less than half of the land in this association has been cleared of trees and surface stones and used for crops. Potatoes, peas, small grains, and hay are grown. Potatoes are the main cash crop but are not grown so extensively as in the soils of association 1.

Many large uncleared areas are potentially better suited to crops than areas now being cultivated. Most of this uncleared land is owned by large lumber companies, which generally own entire townships and maintain the land in forests. Mixed hardwood and softwood trees grow on the soils. More than half of the land produces spruce and fir trees.

Most of the farms are 100 to 120 acres in size and contain about equal acreages of cleared areas and woodland. The farms are not so highly mechanized as those in the limestone valley.

3. Irregularly sloping, shallow to moderately deep soils on till derived from calcareous rocks: Mapleton-Conant association

Irregular relief is the outstanding characteristic of this soil association. The soils do not slope in any one general direction, but in two or more directions.

The knolls are made up of well-drained Mapleton soils that are shallow to limestone and shale bedrock. The glacial till is generally 20 to 30 inches thick, but in places it is more shallow. The soils may be somewhat droughty during dry periods. About half the acreage of Mapleton soils has slopes of 2 to 8 percent, and the other half has slopes of 8 to 15 percent.

The bedrock under Mapleton soils is partly weathered but contains some unweathered seams of limestone. The limestone weathers rapidly because the seams are nearly at right angles to the surface of the soil.

Depressions between the knolls consist of moderately wet Conant soils. These soils are generally more than 30 inches thick. They wind around the higher, well-drained Mapleton soils on the knolls. Nearly three-fourths of the acreage of the Conant soils has slopes of less than 8 percent.

This soil association is common in the towns of Easton, Mars Hill, and Blaine. It occurs to a limited extent in the towns of Caribou, Fort Fairfield, and Presque Isle.

About three-fourths of the land is used for potatoes, peas, small grains, and hay. The soils are slightly difficult to farm because of irregular slopes and scattered outcrops of bedrock; otherwise, they are well suited to cultivated crops.

The farms are about 100 to 120 acres in size, but the trend is toward larger units. Although highly mechanized, the farms are not worked so intensively as those of association 2.

4. Irregularly sloping soils on till derived chiefly from acid rocks: Thorndike-Howland association

Irregular, broken relief is characteristic of this association. In general, the soils occur on knolls and hills and are shallow to bedrock. The thin layer of glacial till in which the soils have formed conforms in shape to the underlying folded, angular, and ribbed shale.

Both the shaly and very rocky Thorndike soils are on irregularly rolling hills. The shaly Thorndike soils are more common, and most of them have slopes of less than 15 percent. The very rocky Thorndike soils generally have very rough relief, and most of the slopes are steeper than 15 percent. These very rocky soils are not extensive in this association.

Moderately wet depressions and seepage areas consist of Howland soils. These soils are deeper than the other soils of this association and have smooth relief. They generally occur as long, narrow bands between areas of soils that are shallow to bedrock.

This soil association occurs mainly in the north and northwestern parts of the survey area. It makes up nearly all the acreage in the towns of St. Francis, St. John, Fort Kent, and Wallagrass.

Approximately 20 percent of the land is used for potatoes, peas, small grains, and hay. Most of the rest is forested. Other land has been cleared and used for crops but has reverted to woodland. Most of the area, however, has never been cleared but has been left to produce maple, beech, and birch. These trees are used for lumber and firewood.

The areas of this association are slightly difficult to farm because of the irregular slopes and scattered outcrops of bedrock. In many places the land slopes in several directions. This restricts contour farming and increases the hazard of erosion when row crops are grown.

Trees grow faster on the soils of this association than on soils that are shallow to granitic bedrock. Tree roots enter cracks in the shale bedrock, become more firmly anchored, and gain access to a larger supply of water.

Most of the farms contain 100 to 120 acres. Only part of each farm is cleared and used for crops. The rest is left in woodland. Large areas in the towns of St. Francis and St. John are owned by large lumber companies and are maintained as woodland.

5. Nearly level to sloping soils of the flood plains and terraces: Stetson-Allagash-Hadley-Winooski association

This association consists of soils formed in water-deposited silt, sand, and gravel. The soils are made up mostly of well-drained sand and gravel, but there are scattered areas of moderately wet fine sand and silt.

Two major physiographic areas—terraces and flood plains—are within this association. The soils on the higher terraces have a surface layer of gravelly loam. They are underlain by sand and gravel at less depth and are more strongly developed than soils on the lower terraces.

Stetson soils are most common on the higher terraces. Most of them have slopes of less than 8 percent, but, where the soils occur on faces of the terraces, the slopes are steep. The steeply sloping areas are narrow and inextensive, however.

Machias soils have developed in the depressions in the high terraces. They are moderately wet and nearly level. Most of the slopes are less than 8 percent.

Soils on the lower terraces have surface layers of fine sandy loam and silt loam. The Allagash and Salmon soils are well drained and mostly nearly level. Madawaska and Nicholville soils are moderately wet; they are minor in extent and occur on undulating areas that have few slopes greater than 8 percent.

The well drained Hadley and moderately well drained Winooski soils are on level areas of the flood plains, only a few feet above the streams. They are often flooded early in spring, especially where they occur as islands. All the soils of this association are in stream valleys. The largest areas are along the St. John and Aroostook Rivers. Most areas are only a few hundred feet wide, but, in a few places along the St. John River, the areas are nearly a mile wide.

Nearly all of the acreage has been used for potatoes, peas, small grains, and hay. Only a few farms occur solely within this association of soils. Most farms along the rivers include some of the soils on terraces and flood plains, as well as soils on upland till.

Farms range in size from 80 to 120 acres. The smallest occur in long, narrow areas along the St. John River and extend up the sides of the adjacent hills.

6. Nearly level to gently sloping, poorly drained and very poorly drained soils on firm till: Easton-Washburn-Monarda-Burnham association

Wet, nearly level, extensive areas covered with dark-green forests of spruce are typical of this association. The soils occur mainly in narrow areas in the valleys between ridges of the Perham, Plaisted, or Caribou soils and also in wide, swampy areas on the more nearly level terrain.

Monarda and Burnham soils are predominant. Easton and Washburn soils are also extensive; they occur next to areas of well-drained Caribou soils.

Only a small part of the acreage has been cleared, because the soils, unless drained, are too wet for row crops. Also, much of the acreage of Monarda and Burnham soils is very stony.

Scattered throughout the large, flat areas are small, low hills that consist of the slightly better drained Howland soils. The poor drainage in the very wet surrounding areas has influenced the type of forest on the hills, which, like the very wet areas, have a cover consisting mainly of spruce and of some fir trees.

The largest area of this association is in the southwestern part of the survey area. Other large areas occur around Portage Lake and Square Lake.

No farms occur in this association of soils. The land is owned by lumber companies. A lumber company cuts all trees in a township, or an extensive area, that are large enough to produce pulpwood. The complete operation, including the lumber camp, is moved to a different location after all suitable trees have been cut. Trees remaining in cutover tracts are left to grow another 15 years or more before the pulpwood operation is renewed.

Use and Management of the Soils

This section consists of three main parts. In the first part the nationwide system of capability classification is described. In the second part the soils are grouped in capability units, or management groups, and management by capability units is described. The third part contains a table that gives estimated yields for crops under two levels of management.

Use of the soils for forestry and engineering is discussed in separate sections.

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable they are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony, and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry. Some of the soils of northeastern Aroostook County have two kinds of major limitations. A double subclass designation, for example, *ew*, is used for such soils.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it have little or no erosion hazard but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping of soils for many statements about their management. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIe-3.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system and the subclasses and units in northeastern Aroostook County are described in the list that follows.

Class I. Soils that have few limitations that restrict their use. (No class I soils in northeastern Aroostook County.)

Class II. Soils that have some limitations that reduce the choice of plants or require some conservation practices.
- Subclass IIe. Gently sloping soils that are subject to moderate erosion if they are not protected.
  - Unit IIe-1.—Well-drained silt loam or shaly silt loam soils that are shallow to bedrock.
  - Unit IIe-3.—Deep, well-drained gravelly loam and gravelly silt loam soils on glacial till.
  - Unit IIe-5.—Deep, well-drained fine sandy loam and gravelly loam soils on stream and outwash terraces.
  - Unit IIe-6.—Deep, well-drained soils on flood plains that have no serious hazard of overflow.
  - Unit IIe-7.—Deep, well-drained silty soils on terraces.
- Subclass IIw. Soils that have moderate limitations because of excess water.
  - Unit IIw-4.—Moderately well drained silt loam and gravelly loam soils on glacial till.
  - Unit IIw-5.—Moderately well drained fine sandy loam and gravelly loam soils on stream and outwash terraces.
  - Unit IIw-6.—Nearly level, moderately well drained soils on flood plains.
  - Unit IIw-7.—Moderately well drained silty soils on terraces.
- Subclass IIc. Soils limited by a short growing season.
  - Unit IIc-3.—Deep, well-drained gravelly loam or gravelly silt loam soils on glacial till.
  - Unit IIc-5.—Deep, well-drained fine sandy loam and gravelly loam soils on terraces and glacial outwash.
  - Unit IIc-6.—Deep, well-drained soils on flood plains that are not subject to damaging overflow.
  - Unit IIc-7.—Deep, well-drained silty soils on terraces.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
- Subclass IIIe. Sloping soils that are subject to severe erosion if they are not protected.
  - Unit IIIe-1.—Well-drained silt loam and shaly silt loam soils on glacial till that is shallow to bedrock.
  - Unit IIIe-3.—Deep, well-drained gravelly loam and gravelly silt loam soils on glacial till.
  - Unit IIIe-5.—Deep, well-drained fine sandy loam and gravelly loam soils on stream and outwash terraces.
  - Unit IIIe-7.—Deep, well-drained silty soils on terraces.
- Subclass IIIew. Sloping soils that are subject to severe erosion and are also limited by excess water.
  - Unit IIIew-4.—Deep, moderately well drained silt loam and gravelly loam soils on glacial till.
  - Unit IIIew-5.—Deep, moderately well drained fine sandy loam and gravelly loam soils on stream and outwash terraces.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
Subclass IVe. Moderately sloping to steep soils subject to very severe erosion if they are cultivated and not protected.
Unit IVe-1.—Well-drained silt loam and shaly silt loam soils on glacial till that is shallow to bedrock.
Unit IVe-3.—Deep, well-drained gravelly silt loam and gravelly loam soils on glacial till.
Unit IVe-5.—Deep, well-drained gravelly loam soils on terraces.
Subclass IVw. Soils that have very severe limitations for cultivation because of excess water.
Unit IVw-3.—Poorly drained and very poorly drained silt loam soils on glacial till.
Unit IVw-5.—Poorly drained and very poorly drained silt loam soils on stream and outwash terraces.
Unit IVw-7.—Poorly drained, slowly permeable silt loam soils on lacustrine deposits.
Class V. Soils not likely to erode that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture, woodland, or wildlife food and cover.
(No class V soils in northeastern Aroostook County.)
Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture, woodland, or wildlife food and cover.
Subclass VIe. Soils limited chiefly by risk of erosion if protective cover is not maintained.
Unit VIe-3.—Deep, well-drained gravelly loam soils on glacial till.
Unit VIe-5.—Deep, well-drained loamy soils on stream or outwash terraces.
Subclass VIw. Soils limited by excess water.
Unit VIw-6.—Poorly and very poorly drained soils on flood plains that are subject to frequent or very frequent flooding.
Subclass VIs. Soils limited for cultivation and other uses chiefly by stones and rocks.
Unit VIs-1.—Very rocky, shallow and very shallow, shaly soils.
Unit VIs-3.—Deep, well drained and moderately well drained, very stony soils on glacial till.
Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation and that restrict their use largely to grazing, woodland, or wildlife areas.
Subclass VIIw. Soils limited by excess water.
Unit VIIw-9.—Poorly drained organic soils.
Subclass VIIs. Soils limited chiefly by stones and rocks.
Unit VIIs-1.—Very shallow, very rocky and shaly soils.
Unit VIIs-3.—Deep, steep, very stony, well-drained soils on glacial till.
Subclass VIIsw. Soils limited by properties that adversely affect soil depth, and by excess water part of the growing season.
Unit VIIsw-3.—Deep, stony, poorly and very poorly drained soils on glacial till.
Class VIII. Soils and landforms that have limitations that preclude their use, without major reclamation, for commercial production of plants, and restrict their use to recreation, wildlife, water supply, or esthetic purposes.
Subclass VIIIw. Soils severely limited by frequent flooding.
Unit VIIIw-6.—Sand and gravel bars along streams.

Management by Capability Units

In this section all the soils, except Made land, have been placed in capability units. The use and management and the limiting factors of each capability unit are described. This information will serve as a general guide for managing the soils, but, for more specific information on establishing a conservation plan, it is best to consult a representative of the local soil conservation district. Information on the amounts of lime and fertilizer to apply and the amount of seed to plant can be obtained from the county agent.

The kinds of crops that are well suited to northeastern Aroostook County are limited by the cool, humid, continental climate. Winters are long, cold, and windy. The ground freezes in November and remains frozen until April. Summers are short and cool. The last killing frost in spring generally occurs around the last of May, and the first in fall occurs about the last of September. Only the crops best suited to the climate of northeastern Aroostook County are discussed in this section, but some other crops are also suitable. (For detailed information on climate, see the section "Climate of northeastern Aroostook County" in the back part of the report.)

The present management suggestions—those referred to as good management practices in the descriptions of individual capability units—are given for the principal crops as follows:

Potatoes.—Soils used for potatoes, the main cash crop, need to be friable, because they are disturbed about seven times during the growing season. They are plowed, harrowed, and seeded when the potato crop is planted; cultivated and ridged around the potato plants at least three times; and elevated on harvesters when the potatoes are dug. As a result, the physical properties of some soils are damaged. These soils need to be planted occasionally to a sod crop to restore good soil structure.

The reaction of the soils should be maintained at about pH 5.2 to 5.4. A higher pH value permits the disease called potato scab (*Actinomyces scabies*), which makes potatoes less marketable. A more acid reaction than suggested permits the fixation of phosphorus in the soil and limits the activity of nitrogen-fixing bacteria.

Mixed fertilizer is applied at the time of planting at the per acre rate of 100 to 160 pounds of nitrogen, 150 to 200 pounds of phosphate, and 150 to 200 pounds of potash. Fertilizer requirements vary according to the variety of potato and the kind of soil, however, and applications should be based on the results of soil tests.

Peas and oats.—Cash crops of peas and oats are grown in a rotation with potatoes. Grown following potatoes, they use the residual fertilizer, but, even so, small amounts of fertilizer are applied when they are grown on moderately fertile soils. Lime is often applied when the soils are prepared for seeding. Larger applications can be made at this time than at the time of potato planting because much of the lime will be used before potatoes are planted. Crop residues should be returned to the soils.

Clover and grasses.—These are grown in the rotation, mainly as soil-building crops. Some farmers harvest part of the forage as hay; others maintain clover and grass in pasture. Soils that are used mainly for hay or pasture are limed to maintain a pH value of 6.5.

Capability unit IIe-1

This unit consists of gently sloping, well-drained, medium-textured soils on glacial till. The soils average about 24 inches in thickness to bedrock, but there are a few outcrops of rock. Water moves freely through the soils. Runoff is medium. The soils are—

Benson silt loam, 0 to 8 percent slopes.
Mapleton shaly silt loam, 0 to 8 percent slopes.
Thorndike shaly silt loam, 0 to 8 percent slopes.

These soils hold enough water to produce good yields of clover and grass. They respond to moderate applications of lime. In some places the subsoil is nearly neutral and small applications of lime will result in good yields of clover. Lack of moisture may limit the response of forage crops to fertilizer in midsummer. In spring, early in summer, and in fall, these soils usually respond to moderate applications of fertilizer, and a succession of forage crops therefore can be produced. When the soils are used for rotational pasture, the plants should be clipped after each grazing period to encourage new growth.

Good yields of potatoes can be obtained if summer rainfall is conserved. High yields can be produced if a rotation consisting of 2 years of potatoes and 1 year of a green-manure crop is followed. The soils need to be farmed in graded strips to limit losses of soil and water. In a few places small outcrops of rock are a hazard to farm equipment, but only 2 to 5 percent of the total acreage is unfit for cultivation. In some places the soils near the outcrops are neutral to alkaline in reaction and, as a result, potato scab may be a problem.

Good yields of oats and peas can be produced. These crops can be grown in a rotation with potatoes.

Capability unit IIe-3

This unit consists of deep, gently sloping, well-drained, medium-textured soils on glacial till. The soils are mainly on gently rolling hilltops. The supply of water for plants is good. Runoff is medium. The soils are—

Caribou gravelly loam, 2 to 8 percent slopes.
Perham gravelly silt loam, 2 to 8 percent slopes.
Plaisted gravelly loam, 2 to 8 percent slopes.

These soils have a wide range in use and are very responsive to good management. Yields are limited by the amount of plant nutrients in the soils. If legumes and grasses are cut frequently and heavily fertilized after each cutting, they will grow rapidly from early in spring until frost and will produce very high yields of hay and pasture.

These are the soils that are used most extensively for growing potatoes. Most areas are broad and are suitable for the heavy specialized machinery used for potatoes. Small grains, clover, and grass are grown in rotation with potatoes.

High yields of potatoes can be produced if the soils are protected from erosion and kept in good condition. A rotation consisting of 2 years of potatoes and 1 year of a soil-building crop, planted in strips on the contour, will help to conserve the soils. With this type of management, soil erosion is seldom a problem on short slopes.

Slopes more than 300 feet long can be managed more easily if divided into strips on the contour and up to 200 feet wide. Soil loss early in spring and late in fall can be reduced if one strip in three is left in sod during the winter.

The Plaisted and Perham soils have a compact subsoil that slows penetration of water; therefore, they need diversion ditches and crop strips that are arranged so that water will not stand in the crop rows after rains.

Capability unit IIe-5

This unit consists of deep, gently sloping, well-drained soils on glacial outwash and stream terraces. The soils have fine sandy loam and gravelly loam surface layers. The water-holding capacity is moderately high, and runoff is medium. The soils are—

Allagash fine sandy loam, 2 to 8 percent slopes.
Stetson gravelly loam, 2 to 8 percent slopes.

These soils are used for potatoes, peas, small grains, clover, and grass. They can be worked early in the spring —as soon as the frost is out of the soils—without damage to the soil structure. These soils are seldom droughty, but irrigation might be profitable on high-value cash crops in years when rainfall is poorly distributed.

Cultivated crops, particularly potatoes, should be planted on the contour to limit runoff and conserve rainfall. If a high organic-matter content is maintained, these soils will hold enough water for plants during midsummer.

The combination of the following factors distinguishes these soils from the other soils in the survey area: Suitability for use early in spring, moderately high water-holding capacity, slight susceptibility to erosion, and medium runoff.

Capability unit IIe-6

This unit consists of a deep, well-drained, undulating soil on bottom lands. The hazard of overflow is not serious. Runoff is medium. The only soil in this unit is—

Hadley silt loam, undulating.

This soil has a wide range in use and responds well to good management. It holds a large amount of water available for plants, but yields are limited by the lack of plant nutrients. This soil can be planted to legumes and grasses and used for hay or pasture. If legumes and grasses are cut frequently, are not allowed to mature, and are heavily fertilized after each cutting, they will grow rapidly from early in spring until late in fall and will produce very high yields.

High yields of potatoes can be obtained if the soil is protected from erosion and maintained in good condition. A rotation consisting of 2 years of potatoes and 1 year of a soil-building crop is needed.

Most areas are narrow and long, and the planting of crops across the slope will limit soil washing.

Early in spring, ice may dam streams and cause water to back up over the banks. Occasionally, streambanks are eroded, but this can be limited by keeping the banks in permanent vegetation.

In some places this soil occurs at the bases of sloping hills where it receives runoff water from other soils. Diversion ditches constructed at the bases of the hills will carry the water away from this soil and limit erosion.

This undulating soil is subject to frosts early in fall and cannot produce crops that require a longer growing season than potatoes. Air drainage is poor, and, during the season of heavy dew, potato plants remain damp until late in the day. Therefore, additional applications of fungicide spray may be needed in years when late blight is prevalent.

Capability unit IIe–7

This unit consists of a deep, well-drained, gently undulating terrace soil on silty sediments laid down by slack water. Runoff is medium. The only soil in this unit is—

Salmon silt loam, 2 to 8 percent slopes.

High yields of clover and grass can be produced if this soil is limed and fertilized. The soil responds well to good management when used for permanent hay or pasture. It holds enough water that clover and grass can be harvested several times during the year. Lack of plant nutrients limits sustained high yields. Yields will improve if fertilizer is applied after each forage crop is removed. When the soil is used for rotational pasture, the plants should be clipped so that they will not mature but will continue to grow.

High yields of potatoes can be produced if the soil is protected from erosion and kept in good condition. A rotation consisting of 2 years of potatoes and 1 year of a soil-building crop, planted in strips on the contour, is suggested. With this type of management, erosion is seldom a problem on short slopes. Long slopes need diversion ditches for additional protection. A long rotation consisting of potatoes and oats or peas can be used.

The soil is easily compacted if worked when wet or if heavy equipment goes over the same area at frequent intervals. This slows down permeability and causes water to stand between the potato rows. Standing water delays harvesting of the crop and increases the hazard of late blight.

Capability unit IIw–4

This unit consists of deep, moderately well drained soils on glacial till. Some of the soils are nearly level; others are gently sloping. The compact subsoil holds water close to the surface. Runoff is slow on the soils that have slopes of 0 to 2 percent and medium on the soils that have slopes of 2 to 8 percent. The soils are—

Conant silt loam, 0 to 2 percent slopes.
Conant silt loam, 2 to 8 percent slopes.
Daigle silt loam, 0 to 2 percent slopes.
Daigle silt loam, 2 to 8 percent slopes.
Howland gravelly loam, 0 to 2 percent slopes.
Howland gravelly loam, 2 to 8 percent slopes.

The use of these soils is limited slightly by slow internal drainage. In spring, fieldwork must be delayed until the soils have lost excess moisture. During unusually wet springs, these soils remain wet so late that potatoes cannot be planted. In these years, however, they can be used for growing peas or oats because these crops require a very short growing season.

If drained, these soils can be farmed more intensively and will produce consistently higher yields than if undrained. Open ditches and tile drains work well, but tile drains are usually preferred. Open ditches are cheaper to construct, but they hinder farm operations and require more maintenance. It is slightly more difficult to establish outlets on slopes of 0 to 2 percent than on slopes of 2 to 8 percent.

The steeper soils are subject to erosion if planted to a row crop. Contour farming can be done on slopes up to 300 feet long. Longer slopes need to be divided into strips 200 feet wide. The strips planted to a cultivated crop should run on the contour. One strip in three should be left over winter in an erosion-resistant crop. Diversion ditches are needed on long slopes that have a strong gradient. They will help control erosion and will intercept water moving horizontally through the subsoil. The slope gradient in the ditch should be as great as possible without causing scouring of the ditch.

Normally, these soils are used in a rotation consisting of potatoes, peas, oats, and hay. It is common to leave the hay crop on the same field for 2 or more years.

Capability unit IIw–5

This unit consists of moderately well drained soils on glacial outwash and stream terraces. Some soils are nearly level; others are gently undulating. They are influenced by either a perched or high water table. The soils on slopes of 0 to 2 percent have slow runoff, and those on slopes of 2 to 8 percent have medium runoff. The soils are—

Machias gravelly loam, 0 to 2 percent slopes.
Machias gravelly loam, 2 to 8 percent slopes.
Madawaska fine sandy loam, 0 to 2 percent slopes.
Madawaska fine sandy loam, 2 to 8 percent slopes.

These soils produce fair yields of grass and clover if limed and fertilized. Their range of use and their yield of crops are limited by excess water. The water can be removed by drainage, however. In many places tile drains are most satisfactory because water moves freely through the soils.

In some places there are small depressions where water stands a large part of the year. Grasses and legumes are often winterkilled in these spots, and this results in uneven stands of forage crops. The depressed spots can be eliminated by land smoothing.

Water is held near the surface in some places and forms a perched water table. These spots can often be drained by dynamiting the slightly firm layer that impedes movement of water. Once the firm layer is broken, water enters the loose substrata and is no longer a hazard.

After these soils are drained, they can be used intensively for forage crops. These crops can be grown and harvested for hay or pasture several times a year if fertilizer is applied after each cutting. If the soils are used for rotational pasture, the plants should be clipped so that they will not mature but will continue to grow.

Potatoes can be grown without improved drainage, but yields are often low or the crop is difficult to harvest. If drained, the soils produce good yields. Drainage makes it easy to farm these soils early in spring and extends the period during which potatoes can be harvested.

Erosion is seldom a problem, but intensive production of row crops increases this hazard. If the stronger slopes are planted in strips, erosion can be limited. This practice also helps conserve rainfall for plants during midsummer.

The nearly level soils can be planted continuously to potatoes without severe loss of soil. A green-manure crop should be grown occasionally to help control diseases and insects, as well as to maintain the physical properties of the soils.

Capability unit IIw-6

This unit consists of a moderately well drained, nearly level soil on bottom lands. Runoff is slow. The only soil in this unit is—

Winooski silt loam.

This soil produces fair yields of grass and clover, if limed and fertilized. Its range in use and its yields of crops are limited by excess water. The water can be removed by drainage, however. In many places, tile drains are most satisfactory because water moves well through the soil. In some places there are small depressions where water remains much of the year. Grasses and legumes are often winterkilled in these places, and this results in uneven stands of forage crops. The depressions can be eliminated by land smoothing.

After this soil is drained, it can be used intensively for forage crops. These crops can be grown and harvested as hay or pasture several times a year, if fertilizer is applied after each cutting. If the soil is used for rotational pasture, the plants should be clipped so they will not mature but will continue to grow.

Potatoes can be grown without improved drainage, but yields are often low or the crop is difficult to harvest. If drained, the soil produces good yields. Drainage makes it easy to farm the soil early in spring and extends the period during which potatoes can be harvested.

This soil may be flooded when ice dams up water, but this occurs too early in spring to influence the growing of most crops. Flooding seldom causes erosion or deposition of soil. In some places streambanks are eroded early in spring, but this hazard can be limited by maintaining vegetation on the banks.

Capability unit IIw-7

This unit consists of moderately well drained, nearly level and gently sloping silty soils on terraces. Runoff is medium on the gently sloping soils and slow on the nearly level soils. The soils are—

Nicholville silt loam, 0 to 2 percent slopes.
Nicholville silt loam, 2 to 8 percent slopes.

These soils produce fair yields of grass and clover if they are limed and fertilized. Their range in use and their yield of crops are limited by excess water. The water can be removed through drainage, however. Tile drainage is usually the most satisfactory. The tile should be enveloped in well-graded sand and gravel that will filter the silt out of the water. In some places bedding is a satisfactory method for draining these soils. In places land smoothing will eliminate depressions in which grasses and legumes are often smothered by standing water or ice.

If drained, these soils produce consistently good yields of potatoes. The hazard of erosion is greater on stronger slopes that are cultivated without protection. Erosion can be limited by farming the soils in graded strips. In most places high yields of potatoes can be obtained and the soils kept in good condition by using a rotation consisting of 2 years of potatoes and 1 year of a green-manure crop. Long slopes can often be farmed more easily and without excess soil loss if diversion ditches are used.

Capability unit IIc-3

This unit consists of deep, well-drained, nearly level, medium-textured soils on glacial till. Runoff is slow. The soils are—

Caribou gravelly loam, 0 to 2 percent slopes.
Perham gravelly silt loam, 0 to 2 percent slopes.
Plaisted gravelly loam, 0 to 2 percent slopes.

These soils have a wide range in use and are very responsive to good management. They hold a large supply of water available to plants, but yields are limited by the lack of plant nutrients. If legumes and grasses are cut frequently and not allowed to mature and are heavily fertilized after each cutting, they will grow rapidly from early in spring until frost and will produce large amounts of hay or pasture.

Potatoes can be grown continuously. Consistently high yields can be produced if adequate amounts of lime and fertilizer are applied and if insects and diseases are controlled. An occasional green-manure or soil-building crop helps to control diseases and insects and to keep the soils in good condition. These soils have good air drainage, which helps to control plant diseases and lengthens the frost-free season. Oats and peas can be grown but usually do not bring so high a cash return as potatoes.

These soils are subject to frosts early in fall and cannot produce crops that require a longer growing season than potatoes.

Capability unit IIc-5

This unit consists of deep, well-drained, nearly level loamy soils on glacial outwash and stream-terrace deposits. Water moves freely through these soils, but they hold enough water available for most crops. Runoff is slow. The soils are—

Allagash fine sandy loam, 0 to 2 percent slopes.
Stetson gravelly loam, 0 to 2 percent slopes.

These soils respond well to proper management and have a wide range in use. They produce high yields of grass and clover and can be used for hay or pasture. In the eastern part of the survey area, less frequent applications of lime are needed than in the rest of the area. For large yields of forage, fertilizer should be applied in at least two applications. Nitrogen fertilizer that is applied early in spring usually leaches out of these soils by midsummer.

Potatoes can be grown continuously, but a soil-building crop should be grown occasionally to maintain the content of organic matter and the physical properties of the soils. Crops are seldom damaged by drought, but irrigation might be profitable on high-value cash crops in years of insufficient rainfall. In most years these soils hold enough water for potatoes, if the organic-matter content is kept high. Oats and peas produce good yields on these soils but are grown more often on soils that need a long rotation.

These soils are subject to frosts early in fall and cannot produce crops that require a longer growing season than potatoes.

Capability unit IIc–6

This unit consists of a deep, well-drained, nearly level soil on bottom lands. The soil is not likely to be damaged by overflow. Runoff is slow. The supply of water for plants is good. The only soil in this unit is—

Hadley silt loam, level.

This soil has a wide range in use and responds well to good management. Yields are limited by the lack of plant nutrients. The soil can be planted to legumes and grasses and used for hay or pasture. If legumes and grasses are cut frequently, are not allowed to mature, and are heavily fertilized after each cutting, they will grow rapidly from early in spring until late in fall and will produce very large yields.

Potatoes can be grown continuously. Consistently high yields can be produced if enough lime and fertilizer are applied and insects and diseases are controlled. An occasional green-manure or soil-building crop helps to control diseases and insects and to keep the soil in good condition.

Because this soil is in low valleys, it is subject to frosts early in fall. This limits the kinds of crops that can be grown, but the frost-free season is long enough for the growing of potatoes. Air drainage is poor, so during the season of heavy dew, potato plants stay damp until late in the day. Therefore, potatoes may require additional applications of fungicide spray during years when late blight is prevalent.

This soil is flooded when ice dams up water, but this occurs too early in spring to affect the growing of most crops. Flooding seldom causes erosion or deposition of soil. In some places, however, streambanks are eroded early in spring; this can be limited by maintaining vegetation on the banks.

Capability unit IIc–7

This unit consists of a deep, well-drained, nearly level soil on terraces laid down in slack water. Runoff is slow. The soil holds a good supply of water for plants. The only soil in this unit is—

Salmon silt loam, 0 to 2 percent slopes.

If fertilized and limed, this soil produces high yields of clover and grass. In some places there are small depressions in which water stands late in fall or early in spring and smothers grasses and legumes. These depressions can be eliminated by land smoothing; then, slightly larger yields can be produced and uniform stands of clover and grass can be maintained more easily for several years.

Potatoes can be grown continuously, but an occasional green-manure crop helps to maintain desirable physical properties of the soil and limits the hazards of insects and diseases. Intensive production of potatoes compacts the soil and limits permeability, and, as a result, water stands between the rows. This increases the hazard of late blight and delays harvesting in the fall.

This soil is subject to early fall frosts and cannot produce crops that require a longer growing season than potatoes.

Capability unit IIIe–1

This unit consists of sloping, well-drained soils on glacial till. These soils are shallow to bedrock. Internal drainage is good, and surface drainage is rapid. The soils are—

Benson silt loam, 8 to 15 percent slopes.
Mapleton shaly silt loam, 8 to 15 percent slopes.
Thorndike shaly silt loam, 8 to 15 percent slopes.

These soils are slightly droughty. They cannot be easily farmed on the contour. In many spots the soil is less than 12 inches deep, and diversion ditches cannot be used.

Potatoes can be grown in narrow strips, in a rotation with peas, small grains, and hay, without severe loss of soil or water.

Good yields of hay and good pasture can be produced, and the soils are easy to manage for these crops.

Capability unit IIIe–3

In this unit are deep, sloping, well-drained soils on glacial till. The soils have gravelly loam and gravelly silt loam surface layers. Internal drainage is medium, and surface drainage is rapid. The soils are—

Caribou gravelly loam, 8 to 15 percent slopes.
Perham gravelly silt loam, 8 to 15 percent slopes.
Plaisted gravelly loam, 8 to 15 percent slopes.

These soils respond well to good management, but they are subject to severe erosion. Contour cultivation helps to control erosion. On long slopes erosion can more easily be controlled if the fields are divided into strips 150 feet wide. The strips on the Caribou soil should be on the contour. Those on Perham and Plaisted soils should be on a grade of 1 percent because the fragipan in these soils slightly impedes internal drainage. If graded strips are used, water will not stand between potato rows during long rainy periods. In most areas diversion ditches are needed after every second strip to divert excess water from the field.

The crops used in the rotation should be established on the strips in alternate order. Potatoes, peas, small grains, and clover are usually grown. If erosion is controlled and moisture is conserved, these soils will produce yields comparable to those produced on less sloping soils.

Capability unit IIIe–5

This unit consists of deep, sloping to moderately steep, well-drained soils on glacial outwash and stream terraces. Runoff is rapid, but these soils hold a moderate amount of water for plants. The soils are—

Allagash fine sandy loam, 8 to 15 percent slopes.
Stetson gravelly loam, 8 to 15 percent slopes.

These soils produce good yields of grass and clover. For high yields of forage, the fertilizer should be used in at least two applications. These soils are permeable, and nitrogen fertilizer that is applied early in spring leaches out of them by midsummer.

Potatoes produce good yields if the organic-matter content of the soils is kept high. Erosion is a problem, and, whenever possible, these soils should be farmed in strips on the contour. This limits erosion and permits the soils to absorb most of the summer rainfall, which is needed for high yields of crops. On long slopes, diversion ditches are needed to control runoff and also to limit the hazard of erosion.

Capability unit IIIe-7

This unit consists of a deep, well-drained silty soil on terraces. The soil is sloping and has slow internal drainage and rapid surface drainage. The only soil in this unit is—

Salmon slit loam, 8 to 15 percent slopes.

This soil produces high yields of clover and grass if limed and fertilized. It can be used for permanent hay or pasture without severe erosion. In most places it cannot be used for row crops without some loss of soil. If potatoes are grown, erosion can be limited by farming in strips on the contour. On long slopes runoff can be controlled by the use of diversion ditches.

This soil needs a rotation that includes several years of a close-growing crop. A rotation consisting of 1 year of potatoes, 1 year of oats or peas, and 3 years of a grass-legume mixture can be used on contour strips without the hazard of severe erosion.

Capability unit IIIew-4

This unit consists of deep, moderately well drained, sloping soils on glacial till. These soils have firm subsoil that holds water close to the surface. Runoff is rapid. The soils are—

Conant silt loam, 8 to 15 percent slopes.
Daigle silt loam, 8 to 15 percent slopes.
Howland gravelly loam, 8 to 15 percent slopes.

These soils produce good yields of grasses and legumes if limed and fertilized. They are well suited to permanent hay and pasture. If excess surface water is removed by diversion ditches, the soils will respond well to large applications of fertilizer. Two crops of hay or several periods of grazings can be obtained in a season.

The soils are suited to tilled crops but need supplemental drainage and practices to control erosion. Potatoes and oats provide good yields but should be planted in graded strips. On long slopes diversion ditches can be used to remove excess water and to limit the hazard of erosion.

Capability unit IIIew-5

This unit consists of deep, sloping soils that are moderately well drained. These soils are on glacial outwash and stream terraces, and they have a perched or high water table. Runoff is rapid. The soils are—

Machias gravelly loam, 8 to 15 percent slopes.
Madawaska fine sandy loam, 8 to 15 percent slopes.

These soils are used for potatoes, peas, small grains, clover, and grasses. They are difficult to use for cultivated crops, especially on the steeper slopes. Most slopes are short and abrupt, and the areas are not long and broad like those of the soils in capability unit IIIew-4.

The more strongly sloping areas can be best managed for permanent hay or pasture.

In areas to be cultivated, improvement of drainage and control of erosion are needed.

Capability unit IVe-1

This unit consists of well-drained, rolling to strongly rolling soils on glacial till. The soils are shallow to bedrock. They have silt loam and shaly silt loam surface layers. Internal drainage is medium, and surface drainage is rapid. The soils are—

Benson silt loam, 15 to 25 percent slopes.
Mapleton shaly silt loam, 8 to 15 percent slopes, eroded.
Mapleton shaly silt loam, 15 to 35 percent slopes.
Thorndike shaly silt loam, 15 to 25 percent slopes.

These soils do not hold enough water to keep plants growing well during dry periods in midsummer. Summer rainfall does not add much moisture to the soils because the slopes are so steep the water does not remain long enough to be absorbed. The soils produce a good growth of grass and clover early in summer. They can be used for hay or pasture, or for an occasional row crop, but early summer pasture is probably their best use.

Capability unit IVe-3

This unit consists of deep, well-drained, medium-textured soils on glacial till. These soils are sloping and eroded or are moderately steep to steep, and they have rapid runoff. They hold a moderate amount of water for plants. The less sloping Caribou soil is eroded, and the Perham and Plaisted soils have a compact subsoil. The soils are—

Caribou gravelly loam, 8 to 15 percent slopes, eroded.
Caribou gravelly loam, 15 to 25 percent slopes.
Perham gravelly silt loam, 15 to 25 percent slopes.
Plaisted gravelly loam, 15 to 25 percent slopes.

These soils are well suited to hay and pasture. They produce good yields of grasses and legumes if limed and fertilized.

The soils are suited to an occasional crop of potatoes, peas, or small grains but must be managed so as to limit losses of soil and water. If used for an occasional row crop, the soils should be divided into strips 150 feet wide, laid out on a slight grade. A diversion ditch is needed below every second strip to remove excess water. The crop rotation should be regulated so that one strip in three is in sod early in spring and in fall. The cultivated crop in the rotation should be planted on the contour. An erosion-resistant crop, such as grass, should be left on the same strip for at least 2 consecutive years.

Capability unit IVe-5

This unit consists of a deep, well-drained, moderately steep soil on terraces. The soil has a gravelly loam surface layer underlain by stratified sand and gravel at a depth of about 20 inches. Internal and surface drainage are rapid. The only soil in this unit is—

Stetson gravelly loam, 15 to 25 percent slopes.

This soil is slightly droughty. It has narrow slopes and is difficult to manage. It should be farmed across the slopes to slow down runoff. The soil is best suited to long-time hay crops, but cultivated crops can be grown occasionally. Alfalfa grows well, especially in the eastern part of the survey area.

Capability unit IVw-3

This unit consists of deep, poorly drained and very poorly drained soils on glacial till. The soils are level to gently sloping and have slow runoff. Internal drainage is impeded by a firm layer in the subsoil or by a high water table. The soils are—

Easton and Washburn silt loams, 0 to 2 percent slopes.
Easton and Washburn silt loams, 2 to 8 percent slopes.
Monarda and Burnham silt loams, 0 to 2 percent slopes.
Monarda and Burnham silt loams, 2 to 8 percent slopes.

Most of the acreage of these soils is forested. Some areas have been used for crops, however. Grass grows well, and much of the acreage could be used for pasture. The soils warm up slowly in spring, even after drainage has been improved.

Much of the surface water can be removed through open ditches. It is slightly more difficult to establish outlets on slopes of 0 to 2 percent than on slopes of 2 to 8 percent. Drained areas are suited to ladino clover and other high-quality varieties of clover, grown for either hay or pasture, and to an occasional row crop. Russet and other varieties of potatoes are grown on some drained areas.

Capability unit IVw–5

This unit consists of deep, poorly drained and very poorly drained soils on glacial outwash and stream terraces. The soils are level to gently sloping and have slow runoff. Internal drainage is impeded by a high water table. The substratum is loose and porous below a depth of about 40 inches. The soils are—

Fredon and Halsey silt loams, 0 to 2 percent slopes.
Fredon and Halsey silt loams, 2 to 8 percent slopes.
Red Hook and Atherton silt loams, 0 to 2 percent slopes.
Red Hook and Atherton silt loams, 2 to 8 percent slopes.

Most of the acreage of these soils is forested. Some areas have been used for crops, however. Grass grows well, and much of the acreage could be used for pasture. The soils warm up slowly in spring, even after drainage has been improved.

Much of the surface water can be removed through open ditches. It is slightly more difficult to establish outlets on slopes of 0 to 2 percent than on slopes of 2 to 8 percent. Drained areas are suitable for ladino clover and other high-quality varieties of clover, grown for either hay or pasture, and to an occasional row crop. Russet and other varieties of potatoes are grown on some drained areas.

Capability unit IVw–7

This unit consists of a deep, poorly drained silty soil on water-laid sediments. The topography is level to gently sloping, and internal and surface drainage are slow. The only soil in this unit is—

Canandaigua silt loam, thin solum, 0 to 8 percent slopes.

This soil is wet until early in summer, and, unless it is drained, heavy machinery is difficult to use. Even after it has been drained, it warms up slowly in spring. If the surface water is removed by bedding or through open drains, the soil can be used for an occasional crop of potatoes or oats. If fertilized and limed, drained areas produce good yields of clover and grass. The soil is well suited to permanent hay or pasture.

Capability unit VIe–3

This unit consists of deep, well-drained, medium-textured soils on firm glacial till. The soils are strongly sloping to steep and have medium internal drainage and rapid surface drainage. The Plaisted soil has a compact subsoil, and the less sloping Caribou soil is eroded. All the soils hold a fair amount of water for plants. The soils are—

Caribou gravelly loam, 15 to 25 percent slopes, eroded.
Caribou gravelly loam, 25 to 45 percent slopes.
Plaisted gravelly loam, 25 to 45 percent slopes.

These soils can be used for pasture. Some of the less sloping areas are suitable for hay. Good yields of grass and clover are obtained, especially early in summer. The Caribou soils are well suited to alfalfa and other deep-rooted legumes. Alfalfa provides high yields of forage during midsummer. Lime and fertilizer are needed at the time of seeding, and fertility should be maintained by the use of phosphate and potash fertilizer. Lime should be applied, whenever necessary, to maintain a pH value of about 6.5.

Capability unit VIe–5

This unit consists of deep, steep, well-drained loamy soils on glacial outwash and stream terraces. The soils have moderately rapid internal drainage and rapid runoff. They hold a moderate amount of water for plants. The soils are—

Allagash fine sandy loam, 15 to 35 percent slopes.
Stetson gravelly loam, 25 to 45 percent slopes.

The soils are suitable for pasture, particularly early spring pasture. Because they occur on terrace faces and have short, steep slopes, they may be better used for woodland than for pasture.

During midsummer, deep-rooted legumes produce higher yields than grasses. Frequent applications of fertilizer, especially phosphate and potash, are needed to maintain fertility. Lime should be applied, whenever necessary, to maintain a pH value of about 6.5. Weeds should be controlled to maintain the growth and quality of the forage.

Capability unit VIw–6

This unit consists of a mixture of deep, nearly level, poorly and very poorly drained deposits on bottom lands. The areas are level and have slow internal and surface drainage. They are subject to frequent or very frequent flooding. This unit consists of one miscellaneous land type—

Mixed alluvial land.

The areas are suitable for pasture, but most of them are forested and occur mainly as very narrow bands adjacent to small streams. Areas used for pasture should be seeded to moisture-tolerant grasses and legumes. Frequent, moderate applications of lime and fertilizer are needed. Grazing should be regulated so as to maintain a good sod.

Trees do not grow rapidly in these areas. Forests consist mostly of larch, cedar, and willow.

Capability unit VIs–1

This unit consists of gently sloping to sloping soils that are shallow or very shallow to bedrock. The soils are on glacial till and have medium internal drainage and medium to rapid runoff. Many outcrops of shale bedrock are exposed and are interspersed with areas of deeper soil. The soils are—

Mapleton very rocky silt loam, 0 to 15 percent slopes.
Thorndike very rocky silt loam, 0 to 8 percent slopes.
Thorndike very rocky silt loam, 8 to 15 percent slopes.

These soils are suitable for pasture. Only small areas have been cleared, however, and it is generally more economical to use the soils mainly for forestry. When used for pasture, they should be seeded to grasses and legumes. They need fertilizer and lime to maintain fertility.

The soils produce almost pure stands of northern hardwoods. The hardwoods grow slowly, but the forests cannot be converted to the faster growing softwoods. Selective cutting should be done to favor the more valuable trees.

Capability unit VIs-3

This unit consists mostly of deep, well drained and moderately well drained, very stony soils on glacial till. These gently sloping and strongly sloping soils have medium to moderately slow internal drainage and medium to rapid runoff. The Thorndike and Howland soils that are mapped together are moderately shallow. The soils are—

Howland very stony loam, 0 to 8 percent slopes.
Howland very stony loam, 8 to 15 percent slopes.
Plaisted very stony loam, 0 to 8 percent slopes.
Plaisted very stony loam, 8 to 15 percent slopes.
Plaisted very stony loam, 15 to 25 percent slopes.
Plaisted and Howland very stony loams, 0 to 8 percent slopes.
Plaisted and Howland very stony loams, 8 to 15 percent slopes.
Thorndike and Howland soils, 0 to 8 percent slopes.
Thorndike and Howland soils, 8 to 15 percent slopes.

These soils are used mainly for woodland, but some acreage could be cleared and used for pasture. At present, it is seldom economical to clear areas for agriculture. The soils produce good stands of mixed northern hardwoods, spruce, and fir. Selective cutting should be done to favor the fast-growing softwoods. It is fairly easy to build and maintain logging roads, but drains may be needed on the Howland soils.

Capability unit VIIw-9

This unit consists of poorly drained organic soils. These soils are generally shallow and contain partly decayed, raw, unstable plant material. They are saturated with water for more than 6 months of the year. The soils are—

Peat and muck.

These organic soils are mapped together; they produce mostly spruce and cedar. The trees grow slowly, and little can be done to improve the rate of growth or to change the species of trees. Tree planting and artificial drainage are not suggested for these soils. Woodland operations are usually done during winter when the soils are frozen.

Capability unit VIIs-1

This unit consists of steep or hilly, very rocky or shaly soils on glacial till. These soils are very shallow to bedrock and are often droughty. Internal drainage is medium, and runoff is rapid. There are many outcrops of rock interspersed within areas of deeper soils. The soils are—

Mapleton very rocky silt loam, 15 to 35 percent slopes.
Steep rockland, Thorndike materials.
Thorndike shaly silt loam, 25 to 45 percent slopes.
Thorndike very rocky silt loam, 15 to 25 percent slopes.
Thorndike very rocky silt loam, 25 to 45 percent slopes.
Thorndike extremely rocky silt loam, 15 to 45 percent slopes.

These soils are too shallow, too rocky, and too steep for uses other than forestry. Trees grow well in areas of moderately deep soil between rock outcrops, but, as a rule, trees are difficult to harvest. The areas should be maintained as woodland to furnish cover for wildlife and to control erosion on these soils and on those that lie below them. Forests consist mostly of hardwoods, but some spruce grows on the northwestern slopes.

Capability unit VIIs-3

This unit consists of a deep, steep, well-drained, very stony soil on glacial till. The soil has medium internal drainage and rapid runoff. It holds a good supply of water for plants. The only soil in this unit is—

Plaisted very stony loam, 25 to 45 percent slopes.

This soil is used for forestry. It is too steep and stony for hay or pasture. Hardwoods grow well. Spruce, fir, and northern hardwoods grow on some of the steeper northwestern slopes. In general, selective cutting should be done to favor the more desirable hardwoods. Logging is difficult on the steeper slopes. Roads should be built on the contour to avoid washouts and loss of soil.

Capability unit VIIsw-3

This unit consists of deep, nearly level to gently undulating, poorly and very poorly drained, stony soils on glacial till. Internal drainage and runoff are slow. The soils are—

Easton and Washburn stony silt loams, 0 to 8 percent slopes.
Monarda and Burnham very stony silt loams, 0 to 8 percent slopes.

These soils are used for forestry. They produce mostly spruce and fir, but the trees grow slowly. Some nearly level areas have thin stands of slow-growing black spruce. Woodland operations are usually done when the soils are frozen.

Capability unit VIIIw-6

This unit consists of soil material on sand and gravel bars along rivers and other streams. The areas are covered with water during part of the year and are subject to very frequent flooding. This unit consists of one miscellaneous land type—

Riverwash.

Riverwash is nearly devoid of vegetation, but the areas are of some value for wildlife and recreation.

Estimated Yields

Estimated yields per acre of crops under two levels of management are given in table 1. Only the soils that are normally used for crops are listed in this table. In northeastern Aroostook County, nearly all the acreage that is suitable for cultivation is used for potatoes, but peas, oats, and hay are also grown in the cropping system.

In columns A of table 1 are yields to be expected under good management, which is practiced by most of the farmers in the survey area. In columns B are yields to be expected under improved management.

In general, the yields in table 1 were estimated on the basis of comparison with yields of crops now being obtained. Yields of crops have steadily increased through the years, however, and this trend will probably continue as the result of the use of improved varieties of seed, new fungicides, and improved cultural and conservation practices.

TABLE 1.—*Estimated average acre yields of crops under two levels of management*

[Average yields in columns A are to be expected under good management; yields in columns B are to be expected under improved management. Absence of a yield figure indicates that the soil is not commonly used for the specified crop]

Soil	Potatoes		Peas		Oats		Hay	
	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Lb.*	*Lb.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Allagash fine sandy loam, 0 to 2 percent slopes	495	495	4,000	4,000	80	80	3	3
Allagash fine sandy loam, 2 to 8 percent slopes	495	495	4,000	4,000	80	80	3	3
Allagash fine sandy loam, 8 to 15 percent slopes	400	495	3,000	3,000	60	80	2.5	3
Allagash fine sandy loam, 15 to 35 percent slopes	----	----	----	----	----	----	2	2.5
Benson silt loam, 0 to 8 percent slopes	385	400	4,000	4,000	80	80	3	3
Benson silt loam, 8 to 15 percent slopes	385	400	3,000	4,000	60	80	2	3
Canandaigua silt loam, thin solum, 0 to 8 percent slopes	----	----	----	----	----	----	2	3
Caribou gravelly loam, 0 to 2 percent slopes	495	495	4,000	4,000	80	80	3	3
Caribou gravelly loam, 2 to 8 percent slopes	410	495	4,000	4,000	80	80	3	3
Caribou gravelly loam, 8 to 15 percent slopes	400	495	3,500	4,000	80	80	3	3
Caribou gravelly loam, 8 to 15 percent slopes, eroded	385	410	3,500	4,000	80	80	2	3
Caribou gravelly loam, 15 to 25 percent slopes	----	----	----	----	----	----	2	3
Caribou gravelly loam, 15 to 25 percent slopes, eroded	----	----	----	----	----	----	2	3
Caribou gravelly loam, 25 to 45 percent slopes	----	----	----	----	----	----	1	2
Conant silt loam, 0 to 2 percent slopes	385	495	3,000	4,000	60	80	3	3
Conant silt loam, 2 to 8 percent slopes	385	495	3,000	4,000	60	80	3	3
Conant silt loam, 8 to 15 percent slopes	385	410	3,000	3,500	60	80	3	3
Daigle silt loam, 0 to 2 percent slopes	300	385	3,000	4,000	60	80	3	3
Daigle silt loam, 2 to 8 percent slopes	300	385	3,000	4,000	60	80	3	3
Daigle silt loam, 8 to 15 percent slopes	300	385	3,000	3,500	60	80	3	3
Easton and Washburn silt loams, 0 to 2 percent slopes	----	----	----	----	----	----	2	3
Easton and Washburn silt loams, 2 to 8 percent slopes	----	----	----	----	----	----	2	3
Fredon and Halsey silt loams, 0 to 2 percent slopes	----	----	----	----	----	----	2	3
Fredon and Halsey silt loams, 2 to 8 percent slopes	----	----	----	----	----	----	2	3
Hadley silt loam, level	495	495	4,000	4,000	80	80	3	3.5
Hadley silt loam, undulating	410	495	4,000	4,000	80	80	3	3
Howland gravelly loam, 0 to 2 percent slopes	385	410	3,000	4,000	60	80	3	3
Howland gravelly loam, 2 to 8 percent slopes	385	410	3,000	4,000	60	80	3	3
Machias gravelly loam, 0 to 2 percent slopes	385	495	3,000	4,000	60	80	2	3
Machias gravelly loam, 2 to 8 percent slopes	385	495	3,000	4,000	60	80	2	3
Machias gravelly loam, 8 to 15 percent slopes	----	----	----	----	----	----	2	3
Madawaska fine sandy loam, 0 to 2 percent slopes	385	495	3,000	4,000	60	80	2	3
Madawaska fine sandy loam, 2 to 8 percent slopes	385	495	3,000	4,000	60	80	2	3
Madawaska fine sandy loam, 8 to 15 percent slopes	----	----	----	----	----	----	2	3
Mapleton shaly silt loam, 0 to 8 percent slopes	410	495	3,000	4,000	80	80	3	3
Mapleton shaly silt loam, 8 to 15 percent slopes	385	495	3,000	4,000	60	80	2	3
Mapleton shaly silt loam, 8 to 15 percent slopes, eroded	385	410	3,000	4,000	60	80	2	3
Mapleton shaly silt loam, 15 to 35 percent slopes	----	----	----	----	----	----	2	3
Mixed alluvial land	----	----	----	----	----	----	2	3
Monarda and Burnham silt loams, 0 to 2 percent slopes	----	----	----	----	----	----	2	3
Monarda and Burnham silt loams, 2 to 8 percent slopes	----	----	----	----	----	----	2	3
Nicholville silt loam, 0 to 2 percent slopes	385	410	3,000	4,000	60	80	2	3
Nicholville silt loam, 2 to 8 percent slopes	385	410	3,000	4,000	60	80	2	3
Perham gravelly silt loam, 0 to 2 percent slopes	495	495	4,000	4,000	80	80	3	3.3
Perham gravelly silt loam, 2 to 8 percent slopes	410	495	4,000	4,000	80	80	3	3.3
Perham gravelly silt loam, 8 to 15 percent slopes	385	495	3,500	4,000	80	80	3	2.8
Perham gravelly silt loam, 15 to 25 percent slopes	----	----	----	----	----	----	3	2.5
Plaisted gravelly loam, 0 to 2 percent slopes	495	495	4,000	4,000	80	80	3	3.3
Plaisted gravelly loam, 2 to 8 percent slopes	410	495	4,000	4,000	80	80	3	3.3
Plaisted gravelly loam, 8 to 15 percent slopes	385	495	3,000	4,000	60	80	3	2.8
Plaisted gravelly loam, 15 to 25 percent slopes	----	----	----	----	----	----	2	2.5
Red Hook and Atherton silt loams, 0 to 2 percent slopes	----	----	----	----	----	----	2	3
Red Hook and Atherton silt loams, 2 to 8 percent slopes	----	----	----	----	----	----	2	3
Salmon silt loam, 0 to 2 percent slopes	495	495	4,000	4,000	80	80	3	3
Salmon silt loam, 2 to 8 percent slopes	410	495	4,000	4,000	80	80	3	3
Salmon silt loam, 8 to 15 percent slopes	----	----	----	----	----	----	2	3
Stetson gravelly loam, 0 to 2 percent slopes	495	495	4,000	4,000	80	80	3	3
Stetson gravelly loam, 2 to 8 percent slopes	410	495	4,000	4,000	80	80	3	3
Stetson gravelly loam, 8 to 15 percent slopes	385	410	3,000	4,000	60	80	2	3
Stetson gravelly loam, 15 to 25 percent slopes	----	----	----	----	----	----	2	2.5
Thorndike shaly silt loam, 0 to 8 percent slopes	410	495	3,000	4,000	80	80	2	2.5
Thorndike shaly silt loam, 8 to 15 percent slopes	385	495	3,000	4,000	60	80	2	2.5
Thorndike shaly silt loam, 15 to 25 percent slopes	----	----	----	----	----	----	2	2.5
Winooski silt loam	385	495	3,000	4,000	60	80	3	3

To obtain yields of potatoes shown in column A, farmers do the following: Plant certified seed; plant varieties of potatoes suited to the soils; use spray to protect potatoes from diseases and insects; control weeds; control the size of potatoes; and apply adequate amounts of fertilizer and other amendments. Present applications of fertilizer usually consist of about 120 to 160 pounds of nitrogen (N), 200 pounds of phosphate (P_2O_5), and 200 pounds of potash (K_2O) per acre. The reaction of the soil is maintained between pH 5.0 and 5.4.

Somewhat higher yields of potatoes could be obtained under the A level of management by applying more fertilizer, but when this is done the quality of the potatoes tends to decline.

To obtain yields of potatoes shown in column B, farmers follow the practices given for the A level of management and, in addition, use more carefully controlled drainage and cultural methods. The response to this higher level of management varies among the different soils. Where wetness limits the yield of potatoes on a soil, use of such practices as artificial drainage (see discussions of individual capability units) normally bring a higher yield, as shown in column B. Many soils, however, show no increase in yields of potatoes under the higher level of management.

The yields for potatoes listed in columns A and B are estimated averages for a period of years, and for all areas of the soil in the county. Thus, they cannot be applied directly to a given area of a soil in any one year, nor do they imply, for example, that a 100-acre farm consisting of Plaisted gravelly loam, 8 to 15 percent slopes, will produce as many bushels of potatoes as a 100-acre farm consisting of Caribou gravelly loam, 0 to 2 percent slopes.

Practices used to obtain a yield of 495 bushels of potatoes per acre on Plaisted gravelly loam, 8 to 15 percent slopes, are described under the heading "Capability unit IIIe-3." These include growing potatoes on the contour, planting another crop in alternate order on the strips, and constructing diversion ditches after alternate strips. With such management, about 30 acres of the 100-acre farm of Plaisted soil could be used for potatoes each year, and the yield would be approximately 14,850 bushels.

Practices used to obtain 495 bushels of potatoes on Caribou gravelly loam, 0 to 2 percent slopes, are described under the heading "Capability unit IIc-3." Potatoes are grown continuously, except when a soil-building crop is grown. Because the growing season is seldom long enough for a potato crop and a soil-building crop in the same year, the soil-building crop is usually grown once in 3 years. Therefore, two-thirds, or about 66 acres, of the 100-acre farm of Caribou soil would be used for potatoes each year. The yield would be approximately 32,670 bushels per year, more than twice as many bushels as produced on the Plaisted soil.

Oats and peas are grown in a rotation with potatoes and on the same soils. Farmers use nearly uniform practices in growing oats and peas. Peas do not require so long a growing season as potatoes. They do best in a cool climate, and in northeastern Aroostook County they can be planted either late in spring or early in summer. This permits a wide range in planting dates and in harvesting dates.

To obtain the yields of oats and peas shown in columns A of table 1, farmers do the following: Plant certified seed; control weeds by using chemical weedkillers; apply lime as needed; and use enough fertilizer to keep plants green. If the oat plants are not dark green, most farmers apply additional nitrogen when the plants are small.

To obtain the yields shown in columns B, farmers apply all of the practices just mentioned and also use the conservation and cultural practices discussed in the descriptions of individual capability units.

Most of the grass and clover grown in this area is plowed under for green manure. Therefore, the estimates in table 1 are not based on yields of hay that have been obtained but are based on the properties of the different soils.

Estimated yields of hay in columns A are those expected without conservation or drainage practices. Yields in columns B are those that can be expected if the practices mentioned in the descriptions of individual capability units are applied.

The crops listed in the yield table are those of commercial importance. Broccoli, cabbage, turnips, strawberries, and raspberries are occasionally grown for home use. Home gardens produce many kinds of vegetables and fruits.

Forestry [2]

Trees were the native vegetation of northeastern Aroostook County and are still predominant. Forest trees grow on about two-thirds of the 1,517,316 acres of land in the survey area. Some land was once cleared for agricultural crops but has reverted to forests. Most of the soils in the survey area are too wet, steep, or shallow to bedrock to produce profitable yields of crops. Reforestation with desirable species of trees will increase the value of these soils.

The forests provide year-round employment for many people and part-time employment for local farmers.

Forest Species

Northern hardwoods—beech, birch, and maple—and a few red spruce and pine grow on the well-drained soils. The original forests probably contained more spruce and pine than the present forests. Spruce is a persistent tree in this climatic zone and grows rapidly on well-drained soils. The northern hardwoods, however, suppress spruce trees on the well-drained ridges, so spruce predominates only on the less well-drained sites.

Mixed stands of softwoods and hardwoods grow on the moderately well drained and somewhat poorly drained soils. Spruce and fir are the predominant softwoods, but the stands contain clumps of pine and larch. White pine probably was more common on the moderately well drained soils, especially the sandy ones, but few pines seeded naturally after the original cuttings.

The poorly and very poorly drained soils produce mostly spruce and fir trees. A few larch, pine, maple, and birch trees are within the stands of spruce. Red spruce predominates on poorly drained soils because northern hardwoods are not suitable and, therefore, offer no competition. Red spruce does not grow rapidly, however.

[2] ALLEN R. GRAY, woodland conservationist, Soil Conservation Service, assisted in the preparation of this section.

Woodland Suitability Groups

To assist owners in planning the use of their woodlands, the soils of northeastern Aroostook County (except Made land) have been placed in woodland suitability groups. Each group consists of soils that have similar physical characteristics, produce similar trees, and respond to similar management practices. Table 2 gives, for each suitability group, the potential productivity for white pine, spruce, and northern hardwoods; the relative severity of some of the limitations on timber production; and ratings for road material. The productivity ratings are estimates based on data collected in Maine and New Hampshire for similar soils. Other ratings in table 2 are based on the judgment of foresters, soil scientists, and others familiar with the survey area. The text first explains the column headings and the ratings given for suitability groups. It also discusses briefly additional factors that affect growing of trees. Then, under each woodland suitability group, it lists the soils and gives a brief statement about their management.

1. *Potential productivity for white pine, spruce, and northern hardwoods.* In these columns ratings of *very good*, *good*, *fair*, and *poor* are given for the woodland suitability groups.
2. *Equipment limitations (also known as trafficability).* These limitations refer to soil characteristics and topographic features that restrict or prohibit the use of equipment commonly used in the tending and harvesting of trees. A knowledge of these factors is helpful in determining the kinds of equipment to use, the methods of operating the equipment, and the seasons in which equipment can be used on different groups of soils. Ratings for equipment limitations, as well as those for seedling mortality and windthrow hazard, are given in terms of *slight*, *moderate*, and *severe*.
3. *Seedling mortality.* This refers to the expected degree of mortality of natural seedlings on soils of different suitability groups.
4. *Windthrow hazard.* This refers to windfirmness as reflected by soil characteristics that control development of the root systems of trees.
5. *Road material.* This refers to the suitability of soil of different groups as sources of surfacing material for roads in wooded areas.

The effects of aspect, position on slope, elevation, insects, and disease were not rated for the woodland suitability groups, because not enough information is available for the different kinds of soils in northeastern Aroostook County. In woodland areas the hazard of erosion is fairly slight, except where roads are constructed on steep slopes. This was considered in the ratings for equipment limitations.

On slopes of less than 15 percent, there is little difficulty in logging or in building roads either by farmers or by large commercial operators. On slopes of 15 to 25 percent, commercial operators have few problems in logging or in building roads, but farmers have some difficulty. Slopes of 25 to 45 percent cause serious problems in logging and in building roads. Erosion makes the maintenance of roads difficult.

Woodland suitability group 1

This group consists of well-drained, medium-textured soils that are more than 2 feet deep to material that limits penetration of roots. The soils in this group are—

Allagash fine sandy loam, 0 to 2 percent slopes.
Allagash fine sandy loam, 2 to 8 percent slopes.
Allagash fine sandy loam, 8 to 15 percent slopes.
Allagash fine sandy loam, 15 to 35 percent slopes.
Caribou gravelly loam, 0 to 2 percent slopes.
Caribou gravelly loam, 2 to 8 percent slopes.
Caribou gravelly loam, 8 to 15 percent slopes.
Caribou gravelly loam, 8 to 15 percent slopes, eroded.
Caribou gravelly loam, 15 to 25 percent slopes.
Caribou gravelly loam, 15 to 25 percent slopes, eroded.
Caribou gravelly loam, 25 to 45 percent slopes.
Hadley silt loam, level.
Hadley silt loam, undulating.
Perham gravelly silt loam, 0 to 2 percent slopes.
Perham gravelly silt loam, 2 to 8 percent slopes.
Perham gravelly silt loam, 8 to 15 percent slopes.
Perham gravelly silt loam, 15 to 25 percent slopes.
Plaisted gravelly loam, 0 to 2 percent slopes.
Plaisted gravelly loam, 2 to 8 percent slopes.
Plaisted gravelly loam, 8 to 15 percent slopes.
Plaisted gravelly loam, 15 to 25 percent slopes.
Plaisted gravelly loam, 25 to 45 percent slopes.
Plaisted very stony loam, 0 to 8 percent slopes.
Plaisted very stony loam, 8 to 15 percent slopes.
Plaisted very stony loam, 15 to 25 percent slopes.
Plaisted very stony loam, 25 to 45 percent slopes.
Plaisted and Howland very stony loams, 0 to 8 percent slopes.
Plaisted and Howland very stony loams, 8 to 15 percent slopes.
Salmon silt loam, 0 to 2 percent slopes.
Salmon silt loam, 2 to 8 percent slopes.
Salmon silt loam, 8 to 15 percent slopes.
Stetson gravelly loam, 0 to 2 percent slopes.
Stetson gravelly loam, 2 to 8 percent slopes.
Stetson gravelly loam, 8 to 15 percent slopes.
Stetson gravelly loam, 15 to 25 percent slopes.
Stetson gravelly loam, 25 to 45 percent slopes.

Because they have fine-textured subsoil, the Salmon and Hadley soils are not so good for road material as the other soils of this group. The subsoil of the Stetson soils is the best source of material for roads.

Woodland suitability group 2

This group consists of dominantly moderately well drained, medium-textured soils. A water-saturated horizon limits penetration of roots to a depth of less than 2 feet. The soils in this group are—

Conant silt loam, 0 to 2 percent slopes.
Conant silt loam, 2 to 8 percent slopes.
Conant silt loam, 8 to 15 percent slopes.
Daigle silt loam, 0 to 2 percent slopes.
Daigle silt loam, 2 to 8 percent slopes.
Daigle silt loam, 8 to 15 percent slopes.
Howland gravelly loam, 0 to 2 percent slopes.
Howland gravelly loam, 2 to 8 percent slopes.
Howland gravelly loam, 8 to 15 percent slopes.
Howland very stony loam, 0 to 8 percent slopes.
Howland very stony loam, 8 to 15 percent slopes.
Machias gravelly loam, 0 to 2 percent slopes.
Machias gravelly loam, 2 to 8 percent slopes.
Machias gravelly loam, 8 to 15 percent slopes.
Madawaska fine sandy loam, 0 to 2 percent slopes.
Madawaska fine sandy loam, 2 to 8 percent slopes.
Madawaska fine sandy loam, 8 to 15 percent slopes.
Nicholville silt loam, 0 to 2 percent slopes.
Nicholville silt loam, 2 to 8 percent slopes.
Winooski silt loam.

Because they have fine-textured subsoil, the Nicholville and Winooski soils are not so good for road material as the other soils of this group. The subsoil of the Machias soils is the best source of material for roads.

TABLE 2.—*Woodland suitability groups, their potential productivity for trees, and their limitations*

Woodland suitability group	Potential productivity for—			Equipment limitations	Seedling mortality	Windthrow hazard	Road material
	White pine	Spruce	Northern hardwoods				
Group 1: Well-drained, medium-textured soils.	Very good	Good	Good	Slight	Slight	Slight	Fair.
Group 2: Moderately well drained, medium-textured soils.	Very good	Very good	Good	Moderate	Slight	Moderate	Fair.
Group 3: Well-drained, medium-textured, shallow soils.	Good	Good	Good	Slight	Slight	Moderate	Fair.
Group 4: Poorly and very poorly drained soils.	Good	Fair	Poor	Severe	Severe	Severe	Poor.
Group 5: Rocky, shallow soils	Poor	Poor	Poor	Moderate	Severe	Severe	Poor.
Group 6: Organic soils and riverwash	These soils are not considered commercial woodland sites.						

Woodland suitability group 3

This group consists of well-drained, medium-textured soils. In general, bedrock limits penetration of roots to a depth of less than 2 feet. The soils in this group are—

Benson silt loam, 0 to 8 percent slopes.
Benson silt loam, 8 to 15 percent slopes.
Benson silt loam, 15 to 25 percent slopes.
Mapleton shaly silt loam, 0 to 8 percent slopes.
Mapleton shaly silt loam, 8 to 15 percent slopes.
Mapleton shaly silt loam, 8 to 15 percent slopes, eroded.
Mapleton shaly silt loam, 15 to 35 percent slopes.
Mapleton very rocky silt loam, 0 to 15 percent slopes.
Mapleton very rocky silt loam, 15 to 35 percent slopes.
Thorndike shaly silt loam, 0 to 8 percent slopes.
Thorndike shaly silt loam, 8 to 15 percent slopes.
Thorndike shaly silt loam, 15 to 25 percent slopes.
Thorndike shaly silt loam, 25 to 45 percent slopes.
Thorndike very rocky silt loam, 0 to 8 percent slopes.
Thorndike very rocky silt loam, 8 to 15 percent slopes.
Thorndike very rocky silt loam, 15 to 25 percent slopes.
Thorndike very rocky silt loam, 25 to 45 percent slopes.
Thorndike and Howland soils, 0 to 8 percent slopes.
Thorndike and Howland soils, 8 to 15 percent slopes.

The Howland soils, which are mapped with the Thorndike soils, are similar to the soils of suitability group 2.

Woodland suitability group 4

This group is made up of poorly and very poorly drained soils. A water-saturated horizon limits penetration of roots to a depth of less than 18 inches. The soils in this group are—

Canandaigua silt loam, thin solum, 0 to 8 percent slopes.
Easton and Washburn silt loams, 0 to 2 percent slopes.
Easton and Washburn silt loams, 2 to 8 percent slopes.
Easton and Washburn stony silt loams, 0 to 8 percent slopes.
Fredon and Halsey silt loams, 0 to 2 percent slopes.
Fredon and Halsey silt loams, 2 to 8 percent slopes.
Mixed alluvial land.
Monarda and Burnham silt loams, 0 to 2 percent slopes.
Monarda and Burnham silt loams, 2 to 8 percent slopes.
Monarda and Burnham very stony silt loams, 0 to 8 percent slopes.
Red Hook and Atherton silt loams, 0 to 2 percent slopes.
Red Hook and Atherton silt loams, 2 to 8 percent slopes.

Woodland suitability group 5

This group consists of rocky soils. Bedrock limits penetration of roots to a depth of about 1 foot. The mapping units in this group are—

Steep rockland, Thorndike materials.
Thorndike extremely rocky silt loam, 15 to 45 percent slopes.

Woodland suitability group 6

The mapping units in this woodland suitability group are—

Peat and muck.
Riverwash.

Individual areas of these mapping units need to be inspected to determine suitable use.

Engineering Applications [3]

This soil survey report was made primarily for agricultural purposes, but it has considerable value for engineering uses. Engineers can use the information in making plans for highways, dams, levees, canals, ditches, and other types of earthwork. *It is not intended, however, that this report will eliminate the need for sampling and testing for design and construction of specific engineering works.* The report can be used in eliminating tests of materials obviously unsuitable for specific uses; in approximating design and construction needs; and in improving the location, design, and construction of low hazard structures that normally are built on the basis of general experience with the soils in a given area.

Information in the report can also be used to—

1. Make soil and land use studies that will aid in the selection and development of industrial, business, residential, and recreational sites.

[3] RICHARD H. STONE, State conservation engineer, Soil Conservation Service, helped prepare this section.

2. Make preliminary estimates of the engineering properties of soils in the planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting highway and airport locations and in planning detailed investigations of the selected locations.
4. Locate probable sources of gravel and other construction materials.
5. Correlate performance of engineering structures with soil mapping units and thus develop information that will be useful in designing and maintaining the structures.
6. Determine the suitability of soil mapping units for cross-country movements of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to a particular area.

Some of the terms used in this section are those used by the agricultural soil scientist and, therefore, may be unfamiliar to the engineer. Other words—for example, clay, silt, sand, aggregate, and granular—have special meanings in soil science. Such terms are defined in the Glossary in the back of the report.

Engineering Test Data and Interpretations

Engineering test data and interpretations are given in tables 3, 4, and 5. Samples of the principal soil types of six extensive series were taken by the survey party and submitted to the Bureau of Public Roads for testing. These samples were tested in accordance with standard procedures to help evaluate the soils for engineering purposes. Results of the tests are shown in table 3. Samples of each soil series were taken in three localities to show some variations in physical characteristics, but three samples do not necessarily show the maximum variations possible in soils of a series. All samples were obtained at depths of less than 6 feet. The test data, therefore, may not be suitable for estimating the characteristics of soil materials that occur in deep cuts in rolling or hilly areas.

All the soils were sampled in the northeastern part of Aroostook County, except for the Plaisted soils, which were sampled in the southern part.

In table 3 each sample is classified according to both the system of the American Association of State Highway Officials (AASHO) and the Unified system. Such soil tests as mechanical analysis, liquid limit, and plastic limit are used to assist in the classification of the soils.

Most highway engineers classify soil materials according to the system approved by the American Association of State Highway Officials. In this system soil materials are classified in seven principal groups. The groups range from A-1, which consists of gravelly soils of high bearing capacity, to A-7, which consists of clay soils having low strength when wet. In each group the relative engineering value of the soil material is indicated by a group index number. Group indexes range from 0, for the best material, to 20, for the poorest. The group index number is shown in parentheses following the soil group symbol in the next to last column in table 3.

TABLE 3.—*Engineering test data* [1] *for soil*

Soil name and location	Parent material	Bureau of Public Roads report number	Depth	Horizon	Moisture-density [2] Maximum dry density	Moisture-density [2] Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Allagash fine sandy loam:						
2.3 miles E. of railroad crossing U.S. No. 1 in Fort Kent (modal profile).	Alluvium on terraces	S35945	0–10	A_p	----------	----------
		S35946	12–16	B_{22}	----------	----------
		S35947	21–36	C_1	----------	----------
0.9 mile W. of Fort Kent-St. John Township line along Route 161 (firm).	Alluvium on terraces	S35948	0–7	A_p	----------	----------
		S35949	9–15	B_{22}	----------	----------
		S35950	21–30	C_1	----------	----------
N. of Parsons Road in Washburn Township (shallow).	Alluvium on terraces	S35951	0–10	A_p	----------	----------
		S35952	14–22	B_{22}	----------	----------
		S35953	22–34	C	----------	----------
Caribou gravelly loam:						
4.5 miles S. of Presque Isle (modal profile)	Glacial till derived from shale.	S34294	0–8	A_p	104	19
		S34295	14–25	A'_2	120	12
		S34296	32–40	B'_{22}	123	12
		S34297	49–58	C_1	124	12

See footnotes at end of table.

Some engineers prefer to use the Unified soil classification system. In this system soil materials are divided into 15 classes: 8 classes are for coarse-grained materials (GW, GP, GM, GC, SW, SP, SM, SC), 6 for fine-grained materials (ML, CL, OL, MH, CH, OH) and 1 for highly organic material (Pt). Mechanical analyses are used to determine the GW, GP, SW, and SP classes of material; mechanical analyses, liquid limit, and plasticity index are used to determine GM, GC, SM, SC, and fine-grained soils. In tables 3 and 4, soils of the survey area are classified according to the Unified system.

The test data given for the soils in table 3, along with field identification and past experience in engineering construction, were used in estimating the engineering classifications for all the soils of the survey area.

The information in table 3 can be supplemented by study of the soil map and tables 4 and 5 in this section of the report. For many details, however, it will be necessary to refer to other parts of the report, particularly to the sections entitled "General Soil Map" and "Soil Series and Mapping Units."

The profile descriptions of the soils, as well as the soil map, should be used in planning detailed surveys at construction sites. This will help the engineer to concentrate on the most suitable soils, will indicate sources of sand and gravel, and will minimize the number of soil samples needed for laboratory testing.

In table 4 the soils are described briefly, and estimates of their physical properties that are significant to engineers are given. The properties listed are those of profiles representative of each series. Physical properties of Made land vary considerably, so no estimates for this mapping unit are given in the table.

The AASHO and Unified classifications and the percentages passing the various sieves, as shown in table 4 for soils from which samples were tested, are based on the test data obtained for the modal profiles. These values exclude the data from the surface layer. For those soils from which samples were not tested, the estimates are based on information obtained from similar soils and on past experience in engineering construction.

There is considerable variation in the texture (grain size) of glacial and water-deposited materials. Hence, the engineering soil classifications in table 4 will not apply to all parts of a mapped soil unit. Furthermore, cobblestones and other stones larger than 3 inches are not considered when soils are given engineering classifications. Construction work is a problem on many of the soils, particularly those derived from glacial till. Such soils have numerous large stones and boulders and are shallow to bedrock. In some parts of the survey area, stones and boulders have been removed from the surface but occur in the subsoil and substratum. Benson, Mapleton, Thorndike, and other soils that are shallow to bedrock require careful investigation when structures that require excavations are planned.

Permeability of the soils was estimated for the soil material as it occurs without compaction. The estimates of permeability, as well as those of other physical properties, are based on local knowledge of the soils, on field examination of the soils, on information given elsewhere in the report, and on laboratory measurements shown in table 3.

The available water in inches per foot of soil depth is an approximation of the capillary water in the soil when it is wet to field capacity. When the soil is "air dry," this amount of water will wet the soil material described to a depth of 1 foot without percolating deeper.

samples taken from 18 soil profiles

Mechanical analysis [3]										Liquid limit	Plasticity index	Classification	
Percentage passing sieve [4]—						Percentage smaller than [4]—							
3 in.	¾ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [5]	Unified [6]
------	------	------	100	85	61	56	42	20	12	38	5	A-4(5)	ML.
------	------	------	100	78	47	42	27	14	8	([7])	([7])	A-4(2)	SM.
------	100	88	81	41	8	6	4	2	2	([7])	([7])	A-1-b(0)	SP-SM.
------	------	------	100	94	35	30	20	11	6	([7])	([7])	A-2-4(0)	SM.
------	------	------	100	93	17	13	9	4	2	([7])	([7])	A-2-4(0)	SM.
------	------	------	100	96	16	10	5	3	1	([7])	([7])	A-2-4(0)	SM.
------	100	96	94	76	36	32	22	12	8	44	9	A-5(0)	SM.
100	99	99	99	71	19	17	13	8	4	([7])	([7])	A-2-4(0)	SM.
------	100	99	98	74	11	9	8	5	2	([7])	([7])	A-2-4(0)	SP-SM.
100	91	80	72	64	53	50	36	20	13	34	7	A-4(4)	ML.
100	85	74	66	56	44	42	30	18	12	22	5	A-4(2)	SM-SC.
100	92	80	70	61	48	45	38	24	18	24	9	A-4(3)	SC.
100	73	57	50	42	34	32	28	18	12	24	8	A-2-4(0)	GC.

TABLE 3.—*Engineering test data* [1] *for soil samples*

Soil name and location	Parent material	Bureau of Public Roads report number	Depth	Horizon	Moisture-density [2]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Caribou gravelly loam—Continued						
2 miles S. of Presque Isle (deep)	Glacial till derived from shale.	S34298	0–3	A_1	80	32
		S34299	8–19	B_{22}	103	18
		S34300	26–43	B'_{21}	109	16
		S34301	63–76	C_2	125	10
300 feet N. of Presque Isle High School (coarse texture).	Glacial till derived from shale.	S34302	0–12	A_p	107	16
		S34303	23–33	B_{22}	122	11
		S34304	52–64	C_1	110	17
Easton silt loam:						
3 miles E. of Presque Isle (modal profile)	Glacial till derived from shale.	S34305	0–8	A_p	91	25
		S34306	27–38	B_{22g}	114	15
		S34307	50–58	C	125	12
3 miles SE. of Presque Isle (better drained)	Glacial till derived from shale.	S34308	0–10	A_p	89	26
		S34309	22–32	B_{22g}	117	15
		S34310	43–54	C	127	11
2 miles SE. of bridge crossing Aroostook River in Caribou Township (sandy subsoil).	Glacial till derived from shale.	S34311	0–12	A_p	108	18
		S34312	25–42	B_{22g}	127	11
		S34313	57–65	C	129	10
Perham gravelly silt loam:						
W. of village of Perham off Route 228 (modal profile).	Glacial till derived from hard, gray shale.	S34587	0–11	A_p	104	18
		S34588	11–15	B_2	112	15
		S34589	26–48	B'_{22}	123	12
1.5 miles W. of Holts School (shallow)	Glacial till derived from shale and phyllite.	S34590	0–9	A_p	105	17
		S34591	9–13	B_2	106	18
		S34592	16–33	B'_{22}	123	12
0.5 mile S. of Holts School (deep)	Glacial till derived from shale.	S34593	0–10	A_p	103	18
		S34594	10–25	B_2	114	15
		S34595	36–58	B'_{22}	128	10
Plaisted stony gravelly loam:						
200 feet S. of DAR marker for Pvt. Hiram Smith on Route 2A (modal profile).	Glacial till derived from shale and granite.	S35553	6–14	B_{22}	104	19
		S35554	14–45	C	114	14
0.3 mile E. and 300 feet S. of DAR marker for Pvt. Hiram Smith on Route 2A (firm).	Glacial till derived from shale and granite.	S35555	7–15	B_{22}	110	16
		S35556	15–40	C	128	8
Plaisted gravelly loam:						
1.25 miles N. of Haynesville (sandy)	Glacial till derived from shale and granite.	S35557	0–7	A_p	106	18
		S35558	12–24	B_{22}	125	10
		S35559	24–40	C	128	8
Stetson gravelly loam:						
0.5 mile N. of Palmer School (modal profile)	Alluvium on terraces	S35954	0–10	A_p	---	---
		S35955	10–16	B_{21}	---	---
		S35956	28–48	C_1	---	---
0.4 mile N. of intersection of Routes 205 and 167 (outwash).	Alluvium on terraces	S35957	0–11	A_p	---	---
		S35958	11–17	B_{21}	---	---
		S35959	29–48	C	---	---
0.75 mile N. of intersection of Routes 163 and 11 (acid).	Alluvium on terraces	S35960	0–11	A_p	---	---
		S35961	11–20	B_{21}	---	---
		S35962	27–40	C_1	---	---

[1] Tests performed by the Bureau of Public Roads in accordance with standard procedures of the American Association of State Highway Officials (AASHO).

[2] Based on the Moisture-density Relations of Soils Using 5.5-lb. Rammer and 12-in. Drop, AASHO Designation: T 99–57, Method C.; dashes in these columns indicate information not available or not applicable.

[3] Mechanical analysis according to AASHO Designation: T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in

taken from 18 soil profiles—Continued

Mechanical analysis [3]										Liquid limit	Plasticity index	Classification	
Percentage passing sieve [4]—						Percentage smaller than [4]—							
3 in.	¾ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [5]	Unified [6]
100	99	90	83	77	66	62	46	27	17	57	11	A-7-5(9)	MH or OH.
100	86	69	61	53	43	40	29	18	11	30	5	A-4(2)	GM.
100	68	48	38	32	28	27	23	13	10	32	9	A-2-4(0)	GM-GC.
100	59	31	24	19	15	14	10	7	5	29	9	A-2-4(0)	GC.
100	92	81	74	61	45	41	31	18	13	33	7	A-4(2)	SM.
95	75	50	36	23	15	13	12	8	5	32	5	A-1-b(0)	GM.
90	68	52	44	33	23	22	16	10	6	22	6	A-2-4(0)	GM-GC.
100	97	88	82	75	66	64	49	30	20	44	12	A-7-5(8)	ML or OL.
100	88	77	72	64	54	51	41	27	17	28	8	A-4(4)	CL.
100	82	70	65	58	46	44	34	22	16	23	7	A-4(2)	GM-GC.
------	100	97	93	86	73	69	51	30	20	45	11	A-7-5(9)	ML or OL.
100	97	88	83	74	59	56	43	27	20	27	10	A-4(5)	CL.
100	86	74	69	59	46	43	32	21	14	22	8	A-4(2)	SC.
97	96	87	77	65	51	48	35	21	13	35	8	A-4(3)	ML or OL.
100	97	91	84	76	53	50	38	23	14	20	6	A-4(4)	ML-CL.
100	96	86	76	58	38	35	24	14	10	18	4	A-4(1)	SM-SC.
100	96	86	80	71	50	48	41	22	13	36	7	A-4(3)	SM.
100	80	62	58	50	41	39	29	17	10	30	6	A-4(1)	GM-GC.
100	94	85	80	70	59	57	45	30	24	28	11	A-6(5)	CL.
100	85	72	66	59	50	48	34	20	13	36	8	A-4(3)	GM.
100	81	77	72	63	53	51	40	24	15	35	9	A-4(4)	ML-CL.
95	83	66	61	52	42	40	29	18	11	23	5	A-4(2)	GM-GC.
100	93	80	74	65	53	50	36	20	13	40	8	A-4(4)	ML.
100	86	65	56	44	34	32	22	12	7	31	6	A-2-4(0)	GM.
100	89	64	55	45	38	36	29	21	16	30	12	A-6(1)	GC.
85	79	71	66	58	45	38	24	8	3	([7])	([7])	A-4(3)	GM.
80	59	51	48	42	33	28	17	5	2	([7])	([7])	A-2-4(0)	GM.
90	70	56	49	37	26	22	14	5	2	([7])	([7])	A-2-4(0)	GM.
70	60	50	44	33	17	12	8	3	2	([7])	([7])	A-1-b(0)	SM.
100	93	81	74	63	44	40	25	11	7	([7])	([7])	A-4(2)	SM.
90	81	68	61	47	27	20	12	4	3	([7])	([7])	A-2-4(0)	SM.
90	77	59	50	39	25	21	12	4	2	([7])	([7])	A-2-4(0)	SM.
100	84	72	66	46	24	22	15	9	5	([7])	([7])	A-1-b(0)	SM.
100	76	54	45	28	16	14	11	7	4	([7])	([7])	A-1-b(0)	GM.
100	85	58	39	15	7	6	5	3	2	([7])	([7])	A-1-a(0)	SW-SM.
100	93	80	73	60	42	39	28	16	10	42	8	A-5(1)	SM.
100	79	64	54	36	25	24	18	11	8	36	7	A-2-4(0)	SM.
100	77	59	51	34	12	10	6	3	1	([7])	([7])	A-1-b(0)	SP-SM.
100	82	57	47	33	24	23	16	9	6	40	8	A-2-4(0)	GM.
100	77	52	41	25	17	16	11	7	4	([7])	([7])	A-1-b(0)	GM.
100	89	65	46	12	5	5	4	2	1	([7])	([7])	A-1-a(0)	SW-SM.

diameter is excluded from calculations of grain-size fractions. The mechanical analysis used in this table are not suitable for use in naming textural classes for soils.

[4] Based on total material. Laborabory test data corrected for amount discarded in field sampling.

[5] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes. AASHO Designation: M 145-49.

[6] Based on the Unified Soil Classification System, Tech. Memo. No. 3-357. v. 1, Waterways Experiment Station, Corps of Engineers, March 1953.

[7] Nonplastic.

TABLE 4.—*Brief descriptions of the soils*

Map symbol	Soils	Depth to seasonally high water table	Brief site and soil description
AgA AgB AgC AgD	Allagash fine sandy loam, 0 to 2 percent slope. Allagash fine sandy loam, 2 to 8 percent slopes. Allagash fine sandy loam, 8 to 15 percent slopes. Allagash fine sandy loam, 15 to 35 percent slopes.	More than 5 feet.	3 feet of well-drained sandy soil over sand and gravel; soils occur on glacial outwash and on river terraces; normally acid in reaction.
BeB BeC BeD	Benson silt loam, 0 to 8 percent slopes. Benson silt loam, 8 to 15 percent slopes. Benson silt loam, 15 to 25 percent slopes.	More than 5 feet.	1 foot of well-drained soil on silty glacial till over limestone bedrock; surface of bedrock weakly shattered; subsoil normally calcareous.
CdB	Canandaigua silt loam, thin solum, 0 to 8 percent slopes.	(Water table at surface.)	3 to 4 feet of poorly drained silty material formed from slack-water deposits; soils occur in level to gently sloping areas; in many places subsoil is weakly calcareous.
CgA CgB CgC CgC2 CgD CgD2 CgE	Caribou gravelly loam, 0 to 2 percent slopes. Caribou gravelly loam, 2 to 8 percent slopes. Caribou gravelly loam, 8 to 15 percent slopes. Caribou gravelly loam, 8 to 15 percent slopes, eroded. Caribou gravelly loam, 15 to 25 percent slopes. Caribou gravelly loam, 15 to 25 percent slopes, eroded. Caribou gravelly loam, 25 to 45 percent slopes.	More than 5 feet.	3 to 5 feet of well-drained soil on silty glacial till over vertically bedded and shattered limestone and shale bedrock; shaly fragments occur throughout the soil.
CoA CoB CoC	Conant silt loam, 0 to 2 percent slopes. Conant silt loam, 2 to 8 percent slopes. Conant silt loam, 8 to 15 percent slopes.	1 foot----------	1½ feet of silty soil over 3 feet of compact silty glacial till; soils are moderately well drained; 20 percent shaly fragments in lower part of soil; lower subsoil normally weakly calcareous.
DaA DaB DaC	Daigle silt loam, 0 to 2 percent slopes. Daigle silt loam, 2 to 8 percent slopes. Daigle silt loam, 8 to 15 percent slopes.	1 foot----------	1½ feet of silty soil over 4 feet of acid silty and clayey glacial till; 20 percent or more shale fragments in lower part of soil.
EaA EaB EsB	Easton and Washburn silt loams, 0 to 2 percent slopes. Easton and Washburn silt loams, 2 to 8 percent slopes. Easton and Washburn stony silt loams, 0 to 8 percent slopes.	(Water table at surface.)	1 foot of friable silty soil over 3½ feet of compact, weakly calcareous loamy glacial till; soils are poorly drained and very poorly drained; very poorly drained Washburn soils have a highly organic layer, 12 inches thick, that should not be used for engineering purposes; the Easton and Washburn soils are similar, except for the organic surface layer of the Washburn.
FhA FhB	Fredon and Halsey silt loams, 0 to 2 percent slopes. Fredon and Halsey silt loams, 2 to 8 percent slopes.	(Water table at surface.)	2 to 3 feet of poorly drained silty and gravelly outwash over stratified sand and gravel; very poorly drained Halsey soils have a highly organic layer, 12 inches thick, that should not be used for engineering purposes; lower part of the surface layer may be calcareous; the Fredon and Halsey soils are similar, except for the organic surface layer of the Halsey.
HaA HaB	Hadley silt loam, level. Hadley silt loam, undulating.	(Occasional flooding.)	3 feet of alluvial deposits that consist of well-drained silty and fine sandy material.
HoA HoB HoC HvB HvC	Howland gravelly loam, 0 to 2 percent slopes. Howland gravelly loam, 2 to 8 percent slopes. Howland gravelly loam, 8 to 15 percent slopes. Howland very stony loam, 0 to 8 percent slopes. Howland very stony loam, 8 to 15 percent slopes.	1 foot----------	1 foot of moderately well drained, friable loamy soil over 3 feet of compact, acid glacial till.
MaA MaB MaC	Machias gravelly loam, 0 to 2 percent slopes. Machias gravelly loam, 2 to 8 percent slopes. Machias gravelly loam, 8 to 15 percent slopes.	1 foot----------	30 inches of moderately well drained gravelly soil underlain by loose, stratified sandy and gravelly glacial outwash; in places the lower subsoil is weakly calcareous.
MbA MbB MbC	Madawaska fine sandy loam, 0 to 2 percent slopes. Madawaska fine sandy loam, 2 to 8 percent slopes. Madawaska fine sandy loam, 8 to 15 percent slopes.	1 foot----------	1½ feet of moderately well drained fine sandy soil over 1½ feet of compact sand; underlain by stratified silt, sand, and gravel; soils developed on stream terraces.

See footnote at end of table.

and their estimated physical properties

Depth from surface (typical profile)	Classification			Percentage passing sieve—			Permeability [1]	Available water	Shrink-swell potential
	USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
Inches								*Inches per inch of depth*	
0–36	Fine sandy loam	SM	A–2	100	100	15–25	Moderate	0.10 to 0.18	Low.
36–60	Sandy and gravelly material.	GM–SM	A–2	55–60	45–55	20–30	Very rapid	Less than 0.04.	Low.
0–12	Silt loam	SM	A–1	70–75	60–65	15–25	Moderate	0.16 to 0.21	Low.
0–36	Silt loam	ML	A–4	100	100	65–75	Very slow	0.15 to 0.19	Moderate.
0–24	Gravelly loam	SM–SC	A–4	70–80	60–70	40–45	Moderate	0.15 to 0.19	Moderate.
24–48	Gravelly loam	SC	A–4	75–85	65–75	40–45	Moderate	0.15 to 0.19	Moderate.
0–18	Silt loam	CL	A–4	75–80	70–75	50–60	Moderate	0.15 to 0.16	Moderate.
18–48	Loam	GM–GC	A–4	65–75	60–70	40–45	Slow	0.15 to 0.16	Moderate.
0–18	Gravelly silt loam	GM–GC	A–4	60–65	55–60	35–45	Moderate	0.15 to 0.16	Moderate.
18–48	Silty clay	CL	A–4	80–90	75–85	55–65	Slow	0.16 to 0.21	Moderate.
0–18	Silt loam	CL	A–4	75–80	70–75	50–60	Moderate	0.15 to 0.16	Moderate.
18–48	Silt loam	GM–GC	A–4	65–75	60–70	40–45	Slow	0.15 to 0.16	Moderate.
0–21	Gravelly silt loam	ML–CL	A–4	70–80	65–75	55–60	Moderate	0.13 to 0.16	Moderate.
21–40	Gravelly sandy loam	GM–SM	A–2	55–65	40–50	25–30	Slow	0.13 to 0.16	Low.
0–36	Silt loam	ML–CL	A–4	90–95	85–90	55–60	Moderate	0.13 to 0.21	Moderate.
0–12	Gravelly loam	ML–CL	A–4	90–95	85–90	55–60	Moderate	0.13 to 0.17	Moderate.
12–48	Very stony loam	ML–CL	A–4	90–95	80–90	55–60	Slow	0.13 to 0.15	Low to moderate.
0–30	Gravel	GM, GM–GC.	A–4	65–75	50–60	35–45	Moderate	0.13 to 0.17	Low.
30–48	Stratified sand and gravel	GM–GC	A–2–4	50–60	40–50	25–35	Very rapid	Less than 0.04.	Low.
0–36	Fine sandy loam	ML–CL	A–4	70–80	65–75	60–65	Moderate	0.17 to 0.22	Moderate.

TABLE 4.—*Brief descriptions of the soils and*

Map symbol	Soils	Depth to seasonally high water table	Brief site and soil description
MhB MhC MhC2 MhD MmC MmD	Mapleton shaly silt loam, 0 to 8 percent slopes. Mapleton shaly silt loam, 8 to 15 percent slopes. Mapleton shaly silt loam, 8 to 15 percent slopes, eroded. Mapleton shaly silt loam, 15 to 35 percent slopes. Mapleton very rocky silt loam, 0 to 15 percent slopes. Mapleton very rocky silt loam, 15 to 35 percent slopes.	More than 5 feet.	2 feet of well-drained, shaly silty soil over limy shale bedrock that is inclined and deeply shattered.
Mn	Mixed alluvial land.	(Water table at surface.)	Mixed stream deposits of silty and sandy material; generally poorly drained.
MoA MoB MrB	Monarda and Burnham silt loams, 0 to 2 percent slopes. Monarda and Burnham silt loams, 2 to 8 percent slopes. Monarda and Burnham very stony silt loams, 0 to 8 percent slopes.	(Water table at surface.)	1½ feet of poorly drained silty soil over 5 feet of compact, acid silty glacial till derived from shale and slate; very poorly drained Burnham soils have a highly organic surface layer, 12 inches thick, that should not be used for engineering purposes; the Monarda and Burnham soils are similar, except for the organic surface layer of the Burnham.
NcA NcB	Nicholville silt loam, 0 to 2 percent slopes. Nicholville silt loam, 2 to 8 percent slopes.	1 foot	1½ feet of moderately well drained, friable silty soil over 1½ feet of compact silty material; underlain by loose fine sandy material; soils developed on slack-water deposits and may be calcareous.
Pa	Peat and muck.	(Water table at surface.)	Highly organic material that varies in depth; each site needs to be examined.
PeA PeB PeC PeD	Perham gravelly silt loam, 0 to 2 percent slopes. Perham gravelly silt loam, 2 to 8 percent slopes. Perham gravelly silt loam, 8 to 15 percent slopes. Perham gravelly silt loam, 15 to 25 percent slopes.	More than 5 feet.	2 feet of well-drained, silty glacial till over 2 feet of compact gravelly, silty, and clayey glacial till.
PgA PgB PgC PgD PgE PrB PrC PrD PrE	Plaisted gravelly loam, 0 to 2 percent slopes. Plaisted gravelly loam, 2 to 8 percent slopes. Plaisted gravelly loam, 8 to 15 percent slopes. Plaisted gravelly loam, 15 to 25 percent slopes. Plaisted gravelly loam, 25 to 45 percent slopes. Plaisted very stony loam, 0 to 8 percent slopes. Plaisted very stony loam, 8 to 15 percent slopes. Plaisted very stony loam, 15 to 25 percent slopes. Plaisted very stony loam, 25 to 45 percent slopes.	More than 5 feet.	1½ feet of well-drained gravelly loam over 2½ feet of compact, acid glacial till.
PvB PvC	Plaisted and Howland very stony loams, 0 to 8 percent slopes. Plaisted and Howland very stony loams, 8 to 15 percent slopes.	See descriptions of Plaisted soils and of Howland soils.	
RaA RaB	Red Hook and Atherton silt loams, 0 to 2 percent slopes. Red Hook and Atherton silt loams, 2 to 8 percent slopes.	(Water table at surface.)	2 to 3 feet of poorly drained silty and gravelly outwash over stratified sand and gravel; very poorly drained Atherton soils have a highly organic surface layer that should not be used for engineering purposes; the Red Hook and Atherton soils are similar, except for the organic surface layer of the Atherton.
Re	Riverwash.	(Flooded)	Deposits of gravel and cobbles that occur as islands in streams and also along streambanks.
SaA SaB SaC	Salmon silt loam, 0 to 2 percent slopes. Salmon silt loam, 2 to 8 percent slopes. Salmon silt loam, 8 to 15 percent slopes.	More than 5 feet.	3 feet of well-drained silty soil over 3 feet of fine sandy material; soils developed on slack-water deposits and may be slightly calcareous in lower subsoil.
Sb	Steep rockland, Thorndike materials.	More than 5 feet.	See description of the Thorndike soils.

See footnote at end of table.

their estimated physical properties—Continued

Depth from surface (typical profile)	Classification			Percentage passing sieve—			Permea-bility [1]	Available water	Shrink-swell potential
	USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
Inches								*Inches per inch of depth*	
0–24	Shaly silt loam	SM	A–1	60–65	45–55	15–20	Moderate	0.11 to 0.14	Low.
0–36	Silt loam	ML	A–4	70–80	65–75	60–65	Very slow	0.13 to 0.16	Moderate.
0–18	Silt loam	ML	A–4	85–90	80–85	55–60	Moderate	0.15 to 0.18	Moderate.
18–72	Silt loam	ML–CL	A–4	85–90	80–85	55–60	Slow	0.15 to 0.21	Moderate.
0–36	Silt loam	ML	A–4	100	100	65–75	Moderate	0.15 to 0.19	Moderate.
Not suitable for engineering purposes.									
0–24	Gravelly silt loam	GM–GC	A–4	60–65	55–60	35–45	Moderate	0.17 to 0.18	Moderate.
24–48	Silty clay loam	CL	A–6	75–85	75–85	55–65	Slow	0.17 to 0.21	Moderate.
0–18	Gravelly loam	SM	A–4	80–90	70–80	40–45	Moderate	0.17 to 0.18	Moderate.
18–48	Gravelly loam	SM	A–2	75–85	60–65	30–35	Slow	0.15 to 0.18	Moderate.
0–21	Gravelly silt loam	ML-CL	A–4	70–80	65–75	55–60	Moderate	0.13 to 0.17	Moderate to low.
21–40	Gravelly silt loam and gravel.	GM-GC	A–2	55–65	40–50	25–30	Rapid	Less than 0.04.	Moderate to low.
Too variable to rate.									
0–36	Silt loam	ML	A–4	100	100	65–75	Moderate	0.15 to 0.19	Moderate.

TABLE 4.—*Brief descriptions of the soils and*

Map symbol	Soils	Depth to seasonally high water table	Brief site and soil description
SgA SgB SgC SgD SgE	Stetson gravelly loam, 0 to 2 percent slopes. Stetson gravelly loam, 2 to 8 percent slopes. Stetson gravelly loam, 8 to 15 percent slopes. Stetson gravelly loam, 15 to 25 percent slopes. Stetson gravelly loam, 25 to 45 percent slopes.	More than 5 feet.	2 feet of well-drained gravelly and sandy soil over 2 or more feet of stratified sand and gravel; soils developed on outwash and may be calcareous in lower subsoil.
ThB ThC ThD ThE TkB TkC TkD TkE TrE	Thorndike shaly silt loam, 0 to 8 percent slopes. Thorndike shaly silt loam, 8 to 15 percent slopes. Thorndike shaly silt loam, 15 to 25 percent slopes. Thorndike shaly silt loam, 25 to 45 percent slopes. Thorndike very rocky silt loam, 0 to 8 percent slopes. Thorndike very rocky silt loam, 8 to 15 percent slopes. Thorndike very rocky silt loam, 15 to 25 percent slopes. Thorndike very rocky silt loam, 25 to 45 percent slopes. Thorndike extremely rocky silt loam, 15 to 45 percent slopes.	More than 5 feet.	1½ feet of well-drained shaly silt loam over shattered shale bedrock that is inclined.
TsB TsC	Thorndike and Howland soils, 0 to 8 percent slopes. Thorndike and Howland soils, 8 to 15 percent slopes.	1 to 5 feet	See descriptions of the Thorndike soils and of
Wn	Winooski silt loam.	(Occasional flooding.)	3 feet of moderately well drained, friable silty soil developed from alluvial deposits of silty and very fine sandy material.

[1] Terms used to describe permeability and the rates of percolation, in inches per hour, are: Very slow, less than 0.20; slow, 0.20 to 0.63; moderate, 0.63 to 2.00; rapid, 2.00 to 6.30; very rapid, over 6.30.

Shrink-swell potential indicates the degree of volume change to be expected with a change in moisture content. It is estimated primarily on the basis of the amount and type of clay present. In general, soils classified as CH and A–7 have a *high* shrink-swell potential. Clean sands and gravels (single grain) and those having small amounts of nonplastic to slightly plastic fines, as well as most other nonplastic to slightly plastic soil materials, have a *low* shrink-swell potential.

The pH values are not shown in table 4 because most of the soils range from pH 5.0 to 5.6. However, the soils in the Caribou catena (Caribou, Conant, Easton, and Washburn) are slightly calcareous in the lower part of the subsoil. Soils on glacial outwash and terraces that are closely associated with the soils of the Caribou catena also may be calcareous in the lower subsoil. These soils have a wide range in pH values, but the general ranges are given in table 4 under the column headed "Brief Site and Soil Description." The soils that show wide ranges in pH may need to be tested for reaction. Extremes in acidity or in alkalinity are important because of the effect on structural materials and on the treatments that may be required to make the soils stable.

Table 5 gives specific features of the soils that may affect engineering work and also rates the soils according to their suitability for various uses. The features listed provide a guide to potential hazards, or to characteristics that require precaution in planning, design, and construction. The ratings are given in such terms as *good*, *fair*, *poor*, *not suitable*, and so on. The information in table 5 is based on test data given in table 3, on interpretations of the estimated physical properties of the soils given in table 4, and on field experience and performance.

Highway Work

Frost action is one of the primary engineering problems in the survey area. While it may be desirable to suspend earthwork operations during the winter months to prevent the use of frozen soil materials for constructing embankments, it may not be economically feasible to do so. (See table 5 for ratings of the soils according to their adaptability to winter grading and susceptibility to frost action.)

The adaptability of the soils to winter grading depends largely on the texture of the soil material, its natural water content, and the depth to the water table during winter. Clay soils, when wet, are difficult to handle and must be dried to proper moisture content for compaction, which is difficult to accomplish at this time of the year. Also, when frozen, they may be difficult to excavate and should not be used in the compacted road section. Therefore, these soils are rated *poor*. Fine sands and silts with high water tables during the freezing period are also rated *poor*. In these soils extensive ice lenses can develop and if the frozen material is placed in the compacted road section, differential settlement may occur in the embankment when the ice melts.

The rating of the soil material for its susceptibility to frost action depends on the texture of the material, the depth to the water table during the freezing period, and the length of time that the temperature is below freezing. Silts and fine sands with high water tables are rated *high*.

Susceptibility of this soil material to frost action has also been considered in rating the soils as sources of sand *their estimated physical properties*—Continued

Depth from surface (typical profile)	Classification			Percentage passing sieve—			Permeability [1]	Available water	Shrink-swell potential
	USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
Inches								*Inches per inch of depth*	
0–24	Gravelly loam	SM	A-2	90–95	85–95	20–30	Moderate	0.10 to 0.21	Low.
24–120	Gravel	GP	A-1	30–40	15–20	0–5	Very rapid	Less than 0.04.	Low.
0–18	Shaly silt loam	SM	A-1	60–65	45–55	15–20	Moderate	0.10 to 0.14	Low.
the Howland soils.									
0–36	Silt loam	ML-CL	A-4	90–95	85–90	55–60	Moderate	0.13 to 0.19	Moderate.

and gravel. In general, soils are not susceptible to frost action if less than 10 percent of the soil material passes the No. 200 sieve. Even if a soil is rated as a good source of sand and gravel, it may be necessary to explore extensively to find materials that meet this requirement.

The suitability of the soil materials for road subgrade and road fill depends largely on the texture of the soil material and its natural water content. Highly plastic soil materials are rated *poor* for road subgrade and *poor* or *fair* for road fill, depending on their natural water content and the ease with which they can be handled, dried, and compacted. Peats and swampy materials are *not suitable* for road subgrade and road fill. Highly erodible soils, such as those composed primarily of fine sands or silts, require moderately gentle slopes, close moisture control during compaction, and the establishment of fast-growing vegetation on side slopes for the control of erosion. These soils are rated *poor* for road subgrade and *poor to fair* for road fill.

The ratings given the soils in table 5 as sources of topdressing for slopes of embankments, ditches, and cut slopes were developed for the survey area. Normally, only the material from the uppermost layer will be used, and the ratings apply only to nonstony soils.

A perched water table that occurs in some of the soils derived from glacial till is caused by a compact, platy layer that is slowly permeable to water. Seepage may occur along the top of this layer. When roads are to be constructed on soils that have a perched water table, a survey should be made to determine the need for underdrains. Some underdrains will be needed in the highway cuts. The requirements for underdrains should be determined by field exploration.

Seepage in back slopes of roadcuts may cause the overlying material to slump or slide. If the perched water table is at a shallow depth below the pavement, differential volume change may occur, particularly within the depth of freezing, and the decrease in bearing capacity of the saturated or thawed foundation material may cause the pavement to deteriorate. Pockets of wet, fine-grained soil material should be removed and replaced by coarser grained material.

Some of the glacial till consists of fine sand and silt that is susceptible to frost heave. Where such material occurs, a sufficient thickness of free-draining material should be used in the highway subgrade to prevent detrimental heaving of the pavement. If there are pockets of fine-grained soil material in the coarse-grained material, differential frost heave can be prevented by mixing these materials so that heaving will be uniform. Differential frost heave can also be prevented by using a sufficient thickness of very permeable sandy gravel or coarse sand in the upper part of the subgrade.

In thick glacial till, bedrock may be exposed in deep cuts. In shallow glacial till, the gradeline should be kept high so that the excavation of the bedrock will be minimized and so that seepage, which occurs at the point where the till and bedrock meet, will be avoided. Adequate surface drainage and underdrainage should be provided, and coarse-grained soil material should be used in the upper part of the subgrade.

TABLE 5.—*Engineering interpretations*

[Made land is too variable to rate for engineering work

Soil and map symbols	Adaptability to winter grading	Susceptibility to frost action	Suitability of soil material for—		Suitability as source of—		Suitability for ponds
			Road subgrade	Road fill	Topsoil	Sand and gravel	Reservoir
Allagash fine sandy loams. AgA, AgB, AgC, AgD	Good	Low	Good	Good	Fair	Good below a depth of 36 inches.	Poor; excessive seepage.
Benson silt loams. BeB, BeC, BeD	Fair	Low	Good	Fair	Not suitable	Not suitable	Poor; excessive seepage and soil too shallow.
Canandaigua silt loam. CdB	Poor	High	Poor	Poor	Not suitable	Not suitable	Good, but have sand lenses in places.
Caribou gravelly loams. CgA, CgB, CgC, CgC2, CgD, CgD2, CgE	Fair	Moderate	Fair	Good	Good	Not suitable	Poor; need treatment.
Conant silt loams. CoA, CoB, CoC	Fair	High	Fair	Fair	Good	Not suitable	Good, but permeable bedrock is a problem in places.
Daigle silt loams. DaA, DaB, DaC	Fair	Moderate	Fair	Fair	Fair	Not suitable	Good
Easton and Washburn silt loams and stony silt loams. EaA, EaB, EsB	Poor	High	Fair	Fair	Not suitable	Not suitable	Good
Fredon and Halsey silt loams. FhA, FhB	Poor	High	Good	Good	Fair	Poor; limited by high water table.	Fair; high water table and sand lenses.
Hadley silt loams. HaA, HaB	Poor	Moderate	Fair	Fair	Good	Not suitable	Poor; moderate permeability and subject to overflow.
Howland gravelly loams. HoA, HoB, HoC	Fair	High	Fair	Fair	Fair	Not suitable	Good
Howland very stony loams. HvB, HvC	Fair	High	Fair	Fair	Fair; some problems with surface stones.	Not suitable	Good
Machias gravelly loams. MaA, MaB, MaC	Poor	Moderate	Good	Good	Fair	Fair; limited by water table.	Poor; moderately permeable sand and gravel layers; seepage in places.
Madawaska fine sandy loams. MbA, MbB, MbC	Poor	High	Fair	Fair	Fair	Not suitable	Poor; sand substratum may cause leakage.
Mapleton shaly silt loams. MhB, MhC, MhC2, MhD	Fair	Low	Good	Fair	Not suitable	Not suitable	Poor; excessive seepage and soil too shallow.
Mapleton very rocky silt loams. MmC, MmD	Fair	Low	Good	Fair; between outcrops.	Not suitable	Not suitable	Poor; excessive seepage and soil too shallow.
Mixed alluvial land. Mn	Poor	High	Poor to fair	Fair	Poor	Not suitable	Poor; high water table and flooding.

of the soils

and is not listed in this table]

Suitability for ponds—Con.	Soil features affecting engineering practices				
Embankment	Vertical alinement in highways	Agricultural drainage	Irrigation	Diversion terraces	Waterways
Poor; rapidly permeable.	No unfavorable features.	(Not needed)	High intake rate; fair water-holding capacity.	Permeable; subject to erosion.	Subject to erosion.
Poor; inadequate strength and stability.	Shallow to bedrock	(Not needed)	Moderate intake rate; good water-holding capacity.	Shallow to bedrock.	Shallow to bedrock.
Fair	High water table most of year.	Fine texture; high water table.	(Not irrigated)	(Not needed)	High water table.
Poor	No unfavorable features, except boulders.	(Not needed)	Moderately low intake rate; good water-holding capacity.	Long slopes subject to erosion.	Subject to erosion.
Fair; contains shale in places.	Seepage and boulders.	Compact subsoil; high water table.	Moderately low intake rate; good water-holding capacity.	Compact subsoil	Subject to erosion.
Good for small dams	Seepage and erosion on cut slopes; bouldery.	Compact subsoil; fine texture.	Low intake rate; good water-holding capacity.	Compact subsoil	Subject to erosion and seepage.
Good	High water table; bouldery.	High water table; compact subsoil.	(Not irrigated)	Wet soils	High water table.
Fair	High water table most of year.	Compact subsoil; high water table.	(Not irrigated)	(Not needed)	High water table.
Fair	Subject to overflow	(Not needed)	Moderate intake rate; good water-holding capacity.	May be flooded occasionally.	Subject to flooding.
Good	Seepage and erosion on cut slopes; bouldery.	Compact subsoil	Low intake rate; good water-holding capacity.	Compact subsoil	Subject to erosion.
Good	Seepage and erosion on cut slopes; bouldery.	Compact subsoil	Low intake rate; good water-holding capacity.	Compact subsoil	Subject to erosion.
Fair; may be used if well compacted and mixed.	Seepage	Sand and gravel lenses; cut slopes subject to seepage and sloughing.	Moderately low intake rate; good water-holding capacity.	Seepage in places	Seepage in places.
Fair; may be used if well compacted and mixed.	Subject to seepage and erosion on cut slopes.	Sand and gravel lenses; cut slopes subject to seepage and sloughing.	Moderately low intake rate; good water-holding capacity.	Seepage in places	Seepage in places.
Poor; inadequate strength and stability.	Shallow to bedrock	(Not needed)	Moderate intake rate; fair water-holding capacity.	Shallow to bedrock	Shallow to bedrock.
Poor; inadequate strength and stability.	Shallow to bedrock	(Not needed)	(Not irrigated)	Shallow to bedrock	Shallow to bedrock.
Fair when mixed	High water table most of year; subject to flooding.	High water table; flooding.	(Not irrigated)	(Not needed)	High water table.

TABLE 5.—*Engineering interpretations*

[Made land is too variable to rate for engineering work and

Soil and map symbols	Adaptability to winter grading	Susceptibility to frost action	Suitability of soil material for—		Suitability as source of—		Suitability for ponds
			Road subgrade	Road fill	Topsoil	Sand and gravel	Reservoir
Monarda and Burnham silt loams. MoA, MoB	Poor	High	Fair	Fair	Not suitable	Not suitable	Good; high water table and slow permeability.
Monarda and Burnham very stony silt loams. MrB	Poor	High	Fair	Fair	Not suitable	Not suitable	Good; high water table.
Nicholville silt loams NcA, NcB	Poor	High	Poor	Poor	Fair	Not suitable	Fair or poor; underlain by sand.
Peat and muck Pa	Not suitable.	High	Not suitable.	Not suitable.	Not suitable	Not suitable	Not suitable
Perham gravelly silt loams PeA, PeB, PeC, PeD	Fair	Moderate	Fair	Fair	Fair	Not suitable	Good
Plaisted gravelly loams PgA, PgB, PgC, PgD, PgE	Fair	Moderate	Fair	Fair	Fair	Not suitable	Fair, but underlain by permeable bedrock in places.
Plaisted very stony loams. PrB, PrC, PrD, PrE	Fair	Moderate	Fair	Fair	Fair; some problems with surface stones.	Not suitable	Fair, but underlain by permeable bedrock in places.
Plaisted and Howland very stony loams. PvB, PvC	Fair	Moderate	Fair	Fair	Fair; some problems with surface stones.	Not suitable	Fair, but underlain by permeable bedrock in places.
Red Hook and Atherton silt loams. RaA, RaB	Poor	High	Fair	Fair	Fair	Poor; limited by high water table.	Fair; high water table and sand lenses.
Riverwash Re	Poor	High	Good	Good	Not suitable	Good	Not suitable
Salmon silt loams SaA, SaB, SaC	Poor	High	Poor	Poor to fair; erodible.	Fair	Not suitable	Poor; without treatment, will not hold water.
Steep rockland, Thorndike materials. Sb	Fair	Low	Fair	Poor; little soil material.	Not suitable	Not suitable	Not suitable; soil too shallow.
Stetson gravelly loams SgA, SgB, SgC, SgD, SgE	Good	Low	Good	Good	Fair	Good	Poor; excessive seepage.
Thorndike shaly silt loams. ThB, ThC, ThD, ThE	Fair	Low	Fair	Fair	Not suitable	Not suitable	Poor; excessive seepage and soil too shallow.
Thorndike very rocky silt loams. TkB, TkC, TkD, TkE	Fair	Low	Fair	Fair, but only between the outcrops.	Not suitable	Not suitable	Poor; excessive seepage and soil too shallow.

of the soils—Continued

is not listed in this table]—Continued

Suitability for ponds—Con.	Soil features affecting engineering practices				
Embankment	Vertical alinement in highways	Agricultural drainage	Irrigation	Diversion terraces	Waterways
Good if dry and compacted.	High water table; seepage along top of compact layer; bouldery.	High water table; slow internal movement of water.	(Not irrigated)	Wet or very wet soils.	High water table; subject to prolonged seepage.
Good if dry	High water table; bouldery.	High water table	(Not irrigated)	Wet or very wet soils.	High water table.
Fair; may slough	Slow internal movement of water; seepage and sloughing.	Fine texture; compact subsoil; high watertable; perched water table.	(Not irrigated)	Subject to erosion	Subject to erosion and seepage.
Not suitable	Unstable; high water table.	High water table; sloughing; difficult to maintain grade.	(Not irrigated)	(Not needed)	(Not needed).
Good if compacted	Seepage on cut slopes; bouldery.	(Not needed)	Moderately slow intake rate; good water-holding capacity.	Compact layer	Subject to erosion; compact layer.
Good; stable when compacted.	Seepage on cut slopes; bouldery.	(Not needed)	Moderate intake rate; good water-holding capacity.	Compact layer	Subject to erosion; compact layer.
Good; stable when compacted.	Seepage on cut slopes; bouldery.	(Not needed)	(Not irrigated)	Compact layer	Subject to erosion; compact subsoil.
Good; stable when compacted.	Seepage on cut slopes; bouldery.	(Not needed)	(Not irrigated)	Compact layer	Subject to erosion; compact subsoil.
Fair	High water table	High water table; unstable cut banks.	(Not irrigated)	Seepage	Continuous flow from high water table.
Not suitable	Channels usually flooded.	(Not needed)	(Not irrigated)	(Not needed)	(Not needed).
Fair to poor; unstable.	Subject to erosion and sloughing. on cut slopes.	(Not needed)	(Not irrigated)	Subject to erosion	Subject to erosion.
Not suitable; inadequate strength and stability and too shallow.	Shallow to bedrock.	(Not needed)	(Not irrigated)	Steep slopes; shallow to bedrock.	Steep-slopes; shallow to bedrock.
Poor; rapidly permeable.	No unfavorable features.	(Not needed)	Moderately high intake rate; fair water-holding capacity.	Loose substrata	Subject to erosion; loose subsoil.
Not suitable; inadequate strength and stability.	Shallow to bedrock	(Not needed)	Moderately high intake rate; fair water-holding capacity.	Shallow to bedrock.	Shallow to bedrock.
Not suitable; soil too shallow.	Shallow to bedrock	(Not needed)	(Not irrigated)	Shallow to bedrock.	Shallow to bedrock.

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TABLE 5.—*Engineering interpretations*

[Made land is too variable to rate for engineering work and

Soil and map symbols	Adaptability to winter grading	Susceptibility to frost action	Suitability of soil material for—		Suitability as source of—		Suitability for ponds
			Road subgrade	Road fill	Topsoil	Sand and gravel	Reservoir
Thorndike extremely rocky silt loam. TrE	Fair	Low	Fair	Poor	Not suitable	Not suitable	Poor; excessive seepage and soil too shallow.
Thorndike and Howland soils. TsB, TsC	See Thorndike or Howland soils for engineering interpretations for the specific soil area.						
Winooski silt loam Wn	Poor	High	Fair	Fair	Good	Not suitable	Poor; periodic high water table and subject to flooding.

Soils formed from slack-water deposits of silts and clays do not make good foundations because they are fine textured and the water table is near the surface. Roads should be built on embankments over such soils, but this may not be practical, especially if good material is not available. If wet, fine-textured soil material is used in the subgrades or in the embankments, the moisture content must be reduced so that it is only slightly above optimum. Otherwise, adequate compaction cannot be obtained. The gradeline should be kept above the water table.

Peat and muck are not suitable for use as foundations for roads or other engineering structures because of the low strength of the material. Because the water table is normally high, these organic soils are subject to subsidence and shrinkage. Roads should be alined to avoid deep muck. Peat and muck within a cut section of a roadway and in embankment sites should be wasted or removed and replaced by suitable soil material. Some areas of Peat and muck may be too small to be shown on the soil map.

Construction of roads on river terraces ordinarily involves a minimum of earthwork, except where the road rises to a high terrace or into the uplands. On terraces and on alluvial bottoms, the gradeline should be kept above the level reached by the highest floods.

Gravelly soils, if properly compacted, form good subgrades for roads. Road construction in glacial outwash generally requires somewhat less earthwork than in other deposits.

All topsoil that contains too much organic matter should be removed in constructing embankments.

Soil and Water Conservation Work

In the survey area, the principal engineering practices and structures used to conserve soil and water are agricultural drainage, irrigation, farm ponds, diversions, and waterways.

Some of the soils derived from glacial till are underlain by a compact, platy substratum that retards the movement of water. When planning to install irrigation systems in these soils or in the soils that are shallow to bedrock, careful investigation is necessary because of the limited depth of tillable soil. Furthermore, seepage usually occurs along the top of this compact layer and results in wet spots. Interception drains—both diversion terraces and subsurface drains—may be required.

Most of the soils in the survey area that formed in glacial till are slowly permeable and are suitable for the construction of farm ponds. Some of these soils, such as the Caribou, Conant, and Easton, however, contain sand lenses that may cause excess seepage from the reservoir. These sand lenses may also cause piping and unstable conditions for the installation of drainage structures.

The soils that formed in glacial outwash, as a rule, are composed of larger particles than the soils derived from glacial till, and they are more permeable. If farm ponds to store water above ground are planned for soils derived from glacial outwash, a sealing agent should be used to prevent seepage of water from the reservoir. In places where the water table is close to the surface of these soils, ponds dug to store water below the ground surface have been successful. When installing open ditches or subsurface drains, care is necessary where there are layers of ungraded silts, fine sands, or sands because these layers are subject to erosion, sloughing, and slumping. Subsurface drainage systems installed in such layers must be protected by filters that prevent their being plugged by silts and fine sands. The soils derived from glacial outwash are normally droughty and have a low water-holding capacity. These factors should be considered when planning an irrigation system.

Soil Series and Mapping Units

In this section the soil series and the mapping units (individual soils) in the survey area are described in approximate alphabetic order. The acreage of the mapping units and their proportionate extent are shown in table 6, and their location can be seen on the detailed map at the back of this report.

of the soils—Continued

is not listed in this table]—Continued

Suitability for ponds—Con.	Soil features affecting engineering practices				
Embankment	Vertical alinement in highways	Agricultural drainage	Irrigation	Diversion terraces	Waterways
Not suitable; soil too shallow.	Shallow to bedrock	(Not needed)	(Not irrigated)	Steep slopes; shallow to bedrock.	Steep slopes; shallow to bedrock.
Fair; if well compacted and dry.	Subject to overflow; periodic high water table.	High water table; flooding.	Moderate intake rate; good water-holding capacity.	(Not needed)	Subject to flooding.

The discussion of each soil series contains a description of a representative profile. In forested areas, the uppermost layer of the profile consists of organic matter and is identified by the symbol A_0. In cultivated fields, the uppermost layer is the A_p horizon (plow layer).

Each horizon of the profile from the surface downward through the parent material is described. Such characteristics as texture, color, thickness, structure, consistence, and kind of boundary are mentioned. Soil reaction is given if there is a wide variation between acidity of the surface layer and lowest horizon in the profile. The percentage of coarse fragments, where listed, is the percentage by volume. Unless otherwise specified, colors are given for moist soil. Symbols following the names of colors are Munsell color notations indicating hue, value, and chroma. The depth ranges at the beginning of the description of a horizon are of the profile sampled. Variations in depth ranges, as observed in many locations, are given at the end of the description of a horizon.

Each mapping unit within a series is described in relation to the representative profile of the series or to other soils within the series. A symbol following the name of the mapping unit is used to identify the areas on the detailed map. General use and management are described for mapping units. The more productive soils are described as producing good or high yields of suitable crops. In general, high yields indicate consistently superior production. In the description of each mapping unit, there is a reference to the capability unit to which that mapping unit belongs. The capability units are described in the section "Use and Management of the Soils."

Some of the mapping units are not classified within soil series but are mapped as miscellaneous land types. Examples of these are Made land and Mixed alluvial land.

To describe the soils in detail, the soil scientists have used some technical terms, such as *bleicherde*, *orterde*, *monosequal*, *sequum*, *eluvial*, and *illuvial*. Definitions of these terms, as well as other technical terms, are given in the Glossary at the back of the report. Also in the Glossary are definitions of the various horizons in the soil profile. The section "How Soils Are Named, Mapped, and Classified" tells how the soil survey was made.

Allagash Series

The Allagash series consists of well-drained sandy soils on stream terraces, mainly along the St. John and Aroostook Rivers but also along other streams. The soils are generally 3 feet thick over stratified sand and gravel or coarse sand. The sand was derived mainly from shale, slate, and sandstone, but a small part of it was derived from granite and limestone.

The surface layer in cultivated areas ranges from very dark grayish brown to dark yellowish brown. Along the St. John River, the soils are generally dark grayish brown and have a discontinuous, gray A_2 horizon just below plow depth. In spots where the profile has an A_2 horizon, the B_{21} horizon is normally firm and is strong brown to yellowish red.

Where undisturbed, the soils have thin A_1 and A_2 horizons, each of which ranges from 2 to 10 inches in thickness. The A_2 horizon has very irregular boundaries and ranges from gray to nearly white. The B_{21} horizon is generally strong brown in soils along the St. John River and yellowish brown in soils along the Aroostook River. In some places the B_{21} horizon contains concretions or is slightly cemented.

Allagash soils have very fine sandy loam or sandy loam B horizons in contrast to the Salmon soils, which have silt loam B horizons. Both soils may be on the same river terraces, however.

The Allagash soils are in the same catena as the moderately well drained to somewhat poorly drained Madawaska soils, which occur in slight depressions on the same stream terraces. They are also associated with the poorly drained Fredon and the very poorly drained Halsey soils, which are generally underlain by gravel. The Allagash soils have developed under mixed softwood and hardwood forests.

Allagash soils are easy to farm early in spring. They are seldom compacted, even though worked when wet. They hold only a moderate amount of water for plants. Crop yields are seldom reduced, however, because rainfall is well distributed throughout the growing season.

TABLE 6.—*Approximate acreage and proportionate extent of the soils*

Mapping units	Acres	Percent
Allagash fine sandy loam, 0 to 2 percent slopes	280	[1]
Allagash fine sandy loam, 2 to 8 percent slopes	6, 400	0. 4
Allagash fine sandy loam, 8 to 15 percent slopes	4, 400	. 3
Allagash fine sandy loam, 15 to 35 percent slopes	700	[1]
Benson silt loam, 0 to 8 percent slopes	240	[1]
Benson silt loam, 8 to 15 percent slopes	290	[1]
Benson silt loam, 15 to 25 percent slopes	160	[1]
Canandaigua silt loam, thin solum, 0 to 8 percent slopes	8, 400	. 6
Caribou gravelly loam, 0 to 2 percent slopes	2, 500	. 2
Caribou gravelly loam, 2 to 8 percent slopes	94, 500	6. 2
Caribou gravelly loam, 8 to 15 percent slopes	27, 500	1. 8
Caribou gravelly loam, 8 to 15 percent slopes, eroded	4, 700	. 3
Caribou gravelly loam, 15 to 25 percent slopes	4, 400	. 3
Caribou gravelly loam, 15 to 25 percent slopes, eroded	1, 800	. 1
Caribou gravelly loam, 25 to 45 percent slopes	1, 300	. 1
Conant silt loam, 0 to 2 percent slopes	4, 100	. 3
Conant silt loam, 2 to 8 percent slopes	46, 800	3. 1
Conant silt loam, 8 to 15 percent slopes	1, 600	. 1
Daigle silt loam, 0 to 2 percent slopes	230	[1]
Daigle silt loam, 2 to 8 percent slopes	5, 200	. 3
Daigle silt loam, 8 to 15 percent slopes	700	[1]
Easton and Washburn silt loams, 0 to 2 percent slopes	33, 000	2. 2
Easton and Washburn silt loams, 2 to 8 percent slopes	11, 600	. 8
Easton and Washburn stony silt loams, 0 to 8 percent slopes	2, 250	. 1
Fredon and Halsey silt loams, 0 to 2 percent slopes	1, 900	. 1
Fredon and Halsey silt loams, 2 to 8 percent slopes	610	[1]
Hadley silt loam, level	610	[1]
Hadley silt loam, undulating	2, 150	. 1
Howland gravelly loam, 0 to 2 percent slopes	1, 800	. 1
Howland gravelly loam, 2 to 8 percent slopes	131, 800	8. 7
Howland gravelly loam, 8 to 15 percent slopes	22, 600	1. 5
Howland very stony loam, 0 to 8 percent slopes	118, 600	7. 8
Howland very stony loam, 8 to 15 percent slopes	2, 550	. 2
Machias gravelly loam, 0 to 2 percent slopes	1, 300	. 1
Machias gravelly loam, 2 to 8 percent slopes	4, 700	. 3
Machias gravelly loam, 8 to 15 percent slopes	330	[1]
Madawaska fine sandy loam, 0 to 2 percent slopes	150	[1]
Madawaska fine sandy loam, 2 to 8 percent slopes	800	. 1
Madawaska fine sandy loam, 8 to 15 percent slopes	85	[1]
Made land	1, 450	. 1
Mapleton shaly silt loam, 0 to 8 percent slopes	6, 500	. 4
Mapleton shaly silt loam, 8 to 15 percent slopes	8, 200	. 5
Mapleton shaly silt loam, 8 to 15 percent slopes, eroded	750	[1]
Mapleton shaly silt loam, 15 to 35 percent slopes	2, 450	. 2
Mapleton very rocky silt loam, 0 to 15 percent slopes	450	[1]
Mapleton very rocky silt loam, 15 to 35 percent slopes	600	[1]
Mixed alluvial land	18, 100	1. 2
Monarda and Burnham silt loams, 0 to 2 percent slopes	98, 500	6. 5
Monarda and Burnham silt loams, 2 to 8 percent slopes	169, 100	11. 1
Monarda and Burnham very stony silt loams, 0 to 8 percent slopes	48, 400	3. 2
Nicholville silt loam, 0 to 2 percent slopes	290	[1]
Nicholville silt loam, 2 to 8 percent slopes	850	. 1
Peat and muck	25, 500	1. 7
Perham gravelly silt loam, 0 to 2 percent slopes	180	[1]
Perham gravelly silt loam, 2 to 8 percent slopes	20, 800	1. 4
Perham gravelly silt loam, 8 to 15 percent slopes	6, 400	. 4
Perham gravelly silt loam, 15 to 25 percent slopes	500	[1]
Plaisted gravelly loam, 0 to 2 percent slopes	110	[1]
Plaisted gravelly loam, 2 to 8 percent slopes	79, 000	5. 2
Plaisted gravelly loam, 8 to 15 percentslopes	35, 000	2. 3
Plaisted gravelly loam, 15 to 25 percent slopes	1, 400	. 1
Plaisted gravelly loam, 25 to 45 percent slopes	416	[1]
Plaisted very stony loam, 0 to 8 percent slopes	43, 400	2. 9
Plaisted very stony loam, 8 to 15 percent slopes	65, 500	4. 3
Plaisted very stony loam, 15 to 25 percent slopes	400	[1]
Plaisted very stony loam, 25 to 45 percent slopes	100	[1]
Plaisted and Howland very stony loams, 0 to 8 percent slopes	28, 600	1. 9
Plaisted and Howland very stony loams, 8 to 15 percent slopes	25, 100	1. 7
Red Hook and Atherton silt loams, 0 to 2 percent slopes	650	[1]
Red Hook and Atherton silt loams, 2 to 8 percent slopes	400	[1]
Riverwash	35	[1]
Salmon silt loam, 0 to 2 percent slopes	230	[1]
Salmon silt loam, 2 to 8 percent slopes	850	. 1
Salmon silt loam, 8 to 15 percent slopes	330	[1]
Steep rockland, Thorndike materials	4, 400	. 3
Stetson gravelly loam, 0 to 2 percent slopes	1, 700	. 1
Stetson gravelly loam, 2 to 8 percent slopes	17, 400	1. 1
Stetson gravelly loam, 8 to 15 percent slopes	8, 600	. 6
Stetson gravelly loam, 15 to 25 percent slopes	2, 750	. 2
Stetson gravelly loam, 25 to 45 percent slopes	550	[1]
Thorndike shaly silt loam, 0 to 8 percent slopes	30, 400	2. 0
Thorndike shaly silt loam, 8 to 15 percent slopes	79, 500	5. 2
Thorndike shaly silt loam, 15 to 25 percent slopes	70, 600	4. 7
Thorndike shaly silt loam, 25 to 45 percent slopes	12, 800	. 8
Thorndike very rocky silt loam, 0 to 8 percent slopes	90	[1]
Thorndike very rocky silt loam, 8 to 15 percent slopes	3, 900	. 3
Thorndike very rocky silt loam, 15 to 25 percent slopes	6, 900	. 5
Thorndike very rocky silt loam, 25 to 45 percent slopes	5, 350	. 4
Thorndike extremely rocky silt loam, 15 to 45 percent slopes	1, 250	. 1
Thorndike and Howland soils, 0 to 8 percent slopes	5, 600	. 4
Thorndike and Howland soils, 8 to 15 percent slopes	11, 900	. 8
Winooski silt loam	3, 850	. 3
Small bodies of water ordinarily included in land area	6, 200	. 4
Total	1, 517, 316	100. 0

[1] Less than 0.1 percent.

The soils lie close to streams, so water is available for irrigation. Dry periods occur during some years, and at these times irrigation will increase crop yields.

Representative profile—Allagash fine sandy loam, 0 to 2 percent slopes (cultivated):

A_p 0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; moderate, fine, granular structure; friable; less than 5 percent coarse fragments; abrupt, smooth boundary; 7 to 12 inches thick.

B_{21} 8 to 12 inches, strong-brown (7.5YR 5/8) fine sandy loam; moderate, fine, granular structure; firm in place; few concretions or cemented particles; less than 5 percent coarse fragments; strongly acid; clear, wavy boundary; 1 to 4 inches thick.

B_{22} 12 to 16 inches, yellowish-brown (10YR 5/6) fine sandy loam; weak, fine, granular structure; friable; less than 5 percent coarse fragments; strongly acid; clear, wavy boundary; 3 to 6 inches thick.

B_3 16 to 21 inches, light olive-brown (2.5Y 5/6) sandy loam; weak, fine, granular structure; loose; less than 10 percent coarse fragments; strongly acid; clear, wavy boundary; 3 to 8 inches thick.

C 21 to 36 inches, olive-gray (5Y 5/2) and olive-yellow (5Y 6/8) sand; single grain; loose; less than 15 percent coarse fragments; clear, wavy boundary; 10 to 20 inches thick.

D 36 to 96 inches +, olive-gray (5Y 5/2), stratified sand and gravel derived dominantly from slate and quartzite.

Allagash fine sandy loam, 0 to 2 percent slopes (AgA).—A profile of this soil is described as representative of the series. When maintained in good condition, the soil holds in the top 30 inches of the profile from 3.5 to 4 inches of water that is available to plants. When in poor condition, which often results from too intensive growing of potatoes, the soil is slightly droughty.

This soil is nearly level, so runoff and erosion are not problems. Although the areas are close to streams, the water table is generally 5 feet or more below the surface.

Included with this soil is a soil that contains some gravel in the upper layers or in the C horizon.

The areas of Allagash fine sandy loam, 0 to 2 percent slopes, are small, and few can be managed as separate fields. They can be used intensively for potatoes if a green-manure or soil-building crop is grown occasionally. Capability unit IIc–5.

Allagash fine sandy loam, 2 to 8 percent slopes (AgB).—Most of this gently undulating soil is cultivated, and it has a profile similar to that described for the series.

Some of the soil is forested and has a thin A_1 horizon over a gray fine sandy loam A_2 horizon that ranges from 2 to 10 inches in thickness. Below the A_2 horizon is a B_{21} horizon, about 3 inches thick. The B_{21} horizon and the underlying horizons are similar to those described in the representative profile of the series.

Included with Allagash fine sandy loam, 2 to 8 percent slopes, is a soil that contains a small percentage of gravel but that responds to similar use and management.

Allagash fine sandy loam, 2 to 8 percent slopes, produces good yields of grass and clover. For high yields of forage, fertilizer should be applied in at least two applications. The soil is permeable, and nitrogen fertilizer applied early in spring will leach out by midsummer. Potatoes produce good yields if the organic-matter content of the soil is kept high. Erosion is seldom a problem, but, wherever possible, this soil should be farmed in strips on the contour. This permits the soil to absorb most of the summer rainfall and to produce high yields.

Forested areas contain mainly pine, fir, and northern hardwoods. It usually is easy to get pine established because hardwoods offer only limited competition. Year-round logging roads are easily built and maintained. Lumbering can be done throughout the year. Capability unit IIe–5.

Allagash fine sandy loam, 8 to 15 percent slopes (AgC).—Several hundred acres of this moderately steep soil are cultivated, and in these areas the profile is similar to that described as representative for the series.

Some of the soil is forested and has a thin A_1 horizon over a gray fine sandy loam A_2 horizon that ranges from 2 to 10 inches in thickness. Below the A_2 horizon is a B_{21} horizon, about 3 inches thick. The B_{21} horizon and the underlying horizons are similar to those described in the representative profile of the series.

Included with Allagash fine sandy loam, 8 to 15 percent slopes, is a soil that is only about 3 feet thick over shale bedrock, but that responds to similar use and management.

Allagash fine sandy loam, 8 to 15 percent slopes, produces good yields of grass and clover. For high yields of forage, fertilizer should be applied in at least two applications. The soil is permeable, and nitrogen fertilizer applied early in spring will leach out by midsummer. Potatoes produce good yields if the organic-matter content of the soil is kept high. Erosion is seldom a problem, but, wherever possible, the soil should be farmed in strips on the contour. This limits erosion and permits the soil to absorb most of the summer rain and thereby produce high yields. On long slopes, diversion ditches are needed to control runoff and further limit the hazard of severe erosion.

Forested areas contain mainly spruce, fir, pine, and northern hardwoods. Lumbering can be easily done throughout the year. Logging roads should be built on the contour, and their exits should be made at an angle to the slope so as to limit the damage caused by washouts. Capability unit IIIe–5.

Allagash fine sandy loam, 15 to 35 percent slopes (AgD).—This soil occurs on terrace faces and has short, steep slopes. The areas are long and narrow and are difficult to use for row crops.

Most of this soil is used for forestry. It has a thin organic surface mat over a grayish-brown A_2 horizon, about 3 inches thick. Except for a thicker B_{21} horizon, the profile of this soil and that of the representative profile of the series are similar below the eluvial (A) horizon.

Where cultivated, the soil has a brown fine sandy loam surface layer, about 7 inches thick.

Included with this soil is a soil that has slopes of slightly more than 35 percent. The included areas are used and managed like the rest of the soil.

Allagash fine sandy loam, 15 to 35 percent slopes, produces fair yields of grass and clover, but it is difficult to harvest the forage for hay. It is very difficult to control erosion when the soil is cultivated.

Pine, spruce, fir, and northern hardwoods grow well, so on most farms this soil is best used for woodland. Capability unit VIe–5.

Atherton Series

The Atherton series consists of very poorly drained soils that have developed on acid, stratified sand and gravel derived mainly from shale, slate, and sandstone. The soils have a thick, faintly mottled A_{1g} horizon and a thin, grayish-brown, mottled A_{2g} horizon that is discontinuous in many places. The B horizons are mottled yellowish-brown and grayish-brown, acid gravelly silt loams. The structure of the B horizons is mainly weak granular, but in some areas it is platy in place and breaks to weak granular when removed. The B horizons are firm in place, but in many spots they are friable when the soil is disturbed.

Atherton soils are similar to Halsey soils in drainage but differ mainly in structure and reaction. They have granular, acid B horizons, unlike the subangular blocky, neutral or alkaline B horizons of the Halsey soils.

Except for the eastern part, the Atherton soils occur throughout the survey area. They have developed under a spruce-fir forest, and only a few acres have been cleared.

In northeastern Aroostook County, the Atherton soils are mapped with the Red Hook soils in undifferentiated units. These undifferentiated units are described under the Red Hook series.

Representative profile—Atherton silt loam, 0 to 2 percent slopes:

A_0 4 inches to 0, partly decomposed organic matter.

A_{1g} 0 to 11 inches, very dark grayish-brown (10YR 3/2) silt loam with few, fine, grayish-brown mottles; moderate, medium, granular structure; friable; acid; clear, irregular boundary; 8 to 12 inches thick.

A_{2g} 11 to 13 inches, grayish-brown (10YR 5/2) gravelly silt loam with few, fine, light yellowish-brown mottles; weak, thin, platy structure; friable; acid; clear, irregular boundary; 1 to 3 inches thick.

B_{21g} 13 to 17 inches, yellowish-brown (10YR 5/4) gravelly silt loam with common, medium, grayish-brown mottles; moderate, fine, granular structure; friable; acid; clear, wavy boundary; 3 to 6 inches thick.

B_{22g} 17 to 26 inches, light yellowish-brown (10YR 6/4) gravelly silt loam with many, fine, grayish-brown and yellowish-brown mottles; weak, fine, granular structure; firm in place, friable when removed; acid; clear, wavy boundary; 5 to 10 inches thick.

C_{1g} 26 to 32 inches, light olive-brown (2.5Y 5/4) gravelly loam with few, fine, grayish-brown and yellowish-brown mottles; weak, thin, platy structure; firm in place, friable when removed; acid; clear, wavy boundary; 5 to 10 inches thick.

D 32 to 48 inches +, light olive-brown (2.5Y 5/4) sand and gravel; single grain (structureless); loose; acid.

Benson Series

The Benson series consists of well-drained soils that are shallow to bedrock. The parent material is yellowish-brown, highly weathered limestone. As much as 80 percent of it is made up of fragments.

Benson soils are on small, abruptly rolling knolls that are scattered throughout the eastern part of the survey area. They are associated with the well-drained Caribou, moderately well drained Conant, poorly drained Easton, and very poorly drained Washburn soils.

The native vegetation was mixed hardwoods—mostly maple, beech, and birch.

Representative profile—Benson silt loam, 0 to 8 percent slopes (cultivated):

A_p 0 to 9 inches, dark-brown (10YR 4/3) silt loam; contains a few, soft, leached fragments of limestone; strong, medium, granular structure; friable; slightly acid; abrupt boundary; 7 to 10 inches thick.

B_{21} 9 to 11 inches, yellowish-brown (10YR 5/8) silt loam; contains soft, leached fragments of limestone; moderate, medium, granular structure; friable; neutral; clear boundary; 1 to 3 inches thick.

B_{22} 11 to 16 inches, yellowish-brown (10YR 5/8) silt loam; contains many, soft, leached fragments of limestone; moderate, medium, granular structure; friable; alkaline; clear boundary; 3 to 7 inches thick.

B_{23} 16 to 21 inches, yellowish-brown (10YR 5/6) silt loam; 50 percent coarse fragments, blocks of weathered limestone ½ to 2 inches in diameter that can be broken by hand; weak, fine, granular structure; friable; alkaline; wavy boundary; 3 to 6 inches thick.

C 21 to 27 inches, yellowish-brown (10YR 5/4) silt loam; 60 percent coarse fragments of limestone that has weathered in place and has seams of silt loam soil material between the weathered limestone blocks, which are ½ to 2 inches in diameter; the seams of soil material are ⅛ to ½ inch wide; the limestone has blocky structure and can be easily removed with a spade; the blocks can be cut with a knife; soil material is alkaline.

D_r 27 inches +, highly calcareous limestone.

Benson silt loam, 0 to 8 percent slopes (BeB).—This soil occurs mostly as a succession of gently undulating areas about 400 feet wide and 1,000 to 1,500 feet long. Some of it is cultivated and has the profile described as representative of the series.

Where forested, the soil has a thin covering of partly decomposed leaves and twigs over a 6- to 8-inch A_1 horizon of dark grayish-brown silt loam. Below this horizon is a B_{21} horizon of silt loam, 3 to 6 inches thick. Below a depth of about 9 inches, the profile of the forested soil and the profile of the cultivated soil are similar.

On the surface of both the forested and cultivated areas are many hard, dark-gray fragments of limestone. These fragments are about 2 inches wide, 2 inches thick, and 7 inches long. The outsides of the fragments have weathered to light gray, but the insides are dark gray. In most places the soil is 16 to 24 inches thick, but there are a few small outcrops of limestone.

The soil produces good yields of clover without applications of lime, because free lime occurs in the root zone. Erosion is seldom a problem, but, if possible, the soil should be farmed in strips on the contour. This permits the soil to absorb most of the summer rainfall, which is needed for high yields of row crops. Potatoes are commonly grown, but the reaction of the soil needs to be tested. In some places where the soil is neutral, potato scab may be a problem.

The trees in forested areas are mainly northern hardwoods. Lumbering can be easily done throughout the year. Capability unit IIe-1.

Benson silt loam, 8 to 15 percent slopes (BeC).—Some of this soil is cultivated and has a profile similar to the profile described as representative of the series. Areas of forested soil have a profile like the one of Benson silt loam, 0 to 8 percent slopes.

In most places the soil is 12 to 16 inches thick, but there are a few small outcrops of limestone. These outcrops make up about 5 percent of the surface area. Few of them extend far enough above the surface to interfere with wheeled equipment, but they are likely to damage equipment used in the preparation of seedbeds and cultivation of row crops.

Except in midsummer, the soil holds enough water to produce good yields of grass and clover. If used for potatoes, it should be farmed in graded strips. This will reduce runoff, hold more water available for the crop, and reduce the hazard of erosion. On long slopes runoff can be limited by the use of diversion ditches. The ditches must be designed to avoid rock outcrops.

Forested areas contain mainly a mixture of northern hardwoods. Lumbering can be easily done throughout the year. Capability unit IIIe–1.

Benson silt loam, 15 to 25 percent slopes (BeD).—This soil generally occurs in moderately steep areas where the slope is irregular. Some of it is cultivated and has a profile similar to the profile described as representative of the series. Areas of forested soil have a profile like the one of Benson silt loam, 0 to 8 percent slopes.

In most places the soil is 16 to 24 inches thick, but there are a few small outcrops of limestone.

Grass and clover grow rapidly early in spring, but the soil does not hold enough water for these plants in midsummer.

The intensive use of this soil for potatoes will most likely cause some erosion. Runoff is rapid, and in most places the relief is too irregular for the use of contour stripcropping.

Forested areas are mainly in northern hardwoods. Lumbering can be done fairly easily. Capability unit IVe–1.

Burnham Series

The Burnham series consists of soils that have developed on very firm, slightly acid to neutral, gravelly loam glacial till. The till was derived mainly from shale, slate, and phyllite. These very poorly drained soils occur in nearly level areas and in depressions where the water table is at the surface from 6 to 9 months of the year.

Most of these soils are forested and have rough microrelief consisting of mounds, 1 to 3 feet high, that probably resulted from windthrow of trees. The A_{1g} horizon is generally 6 to 10 inches thick, and in the mounds it is underlain by a gray, mottled A_{2g} horizon, 1 to 2 inches thick. Most low spots between the mounds have a weakly developed A_{2g} horizon, but in some places the A_{1g} is underlain by a B_{21g} horizon.

The B horizons are mottled light olive-brown and grayish-brown gravelly loams. They grade from weak, granular structure to thin, platy and are generally firm throughout. In most places the B horizons of Burnham soils lack clay films or subangular blocky structure, which are common in the Washburn soils.

The C horizon is mottled grayish-brown to olive-gray gravelly loam and grades from platy structure to massive. This till material is generally very firm and medium acid.

Most areas are very stony, and in some places the surface is nearly covered with small stones. In some areas stones, 8 to 12 inches in diameter, are scattered over the surface at intervals of 2 to 3 feet. In most places granite and sandstone boulders, 3 to 5 feet in diameter, are partly embedded in the soils at intervals of 50 to 100 feet. A few places contain only small stones, which occur at intervals of 20 to 75 feet.

The Burnham soils are members of the same catena as the well drained Plaisted, moderately well drained to somewhat poorly drained Howland, and poorly drained Monarda soils.

The Burnham soils are nearly saturated 9 months of the year. The common vegetation is black spruce, red spruce, and fir.

In northeastern Aroostook County, the Burnham soils are mapped with the Monarda soils in undifferentiated units. These undifferentiated units are described under the Monarda series.

Representative profile—Burnham very stony silt loam, 0 to 8 percent slopes (forested):

A_0 9 inches to 0, black (N 2/1) partly decomposed organic matter; acid; many stones; abrupt, smooth boundary; 3 to 10 inches thick.

A_{1g} 0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, coarse, granular structure; friable; acid; abrupt, irregular boundary; 6 to 10 inches thick.

A_{2g} 9 to 10 inches, gray (10YR 5/1) loam; a few yellowish-brown (10YR 5/6) mottles; weak, fine, granular structure; friable; acid; abrupt, irregular boundary; 0 to 2 inches thick.

B_{21g} 10 to 12 inches, mottled light olive-brown (2.5Y 5/4) and grayish-brown (10YR 5/2) gravelly loam; weak, fine, granular structure; firm in place, friable when removed; acid; 20 to 30 percent coarse fragments; abrupt, wavy boundary; 2 to 3 inches thick.

B_{22g} 12 to 16 inches, grayish-brown (10YR 5/2) gravelly loam; many yellowish-brown (10YR 5/6) mottles; weak, thin, platy structure; firm; acid; 30 to 40 percent coarse fragments; wavy boundary; 3 to 10 inches thick.

C_g 16 to 25 inches, grayish-brown (2.5Y 5/2) gravelly loam; few grayish-brown (10YR 5/2) mottles; platy structure to massive; very firm; medium acid; 30 to 40 percent coarse fragments.

Canandaigua Series

The Canandaigua series is made up of poorly drained soils that have formed on water-laid deposits. These soils occur mainly along the St. John River and the northeastern shore of Cross Lake.

The soils have a silt loam surface layer underlain by bands of silt loam and silty clay loam. They are generally calcareous at a depth of about 30 inches.

The Canandaigua soils have developed on the same kind of materials as the well drained Salmon and moderately well drained Nicholville soils.

Representative profile—Canandaigua silt loam, thin solum, 0 to 8 percent slopes (forested):

A_0 3 inches to 0, very dark grayish-brown (10YR 3/2), partly decomposed organic matter; weak, granular structure; friable; acid; clear boundary.

A_1 0 to 1 inch, very dark grayish-brown (10YR 3/2) silt loam; weak, granular structure; friable; acid; clear boundary; 1 to 2 inches thick.

B_{2g} 1 to 12 inches, light yellowish-brown (2.5Y 6/4) silt loam; coarse, light olive-brown (2.5Y 5/4) mottles; medium, granular structure; friable; neutral; diffuse boundary; 10 to 14 inches thick.

B_{3g} 12 to 15 inches, grayish-brown (2.5Y 5/2) silty clay loam; coarse, light olive-brown (2.5Y 5/4) mottles; weak, subangular blocky structure to thin, platy; plastic; alkaline; diffuse boundary; 2 to 4 inches thick.

C_{1g} 15 to 30 inches, gray (5Y 5/1) silt loam; coarse, yellowish-brown (10YR 5/8) mottles; thin, platy structure; firm; calcareous; diffuse boundary; 12 to 20 inches thick.

C_2 30 to 40 inches, gray (5Y 5/1) silt loam; thin, platy structure; firm; calcareous.

The surface layer ranges from gray to nearly black. If plowed, the soils generally have a grayish-brown surface layer. The nearly level areas are more gray than brown, and the sloping areas are more brown than gray.

Canandaigua silt loam, thin solum, 0 to 8 percent slopes (CdB).—The profile of this soil is representative for the series in northeastern Aroostook County. The surface layer and subsoil are thinner than normal for the Canandaigua series, however.

The large areas are suitable for hay or pasture. The soil produces good yields of grass, and it is fairly high in available nutrients. The structure of the soil is easily damaged. As a result, the soil should not be worked when wet. It cannot be worked early enough in spring to produce good yields of row crops. Open drains or bedding will help remove excess water from the surface and subsoil.

Spruce and fir grow in most areas. On this soil, year-round lumber roads need surface grading and drains. Lumbering can be done more easily when the soil is frozen. Capability unit IVw-7.

Caribou Series

The Caribou series consists of deep, well-drained, friable, medium-textured soils that have a firm gravelly loam subsoil (fig. 3). The soils have developed from calcareous glacial till derived from limestone and shale. The till is generally 3 to 5 feet deep over limestone and shale bedrock, and about 40 percent of it is angular fragments of shale and limestone. Many of the limestone fragments have been leached of free carbonates and can be easily broken into very fine particles. Caribou soils that occur close to streams and near the southern boundary of the survey area have subrounded gravel in the parent material and are generally 10 or more feet deep.

Caribou soils are common in the eastern part of the survey area. They occur mainly on gently rolling ridges in association with the moderately well drained Conant soils.

In most cultivated areas, the Caribou soils have a dark-brown surface horizon, but, in many freshly plowed fields, this layer has spots of lighter brown. Under forest, these soils have thin A_0, A_1, and A_2 horizons, each of which ranges from ½ to 3 inches in thickness.

Caribou soils, like the Perham soils, have bisequal profiles. To a depth of generally 16 inches, they have a sequence of horizons characteristic of Podzols. Below this depth, they have the characteristics of Gray-Brown Podzolic soils. The bisequal nature of the Caribou and Perham soils is discussed in detail in the section "Classification of the Soils." In the upper sequum, both soils are somewhat similar in color, texture, structure, and consistence. In the lower sequum, they differ in texture and structure. Here, the Caribou soils have weak, subangular blocky structure, and they are firm from a depth of about 25 inches down to the unweathered till. Perham soils, in contrast, have strong, subangular blocky structure and are very firm beginning at a depth of 30 inches. In the Caribou soils, clods in the lower part of the subsoil break into easily crushed peds, but, in the Perham soils, the clods in the lower subsoil break into peds that are brittle and snap when pressure is applied. Clay films are common in both soils but are more distinct in the B′ horizons of Perham soils. The B′ horizons in Caribou soils consist of loam, but in Perham soils they are clay loam. No polygons have developed in the Caribou soils, but they are common in the Perham soils below a depth of 30 inches.

Caribou soils were once covered by northern hardwoods, but most areas have been cleared and are now used for potatoes. Nearly all the acreage is cultivated.

Very few large stones occur on these soils. The soils dry out early in spring, but they hold a large supply of water for plants. They can be farmed as soon as they thaw. These soils are higher in natural fertility than any others in the survey area, but they need to be fertilized to produce higher yields of crops.

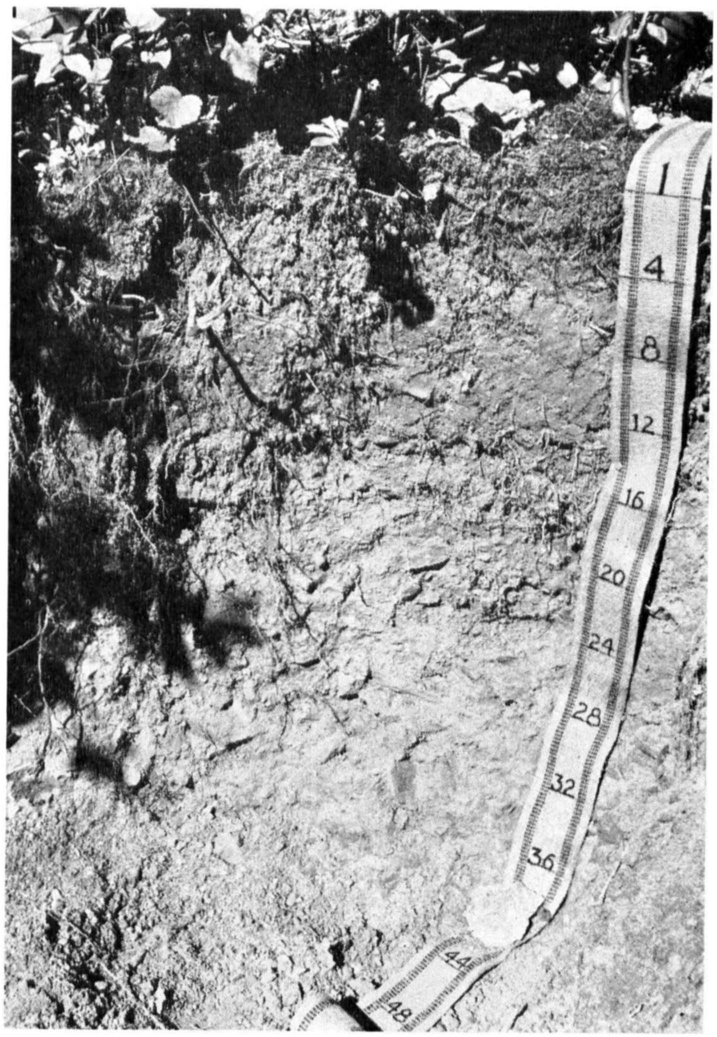

Figure 3.—Profile of Caribou gravelly loam. Plant roots are abundant in the friable uppermost 24 inches of soil.

Representative profile—Caribou gravelly loam, 2 to 8 percent slopes (cultivated):

A_p 0 to 7 inches, dark-brown (10YR 4/3) gravelly loam; weak, fine, granular structure; friable; acid; 20 percent coarse fragments; abrupt, smooth boundary; 6 to 10 inches thick.

B_{21} 7 to 10 inches, strong-brown (7.5YR 5/8) gravelly loam; weak, fine, granular structure; friable; acid; 25 percent coarse fragments; clear, wavy boundary; 3 to 10 inches thick.

B_{22} 10 to 12 inches, yellowish-brown (10YR 5/6) gravelly loam; weak, fine, granular structure; friable; acid; 25 percent coarse fragments; clear, wavy boundary; 2 to 4 inches thick.

A'_2 12 to 19 inches, light olive-brown (2.5Y 5/4) gravelly loam; weak, thin, platy structure; friable; acid; 30 percent coarse fragments; clear, wavy boundary; 5 to 10 inches thick.

B'_{21} 19 to 34 inches, dark-brown (10YR 4/3) gravelly loam; weak, fine, subangular blocky structure; firm; thin clay films on peds; acid; 35 percent coarse fragments; clear, wavy boundary; 10 to 20 inches thick.

B'_{22} 34 to 49 inches, yellowish-brown (10YR 5/4) gravelly loam; weak, coarse, subangular blocky structure; firm; thin clay films on peds; slightly acid; 40 percent coarse fragments; many weathered limestone fragments; (ghosts); clear, wavy boundary; 10 to 20 inches thick.

C 49 to 60 inches, olive-brown (2.5Y 4/4) gravelly loam; moderate, medium, platy structure in upper part but grades to massive: firm; no clay films; alkaline; 40 percent coarse fragments.

The texture of the surface layer ranges from silt loam to gravelly loam, but only the gravelly loam type is mapped in northeastern Aroostook County. Some areas are nearly free of surface gravel. Other areas have a high percentage of gravel on the surface and in the subsoil. In both the gravelly and nearly gravel-free areas, however, the management is not much different from that of the typical areas of gravelly loam.

Caribou gravelly loam, 0 to 2 percent slopes (CgA).—This nearly level soil occurs on the tops of ridges where air drainage is good and the frost-free period is a few days longer than that of other soils. It has a profile similar to that described as representative of the series. The plow layer is generally 9 to 12 inches thick, and it has less gravel than that of the more sloping Caribou soils.

During most of the growing season, the water table is 5 feet or more below the surface. Permeability is moderate, although slightly slower than for other soils in this series. Water often stands on the surface for a few hours after a heavy rain, but, during most of the growing season, water and air move freely through the soil.

Plant roots easily penetrate to a depth of 2 feet, and a few extend to 3 feet. The soil is normally firm at these depths, and only the deep-rooted, calcium-demanding plants root much below 3 feet. The upper part of the firm layer has many cracks that roots can enter.

Runoff is slow. Although a high percentage of the soil material can be suspended in moving water, this soil seldom erodes.

The plow layer usually has a pH value of 5.0 to 5.4, because the soil is often limed. Where forested, the soil usually has a pH value between 4.5 and 5.0. Below a depth of 4 feet, the soil is usually nearly neutral to alkaline and is high in calcium. In the plow layer of well-managed fields, available potassium is medium to high. Potassium may be low in a poorly managed or a forested area. Phosphorus is usually low unless the soil is fertilized. Capability unit IIc-3.

Caribou gravelly loam, 2 to 8 percent slopes (CgB).—This soil is in the limestone valley, in which the relief is mainly gently rolling. It has the largest acreage of any soil of the Caribou series. Many slopes are 1,000 feet or more long, and fields are as large as 25 to 30 acres.

A profile in a cultivated area of this soil is described as representative of the series. Some of the soil is in forest of northern hardwoods, spruce, fir, and a few white pine. Here, the soil has a very dark grayish-brown gravelly loam A_1 horizon, about 3 inches thick, over a brownish-gray gravelly loam A_2 horizon, ½ to 3 inches thick. Except for a thicker B_{21} horizon, the profile of the forested soil below the A_2 horizon is similar to that of the cultivated soil below the A_p horizon.

The water table is usually 5 feet or more below the surface, except where the soil occurs at the bases of hills. Permeability is moderate, and water moves both horizontally and vertically in the soil. Water seldom stands on the surface, even after a heavy rain. Plant roots are common at a depth of 3 feet, and some roots extend to 4 feet. At a depth of 3 feet, the soil is normally firm, but deep-rooted plants penetrate down through cracks.

Runoff is moderate in cultivated areas and moderate to slow on good pastures. The soil is erodible because 50 to 65 percent of the fine material can be suspended in moving water. The slopes are long enough that runoff water can build up to a high velocity. The content of plant nutrients and the soil reaction are similar to those described for Caribou gravelly loam, 0 to 2 percent slopes. Capability unit IIe-3.

Caribou gravelly loam, 8 to 15 percent slopes (CgC).—This soil is mainly on the sides of ridges and slopes that are mostly only 400 to 600 feet long. Much of it occurs below Caribou gravelly loam, 2 to 8 percent slopes.

The profile of cultivated soil is similar to the profile described as representative of the series. Where forested, the soil has a profile like that of forested Caribou gravelly loam, 2 to 8 percent slopes. A few areas of this soil, 4 or 5 acres in size, are surrounded by less sloping Caribou soils.

The A'_2 horizon is normally only 10 to 12 inches below the surface. This may be the result of a slight loss of surface soil or it may be that the deposit of glacial till is thinner than the deposit that normally overlies the A'_2 horizon. The upper 14 to 18 inches of soil is moderately permeable, and plant roots are distributed throughout this layer. Below this depth the soil tends to be firm and movement of water is slower. Roots, especially those of deep-rooted plants, extend into the substratum.

The water table is below 5 feet most of the year because water moves both vertically and horizontally in the soil. In some places this soil receives additional water from higher lying soils. This often results in erosion, since runoff is moderately rapid. Properly placed diversion ditches will limit loss of soil.

The content of plant nutrients and the reaction of the soil are similar to those described for Caribou gravelly loam, 0 to 2 percent slopes. Capability unit IIIe-3.

Caribou gravelly loam, 8 to 15 percent slopes, eroded (CgC2).—This soil is mainly at the bases of long slopes or has gradients in the higher part of the slope range. The profile of the cultivated soil is similar to the profile described as representative of the series. Where forested, the soil is like forested Caribou gravelly loam, 2 to 8 percent slopes, and has a similar profile.

The plow layer is a mixture of the A'_2 and B'_{21} horizons. It is normally heavier textured and holds less water available for plants than the original plow layer. This eroded soil holds only about 2.5 inches of available water per foot. An uneroded soil of the same type holds about 3 to 4 inches per foot. The surface is nearly covered with shale fragments, 1 to 4 inches long.

Permeability is moderately slow in both the surface layer and the underlying material. Also, the soil is readily compacted, which reduces the pore space and the water-holding capacity. Plant roots can readily enter the plow layer, but they are slightly impeded by the firm soil below plow depth.

The plow layer contains a high percentage of silt and clay particles, which are readily suspended in moving water. Because of this and the moderately slow permeability, the soil is more susceptible to erosion than the uneroded Caribou soils. This soil needs to be kept in sod or farmed in contour strips that are protected by diversion ditches. The content of available nitrogen, phosphorus, and potassium is variable, but in most places the present plow layer is high in calcium. In some places the soil pH is 5.8 to 6.5. Capability unit IVe–3.

Caribou gravelly loam, 15 to 25 percent slopes (CgD).—Most of this soil lies just above the narrow stream valleys that separate the ridges on which there are other Caribou soils. In many of the valleys, there are small glacial-outwash deposits of sand and gravel. This soil formed in some of this water-worked material that was pushed up the sides of the ridges and mixed with other material. Therefore, the substratum is about 50 percent gravel. The plow layer and subsoil normally contain 20 to 30 percent gravel. The profile of cultivated soil is similar to the profile described as representative of the series. Where forested, the soil is like forested Caribou gravelly loam, 2 to 8 percent slopes, and has a similar profile.

Permeability is moderate. Runoff is rapid, and the soil is slightly droughty unless the amount of runoff has been reduced by the growing of permanent vegetation. Plant roots, especially roots of trees and deep-rooted legumes, extend to a depth of 4 to 5 feet. The percentage of silt and gravel is low, and only a small part of the soil can be suspended in moving water. The areas are steep, however, and runoff water carries particles of sand down the slopes and erodes unprotected areas. Contour stripcropping and diversion ditches will limit erosion and conserve water for plants.

In cultivated areas the surface soil is usually pH 5.4 to 5.6, and in forested areas the soil below the organic and A_2 horizons is usually pH 5.4. The content of available phosphorus and potassium is usually medium; the content of potassium is generally slightly higher. Below a depth of 3 feet, the soil is slightly acid to neutral. Capability unit IVe–3.

Caribou gravelly loam, 15 to 25 percent slopes, eroded (CgD2).—This soil occurs in the same general area as Caribou gravelly loam, 15 to 25 percent slopes, and has a similar subsoil and substratum. The present plow layer is made up of the original A'_2 and B'_{21} horizons. It contains much gravel and holds less water available for plants than the original plow layer.

Except for the effects of erosion, this soil has a profile similar to that described for the series. Where forested, the soil is like forested Caribou gravelly loam, 2 to 8 percent slopes, and has similar profile characteristics.

Because of the small acreage and many limiting factors, this soil probably should be planted to trees, although deep-rooted legumes could be grown. Capability unit VIe–3.

Caribou gravelly loam, 25 to 45 percent slopes (CgE).—This soil has short, steep slopes, and it occurs mainly on the ridges above streams and on abrupt breaks next to river terraces. It generally has 20 to 30 percent gravel in the surface layer and subsoil and 40 to 50 percent gravel in the substratum.

The soil has a profile similar to that described as representative of the series. Where forested, the soil is like forested Caribou gravelly loam, 2 to 8 percent slopes, and has similar profile characteristics.

Permeability is moderate in both the surface layer and subsoil. Runoff is rapid. Only a small amount of rainfall penetrates the soil during summer. Most plant roots usually penetrate the surface layer and subsoil, but those of trees and deep-rooted legumes go into the substratum. The subsoil is usually neutral in reaction, and the substratum is alkaline. Available calcium is high in the subsoil. The content of plant nutrients in the surface layer is variable. Capability unit VIe–3.

Conant Series

The Conant series consists of moderately well drained, medium-textured soils that have developed on firm, calcareous glacial till. The till was derived mainly from a mixture of weathered limestone and shale. It is generally 4 to 6 feet thick over dark-gray shale or limestone bedrock. The Conant soils are common in the east-central part of the survey area.

The surface layer of the cultivated soils is dark-brown to grayish-brown silt loam. Where forested, the soils have an organic mat, about 4 inches thick, over a thin, nearly black A_1 horizon and a grayish-brown loam A_2 horizon, about 3 inches thick. These are eluvial horizons that developed over a B_{21} horizon of dark-brown loam. In cultivated areas the B_{21} horizon is usually mixed with the overlying eluvial horizons. In both cultivated and forested areas, the soils have a B_2 horizon of dark-brown loam.

On the surface of forested areas, there are a few stones that range from 6 to 18 inches in diameter. These occur at intervals of about 100 to 150 feet.

The Conant soils have bisequal profiles. The lower illuvial (B′) horizon is higher in clay than the upper illuvial (B) horizon. The B'_{21gm} horizon has subangular blocky structure and is composed of firm, brittle peds. This horizon is a fragipan, but water moves through cracks in the layer.

Conant soils have formed in depressions in association with the well-drained Caribou soils. A nearly neutral or slightly alkaline, olive-brown subsoil distinguishes the Conant soils from the Howland soils, which have an acid, yellowish-brown subsoil.

Forested areas contain mixed hardwoods and softwoods, mainly maple, birch, spruce, and fir. In some places there are a few white pine.

These soils are productive, and they respond well to good management. Many crops can be grown without artificial drainage, but drainage is needed for crops that must be planted early in spring. The soils are nearly as high in natural fertility as the Caribou soils, but they require fertilization for high yields. In most areas the subsoil of Conant soils is neutral in reaction, but the plow layer is usually acid. Small applications of lime are necessary for good yields of most crops.

These soils are moderately wet, and they commonly occur in small areas in large, well-drained fields. As a result, work may be delayed on entire fields for several days.

Representative profile—Conant silt loam, 2 to 8 percent slopes (cultivated):

A_p 0 to 10 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; very friable; acid; 20 percent coarse fragments; abrupt, smooth boundary; 6 to 12 inches thick.

B_2 10 to 13 inches, dark-brown (7.5YR 4/4) fine gravelly loam; weak, fine, granular structure; friable; acid; 20 percent coarse fragments; clear, wavy boundary; 2 to 6 inches thick.

A'_{2g} 13 to 17 inches, light olive-brown (2.5Y 5/4) fine gravelly loam with a few, fine, faint, grayish-brown (10YR 5/2) mottles; weak, thin, platy structure; friable; acid; 20 percent coarse fragments; clear, wavy boundary; 3 to 12 inches thick.

B'_{21gm} 17 to 35 inches, olive-brown (2.5Y 4/4) loam with a few, fine, distinct, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles prominent on faces of polygons; moderate, coarse, subangular blocky structure; very firm, brittle; clay films on peds; pore channels stained brown; slightly acid; 15 percent coarse fragments; clear, wavy boundary; 10 to 25 inches thick.

B'_{22g} 35 to 45 inches, light olive-brown (2.5Y 5/4) fine gravelly loam with a few, fine, distinct, grayish-brown (10YR 5/2) mottles; weak, thin, platy structure; firm, slightly plastic; clay films on peds; neutral; 25 percent coarse fragments; clear, wavy boundary; 5 to 15 inches thick.

C 45 to 60 inches, light olive-brown (2.5Y 5/4) fine gravelly loam; massive (structureless); firm; calcareous; 30 percent coarse fragments.

These moderately well drained soils vary in degree of wetness. In some places the profiles show only slight evidence of restricted drainage.

Conant silt loam, 0 to 2 percent slopes (CoA).—The surface layer of this nearly level soil is slightly thicker than that of the profile described as representative of the series. The soil occurs in slight depressions, and a small amount of silt washes into the areas whenever higher lying areas are left bare late in spring.

This soil is used for potatoes, peas, small grains, and hay. It is easy to farm but cannot be worked early in spring. It is the only soil of the Conant series that can be farmed continuously to a row crop without serious loss of soil.

Excess surface water can be removed through tile drains or open ditches. Tile drains are usually preferred because they do not interfere with farming. Capability unit IIw–4.

Conant silt loam, 2 to 8 percent slopes (CoB).—Most of this gently sloping soil is cultivated, but several thousand acres are forested. A profile of cultivated soil is described as representative of the series.

Where forested, the soil has a thin A_1 horizon and a grayish-brown silt loam A_2 horizon, about 3 inches thick. Below this is a dark-brown silt loam B_{21} horizon, 2 to 5 inches thick. Below a depth of about 8 inches, the profiles of the forested soil and the cultivated soil are similar.

This soil can be used for hay or pasture; grass and clover usually produce good yields without artifical drainage. In some years it can be used for potatoes, but higher yields of all crops can be obtained if the soil is drained. Fieldwork is often delayed until late in spring because the soil is wet. This soil can be drained with tile, which is fairly easy to install. There are a few stones in the subsoil. Very few of them are more than 2 feet in diameter, and they can easily be removed. On long slopes the soil should be farmed in graded strips to limit erosion.

Forested areas contain mainly spruce, fir, and a few northern hardwoods. Spruce grows well. Lumbering can be easily done in summer and in winter. Logging roads that are to be used in the spring and fall need drains and surface grading. Capability unit IIw–4.

Conant silt loam, 8 to 15 percent slopes (CoC).—About half the acreage of this moderately steep soil is cultivated, and half is forested. The soil occurs in seepage areas on the sides of hills. The profile of the cultivated soil is similar to that described as representative of the series.

Where forested, the soil has the same profile characteristics as are described for Conant silt loam, 2 to 8 percent slopes. Below a depth of about 8 inches, the profiles of the forested soil and the cultivated soil are similar.

Included with this soil is a soil that has slopes slightly steeper than 15 percent but that responds to similar use and management.

This soil can be used for hay or pasture, and it produces good yields of grass and clover if limed and fertilized. Unless the soil is drained, potatoes can seldom be planted until late in spring. If used in a regular rotation that includes potatoes, the soil should be farmed in graded strips that have diversion ditches. This will limit loss of soil and help remove excess water from the surface and the subsoil.

Forested areas contain mainly spruce, fir, and a few northern hardwoods. Spruce grows well. Lumbering can be easily done in summer and winter. Logging roads that are to be used in spring and fall need drains and surface grading. Capability unit IIIew–4.

Daigle Series

The Daigle series consists of somewhat poorly drained, medium-textured soils developed on firm till that is neutral in reaction. The till was derived mainly from shale, slate, and phyllite. It is usually 3 to 5 feet thick over gray shale bedrock that occurs in nearly vertical beds.

Most of these soils are on drumlinlike formations that have rock cores, but some of them are on the northern and western edges of the rolling ridges of Caribou soils. In general, the Daigle soils occur at an elevation of 650 to 750 feet above sea level.

The soils have bisequal profiles consisting of Podzols over soils resembling Gray-Brown Podzolic soils. The plow layer is dark grayish-brown silt loam that contains gravel. Much of the acreage in the towns of Wade and Perham was not cultivated until after 1918, so the original A_0, A_1, A_2, and upper B_{21g} horizons have not been thoroughly mixed. In many spots the A_2 horizon is below the A_p horizon or slightly mixed with the B_{21g} horizon.

Where forested, the soils have irregular microrelief consisting of mounds and depressions. This type of relief is not so pronounced as on poorly drained soils, but it influences the color of the soils presently cultivated. There are only a few stones in the woods. Angular shale fragments, up to 18 inches long, are present at intervals of 75 to 100 feet.

At a depth of about 12 to 18 inches, or in the A'_{2g} horizon, there are many angular shale fragments. This horizon is so stony that it is difficult to remove when digging a pit (fig. 4). Once it is removed, deeper excavation is less difficult. The A'_{2g} horizon divides the upper gravelly loam B horizon from the lower gravelly clay loam B′ horizons. The B′ horizons are very dark brown to dark brown and have subangular blocky structure and clay films on the peds. These horizons are often brittle and very firm. They have manganese and organic stains around the pores. In some places the solum extends to bedrock and the soils do not have C horizons. Where the bedrock is covered with less than about 4 feet of glacial till, the vertically bedded and shattered, gray shale has silt and clay between the seams. In places where the soils are more than 4 feet deep to bedrock, they have a C_{1g} horizon of weakly mottled, very firm silt loam or clay loam.

These soils have developed under mixed northern hardwoods and spruce-fir forests and occur in depressions in association with the Perham soils.

***Figure 4*.—Profile of Daigle silt loam. Plant roots cannot penetrate the firm layer that occurs at a depth of about 11 inches.**

Representative profile—Daigle silt loam, 2 to 8 percent slopes (cultivated):

A_p 0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; 15 to 20 percent coarse fragments; pH 5.2; abrupt boundary; 7 to 10 inches thick.

B_{2g} 8 to 11 inches, dark-brown (10YR 4/3) gravelly loam with a few, fine, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; weak, medium, granular structure; friable; 20 to 30 percent coarse fragments; pH 5.5; clear, wavy boundary; 2 to 8 inches thick.

A'_{2g} 11 to 16 inches, grayish-brown (2.5Y 5/2) loam with many, medium, grayish-brown (10YR 5/2) and dark grayish-brown (10YR 4/2) mottles; weak, thin, platy structure that breaks to weak, fine, subangular blocky; firm; thin films of silt and clay on tops of plates; 20 to 30 percent coarse fragments; pH 5.2; clear, wavy boundary; 2 to 10 inches thick.

B'_{21gm} 16 to 23 inches, very dark grayish-brown (10YR 3/2) gravelly clay loam; fine, grayish-brown (2.5Y 5/2) mottles comprise the interiors of prisms, which are 8 to 12 inches in diameter; the faces of the prisms have light brownish-gray (2.5Y 6/2) coatings of silt, bordered by dark yellowish brown (10YR 4/4); prisms are made up of moderate, medium, subangular blocky peds; very firm and brittle; films of silt and clay on tops and sides of peds; peds and pores stained with dark-brown material (organic matter or manganese oxide); 20 to 30 percent coarse fragments; pH 5.9; clear, wavy boundary; 6 to 10 inches thick.

B'_{22g} 23 to 39 inches, dark-brown (10YR 4/3) clay loam with few, fine, grayish-brown (2.5Y 5/2) mottles; moderate, fine, subangular blocky structure; very firm; a few thin films of silt and clay around the pores; 35 to 40 percent coarse fragments; pH 6.5; clear, wavy boundary; 10 to 20 inches thick.

C_{1g} 39 to 46 inches, dark-brown (10YR 4/3) heavy silt loam or clay loam with few, fine, grayish-brown (2.5Y 5/2) mottles; moderate, fine, subangular blocky structure; very firm or sticky; 30 to 40 percent coarse fragments; pH 7.4.

Daigle silt loam, 0 to 2 percent slopes (DaA).—The surface layer of this nearly level soil has received deposits that washed from higher areas, and it is 10 to 12 inches thick. In other respects the profile of the soil is like that described as representative of the series.

This soil can be used for hay or pasture. If limed and fertilized, it produces good yields of grasses and legumes. Open drains will remove excess surface water so that the soil will warm up earlier in the spring. If open drains are constructed, the soil can be used for potatoes in years of normal rainfall, though high yields cannot be produced consistently. It also can be drained with tile, but the subsoil is heavy and it drains slowly. If properly drained, the soil can be used intensively for potatoes with little erosion. Because it occurs in an area where dairy cattle are raised, it is used mainly for hay and for an occasional crop of potatoes or oats in areas that have some surface drainage. Capability unit IIw-4.

Daigle silt loam, 2 to 8 percent slopes (DaB).—Most of this gently sloping soil is cultivated, and its profile is that described as representative of the series. Where forested, the soil has a layer of organic matter, 3 to 4 inches thick, over a thin, discontinuous, nearly black A_1 horizon. Below this is a grayish-brown silt loam A_2 horizon, about 3 inches thick, underlain by a brown silt loam B_{21} horizon, also about 3 inches thick. Below a depth of about 8 inches, the profile of the forested soil is like that of the cultivated soil.

On the surface of forested areas, there is a stone about 6 to 18 inches in diameter at intervals of 75 to 100 feet. Each time fields are plowed, a few stones per acre are brought to the surface. Permeability is slow, but, because runoff is medium, water seldom stands on the surface.

The soil produces good yields of grasses and legumes and can be used for hay or pasture. If used for potatoes, it should be drained. Diversion ditches will remove most of the water from the surface and subsurface. Tile drains can be used, but the subsoil is heavy and water moves slowly to the tile. If the soil is properly drained, good yields of potatoes, oats, grass, and clover can be produced. Long slopes should be farmed in graded strips to limit loss of soil.

Forested areas contain mainly spruce, fir, maple, and birch. Spruce grows well and can be encouraged to predominate on this soil. Lumbering can be easily done in summer and winter. Farm roads that are to be used in spring and fall need drains and surface grading. Capability unit IIw-4.

Daigle silt loam, 8 to 15 percent slopes (DaC).—Most of this moderately steep soil is cultivated, and the profile is like that described as representative of the series. Where forested, the soil has a layer of organic matter, 2 to 3 inches thick, over a thin, discontinuous, nearly black A_1 horizon. Below this is a grayish-brown silt loam A_2 horizon, about 2 inches thick, underlain by a brown silt loam B_{21} horizon, about 3 inches thick. Below a depth of about 8 inches, the profiles of the forested soil and the cultivated soil are similar.

On the surface of the forested soil, there is a stone, about 6 to 8 inches in diameter, at intervals of 75 to 100 feet. Each time cultivated soil is plowed, a few stones per acre are brought to the surface. Permeability is slow, but, because runoff is medium to rapid, water seldom stands on the surface.

The soil produces good yields of grasses and legumes and can be used for hay or pasture. If used for potatoes, it should be drained. Diversion ditches will remove most of the water from the surface and subsurface. Tile drains can be used, but the subsoil is heavy and water moves slowly to the tile. If the soil is properly drained, good yields of potatoes, oats, grass, and clover can be produced. Long slopes should be farmed in graded strips to limit loss of soil.

Forested areas contain mainly spruce, fir, maple, and birch. Spruce grows well and can be encouraged to predominate on this soil. Lumbering can be easily done in summer and winter. Farm roads that are to be used in the spring and fall need drains and surface grading. Capability unit IIIew-4.

Easton Series

The soils of the Easton series have developed on firm, moderately calcareous, moderately fine textured till. The till was derived mainly from calcareous, dark-gray shale and sandstone. The soils are poorly drained and occur in low, nearly level depressions between the rolling hills in the eastern part of the survey area. They extend from the town of Blaine north to Van Buren and also from the Canadian border on the east to the town of Wade.

The plow layer ranges from dark brown to very dark brown because of the mixing of the A_1 and A_{2g} horizons. The variation in color has resulted from the leveling of the mounds that occurred in areas formerly forested. In wooded areas there are mounds, 1 to 3 feet high and 1 to 10 feet apart. The soil in the mounds has a thick, light olive-brown A_{2g} horizon, and the soil in slight depressions between the mounds has a thin, grayish-brown A_{2g} horizon.

Spruce and fir grow on these soils; the larger trees and a few pines grow on the mounds.

The Easton soils are poorly drained, like the Monarda soils, but their B_{2g} horizons are higher in clay, and the peds have films of silt and clay. The B_{2g} horizons in the Easton soils have subangular blocky structure and are usually neutral to calcareous; whereas, the same horizons in the Monarda soils have granular to platy structure and are seldom more than pH 6.8.

Easton soils have developed on the same kind of parent material as the very poorly drained Washburn and are members of the same catena. They are not quite so wet as the Washburn soils and have a thinner A_1 horizon. Easton and Washburn soils and the well-drained Caribou and moderately well drained Conant soils are closely associated in the same general areas and have formed on similar parent material.

Representative profile—Easton silt loam, 0 to 2 percent slopes (cultivated):

A_p 0 to 10 inches, very dark brown (10YR 2/2) silt loam; gray (2.5Y 5/1) when dry; strong, coarse and fine, granular structure; very friable; pH 5.5; abrupt, smooth boundary; 8 to 12 inches thick.

A_{2g} 10 to 14 inches, grayish-brown (2.5Y 5/2) silt loam; moderate, thick to very thick, platy structure; firm in place, friable when removed; interiors of peds have fine, faint, olive-brown mottles; 10 to 20 percent coarse fragments; pH 6.0 to 6.3; abrupt, smooth boundary; 2 to 12 inches thick.

B_{21g} 14 to 22 inches, mottled heavy loam with common, medium, distinct mottles of yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and gray (2.5Y 5/1) in about a 40-40-20 proportion; weak, very coarse, gray prisms made up of moderate, very coarse, angular blocky peds; firm in place, slightly sticky and plastic when wet; pH 6.5 to 7.0; 15 to 20 percent coarse fragments; clear, smooth boundary; 6 to 10 inches thick.

B_{22g} 22 to 32 inches, similar to horizon just described but is not prismatic and has very weak, blocky structure; contains many brown, soft, leached, calcareous fragments of shale; gradual, smooth boundary; 8 to 12 inches thick.

B_{23g} 32 to 43 inches, similar to horizon just described but has very weak, coarse, angular blocky to very blocky and thick, platy structure; 30 to 40 percent coarse fragments of shale and quartzite; abrupt, smooth boundary; 6 to 14 inches thick.

C 43 to 54 inches, olive-brown (2.5Y 4/4) gravelly silt loam; contains less clay than B horizons; not mottled; moderate, medium, platy structure; firm in place, friable when removed; 20 to 40 percent coarse fragments; moderately calcareous.

Easton and Washburn silt loams, 0 to 2 percent slopes (EaA).—The Easton soil in this undifferentiated unit has a profile like that described as representative of the Easton series, and the Washburn soil has a profile like that described under the Washburn series.

The Washburn and Easton soils differ little in relief, and so the two soils can seldom be identified except by examination of the profile. Because of their similarity, the soils have not been mapped separately. More than half of the acreage in this mapping unit consists of Easton soil.

For 9 months of the year, the water table is about 1 foot below the surface. Both permeability and runoff are slow, so it is difficult to manage these soils for crops.

A small acreage of the Easton soil is used for hay and pasture—less than that of Easton and Washburn silt loams, 2 to 8 percent slopes. Few cleared fields contain Washburn soil. Forested areas generally are made up of both Easton and Washburn soils. Most of the acreage has a cover of red spruce and fir, but some areas of the Washburn soil produce mainly black spruce. The trees are shallow rooted, even in the Easton soil. Capability unit IVw–3.

Easton and Washburn silt loams, 2 to 8 percent slopes (EaB).—The Easton soil in this undifferentiated unit has a profile like that described as representative of the Easton series, and the Washburn soil has a profile like that described under the Washburn series. These soils are undulating or gently sloping and have slow to medium runoff. The water table is usually close to the surface. The Easton soil can be drained, but even then it cannot be worked until late in spring or early in summer.

Most cultivated areas are made up of Easton soil, but forested areas generally contain both Easton and Washburn soils. Only a few hundred acres have been cleared, but most of the acreage has stands of spruce and fir. Capability unit IVw–3.

Easton and Washburn stony silt loams, 0 to 8 percent slopes (EsB).—The Easton soil in this undifferentiated unit has a profile similar to that described as representative of the Easton series, and the Washburn soil has a profile similar to that described under the Washburn series.

Most of the areas consist of both Easton and Washburn soils, but mainly Easton. The soils are mainly nearly level to gently undulating, but small areas are gently sloping. The relief is very irregular and consists of a succession of small mounds. The surface contains many stones 10 inches or less in diameter but only a few large stones or boulders.

Typical forest trees grow on the mounds, and alder, willow, and similar trees grow on spots between the mounds. Vegetation is so thick that it is difficult to walk through the woods. Low, swampy areas consist mainly of Washburn soil, and, where this soil is extensive, black spruce is the dominant tree.

Spruce and fir trees on these soils are shallow rooted. On these soils, year-round lumber roads need surface grading and drainage. Lumbering can be done more easily when the soils are frozen. Capability unit VIIsw–3.

Fredon Series

The Fredon series consists of poorly drained soils on calcareous, stratified sand and gravel derived mainly from shale, slate, sandstone, and limestone. The soils have developed under spruce-fir forests on terraces mainly along the St. John and Aroostook Rivers.

Where cultivated, the soils have a very dark gray to grayish-brown silt loam surface layer over a mottled A_{2g} horizon that ranges from 2 to 6 inches in thickness. The color of the plow layer and the thickness of the bleicherde (A_{2g}) horizon vary because of the uneven relief of the original, undisturbed soil. In forested areas the soils have a thin A_1 horizon and a thick, mottled A_{2g} horizon.

Fredon soils have gravelly silt loam or sandy loam B horizons that are mottled yellowish brown; have weak, subangular blocky structure; and are usually neutral in reaction. In drainage they are similar to the Red Hook soils, which have mottled, heavy loam to gravelly clay loam B horizons that are acid and of granular structure.

Fredon soils are members of the same drainage catena as the well drained Stetson, moderately well drained Machias, and very poorly drained Halsey soils.

Representative profile—Fredon silt loam, 0 to 2 percent slopes (cultivated):

A_p 0 to 8 inches, very dark gray (10YR 3/1) silt loam; strong, coarse, granular structure; friable; slightly acid; abrupt, smooth boundary; 6 to 10 inches thick.

A_{2g} 8 to 12 inches, grayish-brown (10YR 5/2) gravelly silt loam with few, fine, yellowish-brown (10YR 5/4) mottles; weak, fine, granular structure; friable; neutral; clear, wavy boundary; 2 to 6 inches thick.

B_{21g} 12 to 21 inches, yellowish-brown (10YR 5/4) gravelly silt loam; many, coarse, grayish-brown (2.5Y 5/2) mottles; weak, subangular blocky structure; some silt on tops and sides of gravel; firm; neutral; clear, wavy boundary; 8 to 15 inches thick.

B_{22g} 21 to 32 inches, olive (5Y 5/3) gravelly sandy loam; few, fine, yellowish-brown (10YR 5/8) mottles; strong, thin, platy structure; firm; clear, wavy boundary; 10 to 15 inches thick.

C 32 to 40 inches, olive-gray (5Y 5/2) gravelly sandy loam; weak, platy structure; firm; alkaline; clear, wavy boundary; 5 to 10 inches thick.

D 40 inches +, loose, stratified sand and gravel; calcareous.

Fredon and Halsey silt loams, 0 to 2 percent slopes (FhA).—The Fredon soil in this undifferentiated unit has a profile like that described as representative of the Fredon series, and the Halsey soil has a profile like that described under the Halsey series.

The Halsey and Fredon soils differ little in relief, and so the two soils can seldom be identified, except by examination of the profile. Because of their similarity, the soils have not been mapped separately. More than half of the acreage in this mapping unit consists of Fredon soil.

For 8 months of the year, the water table is about 1 foot below the surface. Since runoff is slow, the soils are slightly difficult to drain. In some places there is a perched water table, and the soil below it is loose, coarse, and rapidly permeable.

A small acreage of the Fredon soil is used for hay and pasture—less than that of Fredon and Halsey silt loams, 2 to 8 percent slopes. Few cleared fields contain Halsey soil. Most forested areas are made up of both Fredon and Halsey soils.

Most of the acreage has a cover of red spruce and fir, but some areas of the Halsey soil produce mainly black spruce. The trees are shallow rooted, even in the Fredon soil. Capability unit IVw–5.

Fredon and Halsey silt loams, 2 to 8 percent slopes (FhB).—The Fredon soil in this undifferentiated unit has a profile like that described as representative of the Fredon series, and the Halsey soil has a profile like that described under the Halsey series. These soils are undulating or gently sloping and have slow to medium runoff. The water table is usually close to the surface. The Fredon soil can be drained, but even then it cannot be worked until late in spring or early in summer.

Most cultivated areas are Fredon soil, but forested areas generally contain both Fredon and Halsey soils. Only a few hundred acres have been cleared, and most of the acreage has stands of spruce and fir trees. Capability unit IVw-5.

Hadley Series

The Hadley series consist of well-drained soils on silty and very fine sandy sediments that have been deposited in narrow bands by the present rivers and streams. The sediments were derived mainly from shale and slate. The soils have not been in place long enough to have developed B horizons, but they have A and C horizons. The largest acreage occurs along the St. John and Aroostook Rivers (fig. 5) and as islands in these rivers.

These soils are closely associated with the moderately well drained Winooski soils, which are forming from a similar kind of sediments.

Hadley soils have developed under a forest of spruce, fir, cedar, maple, and birch. Most large areas are cultivated.

Representative profile—Hadley silt loam, level (cultivated):

A_p 0 to 8 inches, light olive-brown (2.5Y 5/4) silt loam; weak, fine, granular structure; friable; strongly acid; abrupt, smooth boundary; 8 to 10 inches thick.

C_1 8 to 18 inches, light olive-brown (2.5Y 5/6) silt loam; weak, fine, granular structure; friable; acid; abrupt, smooth boundary; 6 to 12 inches thick.

C_2 18 to 40 inches, grayish-brown (2.5Y 5/2) silt loam; weak, fine, granular structure; very friable to loose; strongly acid.

Hadley silt loam, level (HaA).—This soil occurs on the nearly level parts of the bottom lands. A profile of the soil is described as representative of the series. The texture ranges from silt loam to very fine sandy loam because the soil has been deposited in bands of silt and fine sand that are not uniform over a large area.

The areas of silt loam and fine sandy loam soils differ little in use or in yields of crops. Therefore, they have been mapped as silt loam. There is some variation in reaction, but the soil is usually acid to a depth of 30 inches. Areas in the eastern part of the survey area are less acid than those in the western part.

The soil particles are very fine and easily compacted. This results in slow permeability in the upper part of the soil and causes water to stand between the rows of cultivated crops.

Figure 5.—**Hadley soils on nearly level bottom lands along the St. John River.**

If the content of organic matter and the fertility are maintained, this soil can be used intensively for cultivated crops. At present, it is used for potatoes in a rotation that includes peas, oats, and hay. Capability unit IIc–6.

Hadley silt loam, undulating (HaB).—This soil occurs in places where the rivers have backed up and flowed over the area. Wavelike action of the water has created gently undulating relief. The texture of the soil ranges from silt loam to sandy loam and is not uniform over a large area.

This soil is not particularly easy to manage. Some areas can be leveled and will then respond to use and management similar to that described for Hadley silt loam, level. Capability unit IIe–6.

Halsey Series

The Halsey series consists of very poorly drained soils on calcareous, stratified sand and gravel derived mainly from shale, slate, sandstone, and limestone. These soils occur in the eastern part of the survey area in association with the Stetson soils.

The Halsey soils have a thick, faintly mottled A_{1g} horizon and a thin, grayish-brown, mottled A_{2g} horizon that is discontinuous in many places. The B horizons are olive brown or olive yellow and have weak, subangular blocky structure. The structure is not well developed; in some profiles, it is platy in place and breaks to subangular blocky when removed. The B horizons are firm in place, but in many profiles they are friable after the soil has been disturbed.

Halsey soils are similar to Atherton soils in drainage but vary mainly in structure and reaction. They have neutral or alkaline B horizons, but the Atherton soils have granular, acid B horizons.

Halsey soils have developed under a spruce-fir forest, and only a few acres have been cleared.

In northeastern Aroostook County, the Halsey soils are mapped with the Fredon soils in undifferentiated units. These undifferentiated units are described under the Fredon series.

Representative profile—Halsey silt loam, 0 to 2 percent slopes (forested):

A_0 9 inches to 0, partly decomposed organic matter.

A_{1g} 0 to 8 inches, dark olive-gray (5Y 3/2) silt loam; few, fine, gray mottles; weak, fine, granular structure; friable; slightly acid; abrupt, wavy boundary; 5 to 10 inches thick.

A_{2g} 8 to 9 inches, grayish-brown (2.5Y 5/2) silt loam; few, fine, yellowish-brown mottles; thin, platy structure; friable; neutral; abrupt, irregular boundary; 1 to 3 inches thick.

B_{21g} 9 to 12 inches, light olive-brown (2.5Y 5/4) gravelly silt loam; many, coarse, yellowish-brown (10YR 5/8) mottles; weak, subangular blocky structure; friable; alkaline; clear, wavy boundary; 2 to 4 inches thick.

B_{22g} 12 to 28 inches, olive (5Y 5/3) gravelly silt loam; many, coarse, yellowish-brown (10YR 5/8) mottles; granular structure to weak, subangular blocky; firm in place, friable when removed; alkaline; clear, wavy boundary; 10 to 20 inches thick.

C_{1g} 28 to 44 inches, light olive-brown (2.5Y 5/4) gravelly sandy loam; few, fine, yellowish-brown (10YR 5/8) mottles; strong, thin, platy structure; firm in place, friable when removed; alkaline; clear, wavy boundary; 15 to 20 inches thick.

D 44 inches +, light olive-brown (2.5Y 5/4) sand and gravel; single grain (structureless); loose; calcareous.

Howland Series

The Howland series consists of predominantly moderately well drained soils on acid glacial till of firm gravelly loam derived mainly from shale, slate, and sandstone. The soils have a firm subsoil. They are common in the survey area, except in the eastern part.

Where forested, the soils have a thin A_1 horizon and a grayish-brown A_2 horizon, 3 to 4 inches thick. The upper B horizon is mottled brown, yellowish-brown, and grayish-brown, friable gravelly loam.

Where cultivated, these soils have a dark grayish-brown to very dark grayish-brown A_p horizon. The variation in color probably results from spots of somewhat poorly drained soils and, to some extent, from the leveling of the mounds that are common in the woods.

Forested areas are generally stony. In places where the stones have been removed and the soils have been plowed, there are pockets consisting of A_2 and B_{21g} horizons. In some spots the A_2 is buried below the B_{21g} horizon.

Somewhat poorly drained areas of these soils are as wet as the Daigle soils, which, unlike the Howland soils, have a bisequal profile and B′ horizons of mottled clay loam.

Howland soils are members of the same catena as the well-drained Plaisted, poorly drained Monarda, and very poorly drained Burnham soils. They developed under mixed hardwood and softwood forests.

Representative profile—Howland gravelly loam, 2 to 8 percent slopes (cultivated):

A_p 0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly loam; moderate, medium, granular structure; friable; 15 to 20 percent coarse fragments; acid; abrupt, smooth boundary; 6 to 10 inches thick.

B_{21g} 8 to 12 inches, strong-brown (7.5YR 5/6) gravelly loam with grayish-brown and dark yellowish-brown mottles; weak, fine, granular structure; friable; 20 percent coarse fragments; clear, wavy boundary; 2 to 6 inches thick.

B_{22g} 12 to 18 inches, yellowish-brown (10YR 5/4) loam with grayish-brown and dark yellowish-brown mottles; weak, thin, platy structure; firm; 30 percent coarse fragments; clear, wavy boundary; 5 to 10 inches thick.

C_{1g} 18 to 36 inches +, light olive-brown (2.5Y 5/4) fine gravelly loam with few, fine mottles; massive; very firm; 30 percent coarse fragments; acid.

Howland gravelly loam, 0 to 2 percent slopes (HoA).—Most of this nearly level soil is cultivated, but some of it is forested. Where cultivated, the soil has a very dark grayish-brown gravelly loam surface layer, 10 to 12 inches thick. In other respects the profile is like that described as representative of the series.

Where forested, the soil has a surface layer of organic matter, 3 to 4 inches thick, over a thin, nearly black A_1 horizon. Below this is a grayish-brown gravelly loam A_2 horizon, about 2 to 4 inches thick. The A_2 horizon is underlain by a B_{21g} horizon, 4 to 6 inches thick. The profile of the forested soil has a thicker B_{21g} horizon than that of the cultivated soil, but in other respects this horizon and the underlying horizons are similar to those of the cultivated soil.

In forested areas stones, about 6 to 24 inches in diameter, occur on the surface at intervals of 50 to 75 feet. Each time a cultivated field is plowed, a few stones per acre are brought to the surface.

Permeability is moderately slow, and water often stands on the surface in spring and fall. A firm layer at a depth of 12 to 15 inches limits the penetration of water and roots. Most of the water can be removed from the upper part of the soil by either tile or open drains, but roots seldom penetrate the firm subsoil, even after drainage improvement.

Grass and clover produce good yields on undrained areas, but uniform stands can be maintained over a longer period after drainage has been improved. Good yields of potatoes and oats can be obtained on drained fields. In some undrained fields, fair yields of potatoes are produced. After having been drained, the soil can be worked earlier in the spring and high yields can be obtained more consistently.

Forested areas contain mainly spruce, fir, maple, and birch. Spruce grows well. Capability unit IIw–4.

Howland gravelly loam, 2 to 8 percent slopes (HoB).—Much of this gently sloping soil is cultivated, but some of it is forested. A profile of cultivated soil is described as representative of the series.

Where forested, the soil has a layer of organic matter, 2 to 3 inches thick, over a thin, nearly black A_1 horizon. Below this is a grayish-brown gravelly loam A_2 horizon, about 2 to 4 inches thick. The A_2 horizon is underlain by a B_{21g} horizon, 5 to 8 inches thick. The profile of the forested soil has a thicker B_{21g} horizon than that of the cultivated soil, but in other respects this horizon and the underlying horizons are similar to those of the cultivated soil.

In forested areas stones, about 6 to 24 inches in diameter, occur on the surface at intervals of 50 to 75 feet. Each time a cultivated field is plowed, a few stones per acre are brought to the surface.

Runoff is medium, and water seldom stands on the surface. Permeability is moderately slow and a firm layer at a depth of 12 to 15 inches holds water in the upper part of the soil in spring and fall. Most of the excess water can be removed from the upper part of the soil by tile or diversion ditches. Roots are limited to the top 12 to 15 inches of soil, even after drainage.

The soil can be used for hay or pasture, which produce good yields, even in the undrained areas. More uniform stands of forage plants can be maintained after the soil is drained, however. In some undrained areas, good yields of potatoes and oats can be obtained. After having been drained, the soil can be farmed earlier in spring and high yields can be obtained more consistently.

Forested areas contain mainly spruce, fir, beech, birch, and maple. Spruce grows well, and by selective cutting it can be encouraged to predominate on this soil. Lumbering can be easily done in summer and in winter. Logging roads that are to be used in the spring and fall need drains and surface grading. Capability unit IIw–4.

Howland gravelly loam, 8 to 15 percent slopes (HoC).—Most of this soil is moderately steep, and some of it has slopes of more than 15 percent. The soil occurs in seepage areas on the sides of hills. Most of it is forested, but some is cultivated. The profile of the cultivated soil is similar to that described as representative of the series, except that in some places the soil is friable to a depth of 15 to 18 inches.

Where forested, the soil has a layer of organic material, about 2 inches thick, over a grayish-brown A_2 horizon, about 1 to 3 inches thick. The A_2 horizon is underlain by a B_{21g} horizon, 5 to 8 inches thick. The profile of the forested soil has a thicker B_{21g} horizon than that of the cultivated soil, but in other respects this horizon and the underlying horizons are similar to those of the cultivated soil.

In forested areas a few stones, about 6 to 24 inches in diameter, are on the surface at intervals of 50 to 75 feet. Each time a cultivated field is plowed, a few stones per acre are brought to the surface.

The soil produces good yields of clover and grass. It can be used for permanent hay or pasture, if moderate amounts of lime and fertilizer are applied. If used in the usual rotation that includes potatoes, it should be farmed in graded strips with diversion ditches.

The bottom of the diversion ditch should be in the firm subsoil so it can collect the subsoil water that seeps downslope through the material above this layer. The soil in the bottom of the ditch should be loosened, limed, and fertilized before seeding because it is firm, acid, and low in plant nutrients.

Forested areas contain mainly mixed northern hardwoods, spruce, and fir. Lumbering can be easily done in summer and in winter. Logging roads that are to be used in spring and fall need drains and surface grading. Capability unit IIIew–4.

Howland very stony loam, 0 to 8 percent slopes (HvB).—This gently undulating to gently sloping soil occurs on low hills and in depressions on the tops of large ridges. Most of it is forested. Because of the windthrow of trees, the surface is irregular. It consists of mounds, 1 to 3 feet high, surrounded by concave areas. Except that the surface layer is made up of very stony loam, the profile of this soil is similar to that described as representative of the series.

Loose stones, 8 to 12 inches in diameter, are scattered over the surface at intervals of 2 to 3 feet. In some places granite stones, 3 to 4 feet in diameter, are partly embedded in the soil at intervals of about 25 feet.

This soil has never been cleared. It has a mixed stand of spruce, fir, cedar, maple, beech, and birch. The soil is productive and can be converted to or maintained in a spruce-fir type of forest. Logging roads to be used in summer are easy to build and maintain, but year-round roads need drains. Capability unit VIs–3.

Howland very stony loam, 8 to 15 percent slopes (HvC).—This soil occurs on the sides of glacial-till ridges in seepage areas that have resulted from springs or a perched water table. Water is held near the surface of the soil by the very compact substratum and subsoil. Most of the soil has slopes of less than 15 percent, but some of it has slightly greater slopes. Except that the surface layer consists of very stony loam, the profile of this soil is similar to that described as representative of the series.

Loose stones, 8 to 12 inches in diameter, are scattered over the surface at intervals of 2 to 3 feet. In some places granite stones, 3 to 4 feet in diameter, are partly embedded in the soil at intervals of about 25 feet.

Nearly all of this soil is used for forestry. It has never been cleared but has been left to produce a mixed stand of softwoods and hardwoods consisting of spruce, fir, cedar, hemlock, maple, beech, and birch. By selective cutting, spruce and fir can be encouraged to predominate.

Logging roads to be used in summer are easy to build and maintain. Surface drainage and grading are needed to maintain year-round logging roads. Capability unit VIs-3.

Machias Series

The Machias series is made up of moderately well drained soils that have developed on water-deposited sandy and gravelly terraces and on glacial outwash. The soils have a firm subsoil underlain by loose, stratified sand and gravel at a depth of 24 to 30 inches. They occur in small depressions in the larger river valleys.

The Machias soils have developed on the same kind of parent material as the well-drained Stetson, poorly drained Fredon, and very poorly drained Halsey soils. Machias soils, unlike the other terrace soils in the survey area, have gravel throughout their profile.

The native vegetation is spruce, fir, hemlock, and cedar and some beech, birch, and maple trees.

These soils respond well to tile drainage, but open ditches are usually not satisfactory.

Representative profile—Machias gravelly loam, 0 to 2 percent slopes (cultivated):

A_p 0 to 10 inches, dark grayish-brown (10YR 4/2) gravelly loam; fine, granular structure; friable; strongly acid; abrupt boundary; 8 to 12 inches thick.

B_{21} 10 to 15 inches, light olive-brown (2.5Y 5/6) gravelly loam; weak, fine, granular structure; friable; strongly acid; diffuse boundary; 3 to 6 inches thick.

B_{22g} 15 to 21 inches, light olive-brown (2.5Y 5/4) gravelly silt loam; many grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; weak, subangular blocky structure; friable; strongly acid; diffuse boundary; 4 to 8 inches thick.

B_{3g} 21 to 30 inches, light olive-brown (2.5Y 5/4) gravelly silt loam; many grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; thick, platy structure; firm; acid; clear boundary; 7 to 14 inches thick.

D 30 inches +, olive-gray (5Y 5/2) sand and gravel single grain; loose; acid.

The texture of the surface layer ranges from gravelly loam to gravelly silt loam, but the gravelly loam is most extensive. In the east-central part of the survey area, the subsoil is neutral in reaction.

Machias gravelly loam, 0 to 2 percent slopes (MaA).—This nearly level soil was originally in forests of pine, spruce, and fir. It had an organic surface mat, about 3 inches thick, over a grayish-brown A_2 horizon, 2 to 5 inches thick. These horizons were underlain by a thick, light olive-brown B_{21} horizon. Most of this soil is now cultivated, and the A horizon and part of the original B_{21} horizon have been mixed and form the present plow layer. A profile of cultivated soil is described as representative of the series.

Internal drainage is slightly impeded by a perched water table or a high water table. In many places where internal drainage is impeded by a perched water table, the soil can be drained by breaking the soil layer that limits movement of water. Water can then enter the loose, sandy and gravelly substratum and is no longer a hazard to the use of the soil. The areas where internal drainage is limited by a seasonally high water table usually can be drained with tile. Since the soil is nearly level, a tile drainage system is easy to install. The soil is friable to a depth of 20 to 25 inches, so water moves freely to the tile.

Most of this soil can be used for hay and pasture without artificial drainage, but yields of clover and grass are usually higher after drainage. Artificial drainage limits the smothering of plants by water or ice. Potatoes usually can be grown more profitably after the soil has been drained because they can be planted earlier and will mature before the heavy rains in fall. This usually results in higher yields of potatoes that are of better quality. The soil is not subject to erosion, even when planted continuously to potatoes, but a green-manure crop should be grown occasionally to limit the hazards of diseases and insects, as well as to maintain the desirable physical properties of the soil. Capability unit IIw-5.

Machias gravelly loam, 2 to 8 percent slopes (MaB).—Most of this gently sloping soil is cultivated, and the profile is similar to the one described as representative of the series. Some of the soil is forested. It has an organic surface mat, 2 to 3 inches thick, over a grayish-brown A_2 horizon, about 3 inches thick. Other than a slightly thicker B_{21} horizon, the profile of the forested soil below the A_2 horizon is similar to that of the cultivated soil.

Permeability is slightly impeded by a perched water table or a high water table. In many places where internal drainage is impeded by a perched water table, the soil can be drained by breaking the slightly firm layer that limits movement of water. Water can then enter the loose, sandy and gravelly substratum and is no longer a hazard to the use of the soil. The areas where internal drainage is limited by a seasonally high water table can be drained with tile. Water moves freely through the upper, friable part of the soil to the tile. Even without artificial drainage, the water table becomes lower by midsummer and excess water is not a problem. Runoff is generally medium, but it is limited in some places by sags and pockets in the soil. In some of these spots the rate of runoff can be increased by land smoothing.

Erosion is seldom a problem, but contour farming will help to keep more water in the soil. Even though the soil is too wet early in spring and late in fall, crops need the rain that falls during summer.

The soil can be used for hay and pasture without artificial drainage or other conservation practices, but more uniform stands of clover and grass can be maintained by proper control of water. High yields of potatoes can be produced more consistently after this soil has been drained. A rotation of potatoes, oats, and a grass-legume crop is commonly followed. However, 2 years of potatoes followed by a green-manure crop will not result in serious loss of soil.

Forested areas contain mainly spruce, fir, beech, birch, and maple. Spruce grows well, and by selective cutting it can be encouraged to predominate on this soil. Lumbering can be easily done in summer and in winter. Logging roads that are to be used in spring and fall need drains and surface grading. Capability unit IIw-5.

Machias gravelly loam, 8 to 15 percent slopes (MaC).—This soil occurs in long bands, few of which are more than 300 feet wide, and so it is difficult to farm. Most of it is only moderately steep, but some areas have slopes greater than 15 percent.

In undisturbed areas, the soil has an organic surface mat over a leached, grayish-brown A_2 horizon, 2 to 6 inches thick. This is underlain by a yellowish-brown B_{21} horizon. The lower part of the profile is similar to the profile of cultivated soil described as representative of the series. The few acres of this soil that have been cultivated have a yellowish-brown gravelly loam A_p horizon, 7 to 8 inches thick.

Although the soil responds well to management, permeability is slow and runoff is rapid. The soil is likely to erode if it is used for row crops. If consistently high yields of potatoes are to be obtained, the crop must be planted in narrow strips that run across the slope and diversion ditches must be constructed. Grasses and legumes can be grown for pasture without artificial drainage or erosion control practices.

Pine, spruce, fir, and a few northern hardwoods grow on most areas. The soil is productive of white pine and spruce, and on many farms it should be used for woodland. By selective cutting of woodlots, these commercial trees can be encouraged. Roads should be laid out on the contour to limit washouts. If it is necessary for roads to cross this soil, ditches should be built to divert runoff away from the road outlets. Capability unit IIIew-5.

Madawaska Series

The Madawaska series consists dominantly of moderately well drained sandy soils that occur on stream terraces, mainly along the St. John and Aroostook Rivers, and also in small, narrow bands along other rivers and streams. The sand is generally 3 feet or more in thickness over stratified, coarse sand or sand and gravel. The parent material was derived mainly from shale, slate, and sandstone and, to a small extent, from granite or other crystalline rocks.

Undisturbed soils have an organic surface mat, 2 to 5 inches thick, over a thin A_1 horizon that is discontinuous in many places. Below this is a grayish-brown fine sandy loam A_2 horizon that ranges from 2 to 6 inches in thickness. A strong-brown or yellowish-brown fine sandy loam B_{21} horizon has developed below the A_2 horizon. In some places the B_{21} horizon is slightly firm or has concretions, but in most places it is friable.

In cultivated areas the soils have a surface layer of sandy loam that ranges from 6 to 10 inches in thickness. This is an A_p horizon that has been formed by the mixing of the original A horizon and part of the B_{21} horizon. In general, the B_{21} horizon is thinner in areas of cultivated soils than in areas of undisturbed soils.

Madawaska soils are closely associated with the well-drained Allagash soils, which generally occur on the same terraces. In drainage, Madawaska soils are similar to Nicholville soils, but the Nicholville soils contain a high percentage of silt. The Madawaska soils readily can be distinguished from the moderately well drained Machias soils, as the Machias soils are gravelly throughout.

Forested areas contain mainly spruce, fir, pine, and northern hardwoods.

Representative profile—Madawaska fine sandy loam, 0 to 2 percent slopes (cultivated):

A_p 0 to 9 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; friable; acid; abrupt, smooth boundary; 8 to 10 inches thick.

B_{21} 9 to 12 inches, yellowish-brown (10YR 5/6) fine sandy loam; weak, fine, granular structure; friable; acid; clear, wavy boundary; 3 to 6 inches thick.

B_{22g} 12 to 18 inches, yellowish-brown (10YR 5/4) fine sandy loam with dark yellowish-brown and grayish-brown mottles; weak, fine, granular structure; friable; acid; clear, wavy boundary; 5 to 10 inches thick.

B_{3g} 18 to 26 inches, light olive-brown (2.5Y 5/4) loamy sand with yellowish-brown and grayish-brown mottles; weak, platy structure to weak, granular; firm; acid; gradual, wavy boundary; 5 to 10 inches thick.

C 26 to 32 inches, olive-brown (2.5Y 4/4) loamy sand with faint mottles; weak, fine, granular structure; friable; acid; gradual, wavy boundary; 4 to 12 inches thick.

D 32 to 40 inches +, olive-gray (5Y 5/2) sand and gravel; single grain (structureless); loose; acid.

Madawaska fine sandy loam, 0 to 2 percent slopes (MbA).—This is a nearly level sandy soil. A profile of the cultivated soil is described as representative of the series. Where forested, the soil has an organic surface mat over a grayish-brown A_2 horizon, about 4 inches thick. Other than a thicker B_{21} horizon, the underlying horizons in the forested areas are similar to those of the cultivated soil.

This soil is easy to farm and responds well to cultivation. Most of the acreage is cultivated, but a small part is used to grow spruce, fir, pine, and a few northern hardwoods.

Because of a perched water table or a high water table, the soil is wet in spring and early in fall, and fieldwork is therefore delayed. Wetness can be easily corrected by artificial drainage. Tile drains are generally most satisfactory because they can be easily laid at a uniform depth and because water moves freely to the tile. Fair yields of grass can be obtained in undrained areas, but if drainage is improved, high yields can be produced more consistently. In some places land smoothing will limit the smothering of grasses and legumes by standing water or ice. If the land is smoothed, a good stand of hay can be maintained for a number of years.

If the soil is properly drained, consistently high yields of potatoes can be obtained. Potatoes can be grown continuously without serious loss of soil, but an occasional green-manure crop is usually necessary to maintain the desirable physical properties of the soil and to restrict insects and diseases. If potatoes are grown too intensively, the soil compacts at plow depth and restricts permeability. Water will then stand between the potato rows. This increases the hazard of late blight and delays harvesting of potatoes in fall. Capability unit IIw-5.

Madawaska fine sandy loam, 2 to 8 percent slopes (MbB).—The profile of cultivated soil is like that described as representative for the series. Where forested, this soil has an organic mat, about 3 inches thick, over a grayish-brown fine sandy loam A_2 horizon, 2 to 6 inches thick. Except for a thicker B_{21} horizon, the lower horizons are similar to those in the profile described as typical of the series.

This soil is very responsive to good management, but it is gently undulating and slightly difficult to use for row crops. Most of it is cultivated, but small areas are forested.

The soil is wet in spring and early in fall because it has a perched water table or a high water table. It is commonly used for hay or pasture without artificial drainage. Since it is friable and sandy, the soil can be easily drained with tile. Because of the irregular, complex relief, tile is slightly difficult to install, unless it can be laid parallel to the long, narrow depressions. In most places the tile has to be installed across the swells to reach an outlet.

Runoff is medium, but in some places small pockets hold surface water. These pockets can be eliminated by land smoothing. If properly drained, this soil produces good yields of potatoes. Intensive growing of row crops increases the hazard of erosion, but contour stripcropping will help to prevent loss of soil and also help to conserve rainfall for crops during midsummer. A rotation of potatoes and a green-manure crop, or one of potatoes, oats, and a grass-legume crop, used along with contour stripcropping, will prevent erosion and damage to the favorable physical properties of the soil. Capability unit IIw-5.

Madawaska fine sandy loam, 8 to 15 percent slopes (MbC).—This soil occurs in bands several hundred feet long and about 200 to 300 feet wide. In undisturbed areas it has an organic surface mat over a grayish-brown fine sandy loam A_2 horizon, 2 to 6 inches thick. This is underlain by a strong-brown B_{21} horizon. The lower part of the profile is similar to the one described as representative of the series.

This soil is mainly moderately steep, but it includes some areas of a steep soil that respond to similar use and management.

The areas of Madawaska fine sandy loam, 8 to 15 percent slopes, are so difficult to use for row crops that only a few acres have been cleared. Most of the soil has a stand of pine, spruce, fir, and a few hardwood trees.

Permeability is slow and runoff is rapid, but the soil responds well to management. The soil is likely to erode if it is used for row crops. If consistently high yields of potatoes are to be obtained, the crop needs to be planted in narrow strips across the slope and diversion ditches must be constructed. Grasses and legumes can be grown for pasture without improved drainage or erosion control practices.

This soil is productive of white pine and spruce, and on many farms it should be used for woodland. By selective cutting of woodlots, commercial trees can be encouraged. Roads should be laid out on the contour to limit washouts. If it is necessary for roads to cross this soil, ditches should be built to divert runoff water away from road outlets. Capability unit IIIew-5.

Made Land

Made land (Md).—This is a miscellaneous land type that consists of a mixture of soil material. In some areas the material is of variable texture, and the soil cannot be identified. In other places 18 inches or more of soil material has been spread over the area. In fact, most of the land in built up areas is of this kind. Some of the land that has been improved for lawns, for example, is fertile and productive. Large parking lots and other areas that contain coal ashes, gravel, and subsoil material are ordinarily not fertile.

The land suitable for crops has not been mapped separately from that which is unsuitable. Consequently, use and management must be based on a study of each area. This land was not classified as to capability.

Mapleton Series

The Mapleton series consists of well-drained, shallow soils that have formed on glacial till underlain by bedrock. The till parent material was derived mostly from weathered limestone and shale. The shale bedrock has seams of almost pure limestone at approximately right angles to the surface. These soils have shaly silt loam texture throughout the profile. The surface soil is acid, and the subsoil is medium acid to neutral. In a few places, the parent material is calcareous.

Mapleton soils occur on irregularly rolling hills in the east-central part of the survey area (fig. 6). They are common in the towns of Blaine, Mars Hill, Easton, and Caribou.

The Mapleton soils are associated with the deep, well-drained Caribou, moderately well drained Conant, poorly drained Easton, and very poorly drained Washburn soils. All of the associated soils are on the same kind of parent material.

The native vegetation consists of mixed hardwoods, mostly maple, beech, and birch. A few spruce, fir, and cedar trees are scattered throughout the stands of hardwoods.

Representative profile—Mapleton shaly silt loam, 0 to 8 percent slopes (cultivated):

A_p 0 to 7 inches, dark-brown (10YR 4/3) shaly silt loam; strong, medium, granular structure; friable; strongly acid; abrupt boundary; 6 to 9 inches thick.

B_{21} 7 to 10 inches, yellowish-brown (10YR 5/6) shaly silt loam; weak, fine, granular structure; friable; medium acid; abrupt boundary; 2 to 5 inches thick.

B_{22} 10 to 14 inches, light olive-brown (2.5Y 5/4) shaly silt loam; weak, fine, granular structure; friable; medium acid; abrupt boundary; 3 to 6 inches thick.

B_3 14 to 20 inches, olive-brown (2.5Y 4/4) shaly silt loam with many, soft, leached fragments of shale; weak, fine, granular structure; friable; neutral; abrupt boundary; 5 to 10 inches thick.

C 20 to 26 inches, olive (5Y 5/3) shaly silt loam with few, soft, leached fragments of shale; weak, fine, granular structure; friable; neutral.

D_r 26 inches +, shale bedrock.

Mapleton shaly silt loam, 0 to 8 percent slopes (MhB).—Most of this soil is cultivated, and a profile of it is described as representative of the series. Some of the soil is forested and has a thin A_1 horizon and a grayish-brown A_2 horizon, about 2 inches thick. Except for a thicker B_{21} horizon, the profile of the forested soil below the A_2 horizon is similar to that of the cultivated soil below the A_p horizon.

On the surface and throughout the soil are many almost flat, yellowish-brown fragments of shale that range from ¼ inch to 10 inches in length. Very shallow spots and rock outcrops cover from 2 to 5 percent of the surface area. Few outcrops extend far enough above the surface to interfere with wheel equipment, but they are a hazard to equipment used in preparing seedbeds and in cultivating row crops. The average depth of the soil to bedrock is about 18 inches, but a depth of 30 inches is common.

Good yields of clover and grass can be produced if the soil is limed and fertilized. In some places the subsoil is alkaline and lime is not needed. Good yields of potatoes can be obtained if a rotation of 2 years of potatoes and 1 year of a green-manure crop is followed. Runoff is medium on this undulating soil, so row crops should be planted in graded strips. This practice will permit the soil to absorb most of the rainfall and make it available to the crop.

Forested areas contain mainly northern hardwoods. Lumbering can be easily done throughout the year. Capability unit IIe–1.

Mapleton shaly silt loam, 8 to 15 percent slopes (MhC).—Most of this soil is cultivated, and it has a profile similar to the one described as representative of the series. Some of the soil is forested and has a thin A_1 horizon and a grayish-brown A_2 horizon, about 2 inches thick. Except for a thicker B_{21} horizon, the profile of the forested soil below the A_2 horizon is similar to the profile of the cultivated soil below the A_p horizon.

On the surface and throughout the soil are many, almost flat, yellowish-brown fragments of shale that range from ¼ inch to 10 inches in length. Very shallow spots and rock outcrops make up about 5 percent of the surface area. In some places the outcrops extend far enough above the surface to interfere with all types of farm equipment, especially that used in preparing seedbeds and in cultivating row crops. The average depth of the soil to bedrock is about 16 inches, but the depth is 24 to 30 inches in some places.

Good yields of clover and grass can be obtained if the soil is limed and fertilized. In some places the subsoil is alkaline and lime is not needed. Good yields of potatoes can be obtained if they are planted in graded strips. Runoff is medium to rapid, so graded strips are needed to limit runoff and erosion and to permit the soil to absorb most of the rainfall and make it available to crops. Wherever possible, long slopes should have diversion ditches. The ditches collect runoff and divert the water from the fields before it gets enough speed to erode the soil severely.

A common rotation on this soil is 2 years of potatoes, 1 year of oats, and 2 years of grass-legume hay. On some farms, green peas, which are grown for freezing, are substituted for oats.

Forested areas contain mainly northern hardwoods. Lumbering can be easily done throughout the year. Capability unit IIIe–1.

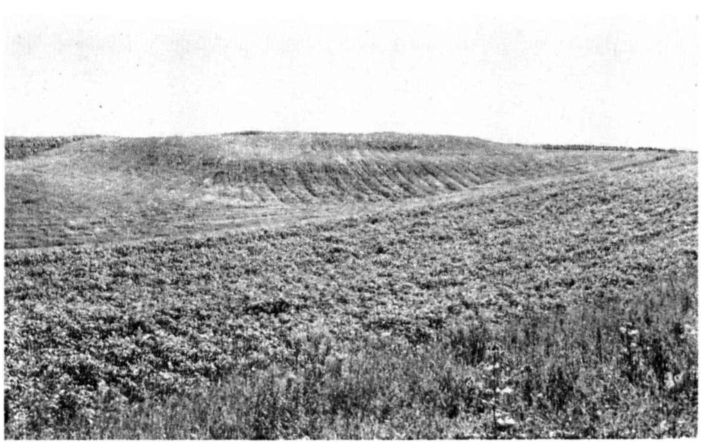

***Figure 6.*—Mapleton soils on irregular relief in the east-central part of the survey area.**

Mapleton shaly silt loam, 8 to 15 percent slopes, eroded (MhC2).—The profile of this soil is similar to the profile described as representative of the series, except that part of the original surface soil has washed away and the original B_{21} horizon has been mixed with the remaining A horizon.

Very shallow spots and rock outcrops make up about 5 to 10 percent of the surface area. In some places the rocks extend far enough above the surface to interfere with all types of farm equipment, especially that used in preparing seedbeds and in cultivating row crops. The average depth of the soil to bedrock is about 14 inches, but the depth is 18 to 24 inches in some places.

Good yields of clover and grass can be obtained if the soil is limed and fertilized. In some places the subsoil is alkaline and lime is not needed. Fair yields of potatoes can be obtained if they are planted in graded strips. Runoff is medium to rapid, so graded strips are needed to limit runoff and to permit the soil to absorb most of the rainfall. This makes more water available for crops and limits loss of soil. Wherever possible, long slopes should have diversion ditches. The ditches collect runoff and divert the water off the fields before it gets enough speed to erode the soil severely.

A common rotation on this soil is 2 years of potatoes, 1 year of oats, and 2 years of grass-legume hay.

Forested areas contain mainly northern hardwoods. Lumbering can be easily done throughout the year. Capability unit IVe–1.

Mapleton shaly silt loam, 15 to 35 percent slopes (MhD).—The areas of this soil that are cultivated have a profile similar to the one described as representative of the series. Where forested, the soil has a thin A_1 horizon and a grayish-brown A_2 horizon, about 2 inches thick. Except for a thicker B_{21} horizon, the profile of the forested soil below the A_2 horizon is similar to that of the cultivated soil below the A_p horizon.

On the surface and throughout the soil are many almost flat, yellowish-brown fragments of shale that range from ¼ inch to 10 inches in length. Very shallow spots and rock outcrops make up from 5 to 10 percent of the surface area. The outcrops extend above the surface and interfere with most farm equipment. The average depth of the soil to bedrock is about 14 inches, but a depth of 24 inches is common.

Good yields of clover and grass can be obtained if the soil is limed and fertilized. In some places the subsoil is alkaline and lime is not needed.

If used intensively for potatoes, this soil most likely will erode. Runoff is rapid, and in most places the relief is too irregular for the use of contour stripcropping.

Forested areas contain mainly northern hardwoods. Lumbering can be done fairly easily. Capability unit IVe–1.

Mapleton very rocky silt loam, 0 to 15 percent slopes (MmC).—Most of this soil is forested. It has a surface mat of organic matter, 1 to 3 inches thick, underlain by a leached A_2 horizon, 2 to 3 inches thick. In many places the A_2 horizon resembles a mixture of the A_1 and A_2 horizons because it is dark grayish brown instead of grayish brown. In small spots close to pine trees, it is grayish brown. The profile has B_{21} and B_{22} horizons similar to those in the profile described for the series, but these horizons are not so thick. The C horizon is only 4 to 6 inches thick, and in many places nearly 75 percent of it consists of angular fragments of shale and limestone.

Outcrops of rock, 3 feet wide and 10 feet long, occur at intervals of about 100 to 150 feet. About 30 percent of the uppermost 4 to 6 inches of soil is made up of shale fragments, which are about 1 inch thick and 3 inches long. Few stones other than shale or limestone occur in this soil.

Because the soil is mainly gently undulating to gently rolling, it is difficult to manage except for permanent pasture or woodland. Capability unit VIs–1.

Mapleton very rocky silt loam, 15 to 35 percent slopes (MmD).—This soil is moderately steep or hilly, but, in most other respects, it resembles Mapleton very rocky silt loam, 0 to 15 percent slopes. It holds only a small amount of water available for plants, and runoff is too rapid to permit the soil to absorb much of the summer rainfall. The soil has stands of maple, beech, and birch, but these trees are shallow rooted and slow growing. Capability unit VIIs-1.

Mixed Alluvial Land

Mixed alluvial land (Mn).—This mapping unit consists mostly of poorly and very poorly drained soils forming in alluvium that has been deposited in narrow bands along small streams. Much of the soil material is like that of the Housatonic or Saco soils (not mapped in northeastern Aroostook County), but some of it is like that of the Winooski soils. The areas have a wide range in texture and in degree of drainage, and most of them are only about 100 feet wide on either side of the stream.

Slow internal and surface drainage and the hazard of flooding limit the use of Mixed alluvial land. Some of the better drained areas could be used for pasture, but most of them are under forest consisting mostly of elm, alder, willow, cedar, and spruce. Capability unit VIw–6.

Monarda Series

The Monarda series is made up of soils that have developed on very firm, slightly acid to neutral gravelly loam glacial till. The till was derived mainly from shale, slate, and phyllite. These poorly drained soils occur on nearly level to gently sloping relief in the western part of the survey area.

In cultivated areas the surface soil ranges from dark brown to very dark brown. The variation in color resulted from the leveling of the mounds that occurred in forested areas and the subsequent mixing of the A_1 and A_{2g} horizons.

Wooded areas still have mounds, 1 to 3 feet high and 1 to 10 feet apart. The mounds have a thick, light olive-brown A_{2g} horizon, and the slight depressions between the mounds have a thin, grayish-brown A_{2g} horizon. Spruce and fir grow on these soils; the larger trees and a few pines grow on the mounds.

The illuvial (B) horizons are mottled olive-brown, yellowish-brown, and grayish-brown gravelly loam. In many places these horizons are uniform throughout, but in some places they are granular and friable grading to platy and firm. In only a few places do the B horizons have subangular blocky structure and clay films, which are also prominent in the B horizons of Easton soils.

The substratum, or C horizon, is generally olive-gray to light olive-brown gravelly loam, but in some places it is gravelly sandy loam. The C horizon is normally massive and very firm, although in places its upper part has platy structure. This till material is usually medium acid to slightly acid, but in a few places it is neutral at a depth of about 5 feet.

Most of the acreage is stony to very stony, and in some places the surface layer is nearly covered with stones, 4 to 6 inches in diameter. Some of the areas have stones, 8 to 12 inches in diameter, scattered over the surface at intervals of 2 to 3 feet. Most of the areas have granite stones, 3 to 5 feet in diameter, partly embedded in the soil at intervals of about 50 feet. Several thousand acres of these soils have stones, 6 to 24 inches in diameter, on the surface and partly embedded in the soil at intervals of 20 to 75 feet. Some areas have been cleared of trees and stones; others are still forested.

Monarda soils have developed on the same kind of parent material as the very poorly drained Burnham soils, and the two soils normally occur in the same general areas. They are members of the same catena as the well drained Plaisted and moderately well drained Howland soils.

Monarda soils have developed under a high water table in spruce-fir forests.

In northeastern Aroostook County, the Monarda soils are mapped only in undifferentiated units with the Burnham soils.

Representative profile—Monarda very stony silt loam, 0 to 2 percent slopes (forested):

A_0 3 inches to 0, black (N 2/1), partly decomposed organic matter; extremely acid; many stones; abrupt, smooth boundary; 2 to 4 inches thick.

A_1 0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, coarse, granular structure; friable; strongly acid; abrupt, wavy boundary; 1 to 3 inches thick.

A_{2g} 2 to 11 inches, grayish-brown (2.5Y 5/2) loam; few, faint, olive-brown (2.5Y 4/4) mottles; weak, fine, granular structure; friable; very strongly acid; clear, wavy boundary; 2 to 10 inches thick.

B_{21g} 11 to 14 inches, yellowish-brown (10YR 5/6) gravelly loam; dark yellowish-brown (10YR 4/4) and grayish-brown (10YR 5/2) mottles; weak, fine, granular structure; friable; strongly acid; 20 to 30 percent coarse fragments; clear, wavy boundary; 2 to 5 inches thick.

B_{22g} 14 to 29 inches, light olive-brown (2.5Y 5/4) gravelly loam; many olive (5Y 5/3) mottles; weak, platy structure; firm; strongly acid; 20 to 40 percent coarse fragments; abrupt, wavy boundary; 10 to 20 inches thick.

C_g 29 to 40 inches +, olive-gray (5Y 5/2) gravelly loam; fine, faint, olive (5Y 5/4) mottles; massive; very firm; medium acid; 30 to 40 percent coarse fragments.

Monarda and Burnham silt loams, 0 to 2 percent slopes (MoA).—The Monarda soil in this undifferentiated unit has a profile like that described as representative of the Monarda series, and the Burnham soil has a profile like that described under the Burnham series.

The Monarda and Burnham soils are mapped as an undifferentiated unit because they occur in the same general areas and because relief varies only slightly from the very poorly drained Burnham soil to the poorly drained Monarda soil. Many areas of each soil are 10 to 40 acres in size and can be easily identified in the field, but few of them could have been accurately outlined on a map of the scale used in this report. Some areas have stones, 20 to 75 feet apart, but in other areas most of the surface stones have been removed.

More than half of the acreage in this mapping unit consists of Monarda soil. A small part of the Monarda soil is used for hay and pasture—less than that of the same soil in Monarda and Burnham silt loams, 2 to 8 percent slopes. Only a few cleared fields consist of Burnham soil, and forest generally is on both Monarda and Burnham soils.

Most areas have forests of red spruce and fir, but some areas of Burnham soil produce mainly black spruce. The trees are shallow rooted, even on the Monarda soil.

For 9 months of the year, the water table is about 1 foot below the surface. Both permeability and runoff are slow, so it is difficult to manage these soils for crops. Slow internal and surface drainage limits the use of undrained areas mainly to forestry. Capability unit IVw-3.

Monarda and Burnham silt loams, 2 to 8 percent slopes (MoB).—Except for stronger slopes, these soils are similar to Monarda and Burnham silt loams, 0 to 2 percent slopes. They are gently sloping to gently undulating.

The soils have slow internal drainage and medium surface drainage. They are used mainly for forestry, but areas could be drained and used for pasture. Even when drained, however, the soils warm up slowly in spring, so they are seldom used for row crops. Capability unit IVw-3.

Monarda and Burnham very stony silt loams, 0 to 8 percent slopes (MrB).—The Monarda soil in this undifferentiated unit has a profile like that described as representative of the Monarda series, and the Burnham soil has a profile like that described under the Burnham series. Most areas of this unit contain both Monarda and Burnham soils, but mainly Monarda.

These soils are mainly nearly level to gently undulating, but small areas are gently sloping. The surface contains many stones, 10 inches or less in diameter, and only a few large stones or boulders. The relief is very irregular and consists of a succession of small mounds. Forest trees grow on the mounds, and alder, willow, and nonforest trees grow on spots between the mounds. Vegetation is so thick that it is difficult to walk through the woods. Low, swampy areas are made up mainly of Burnham soil, and, where this soil is extensive, black spruce is the dominant forest tree.

Spruce and fir trees growing on these soils are shallow rooted. Year-round lumber roads need surface grading and drainage. Lumbering can be done more easily when the soils are frozen. Capability unit VIIsw-3.

Nicholville Series

The Nicholville series consists of moderately wet soils on silty stream terraces. The parent material is stratified silt or silt and very fine sand that is underlain by fine sand.

The Nicholville soils occur in the valley of the St. John River in association with the well-drained Salmon and poorly drained Canandaigua soils. All these soils have developed on similar parent material. Nicholville soils are finer textured than the Madawaska soils.

The native vegetation is mostly spruce, fir, hemlock, and cedar.

Representative profile—Nicholville silt loam, 0 to 2 percent slopes (cultivated):

A_p 0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; fine, granular structure; friable; strongly acid; abrupt boundary; 7 to 11 inches thick.

B_{21} 9 to 14 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, granular structure; friable; strongly acid; clear, wavy boundary; 3 to 6 inches thick.

B_{22g} 14 to 21 inches, light olive-brown (2.5Y 5/4) silt loam; yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; weak, fine, granular structure; friable; medium acid; clear, wavy boundary; 5 to 10 inches thick.

B_{3g} 21 to 30 inches, light olive-brown (2.5Y 5/4) silt loam and very fine sandy loam; yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; weak, thin, platy structure to weak, fine, granular; firm; medium acid; clear, wavy boundary; 8 to 12 inches thick.

D 30 to 40 inches +, olive-gray (5Y 5/2) loamy fine sand; single grain (structureless); loose; medium acid.

Nicholville silt loam, 0 to 2 percent slopes (NcA).—Some of this nearly level soil is cultivated, and a profile of it is described as representative of the series. Several hundred acres are forested. In these places the soil has an organic surface mat, 2 to 3 inches thick, over a grayish-brown silt loam A_2 horizon, about 2 inches thick. Except for a thicker B_{21} horizon, the profile of the forested soil below the A_2 horizon is similar to that of the cultivated soil below the A_p horizon.

The soil is influenced by a perched water table or a seasonally high water table that causes it to be wet in spring and early in fall. Consequently, fieldwork is delayed. This limitation can be overcome by artificial drainage. Tile drainage is usually most satisfactory because the tile can be easily laid at a uniform depth and water moves freely to the tile. The tile should be enveloped with well-graded sand and gravel to filter the silt out of the water. In some places, bedding is a satisfactory method of drainage. In a few places land smoothing can be done to increase runoff and limit the smothering of grasses and legumes by standing water and ice.

Fair yields of grass can be obtained without artificial drainage, but with improved drainage, high yields can be produced more consistently. If the soil is properly drained, consistently good yields of potatoes can be obtained. Potatoes can be grown continuously without severe loss of soil, but an occasional green-manure crop will help to maintain the favorable physical properties of the soil and to limit the hazards of insects and diseases. Too intensive growing of potatoes compacts the soil at plow depth and limits permeability. Water will then stand between the rows. This increases the hazard of late blight and delays harvesting of potatoes in fall.

Forested areas contain mainly spruce, fir, pine, and a few northern hardwoods. Lumbering can be done fairly easily, but year-round logging roads need drains and surface grading. Capability unit IIw-7.

Nicholville silt loam, 2 to 8 percent slopes (NcB).—Some of this gently undulating soil is cultivated. The profile is similar to the one described as representative of the series. Several hundred acres are forested. In these places the soil has an organic surface mat, 2 to 3 inches thick, over a grayish-brown silt loam A_2 horizon, about 2 inches thick. Except for a thicker B_{21} horizon, the profile of the forested soil below the A_2 horizon is similar to that of the cultivated soil below the A_p horizon.

Included with this soil is a soil that has slopes slightly greater than 8 percent but that needs about the same use and management as the rest of the soil.

Nicholville silt loam, 2 to 8 percent slopes, is influenced by a perched water table or a seasonally high water table that causes it to be wet in spring and early in fall. As a result, fieldwork is delayed. This limitation can be overcome by artificial drainage. Tile drainage is effective. The tile is slightly difficult to install because of the irregular, complex relief, and it must be laid parallel to the long, narrow depressions. In most places the tile has to be installed across the swells to reach an outlet. It should be covered with well-graded sand and gravel that will filter the silt out of the water. In some places land smoothing will eliminate sags and increase runoff. This is beneficial in places where grasses and legumes are often smothered by standing water or ice.

Fair yields of grass can be obtained without artificial drainage. If the soil is properly drained, however, consistently good yields of grass and potatoes can be obtained. The soil erodes rapidly, and, when used for a row crop, it needs protection. Contour stripcropping of potatoes is necessary on short slopes. Diversion ditches can be used on long slopes to help remove excess water and to limit the hazard of erosion.

Forested areas contain mainly spruce, fir, pine, and a few northern hardwoods. Lumbering can be done fairly easily, but year-round logging roads need drains and surface grading. Capability unit IIw-7.

Peat and Muck

Peat and muck (Pa).—These organic soils have not been classified into soil series. They consist mostly of the remains of sedges, rushes, and woody plants in various stages of decomposition.

Most of the peat has developed from partly decayed sedges and rushes and is similar to the Littlefield soils (not mapped in northeastern Aroostook County). Some species of heath plants grow on the peat. The areas are mainly long and narrow and are influenced by surrounding soils. They are not well suited to uses other than forestry and produce mostly cedar, spruce, and fir trees.

Muck consists mostly of highly decomposed woody plants. The soil commonly ranges from 18 to 35 inches in thickness. The areas produce mostly cedar and spruce. Capability unit VIIw-9.

Perham Series

The Perham series is made up of well-drained, medium-textured soils that have developed on firm, neutral to alkaline glacial till. The till was derived mainly from shale and slate. It is generally 3 to 6 feet thick over gray, folded shale bedrock. The soils have bisequal profiles consisting of Podzols over soils similar to Gray-Brown Podzolic soils (fig. 7).

Most of these soils have developed on a drumlinlike formation that has a rock core, but some of the soils have developed on the northern and western edges of the rolling ridges of Caribou soils. Most of the Perham soils occur at an elevation of 650 to 750 feet above sea level.

Where the soils are cultivated, the plow layer consists of light olive-brown and brown gravelly silt loam. In many spots the A_2 horizon is below the A_p horizon or is slightly mixed with the B_{21} horizon.

Where forested, the soils have irregular microrelief consisting of mounds and depressions. This type of relief is not so pronounced as on poorly drained soils, but it influences the color of the soils that are presently cultivated. There are only a few stones in wooded areas. About one angular fragment of shale, 18 inches long, occurs every 75 to 100 feet. The slightly stony forested areas have not been mapped separately from the cultivated areas, which also have a few stones.

At a depth of about 2 feet, or in the A'_2 horizon, there are many angular fragments of shale. The A'_2 horizon is so stony that this layer is difficult to remove when digging a pit. Once the A'_2 horizon is removed, further excavation is less difficult. This horizon divides the upper gravelly

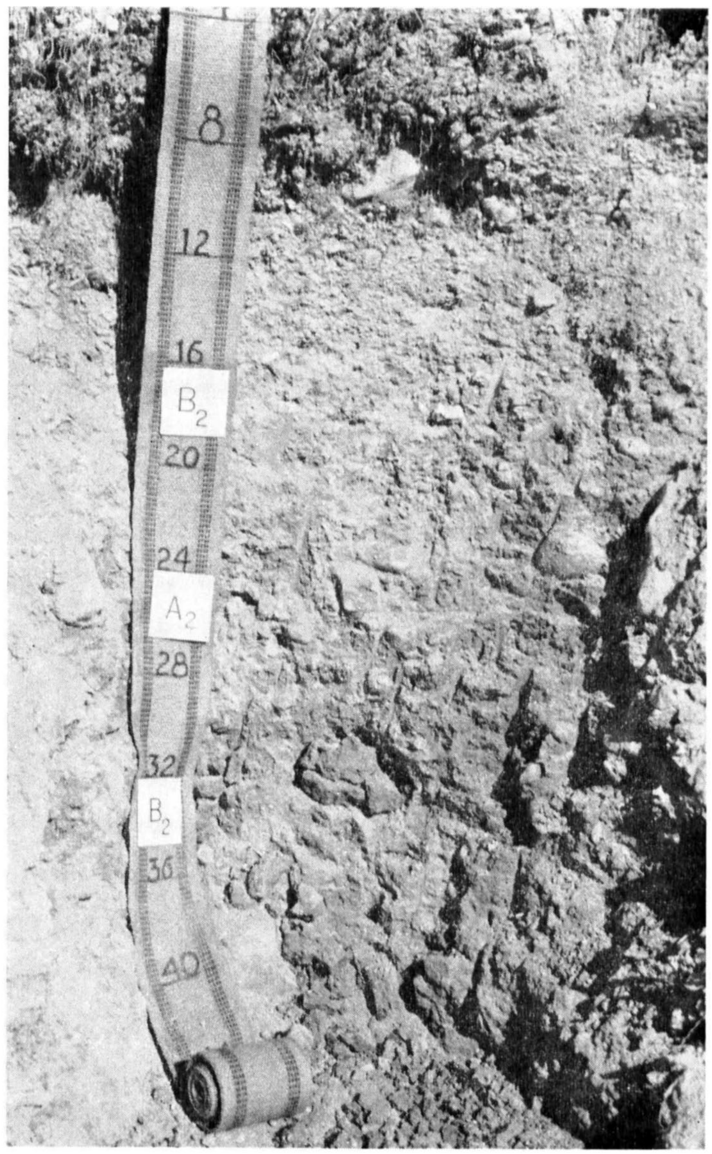

Figure 7.—**Profile of Perham gravelly silt loam. Roots are common in the friable upper part of the soil.**

silt loam B horizons from the lower gravelly clay loam B′ horizons. The B′ horizons are dark brown to light olive brown and have subangular blocky structure and clay films on the peds. In many places these horizons are brittle and very firm and have manganese and organic stains around the pores.

In some places the soils are weathered to bedrock and the profile has no C horizon. Where the bedrock is covered with less than about 5 feet of this kind of glacial till, the vertically bedded and shattered, gray shale has silt and clay between the seams. In places where the soils are more than 5 feet deep to bedrock, they have a C horizon of massive, firm gravelly loam.

The Perham soils are associated with the somewhat poorly drained Daigle soils, which occur in depressions, on similar kind of till, and on the same geological formations.

Perham soils have developed mainly under hardwood forests in which a few spruce and fir trees are scattered.

Representative profile—Perham gravelly silt loam, 2 to 8 percent slopes (cultivated):

A_p 0 to 10 inches, light olive-brown (2.5Y 5/6) gravelly silt loam; moderate, medium, granular structure; friable; acid; abrupt, smooth boundary; 8 to 12 inches thick.

B_{21} 10 to 13 inches, strong-brown (7.5YR 5/8) gravelly silt loam; weak, medium, granular structure; friable; acid; 20 to 30 percent coarse fragments; clear, wavy boundary; 2 to 4 inches thick.

B_{22} 13 to 25 inches, yellowish-brown (10YR 5/6) gravelly silt loam that becomes paler with increasing depth; weak, medium, granular structure; friable; acid; 30 percent coarse fragments; clear, wavy boundary; 10 to 14 inches thick.

A'_2 25 to 30 inches, grayish-brown (2.5Y 5/2) gravelly loam; thin, platy structure; friable; acid; 40 percent coarse fragments; clear, wavy boundary; 3 to 10 inches thick.

B'_{21} 30 to 40 inches, dark-brown (10YR 4/3) gravelly clay loam; prismatic and subangular blocky structure; clay films on sides of prisms and on peds; firm in place, slightly brittle when removed; 20 percent coarse fragments; acid; clear, wavy boundary; 8 to 15 inches thick.

B'_{22} 40 to 50 inches, light olive-brown (2.5Y 5/4) gravelly clay loam; subangular blocky structure; clay films on peds; firm; neutral; 20 to 30 percent coarse fragments; clear, wavy boundary; 10 to 20 inches thick.

C 50 to 60 inches, olive-brown (2.5Y 4/4) gravelly loam; massive (structureless); firm in place, friable when removed; no clay films; 30 to 40 percent coarse fragments; alkaline; 8 to 14 inches thick.

D 60 inches +, folded, hard, gray shale with a few, weak seams of lime.

Perham gravelly silt loam, 0 to 2 percent slopes (PeA).—This nearly level soil occurs on the upper parts of drumlinlike hills and seldom receives runoff from other soils. Permeability is moderate to moderately slow because the upper part of the soil is fairly high in silt and the lower part is high in clay. In some places the soil is slightly mottled at a depth of about 30 inches. The soil has been cleared of trees and surface stones and has a profile similar to that described as representative of the series. A few stones are brought to the surface each time the soil is plowed.

High yields of grass and clover are obtained if the soil is limed and fertilized. This soil produces high yields of potatoes, except in years when it retains too much water. Runoff is slow, and erosion is not a problem. The soil can be used intensively for potatoes without severe erosion. It is easily compacted, so a soil-building crop should be planted every 3 to 5 years to maintain desirable physical properties. Capability unit IIc–3.

Perham gravelly silt loam, 2 to 8 percent slopes (PeB).—This gently sloping soil occurs mainly on the sides of drumlinlike hills. Most of it is cultivated, and its profile is described as representative of the series.

Some of the soil is forested and has an organic mat, 2 to 6 inches thick, over a very thin, nearly black A_1 horizon. This is underlain by a grayish-brown silt loam A_2 horizon, about 4 inches thick. Except for a thicker B_{21} horizon, the profile below the A_2 horizon is similar to that of the cultivated soil.

Forested areas have angular shale fragments, 6 to 18 inches long, on the surface at intervals of about 100 feet. In cultivated areas a few stones are on the surface or partly embedded in the soil.

Permeability is moderate to moderately slow because the content of silt is fairly high.

High yields of grass and clover are obtained if moderate amounts of lime and fertilizer are applied. If the soil is farmed in graded strips, a rotation of 2 years of potatoes and 1 year of a green-manure crop can be followed without severe erosion. Too intensive use of the soil when it is wet will cause compaction.

Northern hardwoods, spruce, and fir are common in forested areas. Spruce grows well on this soil and, through selective cutting, can be encouraged to occupy a greater percentage of the stand. Capability unit IIe–3.

Perham gravelly silt loam, 8 to 15 percent slopes (PeC).—Most of this dominantly moderately steep soil is cultivated, and its profile is similar to that described as representative of the series.

Several hundred acres of the soil are forested and have an organic mat, about 3 inches thick, over a very thin, nearly black A_1 horizon. Below this is a grayish-brown gravelly silt loam A_2 horizon, about 2 inches thick. Except for a slightly thicker B_{21} horizon, the profile of the forested soil below the A_2 horizon is similar to the profile of the cultivated soil below the A_p horizon.

Forest areas have angular shale fragments, 6 to 18 inches long, on the surface at intervals of 75 to 100 feet. Cultivated areas have a few stones on the surface or have stones partly embedded in the soil.

Permeability is moderate to moderately slow. Runoff is moderately rapid. The soil holds a good supply of water available for plants.

High yields of grass and clover are produced if moderate amounts of lime and fertilizer are applied. Good yields of potatoes are obtained if the soil is farmed in contour strips to conserve rainfall and to control erosion. Diversion ditches can be used on long slopes to control runoff and to limit further loss of soil.

Forested areas contain mainly mixed northern hardwoods and a few spruce and fir trees. Lumbering can be easily done throughout the year. Capability unit IIIe–3.

Perham gravelly silt loam, 15 to 25 percent slopes (PeD).—Some of this steep soil is cultivated, and its profile is similar to that described as representative of the series.

Several hundred acres of the soil are forested and have an organic mat, about 2 inches thick, over a very thin, nearly black A_1 horizon. Below this horizon is a grayish-brown gravelly silt loam A_2 horizon, about 2 inches thick.

Except for a slightly thicker B_{21} horizon, the profile of the forested soil below the A_2 horizon is similar to the profile of the cultivated soil below the A_p horizon.

Forested areas have a few angular shale fragments, 6 to 24 inches long, on the surface at intervals of 75 to 100 feet. Cultivated areas have a few stones on the surface.

Permeability is moderate, and runoff is rapid. The soil holds a good supply of water available for plants.

Included with this soil is a soil that has slopes slightly steeper than 25 percent but that is used and managed like the rest of the soil.

Perham gravelly silt loam, 15 to 25 percent slopes, produces good yields of clover and grass and is well suited to permanent hay or pasture. Good yields of potatoes can be obtained if the soil is farmed in graded strips. Long slopes need diversion ditches to limit loss of soil.

Mixed northern hardwoods, spruce, and fir grow in forested areas. Lumbering can be done fairly easily. Capability unit IVe-3.

Plaisted Series

The Plaisted series consists of well-drained, medium-textured soils that have developed on very firm, acid gravelly loam till. The till was derived mainly from shale and slate. It is generally 6 to 12 feet thick, but, in many places along some of the streams, it is 20 feet thick. In these places the till is likely to be gravelly sandy loam and is firm rather than very firm. In many areas adjacent to Thorndike soils, these soils are only 30 to 40 inches deep. The Plaisted soils occur in all of the survey area, except the eastern part.

Most of these soils are forested, and they have small mounds and depressions characteristic in northern forests. On the surface there is a mat of partly decomposed organic material, 3 to 6 inches thick. A very thin A_1 horizon underlies the organic mat, and in most places this horizon cannot be distinguished. The gray, leached A_2 horizon is very prominent and ranges from 2 to 6 inches in thickness. In many places the A_2 horizon occurs in irregularly shaped pockets, and, in some of these places, it curves under the B_{21} horizon. The B horizons consists of strong-brown to yellowish-brown gravelly loam, which is of granular structure in the upper part but grades to thin, platy just above the C horizons.

Most of the areas are stony to very stony, and in some places the surface layer is nearly covered with stones, 4 to 6 inches in diameter. In some places stones, 8 to 12 inches in diameter, are scattered over the surface at intervals of 2 to 3 feet. Most of the areas have granitic stones, 3 to 5 feet in diameter, partly embedded in the soil at intervals of about 50 feet. Several thousand acres of these soils have stones, 6 to 24 inches in diameter, on the surface and partly embedded in the soil at intervals of 30 to 100 feet.

Forested areas that have only a few stones, as well as the cultivated areas, have been mapped as Plaisted gravelly loams. Some of the forested areas were once cleared of stones; others were never very stony. Even the cultivated fields have stones on the surface because a few stones are turned up whenever the soil is plowed.

Where cultivated, the soils are olive-brown to yellowish-brown gravelly loam and contain a few gray spots. Variation in color results from the incomplete mixing of the bleicherde and orterde (A_2 and B horizons).

The Plaisted soils developed under hardwood forests.

Representative profile—Plaisted very stony loam, 8 to 15 percent slopes (forested):

A_0 4 inches to 0, very dark brown, friable, partly decomposed organic matter; extremely acid; clear, smooth boundary; 2 to 5 inches thick.

A_2 0 to 5 inches, light-gray (5Y 7/2) gravelly sandy loam; weak, granular structure; friable; very strongly acid; abrupt, irregular boundary; 2 to 6 inches thick.

B_{21} 5 to 8 inches, strong-brown (7.5YR 5/6) gravelly loam; fine, granular structure; friable; strongly acid; abrupt boundary; 2 to 4 inches thick.

B_{22} 8 to 13 inches, yellowish-brown (10YR 5/4) gravelly loam; weak, granular structure; friable; strongly acid; clear, wavy boundary; 3 to 9 inches thick.

C_1 13 to 24 inches, olive-gray (5Y 5/2) gravelly loam; moderately thin, platy structure; very firm; layer is only slightly penetrated by plant roots; strongly acid; abrupt, wavy boundary; 8 to 15 inches thick.

C_2 24 inches +, olive-gray (5Y 5/2) gravelly loam; massive; very firm; medium acid.

Plaisted gravelly loam, 0 to 2 percent slopes (PgA).—This nearly level soil occurs on the upper parts of long ridges, and it seldom receives runoff from other soils. It is cultivated and has a yellowish-brown gravelly loam surface horizon, about 9 inches thick. This horizon is a mixture of the original A_2 and part of the B_{21} horizons. Below a depth of about 9 inches, the profile of this soil is similar to that of the forested soil described as representative of the series. Each time the soil is plowed a few stones are brought to the surface.

This soil can be used intensively for potatoes without severe erosion, but too intensive growing of row crops compacts the soil. A soil-building crop, such as clover, should be planted every 3 to 5 years to maintain desirable physical properties and to restrict diseases and insects. High yields of potatoes, oats, peas, clover, and grass can be obtained if adequate amounts of lime and fertilizer are applied. Capability unit IIc-3.

Plaisted gravelly loam, 2 to 8 percent slopes (PgB).—Most of this gently sloping soil has been cleared of trees and surface stones and is used for crops. Where cultivated, the soil has a surface layer of yellowish-brown gravelly loam, about 8 inches thick. Below a depth of about 8 inches, the profile of cultivated soil is like that of the representative profile of the series. Each time the soil is plowed a few stones are brought to the surface.

Some of this soil is forested and has a profile similar to that described for the series. Forested areas are not very stony, but a few stones, 6 to 24 inches in diameter, occur about every 30 to 100 feet.

The soil can be seeded to grass and clover and used for permanent hay or pasture; only moderate amounts of lime and fertilizer are needed. If the soil is farmed in graded strips, a rotation consisting of 2 years of potatoes and 1 year of a green-manure crop can be followed without causing severe erosion. Contour stripcropping will reduce loss of soil and conserve rainfall for crops during the summer.

Northern hardwoods and some spruce and fir are most common in forested areas. Spruce grows well despite competition from hardwoods. By selective cutting, spruce can be encouraged. Many woodlots should be managed for maple and birch, however. Year-round logging roads are easy to build and to maintain. Lumbering can be easily done. Capability unit IIe-3.

Plaisted gravelly loam, 8 to 15 percent slopes (PgC).—Some of this moderately steep soil is cultivated. It has a yellowish-brown gravelly loam surface layer, about 8 inches thick. Below a depth of about 8 inches, the profile of the cultivated soil is like that of the representative profile of the series. A few stones are on the surface and partly embedded in the surface layer. Each time the soil is plowed a few more stones are generally brought to the surface, but they are removed before a crop is planted.

Many thousands of acres of this soil are still forested. The profile of the forested soil is similar to that described as representative of the series. A stone, 6 to 24 inches in diameter, occurs on the surface at intervals of 25 to 100 feet. Plant roots are confined by a firm layer to about the uppermost 15 inches of soil. Tree roots seldom penetrate more than a few inches in this firm layer.

The friable top part of the soil holds about 3 inches of available water, enough to provide good yields of grass and clover. The soil can be used for permanent hay or pasture with little erosion. Good yields of potatoes can be obtained if they are planted in strips on the contour to conserve rainfall. Contour stripcropping limits loss of soil. Diversion ditches can be used on long slopes to control runoff and further limit erosion.

Forested areas contain mainly mixed northern hardwoods and a few spruce and fir. Lumbering can be easily done throughout the year. Capability unit IIIe-3.

Plaisted gravelly loam, 15 to 25 percent slopes (PgD).—Some of this steep soil is cultivated, and, where cultivated, it has characteristics like those described for cultivated areas of Plaisted gravelly loam, 8 to 15 percent slopes.

Many thousands of acres of this soil are still forested. Where forested, the soil has the same characteristics as those described for Plaisted gravelly loam, 8 to 15 percent slopes.

The friable top part of this soil holds about 3 inches of available water, enough to provide good yields of grass and clover. The soil can be used for permanent hay or pasture with little erosion.

It is difficult to use this soil for row crops without some loss of soil. Potatoes can be grown if contour stripcropping is followed and diversion ditches are provided. These practices help to limit erosion and to conserve rainfall for crops.

Forested areas contain mainly mixed northern hardwoods and a few spruce and fir. Logging roads should be built on the contour, and road outlets should be at an angle to the slope. Capability unit IVe-3.

Plaisted gravelly loam, 25 to 45 percent slopes (PgE).—Most of this steep soil is forested and has a profile similar to that described as representative of the series.

Some of the soil is cultivated and has a yellowish-brown gravelly loam surface horizon, about 7 inches thick. Below a depth of about 7 inches, the profile of the cultivated soil is similar to the profile of the forested soil.

Stones, 6 to 24 inches in diameter, are partly embedded in the soil at intervals of about 25 to 100 feet.

Included with this soil is a very steep soil that has similar use and management.

Because of very rapid runoff, Plaisted gravelly loam, 25 to 45 percent slopes, can seldom be used for row crops without eroding. It can be used for permanent hay or pasture with but little erosion. Grass and clover are well suited to this soil, and good yields are obtained if lime and fertilizer are applied.

Forested areas contain mainly northern hardwoods and a few spruce and fir. Lumbering is difficult. Logging roads should be built on the contour, and outlets should be protected from erosion. Capability unit VIe-3.

Plaisted very stony loam, 0 to 8 percent slopes (PrB).—This soil occurs mainly in the forested tracts of the survey area. It is common in the southwestern part, where it occurs on the upper parts of glacial-till ridges. In the west-central part of the area, it occurs on small hills. The profile of this soil is similar to the profile described as representative of the series.

Stones, 6 to 24 inches in diameter, are scattered over the surface at intervals of 2 to 10 feet. The stones limit the use of the soil mainly to forestry, but they do not interfere with woodland management.

Because relief is gently sloping, runoff is slow and most rainfall enters the uppermost 12 to 14 inches of the soil. Below this depth the soil is very firm and is seldom penetrated by rainfall in summer. Most tree roots are confined to the uppermost 16 inches of soil.

Areas of this soil on the upper parts of ridges have forests consisting mostly of maple, beech, and berch. Areas at the bases of ridges and on low hills generally produce a mixed stand of northern hardwoods, spruce, and fir. This soil is easy to manage for northern hardwoods and can be logged at any time of the year. Capability unit VIs-3.

Plaisted very stony loam, 8 to 15 percent slopes (PrC).—This soil occurs mainly in the forested parts of the survey area. It is common in the southwestern part, where it occurs on the sides of glacial-till ridges. In the west-central part, it occurs on small hills. The profile of this soil is described as representative of the series.

Stones, 6 to 24 inches in diameter, are scattered over the surface at intervals of 2 to 10 feet. The stones limit the use of this soil mainly to forestry, but they do not interfere with woodland management.

Because the slopes are moderately steep, runoff is medium, and most rainfall enters the uppermost 12 to 14 inches of the soil. Below this depth the soil is very firm and is seldom penetrated by rainfall in summer. Most tree roots are confined to the uppermost 16 inches of soil.

This soil produces mainly maple, beech, and birch. It is easy to manage for northern hardwoods and can be logged at any time of the year. Capability unit VIs-3.

Plaisted very stony loam, 15 to 25 percent slopes (PrD).—This steep soil is mostly forested. It has a profile similar to that described as representative of the series.

Stones, 6 to 24 inches in diameter, are scattered over the surface at intervals of 2 to 10 feet. Runoff is rapid, unless a good cover of vegetation is maintained.

This soil produces good stands of maple, beech, and birch. Logging roads should be built on the contour to prevent loss of soil through gully erosion. Capability unit VIs-3.

Plaisted very stony loam, 25 to 45 percent slopes (PrE).—This soil has steep and very steep slopes. It has a profile similar to that described as representative of the series, although in most places the A_0 and A_2 horizons are very thin.

Stones, 6 inches to 36 inches in diameter, are scattered over the surface at intervals of 2 to 10 feet. The stones and the steep slopes limit the use of the soil mainly to forestry. Harvesting of trees is slightly difficult.

Northern hardwoods are predominant, but a few spruce and fir trees grow on the northwestern slopes. Logging roads should be built on the contour. Road outlets should be protected from erosion because rapid runoff is likely to cause gullying. Capability unit VIIs-3.

Plaisted and Howland very stony loams, 0 to 8 percent slopes (PvB).—This undifferentiated unit consists of about 75 percent Plaisted soil and about 25 percent Howland soil. The profile of the Plaisted soil is similar to the profile described as representative of the Plaisted series. The profile of the Howland soil is similar to that described under the Howland series.

The two soils are forested, and they have been mapped together because boundaries could not be drawn accurately between them.

These soils grow mixed hardwoods and softwoods. At present, maple, birch, and beech are most common, but by selective cutting, spruce could become the predominant tree.

Some of the acreage could be cleared and cultivated, but most areas are too far from public roads to make this practice feasible at present. Capability unit VIs-3.

Plaisted and Howland very stony loams, 8 to 15 percent slopes (PvC).—This undifferentiated unit is about 75 percent Plaisted soil and about 25 percent Howland soil. The profile of the Plaisted soil is similiar to the one described as representative of the Plaisted series. The profile of the Howland soil is similar to that described under the Howland series.

The two soils are forested, and they have been mapped together because boundaries could not be drawn accurately between them.

These soils produce mixed hardwoods and softwoods. They are productive of spruce, and lumbering can be easily done. Capability unit VIs-3.

Red Hook Series

The Red Hook series consists of poorly drained soils that have developed on acid, stratified sand and gravel derived mainly from shale, slate, and sandstone. The soils are on terraces and glacial outwash and occur in all parts of the survey area except the eastern.

Where cultivated, the soils have a very dark gray to grayish-brown silt loam surface horizon over a mottled A_{2g} horizon that ranges from 4 to 12 inches in thickness. The color of the plow layer and the thickness of the bleicherde (A_2) horizon vary because of the uneven relief of the original, undisturbed areas. Where forested, the soils have a thin A_1 horizon and a thick, mottled A_{2g} horizon.

The soils have yellowish-brown, mottled gravelly silt loam and gravelly clay loam B horizons that have weak, subangular blocky structure and are acid in reaction. In drainage they are similar to the Fredon soils, which have mottled gravelly silt loam to gravelly sandy loam B horizons that have weak, subangular blocky to thin, platy structure and are neutral in reaction.

The Red Hook soils have developed under a spruce-fir forest.

Representative profile—Red Hook silt loam, 0 to 2 percent slopes (forested):

A_0 3 inches to 0, partly decomposed organic matter.

A_1 0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, coarse, granular structure; friable; acid; clear, irregular boundary; 2 to 4 inches thick.

A_{2g} 2 to 12 inches, grayish-brown (10YR 5/2) gravelly silt loam; few, fine, light yellowish-brown mottles; weak, thin, platy structure; friable; acid; clear, irregular boundary; 4 to 12 inches thick.

B_{21g} 12 to 16 inches, yellowish-brown (10YR 5/6) heavy gravelly silt loam; common, medium, grayish-brown mottles; moderate, fine, granular structure; friable; acid; clear, wavy boundary; 3 to 6 inches thick.

B_{22g} 16 to 24 inches, light yellowish-brown (10YR 6/4) gravelly clay loam; many, fine, grayish-brown and yellowish-brown mottles; weak, fine, granular structure; firm in place, friable when removed; acid; clear, wavy boundary; 5 to 10 inches thick.

C_{1g} 24 to 30 inches, light olive-brown (2.5Y 5/4) gravelly loam; few, fine, grayish-brown and yellowish-brown mottles; weak, thin, platy structure; firm in place, friable when removed; acid; clear, wavy boundary; 5 to 10 inches thick.

D 30 to 40 inches +, light olive-brown (2.5Y 5/4) sand and gravel; single grain (structureless); loose; acid.

Red Hook and Atherton silt loams, 0 to 2 percent slopes (RaA).—A profile of the Red Hook soil in this undifferentiated unit has just been described. A profile of the Atherton soil is described under the Atherton series.

More than half of the acreage of this mapping unit consists of Red Hook soil. Red Hook and Atherton soils differ little in relief, and the two soils seldom can be identified except by examination of the profile. Because of their similarity, the soils have not been mapped separately.

For 8 months of the year, the water table is about 1 foot below the surface. Since runoff is slow, the soils are slightly difficult to drain. In some places there is a perched water table, and the soil below it is loose, coarse, and rapidly permeable.

A small acreage of the Red Hook soil is used for hay and pasture—less than that of Red Hook and Atherton silt loams, 2 to 8 percent slopes. Few cleared fields contain Atherton soil. Most forested areas consist of both Red Hook and Atherton soils.

Most of the areas are forested with red spruce and fir, but some areas of the Atherton soil produce mainly black spruce. The trees are shallow rooted, even on the Red Hook soil. Capability unit IVw-5.

Red Hook and Atherton silt loams, 2 to 8 percent slopes (RaB).—The Red Hook soil in this undifferentiated unit has a profile similar to that described as representative of the Red Hook series, and the Atherton soil has a profile similar to that described under the Atherton series.

These soils are undulating to gently sloping and have slow to medium runoff. The water table is usually close to the surface. The Red Hook soil can be drained, but even then it cannot be worked until late in spring or early in summer.

Most of the cultivated fields are on the Red Hook soil, but the forested areas generally are on both the Red Hook and Atherton soils. Only a few hundred acres have been cleared, and most of the acreage has stands of spruce and fir. Capability unit IVw-5.

Riverwash

Riverwash (Re).—This is a miscellaneous land type made up of sand, gravel, and cobblestones that have been deposited along streams and rivers. The areas range from about ½ acre to 5 acres in size. Except during summer, they are nearly covered with water. They support only a few willows and alders. The soil material is occasionally removed for use in roads, especially in areas along the St. John River. Capability unit VIIIw–6.

Salmon Series

The Salmon series consists of well-drained silt loam soils on stream terraces. Below a depth of 18 to 40 inches, the soils are fine sandy loam, loamy fine sand, or sand. These soils occur in the valley of the St. John River in association with the moderately well drained Nicholville and poorly drained Canandaigua soils.

Salmon soils have formed under a forest of mixed northern hardwoods, spruce, and fir. Most areas are used for cultivated crops.

Representative profile—Salmon silt loam, 0 to 2 percent slopes (cultivated):

A_p 0 to 8 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; acid; abrupt, smooth boundary; 8 to 10 inches thick.

B_{21} 8 to 12 inches, strong-brown (7.5YR 5/8) silt loam; moderate, medium, granular structure; friable; acid; clear, wavy boundary; 2 to 6 inches thick.

B_{22} 12 to 20 inches, yellowish-brown (10YR 5/8) silt loam; weak, fine, granular structure; friable; acid; clear, wavy boundary; 8 to 12 inches thick.

C 20 to 28 inches, olive-gray (5Y 5/2) silt loam with bands of fine sandy loam; weak, fine, granular structure; friable; acid; clear, wavy boundary; 5 to 10 inches thick.

D 28 to 40 inches, olive-gray (5Y 5/2) sand; single grain (structureless); loose; slightly acid.

Salmon silt loam, 0 to 2 percent slopes (SaA).—Several hundred acres of this nearly level soil are cultivated. The profile is described as representative of the series.

Some of the soil is forested and has a thin A_1 horizon and a grayish-brown silt loam A_2 horizon, about 2 inches thick. Except for a thicker B_{21} horizon, the profile of the forested soil below the A_2 horizon is similar to the profile of the cultivated soil below the A_p horizon.

If fertilized and limed, the soil produces high yields of clover and grass. Water stands in some small depressions late in fall or early in spring and smothers grasses and legumes. These depressions can be eliminated by land smoothing. Slightly larger yields can then be produced, and uniform stands of clover and grass can be more easily maintained for several years.

Potatoes can be grown continuously without severe loss of soil, but an occasional green-manure crop will help to maintain desirable physical properties of the soil and to limit the hazards of insects and diseases. If used too intensively for potatoes, the soil becomes compact and permeability is restricted. Water will then stand between the rows. This increases the hazard of late blight and delays harvesting of potatoes in fall.

Forested areas contain mainly spruce, fir, pine, and a few northern hardwoods. Lumbering can be easily done. Capability unit IIc–7.

Salmon silt loam, 2 to 8 percent slopes (SaB).—Several hundred acres of this gently undulating soil are cultivated. The profile is similar to the one described as representative of the series.

Some of the soil is forested and has a thin A_1 horizon and a grayish-brown silt loam A_2 horizon, about 2 inches thick. Except for a thicker B_{21} horizon, the profile of the forested soil below the A_2 horizon is similar to the profile of the cultivated soil below the A_p horizon.

This soil can be used for hay or pasture. If fertilized and limed, it produces high yields of clover and grass. Water stands in some small depressions late in fall or early in spring and smothers grasses and legumes. These depressions can be eliminated by land smoothing. Slightly larger yields can then be produced, and uniform stands of clover and grass can be more easily maintained for several years.

Good yields of potatoes can be obtained. If used too intensively for potatoes, the soil becomes compact and permeability is restricted. Water will then stand between the rows. This increases the hazard of late blight and delays harvesting of potatoes in fall. Also, if the soil is compacted, the hazard of erosion will increase. Short slopes need to be farmed in strips on the contour. Long slopes need diversion ditches to give added protection against erosion.

Forested areas contain mainly spruce, fir, pine, and a few northern hardwoods. Lumbering can be easily done. Capability unit IIe–7.

Salmon silt loam, 8 to 15 percent slopes (SaC).—A few acres of this moderately steep soil are cultivated. The profile is similar to the one described as representative of the series.

Some of the soil is forested, and it has a thin A_1 horizon and a grayish-brown silt loam A_2 horizon, about 2 inches thick. Except for a thicker B_{21} horizon, the profile of the forested soil below the A_2 horizon is similar to the profile of the cultivated soil below the A_p horizon.

Included with this soil is a soil that has slopes steeper than 15 percent but that responds to similar use and management.

If limed and fertilized, Salmon silt loam, 8 to 15 percent slopes, produces high yields of clover and grass. It can be used for permanent hay or pasture without danger of severe erosion.

In most places this soil cannot be used for row crops without some loss of soil. On long slopes runoff can be controlled by the use of diversion ditches. The soil needs a rotation that includes several years of a close-growing crop; for example, 1 year of potatoes, 1 year of oats or peas, and 3 years of a grass-legume mixture. This rotation, used along with contour stripcropping, will limit the hazard of severe erosion.

Forested areas contain mainly spruce, fir, and northern hardwoods. Logging roads used in harvesting these trees should be on the contour. Exits should be at an angle to the slope to limit washouts. Capability unit IIIe–7.

Steep Rockland, Thorndike Materials

Steep rockland, Thorndike materials (Sb).—Only about 25 to 75 percent of this miscellaneous land type consists of soil material. The rest of it is nearly bare shale bedrock. There are few large stones or boulders but many angular fragments of shale. The soil between the outcrops is similar to that described for the Thorndike series, except that the horizons are not so thick. Trees in these areas are slow growing, shallow rooted, and difficult to harvest. Capability unit VIIs–1.

Stetson Series

The Stetson series is made up of deep, well-drained gravelly loam soils that have developed from water-deposited sandy and gravelly parent material. They have gravelly loam or gravelly sandy loam subsoil that extends to a depth of 18 or more inches. Below this depth is gravelly loamy sand or stratified sand and gravel. The particles of sand and gravel were derived mainly from shale, slate, or limestone, but a small percentage was derived from granite. These soils have parent material like that of the Masardis soils (not mapped in northeastern Aroostook County) but differ in the depth to gravelly loamy sand.

The soils occur on terraces in the valleys of the St. John and Aroostook Rivers. In some places they are on eskers, which are rare in this area. They are associated with the moderately well drained Machias, poorly drained Fredon, and very poorly drained Halsey soils, which have formed in similar parent material.

The Stetson soils developed under a forest of pine and northern hardwoods.

Representative profile—Stetson gravelly loam, 0 to 2 percent slopes (forested):

A_0 2 inches to 0, very dark brown, partly decomposed organic matter; strongly acid; abrupt, smooth boundary; 1 to 4 inches thick.

A_2 0 to 2 inches, gray (N 5/0) gravelly loam; weak, granular structure; strongly acid; abrupt, irregular boundary; 1 to 3 inches thick.

B_{21} 2 to 6 inches, reddish-brown (5YR 4/4) gravelly loam; weak, fine, granular structure; very friable; strongly acid; clear, wavy boundary; 2 to 5 inches thick.

B_{22} 6 to 20 inches, dark yellowish-brown (10YR 4/4) gravelly sandy loam; weak, fine, granular structure; very friable; strongly acid; clear, wavy boundary; 10 to 20 inches thick.

D 20 to 40 inches, dark grayish-brown (10YR 4/2), stratified sand and gravel; single grain (structureless); loose; strongly acid.

Stetson gravelly loam, 0 to 2 percent slopes (SgA).—This nearly level soil occurs on the tops of terraces. Where cultivated, it has a surface layer of yellowish-brown gravelly loam about 10 inches thick. Below a depth of about 10 inches, the profile is similar to the profile of the forested soil described as representative of the series. The profile of cultivated soil has a thinner B_{21} horizon, however.

This soil holds about 3 to 3½ inches of water in the upper 20 inches, where most of the plant roots grow. In some places in the eastern part of the survey area, the soil contains free lime at a depth of 3 or more feet.

This soil produces high yields of grass and clover, if limed and fertilized. In some places deep-rooted plants, like alfalfa, which roots to a depth of 3 feet or more, can obtain lime from the subsoil. Runoff is slow, so potatoes can be grown continuously with little risk of erosion. A soil-building crop should be grown occasionally to maintain the content of organic matter. Capability unit IIc–5.

Stetson gravelly loam, 2 to 8 percent slopes (SgB).—Several thousand acres of this gently sloping soil are forested. The profile is similar to the one described as representative of the series.

A large acreage of this soil is cultivated and has a yellowish-brown gravelly loam surface layer, about 8 inches thick. Below a depth of about 8 inches, the profile and that of the forested soil are similar. The uppermost 18 to 20 inches of this soil holds about 2½ to 3 inches of water available for plants.

Included with this soil is a soil that contains nearly 50 percent gravel below a depth of 15 inches. This included soil is slightly droughty, but it responds to the same use and management as the rest of the soil. In some places the soil contains free lime in the substratum.

Stetson gravelly loam, 2 to 8 percent slopes, can be used for hay; yields of grass, clover, and alfalfa usually are good. A rotation consisting of 2 years of potatoes and 1 year of a green-manure crop is commonly followed. Yields of potatoes are usually larger if the crop is planted in strips on the contour. Erosion is seldom a problem, but contour stripcropping will limit runoff and permit the soil to absorb summer rainfall.

Forested areas contain mainly pine, fir, and northern hardwoods. It is usually easy to get pine established because hardwoods offer only limited competition. Year-round logging roads are easy to build and maintain. Lumbering can be easily done throughout the year. Capability unit IIe–5.

Stetson gravelly loam, 8 to 15 percent slopes (SgC).—Several thousand acres of this moderately steep soil are forested. The profile is similar to the one described as representative of the series.

Some of this soil is cultivated and has a yellowish-brown gravelly loam surface layer, about 8 inches thick. Below a depth of about 8 inches the profile and that of the forested soil are similar.

Included with this soil is a soil that contains a high percentage of angular fragments of limestone and shale but that responds to similar use and management.

Stetson gravelly loam, 8 to 15 percent slopes, produces good yields of clover and grass and can be used for permanent hay or pasture if lime and fertilizer are applied. Good yields of potatoes can be obtained, but intensive cultivation increases the hazard of erosion. Higher yields are usually produced if the soil is farmed in strips on the contour. This practice also reduces erosion. Loss of soil usually can be reduced on long slopes by the use of diversion ditches. If a high content of organic matter is maintained, the water-holding capacity of the soil will be increased.

Forested areas contain mainly pine, fir, and northern hardwoods. Pine is generally easy to establish because hardwoods offer only limited competition. Year-round logging roads are easy to build and maintain. Lumbering can be easily done throughout the year. Capability unit IIIe–5.

Stetson gravelly loam, 15 to 25 percent slopes (SgD).—Most of this steep soil is forested. The profile is similar to the one described as representative of the series.

Some of this soil is cultivated and has a yellowish-brown gravelly loam surface layer about 7 inches thick. Below a depth of about 7 inches, the profile is similar in both cultivated and forested areas.

Because this soil has short, steep slopes and generally occurs on terrace faces, it is difficult to farm. The growing of row crops without some loss of soil is very difficult. This soil produces good yields of grass and clover early in the summer, but, because of rapid runoff, crops do not get enough water to yield well in midsummer. In some places the substratum contains free lime, so it is easy to maintain a stand of alfalfa. These calcareous areas can be used for permanent hay or pasture during the entire growing season.

Forested areas generally contain pine, fir, and northern hardwoods. If laid out on the contour, logging roads are easy to build and maintain. Exits for the roads should be at an angle to the slope to limit washouts. Capability unit IVe–5.

Stetson gravelly loam, 25 to 45 percent slopes (SgE).—The profile of this soil is similar to the one described as representative of the series. Short, steep slopes limit the use of the soil mainly to woodland. Runoff is very rapid and will cause erosion, unless a permanent cover of vegetation is maintained.

Forests consist mainly of fir and northern hardwoods. Lumbering is fairly difficult. Sand and gravel from the subsoil can be used as grade material where it is necessary to build roads on wet soils. Capability unit VIe–5.

Thorndike Series

The Thorndike series is made up of well-drained soils that have developed from glacial till and some weathered shale. The till was derived mainly from shale and slate. The till is thin, rarely more than 24 inches thick, and in most places the lower part of it is the illuvial (B_3) horizon. In these places the soils do not have a C horizon. The illuvial horizon is underlain by a D_r horizon of nearly vertically bedded, shattered shale bedrock. The entire soil is granular and friable. Thin, flat shale fragments, 3 to 10 inches long, make up about one-fourth of the soil mass.

These soils occur in all of the survey area except the east-central part. They do not occur in the limestone valley, which extends from Mapleton east into Canada.

Most of the acreage is forested, but several thousand acres are cultivated. In some areas these soils have not been disturbed, except for lumbering once in 25 to 50 years. They have a climax forest of northern hardwoods and a few white pines.

Hardwood twigs and leaves have built an organic mat, or A_0 horizon, 2 to 6 inches thick, over the irregular microrelief, which consists of small mounds, 1 to 2 feet high. The organic mat is generally thicker between the mounds; here, it is underlain by a black A_1 horizon that is made up of a mixture of mineral and organic material and is one-fourth to one-half inch thick. The A_1 horizon seldom can be distinguished in the mounds. Under the A_0 or A_1 horizons are gray or grayish-brown leached horizons. These eluvial (A) horizons are commonly thickest in the mounds, but in only a few places are they as highly leached as in the depressions. Normally, there is a grayish-brown A_2 horizon, 3 to 4 inches thick, in the mounds and a gray A_2 horizon, 2 to 3 inches thick, between the mounds. In some places, mostly in the mounds, tongues of the A_2 horizon extend for several inches into the lower horizons. The A_2 horizon has developed over brown to strong-brown illuvial (B) horizons, 4 to 8 inches thick. In places the upper part of the B_{21} horizon contains small cemented aggregates, or concretions. These are generally dark reddish brown and may be cemented with organic material.

Where cultivated, the soils normally have a yellowish-brown to dark yellowish-brown shaly silt loam A_p horizon. This is generally underlain by a dark-brown B_{21} horizon, but in some spots there is a grayish-brown A_2 horizon.

In many forested areas, there are a few fragments of shale, more than 10 inches long, on the surface. Also, there is a flat shale fragment, 10 to 18 inches long, about every 100 feet. When formerly forested areas or cultivated areas are plowed, more shale fragments are brought to the surface. The soils in forested areas, as well as cultivated areas of shaly soils, have been mapped as Thorndike shaly silt loams.

Areas in the southwestern and western parts of the survey area have a few crystalline rocks, as well as shale fragments. There are also outcrops of bedrock. These vary in size but are generally larger on the steeper slopes. The soils in these areas have been mapped as Thorndike very rocky silt loams, and more detail on rock outcrops is given in the descriptions of the individual soils.

Thorndike soils can be confused with Mapleton soils, which have developed from thin glacial till. The many shale fragments in Thorndike soils are hard and noncalcareous. Mapleton soils, in contrast, contain many, soft, leached, limy fragments of shale, which are rare in Thorndike soils.

Representative profile—Thorndike shaly silt loam, 0 to 8 percent slopes (cultivated):

A_p 0 to 8 inches, yellowish-brown (10YR 5/6) shaly silt loam; moderate, medium, granular structure; friable; acid; abrupt, wavy boundary; 7 to 10 inches thick.

B_{21} 8 to 12 inches, dark-brown (7.5YR 4/4) shaly silt loam with pockets of grayish-brown (10YR 5/2) loam; moderate, medium, granular structure; friable; 20 to 30 percent coarse fragments; acid; abrupt, wavy boundary; 2 to 6 inches thick.

B_{22} 12 to 16 inches, yellowish-brown (10YR 5/8) shaly silt loam; weak, fine, granular structure; friable; 30 to 40 percent coarse fragments; acid; abrupt, wavy boundary; 2 to 6 inches thick.

B_3 16 to 20 inches, brownish-yellow (10YR 6/6) shaly silt loam; weak, very fine, granular structure; friable; 50 to 75 percent coarse fragments; acid; clear, irregular boundary; 2 to 6 inches thick.

D_r 20 inches +, nearly vertically bedded, gray shale bedrock that has silt among the seams; plant roots enter seams in the bedrock.

Thorndike shaly silt loam, 0 to 8 percent slopes (ThB).—A profile of this gently undulating soil has been described as representative of the series. On the average, the soil is about 16 inches deep to shale bedrock. There is about one rock outcrop or small, very shallow spot per acre. Outcrops consist of shattered shale that is firm in place and is a hazard to farm machinery.

The soil is friable, and plant roots are distributed throughout. The plow layer contains about 30 percent flat shale fragments, 2 to 6 inches long. These fragments restrict the use of mechanical potato harvesters. This soil can generally hold from 2 to 2.5 inches of water available to plants.

Most areas are irregularly sloping, and few can be farmed in strips on the contour. But, wherever possible, contour stripcropping should be practiced. It will help conserve moisture for plants, as well as limit erosion. Most of the soil is used for potatoes in a rotation that includes peas, small grains, and grass-legume hay crops. Capability unit IIe-1.

Thorndike shaly silt loam, 8 to 15 percent slopes (ThC).—Several thousand acres of this soil are cultivated. The profile is similar to the one described as representative of the series.

Some of the soil is forested. Except for the top 8 inches, the profile is similar whether the soil is cultivated or forested. The upper part of the soil in forested areas and the degree of stoniness are discussed under the description of the series.

This soil commonly occurs on the sides of ridges and has rolling relief. There is about one rock outcrop or very shallow spot per acre. In only a few places do shallow spots cover more than 5 percent of the surface area. Few outcrops extend far enough above the surface to interfere with wheel equipment, but they are a hazard to equipment used in preparing seedbeds and in cultivating row crops.

Most of the soil is about 15 inches deep over bedrock, but the depth ranges from 6 inches to about 3 feet. The soil is friable, and roots are distributed throughout. Roots of deep-rooted plants extend into seams in the bedrock.

This soil holds enough water to produce good yields of grass or clover. It can be used for permanent hay or pasture if lime and fertilizer are applied. If used for potatoes, it should be farmed in graded strips to reduce runoff, to hold more water available for the crop, and to reduce the hazard of erosion. On long slopes runoff can be controlled by the use of diversion ditches. The ditches must be laid out to avoid rock outcrops.

Forested areas contain mainly mixed northern hardwoods and a few spruce and fir trees. Lumbering can be easily done throughout the year. Capability unit IIIe-1.

Thorndike shaly silt loam, 15 to 25 percent slopes (ThD).—Several thousand acres of this soil are cultivated. The profile is similar to the one described as representative of the series.

Some of the soil is forested. Except for the top 8 inches, the profile of the forested soil is similar to the profile of the cultivated soil. The upper part of the soil in forested areas and the degree of stoniness are discussed under the description of the series.

Very shallow spots or rock outcrops comprise from 5 to 10 percent of the surface area. The outcrops are about 5 feet wide and 25 feet long and lie parallel to the contour of the slope. They commonly extend far enough above the surface to interfere with the use of nearly all farming equipment.

Most of the soil is from 12 to 15 inches deep over nearly vertically bedded shale. The soil is friable, and roots are distributed throughout.

This soil holds enough water to produce good yields of grass and clover. It can be used for permanent hay or pasture if lime and fertilizer are applied. Because runoff is rapid, the soil most likely will erode if used in a regular rotation that includes potatoes. The relief is too irregular for contour stripcropping, and shallow spots limit the use of diversion ditches. Occasionally, a row crop can be grown in narrow strips without excess loss of soil.

Forested areas consist mainly of mixed northern hardwoods and a few spruce and fir trees. Lumbering can be done fairly easily. Wherever possible, logging roads should be built on the contour and outlets made at an angle to the slope. Capability unit IVe-1.

Thorndike shaly silt loam, 25 to 45 percent slopes (ThE).—This soil occurs mainly on the high hills south of the St. John River. It slopes steeply to the river terraces and has been used for pasture crops, along with the soils on the terraces. The soil is too steep to be used for row crops that require heavy equipment. There are about two small shaly outcrops per acre, but, in general, the soil is 12 to 16 inches deep. Runoff is rapid, and gullies may develop along paths used by animals.

Some areas produce northern hardwoods and, on the northwestern slopes, some spruce. Wherever possible, logging roads should be built on the contour and outlets made at an angle to the slope. Capability units VIIs-1.

Thorndike very rocky silt loam, 0 to 8 percent slopes (TkB).—This soil is gently sloping, but most of the slopes are irregular. At the surface there is an organic mat, 1 to 3 inches thick, over a gray A_2 horizon, 2 to 4 inches thick. The B horizons are similar to those in the profile described as representative of the series.

Areas of shale bedrock, about 2 feet wide and 5 feet long, are exposed at intervals of 150 to 200 feet. In some places the bedrock does not extend to the surface but lies beneath 3 to 6 inches of soil. About 1 cubic yard per acre of loose shale fragments are on the surface. The depth to shale bedrock is very irregular; it ranges from 6 to 30 inches.

This soil is productive of hardwoods. It has almost pure stands of northern hardwoods, mostly maple, beech, and birch. Lumbering can be easily done. Capability unit VIs-1.

Thorndike very rocky silt loam, 8 to 15 percent slopes (TkC).—This moderately steep soil has an organic mat at the surface. This mat consists mainly of hardwood twigs and leaves, and it overlies a thin, discontinuous, nearly black horizon of mixed mineral and organic materials. This mixed layer is underlain by a grayish-brown silt loam A_2 horizon about 2 inches thick. Under the A_2 horizon is a B_{21} horizon about 6 inches thick. Below a depth of about 8 inches, the profile of this soil is similar to the profile described as representative of the series.

This soil ranges from 6 to 36 inches in depth to bedrock, but, in general, it is 12 to 16 inches deep. Areas of shale bedrock, about 2 feet wide and 15 feet long, are exposed at intervals of 125 to 200 feet. Many slopes extend in one general direction for a thousand or more feet, but the outcrops make the relief irregular. About 1 cubic yard per acre of loose shale fragments is on the surface or partly embedded in the soil.

This soil produces almost pure stands of northern hardwoods—mostly maple, beech, and birch. Lumbering can be done fairly easily because the outcrops and stones are not numerous or large enough to interfere with construction of logging roads. The shale bedrock is easily removed and is often used as fill for roads constructed in low, wet areas. Capability unit VIs-1.

Thorndike very rocky silt loam, 15 to 25 percent slopes (TkD).—This soil has an organic mat composed mainly of hardwood twigs and leaves, and under this mat, a thin, discontinuous, nearly black horizon of mixed mineral and organic materials. This mixed layer is underlain by a grayish-brown silt loam A_2 horizon about 2 inches thick. Under the A_2 horizon is a B_{21} horizon about 6 inches thick. Below a depth of about 8 inches, the profile of this soil is similar to the profile described as representative of the series.

This strongly rolling and hilly soil has areas of exposed bedrock, 3 feet wide and 20 feet long, at intervals of 100 to 300 feet; these areas are interspersed with very small outcrops. The soil is very irregular in depth, or from 6 inches to 2 feet deep. About 2 cubic yards per acre of loose stones are on the surface.

Because it is steep, rocky, and shallow, this soil is suited mainly to forestry. Northern hardwoods—mostly maple, birch, and beech—grow on the soil. Logging roads should be built on the contour, and outlets should be protected from erosion. Capability unit VIIs–1.

Thorndike very rocky silt loam, 25 to 45 percent slopes (TkE).—This soil has an organic mat at the surface, composed mainly of hardwood twigs and leaves, over a thin, discontinuous, nearly black horizon of mixed mineral and organic materials. This is underlain by a grayish-brown silt loam A_2 horizon, about 2 inches thick. Under the A_2 horizon is a B_{21} horizon, about 6 inches thick. Below a depth of about 8 inches, the profile of this soil is similar to the profile described as representative of the series.

This steep and hilly soil occurs on the sides of high ridges or mountains and is generally 6 to 18 inches deep. Spots of bare rock that are about 9 square feet in size are interspersed with ridges of rock outcrops that are 3 feet wide and 50 feet long. These areas occupy about one-fourth to one-half of the surface of the soil.

Steep slopes, a rocky surface, and limited depth restrict the use of this soil mainly to forestry. Northern hardwoods grow on the soil, and some spruce grows on the northwestern slopes. Logging roads are very difficult to build and maintain. Capability unit VIIs–1.

Thorndike extremely rocky silt loam, 15 to 45 percent slopes (TrE).—This is a very shallow soil. The top part of the profile is like that of the profile in forested areas, which is described briefly under the series. Below a depth of about 8 inches, the profile is similar to the detailed profile described for cultivated areas under the series.

In most places there are only 12 to 18 inches of soil over the bedrock. Outcrops of sharp, angular rock are common, and these are devoid of soil and of vegetation, except for moss. In the deeper spots, hardwoods grow well, but, in much of the area, the soil is too shallow to hold enough water for rapid growth of trees.

Small areas that have slopes of less than 15 percent have been included with this soil.

Spruce grows on some of the western slopes and in small seepage spots. Lumbering tends to be difficult on the steeper slopes. Logging roads must be laid out to avoid the sharp outcrops of rock. Generally, it is easy to find suitable locations for roads. Capability unit VIIs–1.

Thorndike and Howland soils, 0 to 8 percent slopes (TsB).—The soils in this undifferentiated unit are forested and have not been disturbed.

Nearly 75 percent of the acreage is made up of the Thorndike soil, which is about 16 inches deep to shale bedrock. The Thorndike soil has an organic surface mat, which ranges from 2 to 6 inches in thickness and overlies a thin, discontinuous A_1 horizon. These horizons are underlain by a grayish-brown A_2 horizon, about 3 inches thick. Below a depth of about 8 inches, the profile of this soil is similar to the profile described as representative of the Thorndike series. Rock outcrops and very shallow spots comprise from 2 to 5 percent of the surface area. Only a few shale fragments are on the surface. The characteristics of the upper part of the soil and the degree of stoniness and outcrops are described in more detail under the Thorndike series.

About 25 percent of the acreage is made up of moderately well drained Howland soil. Except for the top 8 inches, the profile of this soil is similar to the profile described as representative of the Howland series. Loose stones, 8 to 12 inches in diameter, are scattered over the surface at intervals of 2 to 3 feet. In some places granite stones, 3 to 4 feet in diameter, are partly embedded in the soil at intervals of about 25 feet.

The Thorndike and Howland soils are used for woodland. The trees are mainly spruce, fir, maple, beech, and birch. Lumbering can be easily done. Capability unit VIs–3.

Thorndike and Howland soils, 8 to 15 percent slopes (TsC).—This undifferentiated unit consists of about 75 percent Thorndike soil and 25 percent Howland soil. The areas of Howland soil are small, and, because both Howland and Thorndike soils are forested, boundaries between the two cannot be drawn accurately.

These soils produce good stands of maple, beech, fir, birch, and spruce. Some areas could be cleared and used for cultivated crops. Capability unit VIs–3.

Washburn Series

The soils of the Washburn series have developed on firm, calcareous glacial till derived mainly from shale and limestone. These very poorly drained soils occur in nearly level areas and in depressions where the water table is within a few inches of the surface for about 9 months of the year.

Most of the acreage is forested, and the microrelief is irregular. Small mounds, 1 to 3 feet high, occur at intervals of 10 to 25 feet. These mounds have a very dark grayish-brown silt loam A_1 horizon, about 6 inches thick, over a grayish-brown silt loam A_{2g} horizon, 1 to 2 inches thick. Between the mounds the A_1 horizon consists of nearly black silt loam, about 12 inches thick. No A_{2g} horizon has developed in the depressions. In fact, most areas of the Washburn soils have no A_{2g} horizon, only mixed mineral and organic horizons. Below the eluvial (A) horizons are mottled, alkaline, firm B_{21g} and B_{22g} horizons.

Most areas have stones, 6 to 18 inches in diameter, on the surface at intervals of 75 to 100 feet, but in some areas stones, 6 to 12 inches in diameter, occur at intervals of 3 to 5 feet.

Washburn soils have developed from the same kind of glacial till as the poorly drained Easton, moderately well drained to somewhat poorly drained Conant, and well drained Caribou soils. Washburn and these associated soils are common in the east-central part of the survey

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area. Washburn soils are similar to Burnham soils in drainage but differ in reaction. The subsoil of Washburn soils is alkaline, and the subsoil of Burnham soils is acid.

In northeastern Aroostook County, the Washburn soils are mapped only in undifferentiated units with the Easton soils. These undifferentiated units are described under the Easton series.

Representative profile—Washburn silt loam, 0 to 2 percent slopes (cultivated):

A_0 1 inch to 0, dark-brown, partly decomposed cedar, spruce, and fir twigs and ferns, sedges, and moss.

A_1 0 to 12 inches, black (10YR 2/1) silt loam; strong, coarse, granular structure; friable; 5 percent coarse fragments; abrupt, wavy boundary; 8 to 14 inches thick.

B_{21g} 12 to 20 inches, olive-gray (5Y 5/2) gravelly loam with pockets of silty clay loam; common, medium, distinct mottles; firm when moist, very hard when dry; 20 percent coarse fragments; weathered fragments of limestone are common; abrupt, wavy boundary; 3 to 10 inches thick.

B_{22g} 20 to 35 inches, olive-gray (5Y 5/2) heavy gravelly loam; common, coarse, distinct mottles; moderate, coarse, subangular blocky structure to massive; plastic, very hard when dry; clay films on stones and peds; 40 percent coarse fragments; weakly calcareous; many weathered fragments of limestone; abrupt, wavy boundary; 10 to 20 inches thick.

C_g 35 to 42 inches +, olive-gray (5Y 5/2) gravelly loam; few, medium, distinct mottles; massive; very firm, very hard when dry; 40 percent coarse fragments; calcareous.

Winooski Series

The Winooski series consists of moderately wet soils that are forming in alluvial deposits. The soils are on bottom lands that are only a few feet above streams. They are common along the St. John and Aroostook Rivers and also occur as islands in these rivers. They comprise only a small part of the total acreage in the survey area.

Winooski soils are associated with the well-drained Hadley soils and have formed on similar parent material.

The native trees are spruce, fir, cedar, maple, and birch.

Representative profile—Winooski silt loam (cultivated):

A_p 0 to 10 inches, light olive-brown (2.5Y 5/4) silt loam; weak, fine, granular structure; friable; strongly acid; abrupt, smooth boundary; 8 to 10 inches thick.

C_1 10 to 20 inches, light olive-brown (2.5Y 5/6) silt loam; weak, fine, granular structure; friable; acid; abrupt, smooth boundary; 3 to 6 inches thick.

C_{2g} 20 to 36 inches, grayish-brown (2.5Y 5/2) fine sandy loam with fine, olive-gray (5Y 4/2) mottles; weak, fine, granular structure; friable; strongly acid.

Winooski silt loam (Wn).—This nearly level soil has moderately slow permeability and slow runoff. It is only a few feet above the streams and is subject to overflow. The soil is seldom flooded, however, except early in spring when it is usually frozen. The level of water in the streams is usually several feet below the soil during the summer, when the areas are used for potatoes.

Included with this soil is a soil that has fine sandy loam texture but has similar use and management.

Physical properties of Winooski silt loam are damaged if it is farmed when wet. The soil responds well to good management practices, and, if the organic-matter content and fertility are maintained, it can be used intensively for potatoes. Capability unit IIw-6.

Soil Formation and Classification

Soil consists of mineral particles of clay, silt, and sand and coarse fragments mixed with varying proportions of organic matter and living organisms. Water and air or gases are also part of the soil; they surround the mineral particles and fill, in varying degrees, the pore spaces in the soil. Different soils are formed by the action of soil-forming processes on material deposited by geologic agencies. The important factors in the development of soils are the parent material, the climate, the biological forces, the relief or lay of the land, and time. The kind of soil that develops in any given environment depends on the interaction of these five factors. And at any given point, the effect of one or more factors may be much more clearly expressed than the effect of others. For example, low relief and a high water table can show a greater effect than parent material in the development of some very poorly drained soils.

Soil Formation in Northeastern Aroostook County

The soil-forming factors of northeastern Aroostook County are considered separately here. Some, such as climate and vegetation, cause local variations in soils but are, in a broad sense, relatively uniform over the county. Others, such as parent material, relief, and the time that some soil-forming processes have been active, are so different that they cause marked differences in the soils.

Climate

Northeastern Aroostook County has a cool, continental climate. Winters are long, and temperatures go below zero on a number of days. Precipitation averages about 34 inches each year; a large part of the moisture falls as snow. The climate varies within short distances and is influenced by local variations in relief, natural drainage, and exposure to sun and wind. Therefore, soils may not be uniform over a large area.

Vegetation

Forests covered the land before the first settlers came to the county. Beech, birch, maple, and pine were the major trees on the ridges. Spruce and fir grew in the low, depressed areas and in slight depressions on the sides of ridges. Rushes and sedges grew in depressions that had poor natural outlets for water. Thus, the type of vegetation was strongly influenced by drainage. The general topography, however, seems to have influenced the predominant kinds of trees that grow on different parts of the landscape.

Parent material

Glacial till is the dominant parent material in the county. It was derived from sedimentary rocks—mainly shale, slate, phyllite, and limestone.

In the Aroostook Valley, most of the till was derived from limestone and shale; in the rest of the county, the till was formed mainly from sedimentary rocks other than limestone.

Sandy and gravelly outwash deposited by glacial meltwater extends along the St. John and Aroostook Rivers. Narrow, discontinuous bands of this material are along smaller streams.

Long, narrow silty and sandy stream terraces also extend along the larger streams, especially the St. John River. These terraces have formed from alluvial material deposited in areas that were flood plains of the streams when they carried much more water. The alluvium of these terraces has lain in place long enough that soils with a B horizon have formed. About every 25 years, broken ice dams the adjacent streams, and water floods the terraces. Because the ground is frozen when such floods occur, little fresh alluvium is added to the terraces.

Small islands of recent alluvium lie in the St. John and Aroostook Rivers. Material of the same kind is deposited in small areas along all of the major streams. Most of this recent alluvium is very fine sand and silt, but in some places this material is intermixed with coarse sand.

Topography

The land surface of northeastern Aroostook County is a succession of gently rolling to strongly sloping ridges separated by narrow swamps. In the Aroostook Valley, the gently rolling hills are cut through by the Aroostook River. The tops of the ridges are from 600 to 700 feet above sea level.

In the northern part of the area, the ridges are strongly sloping. They are 800 to 1,400 feet above sea level. The steepest slopes extend in a northerly direction toward the St. John River. In the southeastern part of the area, the ridges are 1,000 to 1,600 feet above sea level.

The southwestern part of the area is gently undulating to flat. Drainage is slow, and swamps and bogs are common. Narrow fingers of swamps extend among the rolling ridges. These swamps are from 400 to 500 feet above sea level.

Narrow, nearly level areas lie along the banks of the St. John and Aroostook Rivers. Few of the flood plains are more than one-half mile wide, and in places the rolling ridges extend to the rivers.

Time

The length of time that soil material has been developing influences the kind of soil that forms in it.

The oldest soils in the area have formed in glacial till or outwash. Most of these soils have clearly expressed A, B, and C horizons, although they have formed since the last glaciation (Late Wisconsin age) and are relatively young. Most soils formed on stream terraces have thin, moderately to weakly developed horizons. Soils on recently deposited alluvium show little or no development of horizons.

Classification of the Soils

The soil series of the survey area are classified by great soil groups in table 7. This table also shows the kind of parent material in which the soils formed and how drainage has influenced formation of the different soil series. The soil series that have formed from one kind of parent material, as shown in table 7, are a catena; this is, soils that have formed in the same kind of parent material but are unlike because they formed under the influence of different drainage and relief.

Following are descriptions of each great soil group and the soil series within each group. Detailed profile descriptions of each series are given in the section "Soil Series and Mapping Units."

Podzols

Podzols have a surface mat of leaf litter and acid humus; a leached, acid, light-colored A_2 horizon; a B horizon that contains accumulated organic matter or sesquioxides (or both); and a lighter colored C horizon. In northeastern Aroostook County, the Podzol great soil group is made up of many of the well drained and moderately well drained soils.

A large part of the survey area is in woods and here the soils have not been disturbed, except to harvest trees, and in some places they have been logged only three times. In these relatively undisturbed places, the soils have irregular microrelief consisting of mounds, 1 to 3 feet high and 1 to 10 feet apart. Some mounds are prominent; others are subdued. The edges of one mound nearly touch those of the surrounding mounds.

The forest floor is covered with a litter of leaves, twigs, and a few decaying trees, and this litter is underlain by similar material that is nearly decomposed. These materials make up the A_0 horizon, which ranges from 1 to 4 inches in thickness.

In most places the organic horizons are underlain by an A_1 horizon that consists of organic matter and mineral material. Where present, this horizon is grayish brown and ranges from about 1/4 to 1 inch in thickness. The old, subdued mounds have a coarse, granular A_1 horizon, 1/2 to 1 inch thick, that is indistinct between the mounds. Some of the prominent mounds have horizons, 3 to 4 inches thick, that are apparently mixtures of A_1 and A_2 horizons, since they range from dark grayish brown to very dark grayish brown.

Under the A_0 or A_1 horizon, there is a light-gray to grayish-brown, strongly acid, mineral A_2 horizon of platy or weak, granular structure. The A_2 horizon ranges from 1 to 6 inches in thickness. In most places it is thickest in the mounds, where it forms pockets, 4 to 6 inches deep and 1 to 3 inches wide. In some places these pockets of the A_2 horizon curve under the B_2 horizon; consequently, a vertical cut through a mound may pass through the horizons in the following order: A_0, A_1, A_2, B_2, A_2, and B_2. In the depressions the A_2 horizon is more than 2 inches thick in only a few places.

Below the A_2 horizon is a strong-brown to yellowish-brown B horizon. The B horizon has two or three subhorizons, and the lower ones are paler, or less brown, than the subhorizon above. The upper subhorizon, the B_{21}, is friable, has granular structure, and is strong brown. Below this a B_{22} horizon that is yellowish brown to strong brown, has granular to platy structure, and is friable to firm. In some soils there is a B_3 horizon that varies in characteristics according to the kind of parent material. In some places this horizon is transitional from the B to the C horizon.

TABLE 7.—*Soil series arranged according to great soil groups, and the parent material and drainage for each*

Parent material and great soil groups	Well-drained soils	Moderately well drained to somewhat poorly drained soils	Poorly drained soils	Very poorly drained soils
Glacial outwash and gravelly material on terraces:				
Podzol	Stetson	Machias		
Low-Humic Gley			Fredon	
Humic Gley				Halsey.
Sandy material on terraces:				
Podzol	Allagash	Madawaska		
Low-Humic Gley			Red Hook	
Humic Gley				Atherton.
Silty material on terraces:				
Podzol	Salmon	Nicholville		
Low-Humic Gley			Canandaigua	
Glacial till from:				
Acid or weakly calcareous shale:				
Podzol	Thorndike			
Weathered calcareous rock:				
Podzol	Mapleton			
Weathered, acid shale and slate:				
Podzol	Plaisted	Howland		
Low-Humic Gley			Monarda	
Humic Gley				Burnham.
Hard, gray limestone:				
Brown Forest	Benson			
Weathered, limy shale:				
Podzol over Gray-Brown Podzolic-like soils.	Caribou	Conant		
Low-Humic Gley			Easton	
Humic Gley				Washburn.
Weathered, weakly calcareous or acid shale and slate:				
Podzol over Gray-Brown Podzolic-like soils.	Perham	Daigle [1]		
Silty and fine sandy flood-plain deposits:				
Alluvial	Hadley	Winooski		

[1] Somewhat poorly drained soils.

Cultivation has mixed the organic horizons with the bleicherde and orterde and resulted in a dark-brown A_p horizon that has a few spots of strong brown, yellowish brown, and grayish brown. When the land was cleared and first plowed, the A horizons and part of the B_{21} on the mounds were reversed by the moldboard on the plow. The A_2 horizon fell into the depressions and was covered by part of the B_{21}. Further cultivation mixed the horizons and partly obliterated them.

In Northeastern Aroostook County, the following soils are members of the Podzol great soil group: Plaisted, Howland, Stetson, Machias, Allagash, Madawaska, Salmon, Nicholville, Thorndike, and Mapleton. Podzols that have formed over soils that are like Gray-Brown Podzolic soils are as follows: Caribou, Perham, Conant, and Daigle.

Plaisted series.—Plaisted soils are typical, well-drained Podzols. They have developed in very firm, slightly brittle, olive-gray glacial till of gravelly loam texture. The till is platy in the upper part and becomes massive with increasing depth. In some places the soils have a yellowish-brown, firm B_3 horizon of thin, platy structure. In others a B_3 horizon cannot be distinguished, and in these places a yellowish-brown, slightly firm to friable gravelly loam B_{22} horizon of thin, platy or weak, granular structure is just above the parent material.

These soils have a fragipan, which is firm, brittle, and platy, at a depth of about 16 inches. In some places it occurs as a B_3 horizon, but in others it is the upper part of the C_1 horizon or the lower part of the B_{22} horizon. In all places the soil below the fragipan is very firm and massive. Bedrock occurs at a depth of 5 to 20 feet.

Howland series.—Howland soils are moderately well drained Podzols. They are similar to the Plaisted soils, except that they have mottled B and C horizons and, in nearly all places, the B_{22g} horizon is firm and has platy structure. Howland soils are influenced slightly by a seasonally high water table.

Stetson series.—The Stetson soils are well-drained Podzols. These soils have developed in stratified sand and gravel derived mainly from slate, shale, sandstone, and limestone. They have a friable gravelly loam B horizon of granular structure but generally do not have a C horizon. The D horizon of stratified sand and gravel occurs at a depth of 20 to 30 inches.

Machias series.—Machias soils are moderately well drained Podzols. They have developed in stratified sand and gravel derived mainly from slate, shale, sandstone, and limestone. They have a friable, mottled, gravelly silt loam or gravelly loam B_{2g} horizon of granular structure over mottled, slightly firm B_{3g} or B_u horizon. The B horizons are slightly influenced by a perched or seasonally high water table. Machias soils generally lack a C horizon, but a D horizon of stratified sand and gravel occurs at a depth of 20 to 30 inches.

Allagash series.—The Allagash soils are well-drained Podzols. They have developed in weakly stratified sand derived mainly from slate, shale, and sandstone. These soils have a friable fine sandy loam or sandy loam B horizon of granular structure that is underlain, at a depth of about 20 inches, by a C horizon of sand or loamy sand. At a depth of 3 feet or more, there is a D horizon of stratified sand and gravel.

Madawaska series.—The Madawaska soils are moderately well drained Podzols that have developed in weakly stratified sand derived mainly from slate, shale, and sandstone. They have a mottled, friable B_{2g} horizon with granular structure over a B_{3g} or B_u horizon of mottled, slightly firm loamy sand. The lower B horizons are slightly influenced by a perched or seasonally high water table. At a depth of about 24 inches, there is either a C horizon of weakly stratified sand or a D horizon of stratified sand and gravel.

Salmon series.—Salmon soils are well-drained Podzols that have developed in water-laid sediments of very fine sandy loam and silt loam. The B horizon of granular, friable silt loam is underlain, at a depth of about 24 inches, by a C horizon of weakly stratified silt loam and very fine sandy loam. At a depth of 3 feet or more, there is a D horizon of weakly stratified fine and coarse sand.

Nicholville series.—The Nicholville soils are moderately well drained Podzols. They have developed in water-laid, weakly stratified very fine sandy loam and silt loam. These soils have a friable, mottled silt loam B_{22g} horizon of granular structure over B_{3g} or B_u horizons of mottled, slightly firm, weakly stratified silt loam and very fine sandy loam. The lower B horizons are slightly influenced by a perched or seasonally high water table. In most places no C horizon occurs but there is a D horizon of loamy fine sand and sand.

Thorndike series.—Thorndike soils are well-drained Podzols. They have developed from thin glacial till and shattered shale bedrock. The B horizon consists of friable shaly silt loam of granular structure; more than 25 percent of the lower part is made up of hard, gray fragments of shale. In most places the B horizon extends to bedrock, but in some places there is a thin C horizon. Thorndike soils are underlain, at a depth of 16 to 24 inches, by hard, gray shale that occurs in nearly vertical beds and has silt in the seams.

Mapleton series.—The Mapleton soils are well-drained Podzols. They have developed from thin glacial till and shattered limy shale and limestone bedrock. Their B horizon consists of friable shaly silt loam with granular structure; more than 25 percent of this horizon is made up of soft, leached fragments of shale and limestone. Many of the limestone fragments can be broken with the fingers, and these are called ghosts. In many places the B horizon extends to bedrock and there is no C horizon. In other places there is a thin C horizon that is neutral in reaction. Weakly calcareous bedrock occurs at a depth of 18 to 30 inches.

Caribou series.—The well-drained Caribou soils have a Podzol sequence of horizons to a depth of about 16 inches. Below this, they have horizons similar to those formed in Gray-Brown Podzolic soils. They have a friable gravelly loam Pozdol B horizon of granular structure. This is underlain, at a depth of about 16 inches, by a light olive-brown or grayish-brown, slightly firm, leached A'_2 horizon. This horizon is 5 to 15 inches thick and resembles the A_2 horizon of Gray-Brown Podzolic soils. The A'_2 horizon has developed over a B'_2 horizon that has subangular blocky structure and has clay films on peds similar to those in Gray-Brown Podzolic soils. The B'_2 horizon is underlain by a C horizon of firm, slightly acid to neutral gravelly loam parent material.

Perham series.—Perham soils are well-drained Podzols with an underlying sequence of horizons similar to those of Gray-Brown Podzolic soils. They have a friable gravelly silt loam Podzol B horizon of granular structure. At a depth of about 2 feet, this is underlain by a leached, grayish-brown A'_2 horizon, 3 to 10 inches thick. The A'_2 horizon resembles the A_2 horizon of Gray-Brown Podzolic soils. The underlying B' horizon resembles the B horizon of Gray-Brown Podzolic soils, since it has subangular blocky structure and clay films on the peds. In Perham soils the B' horizon consists of gravelly clay loam, and, in this respect, they differ from Caribou soils, which have a gravelly loam B' horizon.

In some places there is no C horizon and the B' horizon extends to hard, gray shale bedrock. In areas where the Perham soils are more than 5 feet deep to bedrock, they have a firm gravelly loam C horizon.

Conant series.—Conant soils are moderately well drained Podzols with an underlying sequence of horizons similar to those of Gray-Brown Podzolic soils. They formed from calcareous glacial till of firm, heavy loam. They have a B horizon of granular, friable, dark-brown loam underlain, at about 16 inches from the surface, by a light olive-brown, mottled A'_2 horizon. The leached A'_2 horizon and the underlying horizons are similar to corresponding horizons of Gray-Brown Podzolic soils. The B'_2 has characteristics of a fragipan; it is mottled, firm, and brittle. It is also a textural B horizon, since it has clay films on the peds and has about 7 percent more clay than the overlying A'_2 horizon.

Daigle series.—Daigle soils are somewhat poorly drained, as indicated by mottling in all horizons below plow depth. They are classified as Podzols but have an underlying sequence of horizons similar to those of Gray-Brown Podzolic soils. They have an upper B horizon of granular, friable, dark-brown loam. At a depth of 12 to 16 inches, this horizon is underlain by a mottled grayish-brown A' horizon that is leached of free iron. This is an eluvial horizon that resembles a corresponding horizon in Gray-Brown Podzolic soils.

Below this, the illuvial B'_2 horizon contains more clay than the A' horizon and has subangular blocky structure and clay films on the peds. The illuvial horizon has characteristics of a fragipan; it is mottled, very firm, and brittle. This horizon is also a textural B horizon, since it has clay films on the peds and contains about 8 percent more clay than the eluvial horizon. In some places there is no C horizon and the B′ horizon extends to hard, gray shale. In places where the soils are more than 4 feet to bedrock, there is a C horizon consisting of silt loam or clay loam parent material that is weakly mottled and very firm.

Humic Gley soils

Humic Gley soils have a thick, very dark A horizon over a gray or mottled B or C horizon. They are poorly drained or very poorly drained soils that have formed under vegetation that is typical of very wet land.

In northeastern Aroostook County, the Humic Gley soils occur in flats, depressions, and swampy areas that have a high water table. During most of the year, water moves laterally through the soils, but, during a few weeks in midsummer, it moves downward. The dominant trees on these soils are red spruce, black spruce, and fir, and there is an understory of willow, alder, and a few swamp maples. The trees are shallow rooted, and a few have been blown down. As a result, the microrelief is uneven and consists of knobs and depressions. In most places the dominant trees grow on the mounds, and shrub-type vegetation is confined to the depressions. Consequently, the areas are difficult to walk through.

The Burnham, Washburn, Halsey, and Atherton soils are members of the Humic Gley great soil group.

Burnham series.—The Burnham soils are very poorly drained Humic Gley soils. They have developed in very firm, slightly acid to neutral glacial till derived mainly from shale, slate, and phyllite. These soils have a very dark grayish-brown A_{1g} horizon, 6 to 10 inches thick, over a thin, gray, mottled A_{2g} horizon. In some places an A_{2g} horizon has not formed or cannot be distinguished. This horizon is thickest in the mounds, but it occurs in only a few of the depressions between the mounds.

Below the A_{2g} horizon is a B_{21g} horizon of mottled olive-gray and grayish-brown, firm gravelly loam. The B_{21g} horizon generally is more highly mottled than any other horizon, and it is often difficult to determine the matrix from the mottles. The B_{22g} horizon is generally less mottled, but it is firm and has platy structure. Most tree roots do not enter the B_{22g} horizon, and the water table seldom drops below it. The high water table limits soil development and leaching; therefore, below a depth of about 20 inches, the soils consist of medium acid to neutral parent material.

Washburn series.—Washburn soils are very poorly drained Humic Gley soils that have developed in very firm, calcareous glacial till derived mainly from shale and limestone. They have a black A_1 horizon, 8 to 14 inches thick. In a few places, a thin, grayish-brown, mottled A_{2g} horizon has formed. The soils have olive-gray, mottled B_{21g} and B_{22g} horizons that have subangular blocky structure and clay films on the peds. The B_{22g} horizon is very firm and is neutral to weakly calcareous.

Halsey series.—Halsey soils are very poorly drained Humic Gley soils that have developed in calcareous, stratified sand and gravel derived mainly from shale, slate, sandstone, and limestone. They have a dark olive-gray, mottled A_1 horizon, 5 to 10 inches thick, over a thin, discontinuous, grayish-brown, mottled A_{2g} horizon. The B_{21g} and B_{22g} horizons consist of light olive-brown to olive, mottled gravelly silt loam that is alkaline and has weak, subangular blocky to weak, platy structure. In places there are thin films of silt or clay on the tops of the peds. The Halsey soils have not weathered so deeply as well-drained soils formed in similar parent material, and in many places they are calcareous at a depth of 4 feet.

Atherton series.—The Atherton soils are very poorly drained Humic Gley soils that have developed in acid, stratified sand and gravel derived from shale, slate, and sandstone. They have a very dark grayish-brown, mottled A_{1g} horizon, 8 to 12 inches thick, over a thin, discontinuous, grayish-brown, mottled A_{2g} horizon. The B_{21g} and B_{22g} horizons consist of mottled yellowish-brown and grayish-brown gravelly silt loam and gravelly loam that is acid throughout. In general, these horizons have weak, granular structure, but in some places the B_{22g} horizon has weak, platy structure and has a slight tendency to be firm.

Low-Humic Gley soils

Low-Humic Gley soils have a thinner A_1 horizon and slightly better drainage than the Humic Gley soils, but deeper in the profile they are similar. Their A_{2g} horizon is thick.

In northeastern Aroostook County, some of the Low-Humic Gley soils have been cultivated. As the result, a dark-brown to very dark brown or grayish-brown A_p horizon has developed through mixing of the A_1 and A_{2g} horizons. Underlying the A_p horizon is a grayish-brown A_{2g} horizon. Beneath this is a B_{2g} horizon, which is typical of both Low-Humic Gley and Humic Gley soils.

The Monarda, Easton, Fredon, Red Hook, and Canandaigua soils are members of the Low-Humic Gley great soil group.

Monarda series.—Monarda soils are poorly drained Low-Humic Gley soils. They have developed in very firm, acid to neutral gravelly loam glacial till derived mainly from shale, slate, and phyllite. The thin, very dark grayish-brown A_1 horizon is underlain by a grayish-brown, mottled A_{2g} horizon, 2 to 10 inches thick. The B_{21g} and B_{22g} horizons consist of yellowish-brown to light olive-brown, mottled gravelly loam. The B_{21g} horizon has granular structure and is acid, and the B_{22g} horizon has weak, platy structure, is acid, and is firm. The parent material is firm, olive-gray gravelly loam.

Easton series.—The Easton soils are poorly drained Low-Humic Gley soils. They have developed in firm, moderately calcareous, moderately fine textured glacial till derived mainly from calcareous, dark-gray shale and sandstone. The surface horizons are similar to those of the Monarda soils. The B_{21g} and B_{22g} horizons consist of mottled yellowish-brown and grayish-brown heavy loam. The B_{21g} horizon is slightly acid, and the B_{22g} horizon is neutral. Both horizons are firm and have subangular blocky structure and clay films on the peds.

Fredon series.—Fredon soils are poorly drained Low-Humic Gley soils. They have developed in calcareous, stratified sand and gravel derived mainly from shale, slate, sandstone, and limestone. The thin A_{2g} horizon consists of very dark grayish-brown gravelly silt loam. Beneath this are B_{21g} and B_{22g} horizons of mottled yellowish-brown gravelly silt loam or sandy loam that is neutral in reaction. The B_{21g} horizon has weak, subangular blocky to weak, granular structure, and there are a few, thin films of silt or clay on the peds. The B_{22g} horizon has thin, platy structure; it is firm in place but breaks to granular structure when removed. The underlying parent material is mottled olive-gray gravelly sandy loam. This is underlain, 3 to 4 feet from the surface, by calcareous sand and gravel.

Red Hook series.—Red Hook soils are poorly drained Low-Humic Gley soils. They have developed in acid, stratified sand and gravel derived mainly from shale, slate, and sandstone. Their A horizons are similar to those of Fredon soils. Their B_{21g} and B_{22g} horizons consist of yellowish-brown, mottled gravelly loam, gravelly silt loam, or gravelly clay loam. The B_{21g} horizon has granular structure and is friable. In some places the B_{22g} horizon has weak, subangular blocky structure and tends to be firm. Both of these horizons are acid in reaction. The underlying parent material is mottled light olive-brown, yellowish-brown, and grayish-brown gravelly loam. It is underlain, about 3 feet from the surface, by a D horizon of sand and gravel.

Canandaigua series.—The Canandaigua soils are poorly drained Low-Humic Gley soils that have developed in water-laid, calcareous silt and very fine sandy loam. They have a very dark grayish-brown A_1 horizon over a grayish-brown A_{2g} horizon. Thickness of the A_{2g} horizon varies according to the texture of the soils. Where the texture is heavy silt loam, the A_{2g} horizon is thin and discontinuous. Where the texture is principally very fine sandy loam, the A_{2g} horizon is thick. The B_{2g} horizon has granular to weak, subangular blocky structure and is neutral to alkaline in reaction. At a depth of about 15 to 18 inches, these soils are calcareous.

Brown Forest soils

The Brown Forest soils have formed on highly calcareous glacial drift. They are saturated with bases from the surface downward and are leached of carbonates to only a shallow depth. Profile development is weak. The profile consists chiefly of an A_1 horizon, in which humus has accumulated, and under this is a brownish B horizon that derives its color from iron oxides that were released as the parent material weathered in the presence of humus. The content of organic matter decreases with depth, the pH increases with depth, and the content of clay remains constant or decreases with depth. The Benson soils are members of the Brown Forest great soil group.

Benson series.—Benson soils are well-drained Brown Forest soils that have developed in material derived from limestone. They have a slightly acid, dark grayish-brown silt loam A_1 horizon, 6 to 8 inches thick. Many gray fragments of limestone are on the surface and in the soil profile. The B horizon consists of yellowish-brown, alkaline silt loam and contains many limestone fragments. These soils are generally less than 2 feet thick over limestone.

Alluvial soils

Alluvial soils occur on flood plains only a few feet above rivers and streams. They are forming in sediments transported and redeposited by overflow from present streams. The soils have not been in place long enough to develop distinct horizons. They do, however, show an accumulation of organic matter in the surface horizon and slight leaching to moderate depths. These immature soils have only A and C horizons. The soils of the Hadley and Winooski series are classified as Alluvial soils.

Hadley series.—The Hadley soils are well-drained Alluvial soils that are forming in siltv and very fine sandy sediments deposited by streams. The sediments were derived mainly from shale and slate. Hadley soils have light olive-brown A_1 or A_p horizons and a grayish-brown C horizon.

Winooski series.—Winooski soils are moderately well drained Alluvial soils that are forming in silty and very fine sandy sediments. They have light olive-brown A_1 or A_p horizon and a weakly mottled C_g horizon.

Bog (organic) soils

Bog soils consist of brown, dark-brown, or black peat or muck. These organic soils are made up of partly decomposed remains of sedges, rushes, and trees that grew along the banks of shallow ponds and in depressions. They have been preserved in these places since they are saturated with water most of the time. Muck is more highly decomposed than peat. Neither muck nor peat shows evident development of horizons in the profile. Some of the soils are alkaline, but most are acid. They are generally waterlogged the entire year.

The Bog soils in northeastern Aroostook County—Peat and muck—have not been classified in soil series.

Chemical and Physical Data

Samples from profiles of representative series were analyzed by the Soil Survey Laboratory. Results are reported in tables 8 and 9.

The particle-size distribution, as given in table 9, indicates that the Caribou, Conant, and Easton soils have developed from the same kind of parent material. In general, the B horizons of the Easton soils and the B′ horizons of the Caribou and Conant soils contain more clay than the horizons above.

In the following paragraphs, the individual soils are discussed in relation to the chemical and moisture data in table 8 and the mechanical analyses in table 9.

Caribou soils.—Profiles 1 and 2 of Caribou gravelly loam are of cultivated soil. The A'_2 horizon of profile 1 contains less clay than the adjoining horizons, but this is not true of the A'_2 horizon of profile 2. The A'_2 horizons of both profiles have less free iron than the adjoining horizons but hardly enough less to be significant. Base saturation is highest in profile 1. The lower parts of both profiles resemble the profiles of Gray-Brown Podzolic soils.

In the undisturbed sample (profile 3) of Caribou gravelly loam, the A_2 horizon contains less clay than the adjoining horizons. The clay content in the upper profile (sequum) is highest in the B_{22} horizon. The percentages of organic carbon and free iron are highest in the B_{21} horizon. Data for this sample indicate that the upper profile is like that of a normal Podzol. The A'_2 horizon contains less clay than the adjoining horizons, and the content of clay increases below the A'_2 horizon. The C_1 horizon contains the greatest amount of clay.

Conant soils.—The A_p horizons of both profiles contain more silt and clay than the lower horizons. This may be caused by sedimentation, since the Conant soils are at the bases of slopes. The A'_{2g} horizons contain less clay than the adjoining horizons. The B'_{22} horizons of both profiles contain the greatest amount of clay. The degree of base saturation is high in the B horizons of both profiles, and profile 1 is calcareous.

Daigle soils.—The upper horizons of the profiles have been disturbed by cultivation. Part of the A'_{2g} horizons probably has been mixed with the upper horizons. The B′ horizons are high in clay; the B_{21g} horizons contain the greatest amount. The B′ horizons have a high degree of base saturation.

TABLE 8.—*Chemical and moisture data*

Soil	Horizon	Depth	Reaction	Organic carbon	Nitrogen	Carbon-nitrogen ratio	Free iron oxides (Fe_2O_3)	$CaCO_3$ equivalent	Bulk density
		Inches	*pH*	*Percent*	*Percent*		*Percent*	*Percent*	*Gm. per cc.*
Caribou gravelly loam, profile 1.	A_p	0–8	4.8	2.08	0.202	10.0	2.1	------	1.09
	B_{21}	8–14	4.6	1.55	.127	12.0	2.1	------	[1]
	A'_2	14–25	4.8	.16	------	------	1.5	------	[1]
	B'_{21}	25–32	5.1	.14	------	------	2.1	------	[1]
	B'_{22}	32–40	6.0	.08	------	------	1.8	------	[1]
	B'_{23}	40–49	6.2	.10	------	------	1.9	------	[1]
	C_1	49–58+	7.7	.08	------	------	2.0	10	[1]
Caribou gravelly loam, profile 2.	A_p	0–9	4.9	2.32	.184	12.6	2.7	------	1.39
	B_2	9–13	4.9	2.19	.141	15.5	3.1	------	1.26
	A'_2	13–17	5.0	.82	.078	10.0	2.0	------	1.33
	B'_{21}	17–24	5.1	.41	.060	7.0	2.1	------	------
	B'_{22}	24–29	5.0	.28	------	------	2.7	------	1.65
Caribou gravelly loam, profile 3.	A_1	0–3	4.6	7.6	.373	20.0	2.6	------	.67
	A_2	3–5	4.4	.92	.084	11.0	1.4	------	------
	B_{21}	5–8	4.3	3.20	.231	14.0	4.0	------	.84
	B_{22}	8–19	4.7	1.50	.098	15.0	2.2	------	.97
	A'_2	19–26	4.6	.27	------	------	2.3	------	[1]
	B'_{21}	26–43	4.7	.17	------	------	3.3	------	[1]
	B'_{22}	43–53	7.5	.17	------	------	4.0	5	[1]
	C_1	53–63	7.6	.22	------	------	3.3	1	[1]
	C_2	63–76	7.6	.12	------	------	2.8	9	[1]
	D_1	76–90+	7.5	.23	------	------	2.8	------	------
Conant silt loam, profile 1.	A_p	0–10	5.1	3.51	.238	14.7	2.7	------	1.26
	B_2	10–13	5.2	1.17	.106	11.0	2.4	------	1.27
	A'_{2g}	13–17	5.4	.31	.052	6.0	1.8	------	1.77
	B'_{21gm}	17–25	5.7	.22	.046	5.0	1.8	------	1.78
	B'_{22gm}	25–35	7.1	.19	------	------	2.2	<1	1.78
	B'_{23g}	35–42	7.4	.16	------	------	2.0	<1	1.74
	B'_{24}	42–49	7.9	.09	------	------	1.8	<1	1.77
	C_1	49–64	8.1	.09	------	------	1.7	5	1.86
	C_2	64–69	8.2	.08	------	------	1.6	8	------
	C_3	69–73	8.2	.10	------	------	1.7	8	------
	C_4	73–79+	8.2	.11	------	------	1.6	5	------
Conant silt loam, profile 2.	A_p	0–9	5.3	3.57	.207	17.2	2.1	------	1.23
	A_2B_2	9–12	5.2	1.45	.092	15.8	1.7	------	1.39
	A'_{2g}	12–19	5.3	.46	.044	10.0	1.1	------	1.97
	B'_{21gm}	19–27	5.4	.14	.031	4.0	1.4	------	1.92
	B'_{22gm}	27–35	6.2	.13	------	------	1.5	------	1.96
	D_u	35–40	6.2	.09	------	------	1.7	------	------
	C	40–53+	6.6	.10	------	------	1.5	<1	1.99

See footnotes at end of table.

Easton soils.—The A_p horizons of profiles 1 and 2 contain more silt and clay than the lower horizons. This may be the result of sedimentation, since the Easton soils occur at low elevations. The A_{2g} horizons contain less clay than the adjoining horizons. The B horizons are high in clay, and the B_{21g} horizons contain the greatest amount. The B horizons of profile 2 are calcareous. The B horizons of profile 1 are slightly acid, but they have a high degree of base saturation.

Perham soils.—The A'_2 horizon of profile 1 contains less clay than the underlying horizons. The content of clay is highest in the B'_{21} horizon. The B′ horizons are acid, but those of profile 1 have a moderately high degree of base saturation.

Washburn soils.—The thick A_1 horizon is high in organic carbon. In general, the B_{22g} horizons are higher in free iron than the adjoining horizons. Soil reaction increases with depth, and the parent material is calcareous. All horizons have a high degree of base saturation, and calcium is the most common element. In profile 1 the content of clay increases below the B_{21g} horizon. The B_{22g} horizon of profile 2 has a slightly higher content of clay than the adjoining horizons.

for representative soils

Moisture held at—			Cation exchange capacity		Extractable cations (milliequivalents per 100 grams of soil)					Base saturation by sum of cations	Calcium-magnesium ratio
1/10 atmosphere	1/3 atmosphere	15 atmospheres	By NH_4AC	By sum of cations	Ca	Mg	H	Na	K		
Percent	*Percent*	*Percent*	*Meq./100 gm.*	*Meq./100 gm.*						*Percent*	
----------	27.8	8.2	----------	22.7	3.0	0.7	18.2	0.1	0.7	20	4.3
----------	28.3	8.5	----------	23.8	1.0	.1	22.3	<.1	.4	6	10.0
----------	16.8	5.1	----------	7.1	2.0	.3	4.6	<.1	.2	35	6.7
----------	21.0	9.2	----------	10.8	5.1	.8	4.6	.1	.2	57	6.4
----------	20.0	8.2	----------	9.7	6.1	.8	2.7	<.1	.1	72	7.6
----------	19.3	7.5	----------	9.7	6.1	.9	2.5	.1	.1	74	6.8
----------	20.1	9.0	----------	[2]	[2]	[2]	[2]	[2]	[2]	[2]	----------
37.5	29.2	8.7	12.6	22.8	2.5	.6	19.1	<.1	.6	16	4.2
43.4	34.2	10.6	12.5	27.0	1.4	.3	24.8	<.1	.5	8	4.7
33.3	24.8	8.0	7.6	13.7	.9	.3	12.2	<.1	.3	11	3.0
26.8	22.7	6.5	5.5	9.6	.9	.2	8.2	<.1	.3	14	4.5
25.0	21.1	5.9	5.6	8.1	1.5	.3	6.0	<.1	.3	26	5.0
----------	41.3	14.9	----------	37.8	8.6	2.3	26.5	.1	.3	30	3.7
----------	27.5	5.5	----------	13.9	2.4	.6	10.7	.1	.1	23	4.0
----------	35.8	14.2	----------	38.9	1.4	.4	36.9	<.1	.2	5	3.5
----------	25.3	8.1	----------	18.6	.5	.1	17.8	<.1	.2	4	5.0
----------	23.7	7.2	----------	12.9	1.3	.2	11.2	<.1	.2	13	6.5
----------	23.9	7.8	----------	12.6	3.6	.2	8.5	.1	.2	32	18.0
----------	24.2	11.2	----------	----------	----------	----------	----------	----------	----------	----------	----------
----------	25.9	13.6	----------	----------	----------	----------	----------	----------	----------	----------	----------
----------	21.2	9.8	----------	----------	----------	----------	----------	----------	----------	----------	----------
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
45.2	37.5	10.9	17.4	27.2	5.2	.6	21.1	<.1	.3	22	8.7
33.8	29.4	8.2	9.0	15.8	2.1	.3	13.1	<.1	.3	17	7.0
25.5	22.9	6.6	5.5	11.1	4.2	.4	6.3	<.1	.2	43	10.5
24.2	21.8	7.5	6.8	9.9	4.0	.7	5.1	<.1	.1	48	5.7
27.1	23.0	9.9	10.9	13.6	8.8	.6	4.1	<.1	.1	70	14.7
24.7	20.8	9.6	11.0	12.8	9.3	.9	2.4	.1	.1	81	10.3
24.7	20.7	8.6	9.1	13.3	11.5	.6	1.0	.1	.1	92	19.2
21.5	18.7	7.9	7.6	20.2	19.4	.6	<.1	.1	.1	100	32.3
22.1	18.4	8.3	7.0	23.6	22.8	.6	<.1	.1	.1	100	38.0
21.8	18.4	8.5	6.9	23.1	22.4	.5	<.1	.1	.1	100	44.8
21.5	18.7	8.5	8.1	23.4	22.6	.6	<.1	.1	.1	100	37.7
48.3	38.4	10.6	16.6	27.3	4.2	.9	21.9	<.1	.3	20	4.7
33.6	27.8	7.5	10.4	16.9	1.4	.5	14.8	<.1	.2	12	2.8
21.4	19.1	4.4	5.2	8.3	.6	.2	7.3	<.1	.2	12	3.0
26.1	17.8	6.2	6.6	9.7	2.6	1.0	6.0	<.1	.1	38	2.6
19.4	16.8	6.4	7.0	9.6	4.6	1.5	3.4	<.1	.1	64	3.1
15.8	14.4	6.2	7.5	9.6	4.8	1.8	2.9	<.1	.1	70	2.7
19.5	17.0	5.7	7.2	9.0	5.3	1.2	2.4	<.1	.1	73	4.4

TABLE 8.—*Chemical and moisture data*

Soil	Horizon	Depth	Reaction	Organic carbon	Nitrogen	Carbon-nitrogen ratio	Free iron oxides (Fe_2O_3)	$CaCO_3$ equivalent	Bulk density
		Inches	*pH*	*Percent*	*Percent*		*Percent*	*Percent*	*Gm. per cc.*
Daigle silt loam, profile 1.	A_p	0–8	5.4	2.96	0.185	16.0	1.9	----	1.34
	$B_2A'_{2g}$	8–13	5.8	.54	.050	11.0	1.6	----	1.83
	B'_{21gm}	13–23	6.7	.21	.034	6.0	2.5	<1	1.80
	B'_{22g}	23–34	7.1	.15	.034	4.0	2.4	<1	1.80
	B'_{23}	34–39	7.3	.13	----	----	2.3	<1	1.78
	B'_{24}	39–46+	7.4	.13	----	----	2.1	<1	1.77
Daigle silt loam, profile 2.	A_p	0–7	4.9	3.37	.214	15.7	2.8	----	----
	B_{2g}	7–11	5.0	1.04	.088	11.8	2.0	----	----
	A'_{2g}	11–16	5.0	.31	.045	7.0	1.8	----	----
	B'_{2gm}	16–27	6.2	.13	.033	4.0	2.2	----	----
	D_u	27–33	6.7	.11	----	----	2.3	<1	----
	C	33–44	7.1	.11	----	----	2.0	<1	----
Easton silt loam, profile 1.	A_p	0–10	5.5	3.23	.244	13.0	1.8	----	.92
	A_{2g}	10–14	6.0	.27	----	----	1.8	----	1.74
	B_{21g}	14–22	6.5	.16	----	----	2.4	----	1.78
	B_{22g}	22–32	6.5	.13	----	----	2.4	----	1.84
	B_{23g}	32–43	6.9	.08	----	----	2.2	----	1.76
	C	43–54	7.8	.12	----	----	1.9	5	(1)
Easton silt loam, profile 2.	A_p	0–8	4.8	5.8	.328	18.0	2.1	----	----
	A_{2g}	8–15	5.2	.63	.069	9.0	2.2	----	----
	B_{21g}	15–27	7.2	.27	----	----	2.6	1	----
	B_{22g}	27–38	7.7	.15	----	----	2.6	2	----
	B_{23g}	38–50	7.8	.08	----	----	2.1	9	----
	C_1	50–58+	7.8	.09	----	----	1.8	6	----
Perham gravelly silt loam, profile 1.	A_p	0–9	5.1	3.03	.195	15.5	2.5	----	1.29
	A_2B_2	9–12	5.2	1.15	.095	12.1	2.4	----	1.54
	A'_2	12–19	4.8	.29	.037	8.0	1.6	----	1.87
	B'_{21}	19–27	4.8	.17	.036	5.0	2.2	----	1.80
	B'_{22}	27–36	5.0	.20	----	----	2.0	----	1.87
	B'_{23}	36–48	5.6	.13	----	----	1.8	----	1.89
	B'_3	48–60	5.3	.13	----	----	1.8	----	1.87
Perham gravelly silt loam, profile 2.	A_p	0–10	5.1	3.35	.223	15.0	2.6	----	1.40
	$B_2A'_2$	10–14	5.2	.62	.056	11.0	1.4	----	1.48
	B'_2	14–31	5.0	.20	.031	6.0	1.5	----	1.89
Washburn silt loam, profile 1.	A_1	0–19	6.1	14.29	.828	17.2	1.3	----	----
	B_{21g}	19–21	7.2	.28	.045	6.0	1.7	<1	----
	B_{22g}	21–26	7.8	.22	.051	4.0	2.0	1	----
	C_{1g}	26–31	8.2	.17	----	----	1.6	8	----
	C_{2g}	31–36	8.2	.19	----	----	1.5	14	----
Washburn silt loam, profile 2.	A_1	0–12	5.6	5.19	.341	15.2	2.1	----	----
	B_{21g}	12–20	7.0	.28	.042	7.0	1.7	<1	----
	B_{22g}	20–35	8.2	.14	.044	3.0	1.8	4	----
	C_{1g}	35–42	8.3	.12	----	----	1.6	11	----

[1] Soils too stony to obtain cores.
[2] Calcareous.

for representative soils—Continued

Moisture held at—			Cation exchange capacity		Extractable cations (milliequivalents per 100 grams of soil)					Base saturation by sum of cations	Calcium-magnesium ratio
1/10 atmosphere	1/3 atmosphere	15 atmospheres	By NH_4AC	By sum of cations	Ca	Mg	H	Na	K		
Percent	*Percent*	*Percent*	*Meq./100 gm.*	*Meq./100 gm.*						*Percent*	
37.3	29.2	10.4	15.1	20.9	6.5	0.5	13.6	0.1	0.2	35	13.0
23.9	20.9	6.4	7.6	10.8	4.2	.8	5.6	<.1	.2	48	5.2
27.0	21.1	12.2	14.8	19.6	12.8	2.1	4.4	.1	.2	78	6.1
26.0	21.9	11.7	13.4	17.1	11.8	1.9	3.2	.1	.1	81	6.2
25.5	20.8	11.2	11.7	15.3	10.8	1.6	2.7	.1	.1	82	6.8
25.4	20.6	10.9	10.6	13.4	9.8	.9	2.4	.1	.2	82	10.9
38.6	31.0	12.4	19.0	25.1	3.8	1.0	19.9	.1	.3	21	3.8
27.4	23.1	8.5	10.1	15.2	1.3	.3	13.4	<.1	.2	12	4.3
24.0	19.8	7.8	7.3	11.0	1.7	.5	8.7	<.1	.1	21	3.4
25.2	20.0	12.2	14.4	17.9	10.1	3.1	4.4	.1	.2	75	3.3
18.2	15.3	9.0	12.3	14.7	9.1	2.4	2.9	.1	.2	80	3.8
23.5	19.2	10.0	10.8	12.3	8.7	.9	2.4	.1	.2	80	9.7
-----	30.8	10.4	-----	25.5	9.6	.4	15.2	.1	.2	40	24.0
-----	17.3	4.9	-----	8.9	5.1	.3	3.3	.1	.1	63	17.0
-----	19.5	9.7	-----	13.8	9.8	.8	3.0	.1	.1	78	12.3
-----	19.8	9.8	-----	13.5	10.1	.9	2.3	.1	.1	83	11.2
-----	19.7	8.8	-----	12.2	9.1	1.0	1.9	.1	.1	84	9.1
-----	17.1	7.2	-----	([2])	([2])	([2])	([2])	([2])	([2])	([2])	-----
-----	41.2	15.5	-----	32.5	4.0	1.3	26.7	.1	.4	18	3.1
-----	23.1	5.7	-----	9.4	1.8	.3	7.0	.1	.2	26	6.0
-----	22.1	9.6	-----	([2])	([2])	([2])	([2])	([2])	([2])	([2])	-----
-----	27.5	8.9	-----	([2])	([2])	([2])	([2])	([2])	([2])	([2])	-----
-----	22.1	8.3	-----	([2])	([2])	([2])	([2])	([2])	([2])	([2])	-----
-----	19.0	8.0	-----	([2])	([2])	([2])	([2])	([2])	([2])	([2])	-----
42.0	33.2	9.1	15.2	24.4	2.8	.8	20.3	<.1	.5	17	3.5
38.4	30.6	7.7	10.0	16.7	.8	.2	15.4	<.1	.3	8	4.0
23.4	20.4	7.0	6.8	9.9	1.1	.5	8.0	<.1	.3	19	2.2
26.1	21.7	11.3	10.8	15.2	3.5	1.0	10.4	<.1	.3	32	3.5
25.2	20.5	10.5	10.7	14.7	4.4	1.6	8.5	<.1	.2	42	2.8
23.5	19.2	8.5	8.8	12.0	4.8	1.7	5.3	<.1	.2	56	2.8
24.6	20.3	8.9	8.6	12.5	4.4	1.6	6.3	<.1	.2	50	2.8
38.5	32.6	9.6	16.2	25.7	3.9	.4	20.6	<.1	.8	20	9.8
27.4	22.2	5.4	6.2	10.3	.6	.4	9.0	<.1	.3	13	1.5
22.1	18.6	5.6	5.9	8.7	1.1	.3	7.0	<.1	.3	20	3.7
73.4	65.6	30.7	42.9	70.0	37.2	3.1	29.3	.1	.3	58	12.0
22.2	20.4	7.9	8.1	10.0	7.2	.6	2.1	<.1	.1	79	12.0
25.6	22.9	8.1	6.7	16.7	14.8	.6	1.2	<.1	.1	93	24.7
21.9	19.2	9.2	6.5	20.2	19.3	.8	<.1	<.1	.1	100	24.1
20.2	17.6	8.9	7.3	20.3	19.3	.9	<.1	<.1	.1	100	21.4
42.2	35.3	14.5	20.6	31.6	12.9	1.5	16.9	<.1	.3	46	8.6
19.8	17.9	7.6	7.4	10.3	6.4	.7	3.1	<.1	.1	70	9.1
22.6	20.2	8.4	6.2	20.6	19.5	1.0	<.1	<.1	.1	100	19.5
19.3	17.9	7.6	5.0	19.4	18.3	1.0	<.1	<.1	.1	100	18.3

TABLE 9.—*Mechanical analyses of representative soils*

Soil	Horizon	Particle size distribution (in millimeters)										
		Very coarse sand (2–1)	Coarse sand (1–0.5)	Medium sand (0.5–0.25)	Fine sand (0.25–0.10)	Very fine sand (0.10–0.05)	Total sand	Silt (0.05–0.002)	Clay (less than 0.002)	Other size classes		
										0.2–0.02	0.02–0.002	More than 2
		Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Caribou gravelly loam, profile 1.	A_p	8.8	6.2	4.0	7.6	8.6	35.2	49.6	15.2	32.6	30.0	26.0
	B_{21}	6.3	7.3	4.8	9.2	9.7	37.3	47.9	14.8	41.2	21.6	24.0
	A'_2	8.9	9.3	6.0	11.0	11.0	46.2	41.3	12.5	33.8	24.8	28.0
	B'_{21}	6.7	6.5	4.0	7.6	8.5	33.3	42.0	24.7	26.8	28.1	32.0
	B'_{22}	7.0	6.8	4.7	8.9	9.1	36.5	42.3	21.2	29.7	27.1	19.0
	B'_{23}	6.4	7.4	4.7	9.2	9.2	36.9	42.5	20.6	29.2	28.0	22.0
	C_1	9.4	7.7	4.2	7.1	7.8	36.2	41.6	22.2	25.8	27.6	25.0
Caribou gravelly loam, profile 2.	A_p	8.6	6.5	4.0	8.2	10.1	37.4	46.6	16.0	32.8	28.3	28.7
	B_2	10.0	7.2	4.2	8.1	9.7	39.2	45.9	14.9	30.9	29.1	29.3
	A'_2	7.4	7.1	4.8	9.5	11.2	40.0	44.7	15.3	34.5	26.7	30.4
	B'_{21}	9.5	8.1	4.7	9.8	10.7	42.8	44.8	12.4	34.3	26.5	31.7
	B_{22}	13.2	8.2	4.4	9.2	8.9	43.9	42.3	13.8	29.3	27.0	35.2
Caribou gravelly loam, profile 3.	A_1	.6	7.8	12.4	12.8	3.0	36.6	40.3	23.1	24.7	23.8	12.0
	A_2	.8	12.2	17.2	17.1	3.9	51.2	38.5	10.3	26.3	23.0	21.0
	B_{21}	3.7	4.8	2.9	5.1	8.9	25.4	51.4	23.2	28.1	35.1	35.0
	B_{22}	1.0	11.2	15.6	15.8	3.8	47.4	23.6	29.0	18.9	14.7	54.0
	A'_2	8.9	8.3	3.9	5.8	8.0	34.9	48.9	16.2	27.0	33.1	28.0
	B'_{21}	7.8	7.3	2.6	3.4	6.3	27.4	52.3	20.3	24.0	36.5	38.0
	B'_{22}	16.0	12.4	4.3	4.8	4.5	42.0	33.6	24.4	17.1	23.4	39.0
	C_1	13.8	15.3	5.6	6.3	5.1	46.1	24.7	29.2	15.6	17.4	48.0
	C_2	16.2	14.4	5.5	6.4	5.1	47.6	32.9	19.5	18.8	22.7	55.0
	D_1	12.6	13.1	6.3	5.3	5.0	42.3	33.7	24.0	19.0	23.2	62.0
Conant silt loam, profile 1.	A_p	6.5	4.4	3.0	6.4	7.5	27.8	52.4	19.8	29.3	34.2	20.1
	B_2	7.0	6.0	3.7	8.5	10.1	35.3	45.7	19.0	32.2	28.5	22.0
	A'_{2g}	5.9	5.8	4.4	9.6	9.8	35.5	46.2	18.3	32.0	29.4	22.4
	B'_{21gm}	4.9	5.6	4.6	9.9	8.7	33.7	45.1	21.2	29.8	29.4	18.4
	B'_{22gm}	6.1	6.0	5.0	9.2	7.3	33.6	41.2	25.2	26.7	26.6	19.9
	B'_{23g}	8.0	8.5	6.7	10.2	6.7	40.1	37.5	22.4	24.6	24.5	24.3
	B'_{24}	6.0	6.4	5.6	9.3	7.3	34.6	44.9	20.5	28.0	28.9	23.9
	C_1	6.9	6.1	4.7	7.6	7.1	32.4	49.1	18.5	28.7	31.3	23.5
	C_2	8.1	6.1	4.2	7.5	8.1	34.0	47.4	18.6	28.9	30.7	20.4
	C_3	8.2	6.0	4.2	8.0	8.3	34.7	45.5	19.8	29.0	29.2	23.3
	C_4	9.5	6.8	4.9	8.7	8.1	38.0	42.1	19.9	27.7	27.0	16.7
Conant silt loam, profile 2.	A_p	9.3	6.0	3.3	7.4	8.5	34.5	49.6	15.9	30.1	32.3	31.6
	A_2B_2	10.2	8.2	4.6	9.9	9.1	42.0	44.0	14.0	30.3	28.3	33.4
	A'_{2g}	13.7	9.9	5.3	10.2	9.2	48.3	40.3	11.4	29.0	25.8	36.4
	B'_{21gm}	12.8	8.9	5.1	10.0	9.0	45.8	38.0	16.2	28.5	23.9	24.0
	B'_{22gm}	9.3	8.3	5.0	9.7	9.3	41.6	41.0	17.4	29.2	26.3	29.8
	D_u	27.8	14.3	7.0	11.4	7.2	67.7	19.5	12.8	21.4	11.2	44.6
	C	15.3	10.3	6.0	11.3	8.7	51.6	35.0	13.4	29.2	20.5	34.3
Daigle silt loam, profile 1.	A_p	6.4	4.6	2.9	6.2	6.6	26.7	52.0	21.3	28.6	33.4	30.8
	$B_2A'_{2g}$	9.9	5.7	3.8	7.9	8.9	36.2	48.3	15.5	31.2	30.1	33.9
	B'_{21gm}	6.6	4.5	2.7	6.1	7.2	27.1	41.2	31.7	24.8	27.0	27.8
	B'_{22g}	7.2	4.3	2.7	6.2	7.3	27.7	43.2	29.1	25.2	28.8	27.2
	B'_{23}	5.7	4.3	2.7	6.5	7.5	26.7	43.9	29.4	25.5	29.7	28.9
	B'_{24}	6.0	4.7	3.0	6.9	7.6	28.2	43.2	28.6	26.2	28.5	18.9
Daigle silt loam, profile 2.	A_p	7.0	4.8	2.4	4.9	6.0	25.1	51.7	23.2	25.1	35.0	23.3
	B_{2g}	11.5	7.2	3.9	7.5	6.7	36.8	43.0	20.2	24.6	29.0	32.8
	A'_{2g}	9.3	6.1	3.6	7.4	6.9	33.3	44.8	21.9	25.0	30.7	28.1
	B'_{2gm}	8.2	5.0	2.9	6.2	6.1	28.4	41.9	29.7	22.8	28.6	33.8
	D_u	25.5	12.4	6.3	9.3	5.8	59.3	20.9	19.8	16.5	13.5	56.9
	C	7.2	5.5	3.4	7.0	6.4	29.5	42.0	28.5	23.2	29.0	28.2
Easton silt loam, profile 1.	A_p	7.9	5.9	3.9	7.3	9.3	34.3	49.4	16.3	32.4	30.4	13.0
	A_{2g}	7.5	7.4	5.2	9.0	10.5	39.6	45.3	15.1	31.9	29.3	15.0
	B_{21g}	5.4	6.0	4.5	8.0	9.4	33.3	42.5	24.2	27.3	29.3	15.0
	B_{22g}	6.2	6.2	4.6	8.0	9.1	34.1	42.8	23.1	27.2	29.3	13.0
	B_{23g}	5.3	6.6	4.9	8.9	9.7	35.4	42.4	22.2	30.2	27.2	16.0
	C	5.7	7.8	5.8	9.6	9.4	38.3	43.1	13.6	28.9	29.0	28.0

TABLE 9.—*Mechanical analyses of representative soils*—Continued

Soil	Horizon	Particle size distribution (in millimeters)										
		Very coarse sand (2–1)	Coarse sand (1–0.5)	Medium sand (0.5–0.25)	Fine sand (0.25–0.10)	Very fine sand (0.10–0.05)	Total sand	Silt (0.05–0.002)	Clay (less than 0.002)	Other size classes: 0.2–0.02	Other size classes: 0.02–0.002	Other size classes: More than 2
		Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Easton silt loam, profile 2.	A_p	3.6	3.9	2.4	4.5	5.9	20.3	51.2	28.5	22.7	37.1	9.0
	A_{2g}	10.8	6.6	3.6	6.3	7.8	35.1	50.7	14.2	30.0	32.1	7.0
	B_{21g}	5.8	6.0	3.8	6.6	7.4	29.6	44.6	25.8	24.6	31.1	18.0
	B_{22g}	6.1	5.9	3.5	6.3	8.0	29.8	48.2	22.0	26.6	33.1	14.0
	B_{23g}	8.0	6.7	4.1	7.2	8.2	34.2	44.7	21.1	26.0	30.9	18.0
	C_1	6.3	7.3	4.5	7.7	8.4	34.2	44.7	21.1	26.4	31.0	16.0
Perham gravelly silt loam, profile 1.	A_p	4.8	4.6	3.3	7.0	8.9	28.6	56.1	15.3	33.6	35.3	22.1
	A_2B_2	8.4	6.6	3.9	8.1	8.7	35.7	49.6	14.7	30.0	32.7	36.1
	A'_2	10.3	5.7	3.7	8.1	8.5	36.3	43.8	19.9	28.7	28.2	27.7
	B'_{21}	6.2	4.2	2.8	6.4	7.3	26.9	42.5	30.6	24.6	28.8	19.1
	B'_{22}	6.6	4.7	3.2	5.6	8.2	28.3	43.8	27.9	25.2	29.3	26.4
	B'_{23}	8.0	6.1	4.0	8.3	7.9	34.3	43.9	21.8	27.1	29.4	24.9
	B'_3	5.1	4.2	3.1	7.3	8.1	27.8	49.3	22.9	29.4	32.0	23.2
Perham gravelly silt loam, profile 2.	A_p	4.6	4.4	3.0	6.8	7.8	26.6	55.7	17.7	31.3	35.9	32.4
	$B_2A'_2$	6.9	5.8	4.0	8.7	9.0	34.4	51.8	13.8	32.0	33.6	25.7
	B'_2	10.5	7.0	4.3	9.4	8.3	39.5	43.4	17.1	28.8	28.2	32.0
Washburn silt loam, profile 1.	A_1	.7	1.4	.9	3.7	6.5	13.2	60.9	25.9	29.6	40.2	------
	B_{21g}	7.7	6.2	3.8	9.0	9.0	35.7	45.6	18.7	30.0	29.6	24.2
	B_{22g}	9.1	7.0	4.6	9.1	8.4	38.2	42.4	19.4	29.0	26.8	37.0
	C_{1g}	9.7	7.5	4.8	10.5	8.1	40.6	38.2	21.2	26.0	25.5	29.9
	C_{2g}	9.1	6.9	5.1	10.1	8.0	39.2	38.9	21.9	26.1	26.3	29.3
Washburn silt loam, profile 2.	A_1	1.9	3.6	2.9	7.2	9.7	25.3	51.5	23.2	35.3	30.2	------
	B_{21g}	7.6	7.4	5.1	12.4	10.9	43.4	39.8	16.8	33.1	24.3	25.5
	B_{22g}	7.3	6.8	5.2	9.2	9.7	38.2	42.8	19.0	30.6	26.8	25.7
	C_{1g}	7.4	6.9	5.1	9.3	9.2	37.9	44.1	18.0	29.9	28.2	22.0

Climate of Northeastern Aroostook County

Northeastern Aroostook County has a humid, cool, continental climate. Winters are long, cold, and windy. Temperatures fall below zero between November and April, but, on the average, there are only about 43 days during the year when the temperature is zero or below. Summers are cool and fairly short. The temperature averages about 62° F. It seldom reaches 90°, and, even on such days, the nights are cool.

Table 10 gives the monthly, seasonal, and annual temperature and precipitation as recorded at the United States Weather Bureau station at Presque Isle.

The average annual rainfall of about 34 inches is distributed throughout the year. In summer, there is approximately 3½ to 4 inches of rainfall per month. The average annual snowfall is about 100 inches. Snow falls between the first of October and the last of April.

The average frost-free season is 108 days. The average date of the last killing frost in spring is May 30, and the first in fall is September 15. Killing frosts have occurred as late as June 28 and as early in fall as August 28.

Over a 15-year period, the weather station at Caribou has registered slightly higher precipitation and slightly lower temperature than the station at Presque Isle.

TABLE 10.—*Temperature and precipitation at Presque Isle, Aroostook County, Maine*

[Elevation, 606 feet]

Month	Temperature [1]			Precipitation [2]		
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1924)	Wettest year (1936)
	°F.	*°F.*	*°F.*	*Inches*	*Inches*	*Inches*
January	10.7	54	−41	2.26	1.32	4.27
February	13.3	51	−36	1.83	1.40	1.73
March	23.7	65	−30	2.22	1.50	4.11
April	37.4	85	−2	2.61	3.08	2.55
May	50.5	94	19	2.87	3.03	6.36
June	58.8	95	25	3.70	.76	4.00
July	65.7	97	37	3.72	2.09	3.52
August	63.3	99	31	3.10	3.07	4.03
September	54.4	90	21	3.39	3.34	3.93
October	44.1	84	8	3.36	.78	5.19
November	30.1	69	−15	2.52	2.52	1.96
December	16.4	58	−35	2.38	1.73	2.32
Year	39.0	99	−41	33.96	24.62	43.97

[1] Average temperature based on a 43-year record, through 1955; highest temperature based on a 38-year record and lowest temperature on a 40-year record, through 1952.

[2] Average precipitation based on a 43-year record, through 1955; wettest and driest years based on a 40-year record, in the period 1910–1955.

General Nature of the Area

This section tells something of the geography, settlement, development and transportation, agriculture, and other interesting facts about Aroostook County. This part of the report differs from other sections in that it concerns the entire county, not just the northeastern part. Some information, such as U.S. Census statistics on population and agriculture, are available only for the county as a whole. By understanding the general nature of the entire county, one can better understand that of the area covered by this survey.

Geography

Aroostook County, which was originally part of Penobscot and Washington Counties, forms the northern and most of the eastern boundary of Maine. After the county was formed in 1839, parts of Piscataquis and Somerset Counties were added to it. The county covers an area of 6,805 square miles.

Aroostook County is an important agricultural county. It is called the potato empire, though less than one-fifth of the land area is under cultivation. The rest consists of roadless wilderness and is the most extensive such area east of the Mississippi River.

The county can be divided into four areas. Three of these are near the first settlements; the other consists of wilderness in the western part of the county.

1. The southernmost area centers around Houlton, the county seat and third largest community. In this area farmers practice a general type of agriculture; potatoes are the cash crop. Less acreage per farm is in potatoes than in the area around Presque Isle, Caribou, and Fort Fairfield.
2. The most highly specialized area for the growing of potatoes is about 50 miles north of Houlton. It occurs around Presque Isle, Caribou, and Fort Fairfield. Many potato-processing plants and potato-marketing offices and the largest, most highly developed potato farms are in this area.
3. The northernmost area is in the St. John valley. It occurs around Van Buren, Madawaska, and Fort Kent. Potatoes are grown in a one-crop system. In this area there are fewer acres per farm in potatoes than in the area around Presque Isle, Caribou, and Fort Fairfield. Farmers supplement their incomes by working for lumbering concerns.
4. The western two-thirds of the county is forested, and many lumbering operations are carried on in this area.

Settlement

In 1607, Father Lebrun, a French missionary, and a group of explorers made their way up the St. John River and planted a cross on Mars Hill. During the rest of the 17th century, few white men, except traders, entered this area.

The Acadians, of whom Longfellow wrote in "Evangeline," left Nova Scotia in 1785, and some of them settled in the St. John valley in what are now Madawaska, Van Buren, and Fort Kent. Others settled in Edmundston, St. Leonard, and Clair, New Brunswick. The inhabitants of the valley did not bear allegiance to the United States or Canada. They were Madawaskans, and the entire valley was called Madawaska. They inherited qualities of both the English and the French.

Early settlers along the upper part of the St. John River were largely French, chiefly emigrants from Canada along with some descendants of the Acadians. Most of them worked for lumbering concerns in Maine and New Brunswick.

Maine was originally part of the State of Massachusetts. In 1799, the Massachusetts Legislature granted land for establishment of academies in what are now Houlton and Hodgdon.

In 1806, a group of Puritans settled in this area that was then called the District of Maine. After the War of 1812, other settlers arrived. In 1820, Maine became a State; the settlers came under its jurisdiction, but there was still no local government. Houlton was organized as a plantation in about 1826, and it was incorporated in 1831.

A sawmill and a gristmill were established in Presque Isle in 1828. The machinery for these mills was loaded at Old Town on two bateaux (flat-bottomed boats) that were poled up the Penobscot River and hauled across the portage to the Aroostook River. Settlers continued to arrive in the Presque Isle area, but it was 10 years before a road, known as Military Road, was cut through the wilderness from Monticello to Presque Isle.

Although Maine had become a State, her northern boundary was under dispute. The United States claimed that the boundary of Maine overlapped the upper part of the St. John River and extended to the St. Lawrence River. Great Britain claimed that the boundary ran from Mars Hill Mountain westerly across the State to Canada. Because of the likelihood of hostilities, Maine militia were rushed to Houlton, Fort Fairfield, and Fort Kent, which were named after the blockhouses erected at that time. The boundary dispute was settled peaceably, however. Daniel Webster represented the claim of the United States and Lord Ashburton that of Great Britain. The St. John River became the northern boundary of the State.

Troops were kept stationed at Houlton and Fort Fairfield, and some of the soldiers settled in these places. Others settled in Lyndon, which is now called Caribou.

In 1869, W. W. Thomas, a former U.S. consul to Sweden, recruited 51 emigrants from Sweden to settle in what is now called New Sweden. The head of each family was granted 100 acres of land. During the next few years, many more Swedes arrived.

Aroostook County was sparsely settled up to 1839, when it was incorporated. At that time the population was only 3,399. Population increased rapidly between 1850 and 1860, but the rate of growth decreased during the Civil War. With the introduction of the potato-starch industry in 1871, population again increased. During the next 10 years, the number of people increased to 41,700. By 1920, the population of the county had almost doubled. Between 1930 and 1940, it increased about 7 percent and between 1940 and 1950, nearly 2 percent. In 1954, the population was 96,039.

Development and Transportation

Railroads played an important part in the growth and development of Aroostook County. Originally, produce was hauled by horses as much as 90 miles to Houlton. After the coming of the railroads in 1870, potatoes, starch, and other products were transported to markets outside the county and Houlton became a trading center for the area. In 1881, the European and North American line connected Fort Fairfield, Caribou, and Presque Isle with communities in New Brunswick, Canada. Fort Kent was originally served by a Canadian railroad. Goods had to be ferried from Clair Station, New Brunswick, to Fort Kent.

A starch factory was built in Caribou in 1871, and by 1890, there were 42 starch factories in the county. The Bangor and Aroostook Railroad, which opened in 1894, connected Caribou and Fort Fairfield with Houlton. By 1915, the railroad had been extended northward to Canada.

The Aroostook Valley Railroad began to serve Presque Isle, Caribou, Washburn, New Sweden, and Crouseville in 1911. This railroad connects with the Canadian Pacific Railway at Presque Isle, and the first potato-storage houses in the county were erected along its lines (fig. 8).

At present the Bangor and Aroostook Railroad runs north through Masardis, Ashland, Eagle Lake, and Fort Kent in the western part of the agricultural area. A line of this railroad extends north along the eastern edge of the county. It connects Houlton, Mars Hill, Caribou, New Sweden, Stockholm, and Van Buren. Another line along the St. John River connects St. Francis and Van Buren. Branch lines serve Mapleton, Presque Isle, Fort Fairfield, and the smaller communities. Many of these places are also served by the Canadian Pacific Railroad.

In Aroostook County, two main highways extend north and south through the agricultural area, which is about 25 miles wide and 75 miles long. U.S. Highway No. 1 enters the county near Weston and extends nearly to the Canadian border. It goes through Houlton, Mars Hill, Presque Isle, Caribou, and Van Buren. At Van Buren it turns west and follows the St. John River through Madawaska to Fort Kent.

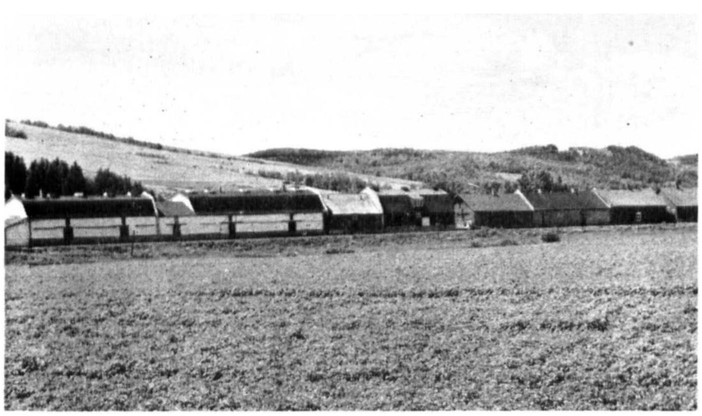

Figure 8.—**Potato-storage houses, along the railroad tracks, are characteristic of communities in the county.**

State Highway No. 11 enters Aroostook County at Hersey and extends north along the western side of the agricultural area through Ashland, Portage, Eagle Lake, and Fort Kent. State Highway No. 163, which extends from Ashland to Presque Isle, connects State Highway No. 11 with U.S. Highway No. 1.

State Highway No. 161 connects Caribou with Fort Kent and then extends west along the St. John River to Allagash. This is the only State highway that penetrates the forested wilderness in the western part of the county.

Large areas between State Highway No. 11 and U.S. Highway No. 1 are used only for forestry and are not crossed by public highways. However, there are logging roads, owned and maintained by lumber operators, in these areas, as well as in the wilderness to the west.

The most extensive network of roads in the county centers around Mars Hill, Fort Fairfield, Caribou, and Presque Isle. These roads provide easy access to New Brunswick, Canada.

In Aroostook County, commercial airline service is available at Presque Isle.

Natural Resources

The forests are the principal natural resource of Aroostook County, and about 82 percent of the area is still forested. Most of the wood is used to manufacture paper, but many thousands of board feet of pine and spruce lumber are harvested each year.

The many streams and lakes in the county were used by early settlers for transportation. Highways and railroads now provide most of the transportation needs, but streams still transport pulpwood. In some places, especially on the Aroostook River at Caribou, electricity is generated by waterpower.

Industries

Agricultural and forest products are processed and manufactured in Aroostook County.

Most of the potato-starch factories in the United States are located in the county. Starch is a major diversion for potatoes when prices are low. Consequently, the production of starch fluctuates from year to year, depending on the demand for potatoes.

Paper products are manufactured at Madawaska. A lumber company at Ashland processes quality pine lumber. This is one of the largest operations of its kind in Maine. Lumbering operations in the basins of the upper parts of the St. John and Allagash Rivers are carried on by men from the nearby towns.

Frozen peas, French fried potatoes, and other potato products are processed at Caribou and Washburn.

Fertilizer plants are located at Houlton, Mars Hill, Presque Isle, Caribou, and Fort Kent.

Community Facilities

Elementary and secondary schools are located conveniently throughout the county. Ricker College in Houlton offers degrees in arts and sciences and also provides preprofessional and vocational curriculums. Aroostook State Normal School at Presque Isle and Madawaska

Training School at Fort Kent provide the first 3 years of a 4-year course in teachers' training. The Madigan Hospital in Houlton offers a 3-year program in nurses' training.

Nearly all communities in the county have telephone service. Electricity is available in all except the most remote areas. Radio stations are located at Houlton, Presque Isle, and Caribou. There is a television station in Presque Isle.

Recreational Facilities

Aroostook County offers excellent facilities for hunting, fishing, hiking, and canoeing. Many small streams along State Highway No. 11 can be fished from the roadbanks. These streams are spawning and feeding grounds for trout.

Lumbering roads that run east and west provide access to many lakes where the allowed limit of salmon and togue can be caught. Many lakes that lie as much as 25 miles in the wilderness can be reached by logging trails off of State Highway No. 11. A few isolated lakes that are not easily accessible can be reached by pontoon planes based at Portage Lake. Pilots transport fishermen to all the lakes in the county.

A guided canoe trip of 150 miles can be taken from Greenville, Piscataquis County, to Allagash. Canoe trips can also be made up the St. John River in the far western part of the county.

Deer, bear, bobcat, and ruffed grouse are plentiful throughout the county. Hunting of deer and grouse is good, even in the more thickly settled areas. Bear hunting is done in the larger wooded areas.

Agriculture

The first part of this section consists of a brief discussion of early agriculture in the county, and the second, of a more detailed discussion of present agriculture.

Early agriculture

Part-time agriculture was practiced by early lumbermen, who produced their own food and also raised hay for livestock. Fields were not cleared for potatoes until 1871, when the first potato-starch factory was erected. A railroad began operation in the same year and shipped 4,000 bushels of potatoes out of the county. By 1891, shipments had increased to 3,000,000 bushels of potatoes, in addition to 10,000 tons of hay.

Between 1880 and 1890, the acreage in potatoes doubled; an estimated 28,000 acres produced 5,000,000 bushels of potatoes in 1890. About 1,500,000 bushels were manufactured into starch. Approximately 172,000 acres were in potatoes by 1943, because of the demand created by World War II.

Present agriculture

Only 1,517,316 acres of the total of 4,355,200 acres in Aroostook County are included in the survey area. The survey area has an estimated 2,610 farms. About 217,750 acres are used for potatoes, grown in a rotation with peas, small grains, and hay. An estimated 62,371 acres are used for permanent pasture. Most of the rest of the acreage is in forests.

The statistics in the rest of this section are taken from the U.S. Census reports for 1954, unless otherwise specified and apply to the entire county.

About 18 percent of the total acreage of the county was in farms in 1954. There were an estimated 3,940 farms containing a total of 782,542 acres. The land in farms consisted of 381,334 acres of cropland; 23,953 acres of pasture (not cropland and not woodland); 342,425 acres of woodland; and 34,830 acres of other land (house lots, roads, wasteland, etc.).

The estimated 3,940 farms in the county were grouped by type as follows:

	Number of farms
Field crop (potato)	3,032
Cash-grain	20
Dairy	266
Poultry	30
Livestock (other than dairy and poultry)	60
General	71
Miscellaneous and unclassified	461

A total of 165 farms were between 1 and 29 acres in size, 821 were between 30 and 100 acres, and 2,954 were more than 100 acres. The average size of farm was 198.6 acres in 1954, as compared to 182.2 acres in 1950. The number of farms, however, has decreased in recent years. There were 4,614 farms in 1950, and only 3,940 in 1954.

The acreage used for important crops in 1954 was as follows:

	Number of acres
Small grains grown together and threshed as a mixture	877
Oats threshed or combined	64,799
Other grain threshed or combined	4,753
Hay crops, total	84,330
Irish potatoes harvested for home use or for sale	120,414
Green peas harvested for sale	7,585

The number of livestock raised in the county in 1954 was as follows:

	Number
Steers and bulls	4,993
Dairy cattle	17,398
Hogs and pigs	6,509
Sheep and lambs	6,926
Chickens (4 months old and over)	180,986
Turkeys raised	111,133

Most of the farms in Aroostook County are operated by owners. In 1954, only 111 farms, or 2.8 percent of the total, were operated by tenants. A total of 671,795 acres were operated by full owners; 85,831, by part owners; 16,199, by managers; and 8,717, by tenants.

There were 5,775 tractors reported on 3,395 farms. A total of 3,763 farms reported having electricity.

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Glossary

Aeration, soil.—The process by which air and other gases in the soil are renewed. The rate of soil aeration depends largely on the size and number of pores in the soil and on the amount of water clogging the pores.

Aggregate, soil.—A single mass or cluster consisting of many primary soil particles held together, such as a prism, crumb, or granule.

Alluvial soil.—Soil formed from material, such as gravel, sand, silt, or clay, deposited by a stream of water and showing little or no modification of the original materials by soil-forming processes.

Base saturation.—The relative degree to which a soil has absorbed metallic cations (calcium, potassium, magnesium, etc.). The proportion of the cation-exchange capacity that is saturated with metallic cations.

Bedding, soil.—Plowing, grading, or otherwise elevating the surface of fields into a series of parallel beds, or "lands," separated by shallow surface drains.

Bedrock.—The solid rock that underlies the soils and other unconsolidated material or that is exposed at the surface.

Bleicherde.—The principal gray or light-colored, leached layer (A_2) in Podzols.

Calcareous.—Containing calcium carbonate or lime.

Climax, forest.—The stable, final stage of plant succession that continues to occupy an area as long as climatic and soil conditions remain unchanged.

Coarse-textured soil.—A sandy soil consisting of sand or loamy sand. A moderately coarse textured soil consists of sandy loam or fine sandy loam.

Colluvial soils.—Soils formed from material that has been moved downhill by gravity, soil creep, frost action, or local erosion. It accumulates on lower slopes and at the bases of slopes.

Conglomerate.—Rock composed of gravel and rounded stones cemented together by hardened clay, lime, iron oxide, or silica.

Consistence, soil.—The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are as follows:

Loose.—Noncoherent; will not hold together in a mass.

Friable.—When moist, crushes easily under moderate pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a wire when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material.

Hard.—When dry, moderately resistant to pressure; can barely be broken between thumb and forefinger.

Cemented.—Hard and brittle; little affected by moistening.

Contour farming.—Plowing, planting, cultivating, and harvesting in rows that are at right angles to the natural direction of the slope and as nearly level as practical.

Cover crops.—Close-growing crops, grown primarily to improve the soil and protect it between periods of regular crop production; or crops grown between trees in orchards.

Diversion terrace.—A channel with a supporting ridge on the lower side, constructed across the slope to intercept runoff and carry it to a planned outlet. The terrace is maintained in permanent sod.

Drainage terrace.—A relatively deep channel and low ridge constructed across the slope primarily for drainage. It may be either a diversion terrace or a field terrace.

Eluvial horizon.—A horizon (the A) from which material dissolved or suspended in water has been removed.

Erodible.—Susceptible to erosion; easily lost through the action of water or wind.

Erosion.—The wearing away of the surface of the soil by running water, wind, or other geological agencies.

Geological erosion.—Normal erosion that takes place when soil is under native vegetation and undisturbed by human activity.

Sheet erosion.—Gradual and uniform removal of soil material from the surface of the soil without the formation of rills and gullies.

Fine-textured soil.—A soil consisting predominantly of silt and clay; a sandy clay, silty clay, or clay. A moderately fine textured soil is a clay loam, sandy clay loam, or silty clay loam.

Flaggy.—Containing thin fragments of rock measuring 6 to 15 inches along the longer axis.

Flood plain.—A nearly level area, subject to overflow, that occurs along streams.

Grassed waterway.—A natural or constructed waterway, typically broad and shallow, covered with grasses that will protect the soil from erosion, and used to conduct surface water away from cropland.

Green-manure crop.—A crop of grasses or legumes worked into the soil while green or soon after maturity for the purpose of soil improvement.

Hardpan.—A horizon or soil layer that is strongly compacted or cemented.

Horizon, soil.—A layer of soil, approximately parallel to the soil surface, with distinct characteristics produced by soil-forming processes. Horizons are identified by letters of the alphabet.

A horizon.—The horizon at the surface. It contains organic matter, or it has been leached of soluble minerals and clay, or it shows the effects of both. The major A horizon may be subdivided into A_1, the part that is darkest in color because it contains organic matter, and A_2, the part that is the most leached and light-colored layer in the profile. In woodlands, a layer of organic matter accumulates on top of the mineral soil; this layer is called the A_0 horizon. The depth of the soil, however, is measured from the top of the mineral soil, because the A_0 horizon is rapidly destroyed if fire occurs or if the soil is cultivated. Where the upper part of the soil is thoroughly mixed by cultivation, this plow layer is called the A_p horizon

Horizon, soil—Continued

B horizon.—The horizon in which clay, minerals, or other materials has accumulated, or which has developed a characteristic blocky or prismatic structure, or which shows the characteristics of both processes. It may be subdivided into B_1, B_2, or B_3 horizons. The B_2 horizon may be subdivided further and this is shown by adding another number to the symbol, such as B_{21}, B_{22}, or B_{23}.

C horizon.—The unconsolidated material immedately under the true soil. It is presumed to be similar in chemical, physical, and mineral composition to the material from which at least part of the overlying solum has developed.

D horizon.—The stratum beneath the parent material. It may be unlike the parent material of the soil. If it consists of solid rock like that from which the parent material has developed, it is designated as D_r.

Gleyed horizon.—A strongly mottled or gray horizon that occurs in wet soils. It is designated by the letters BG, CG, or sometimes merely by G. A horizon only slightly gleyed may have the letter $_g$ added to the symbol.

Igneous rock.—A rock produced through the cooling of melted mineral materials.

Illuvial horizon.—A soil horizon (the B) that contains an accumulation of suspended mineral and organic matter orginating from horizons above.

Leached layer.—A layer in which the soluble constituents have been dissolved and washed away by the percolating water.

Liquid limit.—The moisture content at which soil passes from a plastic to a liquid state. In engineering a high liquid limit indicates that the soil has a high content of clay and a low capacity for carrying loads.

Medium-textured soil.—A loamy soil that consists of very fine sandy loam, loam, silt loam, or silt.

Mottling, soil.—Contrasting color patches that vary in number and size. Descriptive terms are as follows: Contrast—*faint, distinct,* and *prominent;* abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse.* The size measurements are the following: Fine, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; medium, ranging from 5 to 15 millimeters (about 0.2 to 0.6 inch) in diameter; and coarse, more than 15 millimeters (about 0.6 inch) in diameter.

Orterde.—Horizons that have accumulations of iron and organic matter but are not cemented.

Parent material.—The mass of rock material (or peat) from which the soil develops.

Ped.—A soil aggregate; the natural structural pieces into which the soil tends to separate when disturbed.

Permeability.—The quality of the soil that enables it to transmit water or air. (Terms used to describe permeability are given in a footnote to table 4.)

Phyllite.—A micaceous schist, intermediate between mica-schist and slate.

Plastic limit.—The moisture content at which a soil changes from a semisolid to a plastic state.

Plasticity index.—The numerical difference between the liquid limit and the plastic limit; the range in moisture content over which the soil remains plastic.

Profile, soil.—A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil.—The degree of acidity or alkalinity of the soil expressed in pH values or in words as follows:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher.

Residual soil.—Soil formed in place by the disintegration and decomposition of rocks and the consequent weathering of the mineral materials. Presumably developed from the same kind of rock as that on which it lies.

Runoff.—Rainwater or melted snow that flows away over the surface of the soil without sinking in.

Sedimentary rock.—A rock composed of particles deposited from suspension in water. Although there are many intermediate types, the principal groups of sedimentary rocks are (1) conglomerates (from gravels), (2) sandstones (from sands), (3) shales (from clays), and (4) limestones (from calcium carbonate deposits).

Sequum.—An illuvial (B) horizon, together with its overlying eluvial (A) horizon if one is present. If more than one sequum is present in vertical sequence, the lower sequum is given A and B designation with a prime accent, such as A'_2, B'_2. A *bisequal* profile contains both an upper and lower sequum, whereas a *monosequal* profile has only one sequum.

Shale.—A sedimentary rock formed by hardening of clay deposits into rock.

Shaly.—Containing flat fragments of shale less than 6 inches long.

Solum.—The upper part of the soil profile, above the parent material; the part of the profile that has been noticeably affected by the soil-forming processes. The solum of mature soils consists of the A and B horizons.

Stripcropping.—A management practice using alternate strips of close-growing crops and clean-tilled crops or fallow on the contour or parralel to terraces.

Structure, soil.—The arrangement of the primary soil particles into lumps, granules, or other aggregates. Structure is described by grade—*weak, moderate,* or *strong,* that is, the distinctness and durability of the aggregates; by the size of the aggregates—*very fine* or *very thin, fine* or *thin, medium, coarse* or *thick,* or *very coarse* or *very thick;* and by their shape—*platy, prismatic, blocky, columnar, crumb,* or *granular.* A soil is described as *structureless* if there are no observable aggregates. Structureless soils may be *massive* (coherent) *or single grain* (noncoherent).

Blocky, subangular.—Aggregates have some rounded and some flat surfaces; upper sides are rounded.

Columnar.—Aggregates are prismatic and are rounded at the top.

Crumb.—Aggregates are generally soft, small, porous, and irregular, but tend toward a spherical shape.

Granular.—Aggregates are roughly spherical, firm, and small. They may be either hard or soft but are generally more firm and less porous than crumb and without the distinct faces of blocky structure.

Platy.—Aggregates are flaky or platelike.

Prismatic.—Aggregates have flat vertical surfaces, and their height is greater than their width.

Subsoil.—The soil layers below the plow layer; the B horizon.

Substratum.—The soil material below the surface soil and the subsoil; the C or D horizon.

Surface soil (plow layer).—The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches thick.

Texture, soil.—The relative amounts of particles of different size classes, called *sand, silt,* and *clay,* determine texture. The common soil textures in northeastern Aroostook County are gravelly loam, loam, and silt loam. Each of these textural classes covers a given range in content of sand, silt, and clay.

Clay.—Small mineral soil grains, less than 0.002 millimeter (0.000079 inch) in diameter.

Silt.—Small mineral soil grains ranging from 0.05 millimeter (0.002 inch) to 0.002 millimeter (0.000079 inch) in diameter.

Sand.—Small rock or mineral fragments ranging from 0.05 millimeter (0.002 inch) to 2.0 millimeters (0.079 inch) in diameter.

Tilth.—The physical properties of the soil that affect the ease of cultivating it or its suitability for crops.

Topsoil (engineering application).—Soil material containing organic matter and suitable as a surfacing for shoulders and slopes.

Water-holding capacity.—The ability of a soil to hold water that will not drain away but can be taken up by plant roots.

Water table.—The upper surface of the ground water.

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