

# SOIL SURVEY

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## **Caldwell County Kentucky**

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UNITED STATES DEPARTMENT OF AGRICULTURE  
Soil Conservation Service  
in cooperation with  
KENTUCKY AGRICULTURAL EXPERIMENT STATION

Issued September 1966

# HOW TO USE THIS SOIL SURVEY REPORT

Major fieldwork for this soil survey was done in the period 1958-62. Soil names and descriptions were approved in 1964. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1962. This survey was made cooperatively by the Soil Conservation Service and the Kentucky Agricultural Experiment Station. It is part of the technical assistance furnished to the Caldwell County Soil Conservation District.

**T**HIS SOIL SURVEY of Caldwell County contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, or other structures; and in appraising the value of tracts of land for agriculture, industry, or recreation.

## Locating Soils

All the soils of Caldwell County are shown on the detailed map at the back of this report. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

## Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the report. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit, woodland group, wildlife group, or any other group in which the soil has been placed.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use.

Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

*Farmers and those who work with farmers* can learn about use and management of the soils in the soil descriptions and in the discussions of the interpretative groupings.

*Foresters and others* can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

*Game managers, sportsmen, and others concerned with wildlife* will find information about soils and wildlife in the section "Wildlife."

*Engineers and builders* will find, under "Engineering," tables that give engineering descriptions of the soils in the county and that name soil features that affect engineering practices and structures.

*Scientists and others* can read about how the soils formed and how they are classified in the section "Formation, Classification, and Morphology of the Soils."

*Students, teachers, and others* will find information about soils and their management in various parts of the text, including the section on "Formation, Classification, and Morphology of the Soils."

*Newcomers in Caldwell County* may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County," which gives additional information.

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### NOTICE TO LIBRARIANS

Series year and series number are no longer shown on soil surveys. See explanation on the next page.

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## EXPLANATION

### Series Year and Series Number

Series year and number were dropped from all soil surveys sent to the printer after December 31, 1965. Many surveys, however, were then at such advanced stage of printing that it was not feasible to remove series year and number. Consequently, the last issues bearing series year and number will be as follows:

Series 1957, No. 23, Las Vegas-Eldorado Area, Nev.

Series 1958, No. 34, Grand Traverse County, Mich.

Series 1959, No. 42, Judith Basin Area, Mont.

Series 1960, No. 31, Elbert County, Colo. (Eastern Part)

Series 1961, No. 42, Camden County, N.J.

Series 1962, No. 13, Chicot County, Ark.

Series 1963, No. 1, Tippah County, Miss.

Series numbers will be consecutive in each series year, up to and including the numbers shown in the foregoing list. The soil survey for Tippah County, Miss., will be the last to have a series year and series number.

# SOIL SURVEY OF CALDWELL COUNTY, KENTUCKY

BY MAURICE E. HUMPHREY, RAYMOND A. HAYES, AND PAUL M. LOVE, SOIL CONSERVATION SERVICE

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

**C**ALDWELL COUNTY is in the west-central part of Kentucky (fig. 1). It is 23 to 30 miles from north to south and 10 to 20 miles from east to west. The total land area is 228,480 acres, or 357 square miles. Princeton, the county seat and the largest town, has a population of 5,600. U.S. Highway No. 62 crosses the county from east to west, and State Highways No. 91, No. 139, and No. 293 cross from north to south.

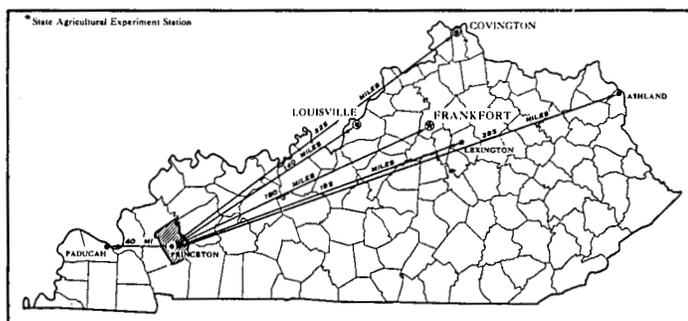


Figure 1.—Location of Caldwell County in Kentucky.

This county is in the Western Pennyrile and Western Coal Field physiographic regions. About 36 percent of it, the southern and western parts, is underlain by the high-grade cherty limestone of the Western Pennyrile. The northern and eastern parts are underlain by sandstone and shale formations of the Western Coal Field region and by mixed limestone, sandstone, and shale formations of the Western Pennyrile.

The northern and eastern parts of the county drain to the Tradewater River. The southern and western parts drain to the Cumberland River.

The climate is characterized by moderately cold winters and hot, humid summers. Precipitation is well distributed throughout the year.

In recent years, livestock and livestock products have accounted for the major part of farm income in Caldwell County. Crops, mainly tobacco and corn, have accounted for a smaller but a significant part. For the most part, the farms in the southern and western parts of the county are commercial. There are a few commercial farms and many part-time or part-retirement farms in the eastern and northern parts.

Barkley Lake and Kentucky Lake, both of which are within a short driving distance of the county, and Lake Beshear, more than half of which is in the county, afford opportunities for people who are interested in water sports.

## How This Soil Survey Was Made

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

They went into the county 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 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 into the parent material that has not been changed much by leaching or by roots.

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 nationwide, 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, the major horizons of all the soils of one series are 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. Crider and Russellville, 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 those characteristics that affect their behavior in the natural, undisturbed landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences 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. Crider silt loam and Crider silty clay loam are two soil types in the Crider 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 phases. The name of a soil phase indicates a feature that affects

management. For example, Crider silt loam, 2 to 6 percent slopes, is one of several phases of Crider silt loam, a soil type that ranges from nearly level to moderately steep.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The 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 some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, or occur in such small individual tracts, that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soils in it, for example, Fredonia-Rock land complex, 6 to 20 percent slopes, eroded. Another kind of mapping unit is the undifferentiated group, which consists of two or more soils that may occur together without regularity in pattern or relative proportion. The individual tracts of the component soils could be shown separately on the map, but the differences between the soils are so slight that their separation is not important for the objectives of the soil survey. An example is Dekalb, Ramsey, and Muskingum stony soils, 12 to 20 percent slopes. Also, in most areas surveyed there are tracts that are so rocky, so shallow, or so frequently worked by wind and water that they scarcely can be called soils. These tracts are shown on the soil map, like other mapping units, but they are given descriptive names, such as Gullied land or Rock land, sandstone, and are called land types rather than soils.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field and plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way that it is readily useful to different groups of readers, among them farmers, managers of woodland, and engineers. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in soil survey reports. The soil scientists set up trial groups based on the yield and practice tables and other data. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then they adjust the groups according to the results of their studies and con-

sultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

## General Soil Map

The general soil map at the back of this report shows, in color, the soil associations in Caldwell County, Kentucky. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils of one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The seven soil associations in Caldwell County are described in the paragraphs that follow.

### 1. Zanesville-Tilsit-Crider association

*Gently rolling soils with fragipans, in thin loess over bedrock*

Broad ridges dominate the landscape in association 1. The ridges have gentle side slopes and rolling tops that are between 100 and 1,500 feet wide. Moderately steep, irregularly shaped hills rise 100 to 150 feet above the ridgetops. About 40 percent of this association consists of Zanesville soils, 11 percent of Tilsit soils, 10 percent of Crider soils, and the rest of Newark and other minor soils. The association occupies about 35 percent of the county.

Zanesville and Tilsit soils are on the broad, rolling ridges. Zanesville soils have a fragipan at a depth of about 30 inches, and Tilsit soils have one at a depth of 22 inches. Crider soils, which are deep and well drained, are generally on the gently sloping hillsides.

The minor soils in this association are the somewhat poorly drained Newark soils, which are mainly along Donaldson Creek; the Melvin and Lindsides soils, which are also on bottom lands; and the Caneyville, Dekalb, Ramsey, Muskingum, Wellston, and Johnsbury soils, which are on uplands. Figure 2 shows a typical pattern of soils and underlying materials in association 1.

Most of the acreage is cleared. The gently sloping parts are used for crops, including corn and lespedeza and, to a lesser extent, tobacco, small grain, and truck crops. Much of the strongly rolling acreage has been cultivated in the past, but now only small scattered areas are used for crops and the rest is idle or is used as pasture or woodland (fig. 3).

About half of the bottom land along Donaldson Creek is wooded, mainly because floods make it hazardous to grow crops. Corn, soybeans, and lespedeza are grown on the scattered cleared parts of the bottom land.

Except for some areas of steep, shallow, rocky soils, this association is suited to commercial farming. The steeper areas can be used as woodland, as pasture, or as hayfields.

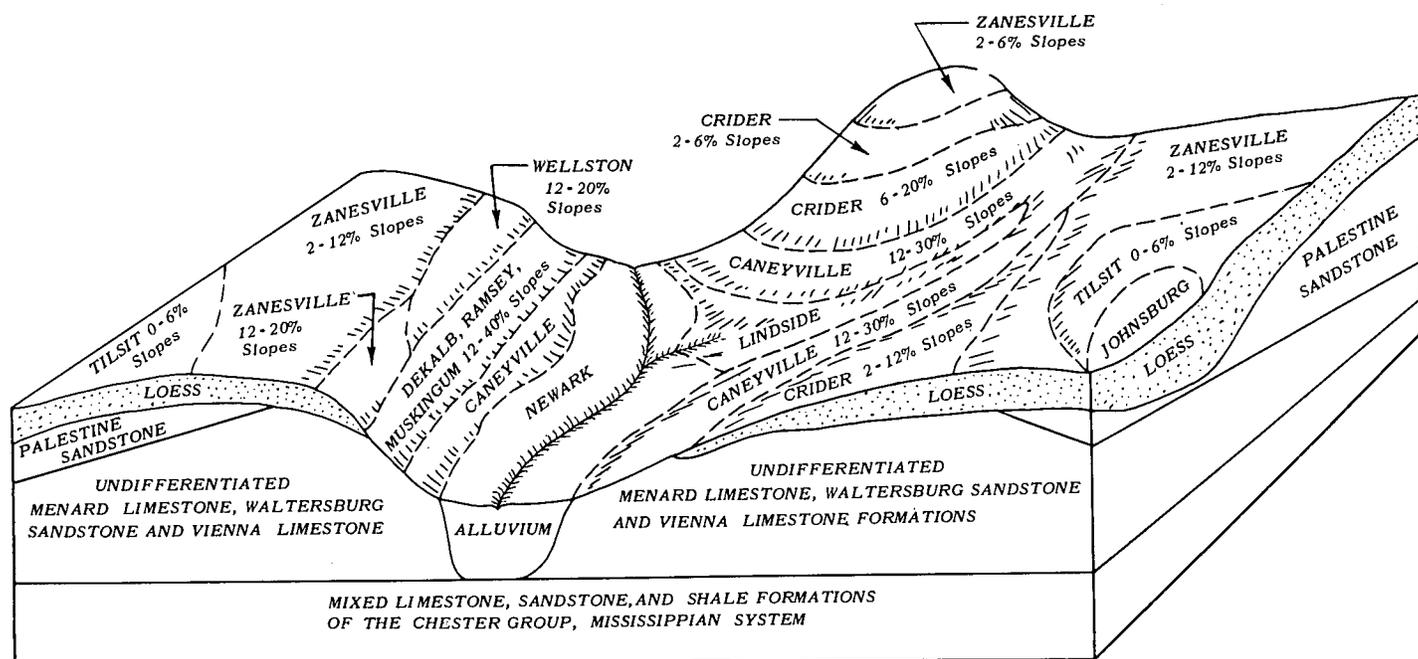


Figure 2.—Typical pattern of soils and underlying materials in association 1.

Most of the farms are commercial (full-time) enterprises. The largest farm is 700 acres in size, and the smallest 8 acres. The farms average 130 acres in size; 63 percent of them are smaller than average. The size of farms is increasing, partly because bulldozers, rotary mowers, and other modern equipment make it practical to put idle land back into production.

**2. Caneyville-Dekalb-Muskingum-Wellston association**

*Steep soils that are shallow to bedrock or commonly contain rock outcrops*

Escarpmnts made up of rocky soils dominate in association 2. The areas are irregularly shaped and are generally longer than they are wide. Some are several miles long. The width ranges from less than half a mile to about 3 miles but is most commonly between half a mile and a mile. About 33 percent of the association consists of Caneyville soils, 25 percent of Dekalb and Muskingum soils, and 20 percent of Wellston soils. The rest of the association consists of Hayter, Zanesville, and other minor soils, and of Rock land, sandstone, and Rock land, limestone. The association occupies about 9 percent of the county.

Caneyville soils occupy the lower half or two-thirds of the steeper slopes. Their gradient ranges from 6 to 50 percent but is generally between 12 and 30 percent. These soils developed in residuum weathered from limestone, sandstone, and shale. The subsoil is thin. It generally consists of silty clay or clay. The color is brown or yellowish red mottled with gray. Bedrock is at a depth of about 2 feet. Rock crops out in many places. Dekalb and Muskingum soils, which are mapped with Ramsey soils, occupy the upper half or the uppermost third of the steep slopes. Their gradient is between 12 and 40 percent. They have a stony surface layer, a weakly developed subsoil, and shattered sandstone and shale bedrock at a depth

of about 18 inches. Wellston soils are generally on the narrow ridgetops or on the strong side slopes above Dekalb and Muskingum soils. These soils are the deepest and the least steep of the soils in this association. They have a well-developed subsoil of strong-brown or yellowish-red silty clay loam and have shattered sandstone and shale bedrock at a depth of about 3 feet.

Minor soils in this association are Hayter soils, which occupy foot slopes, Zanesville soils, which are on uplands, and small areas of well-drained soils on bottom lands. Also in this association are two land types, Rock land, limestone, and Rock land, sandstone, which cover more than 2,000 acres. There are loose stones and rock outcrops on 25 to 90 percent of this acreage. Figure 4 shows a typical pattern of soils and underlying materials in association 2.



Figure 3.—Pasture on Tilsit silt loam. In background, a hill about 100 feet high; Crider soils on the side slopes, and Zanesville soils on the hilltop.

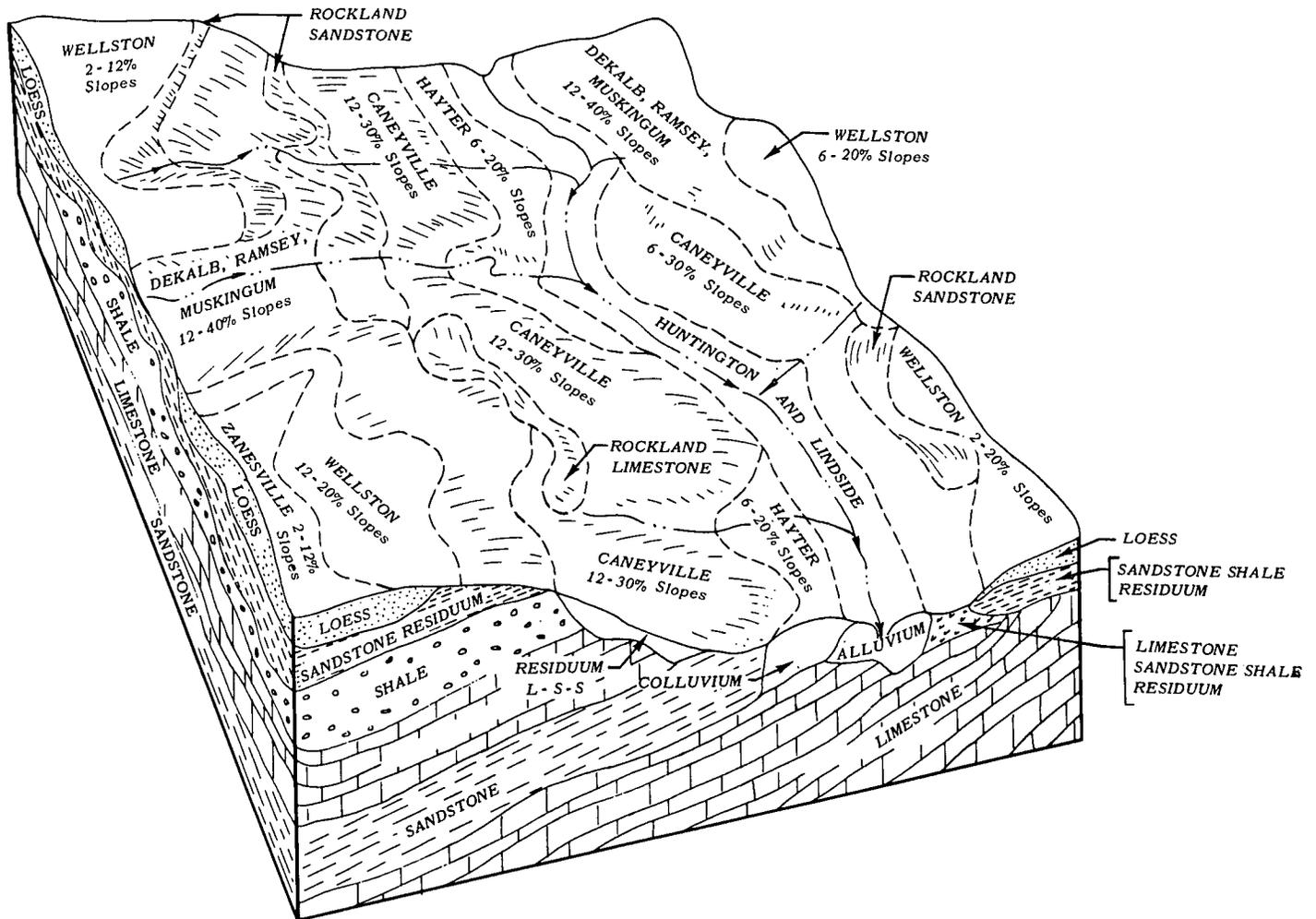


Figure 4.—Typical pattern of soils and underlying materials in association 2.

Nearly all of this association is forested (fig. 5). Timber is supplied for farm use, and some timber is sold. Because of previous cutting operations, the trees are of poor quality on much of the acreage. Owners of some areas are reforesting or making improvement cuttings.

There are very few farms entirely within this narrow association. Most farms extend into the adjoining associations. Those that extend into associations 1 and 4 are generally owner operated, full-time enterprises. Those that extend into association 3 are generally owned by part-time farmers or by absentee owners. Owners of some large tracts are interested in minerals, mainly fluorspar.

### 3. Zanesville-Dekalb-Muskingum-Falaya association

*Gently sloping, deep soils on ridgetops; steep, shallow soils on side slopes; and deep, silty soils on bottom lands*

Narrow ridgetops and long side slopes dominate in association 3. The elevation ranges from 375 to 767 feet. The ridgetops are generally 150 to 200 feet higher than the surrounding bottom lands, and on the long ridges the elevation varies as much as 30 to 50 feet. About 40 percent of this association consists of Zanesville soils, 30 percent of

Dekalb and Muskingum soils, 14 percent of Falaya soils, and the rest of Wellston, Hayter, and other minor soils. Wellston soils make up 10 percent of the association, and Hayter soils 2 percent. The association occupies about 20.7 percent of the county.



Figure 5.—Typical landscape in association 2.

Zanesville soils are on the ridgetops and the upper part of side slopes. Their gradient ranges from 2 to 20 percent. These soils developed partly in loess and partly in residuum weathered from the underlying sandstone and shale. The loess is about 40 inches thick on the ridgetops and about 30 inches thick on the side slopes. There is a fragipan at a depth of 26 to 30 inches.

Dekalb and Muskingum soils, which are mapped with Ramsey soils, occupy the steep side slopes. Their gradient ranges from 12 to 40 percent but is generally between 20 and 30 percent. These soils developed in residuum weathered from sandstone, siltstone, and shale. They have a weakly developed profile. The surface layer is stony, and much of the subsoil is rocky and stony. Ordinarily, bedrock is at a depth of 24 inches, but it crops out in spots and is 50 inches below the surface in other spots. Muskingum soils are also mapped with Gilpin and Litz soils, which have a well-developed, 12- to 18-inch subsoil that developed partly in loess.

Falaya soils are on bottom lands. The largest acreage is along the Tradewater River. These soils are forming in alluvium that consists of loess and of residuum weathered from sandstone and shale. Falaya soils are poorly drained. They are mottled with gray below a depth of 7 inches and are predominantly gray below a depth of 24 inches.

Wellston and Hayter soils, which are minor soils in the association, are on uplands. Both are well drained. These soils developed partly in loess but ordinarily lack a distinct loessal layer. Wellston soils commonly are between the

Zanesville soils and the Dekalb, Ramsey, and Muskingum stony soils. Hayter soils occupy foot slopes. Other minor soils make up the rest of the association. Collins and Vicksburg soils are on bottom lands. They are better drained than Falaya soils and occur nearer the larger streams or the upper reaches of small drains. McGary and Sharkey soils are in the extreme northeastern corner of the association. These soils developed in clayey, slack-water deposits. McGary soils are on terraces, are somewhat poorly drained, and have a fine-textured subsoil. Sharkey soils, which make up about 500 acres in the association, are dark colored and poorly drained. Figure 6 shows a typical pattern of soils and underlying materials in association 3.

The Pennyrile State Forest and the Jones-Keeney Game Refuge occupy about 7,700 acres in this association. Also, more than half of Lake Beshear, which recently has been impounded along Piny Creek and covers 857 acres, is in this association.

Most of the steep slopes have never been cleared. The ridgetops and bottom lands have been used for cultivated crops, but, as a result of a decrease in population in this part of the county, are now idle or have volunteer stands of hardwoods or Virginia pine.

The largest farm is 820 acres, and the smallest 37 acres. The farms average 212 acres in size; 35 percent of them are larger than average. Much of the acreage consists of steep, stony soils that are still wooded. As a result of poor cutting practices, only poor-quality trees are now left in these areas. Most of the farms that are near large streams

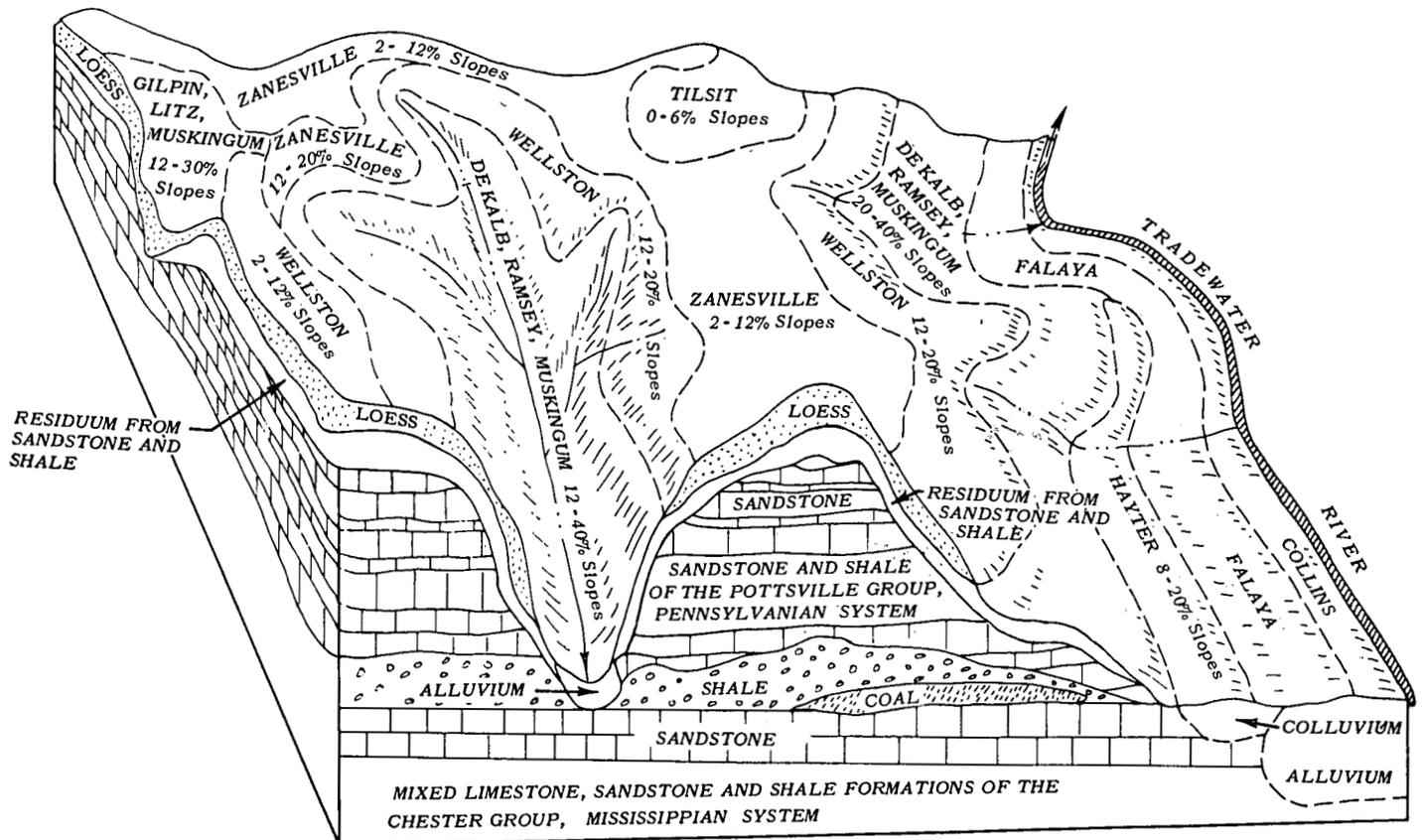


Figure 6.—Typical pattern of soils and underlying materials in association 3.

and partly on bottom lands are full-time enterprises. Frequently, planting is late on these acreages because of periodic overflow and a high water table. The farms on uplands are largely part-time enterprises. A number of farms in this association are old estates that for the most part are now idle. Figure 7 shows an unimproved pasture on association 3.



Figure 7.—Unimproved pasture. Zanesville silt loam is in the foreground. The level area near the woods is Falaya silt loam.

#### 4. Crider-Pembroke association

*Gently rolling, deep, well-drained soils in loess and residuum over limestone*

Undulating and karst topography is typical of the landscape in association 4. The elevation ranges from 430 to 490 feet. The gradient ranges from nearly level to strongly sloping but is predominantly gently sloping or sloping. Part of the association drains into surface streams, and part of it drains into sinkholes (fig. 8) and depressions. Natural ponds or small lakes form in depressions that hold water. About 50 percent of the association consists of Crider soils, and about 20 percent of Pembroke soils. The rest consists of Huntington soils, which make up about 10 percent of the association, and of other minor soils. The association occupies about 14 percent of the county.



Figure 8.—Small sinkholes in Crider silt loam.

Crider soils have a mantle of loess that is dark brown and is generally 30 to 40 inches thick. The lower part of these soils, which developed in residuum weathered from high-grade limestone, is reddish-brown to red silty clay loam or silty clay and contains some chert. Pembroke soils developed partly in limestone residuum and partly in loess, although the amount of loess in these soils is smaller than that in Crider soils. The subsoil is yellowish-red to red silty clay loam. The upper part of the subsoil is somewhat friable, and in some areas the lower part contains a small amount of chert.

The minor soils in this association are the well-drained Huntington soils, which occur along streams and as small areas in depressions; the moderately well drained Lindside soils and the somewhat poorly drained Newark soils, both of which also are on bottom lands; the well-drained Elk and Ashton soils, which are on second bottoms; and the well-drained Fredonia soils, which are on uplands. Figure 9 shows a typical pattern of soils and underlying materials in association 4.

For the most part, this association is cleared and used for commercial farming. It includes many of the best farms in the county. The soils are well suited to all of the crops commonly grown. Tobacco is the main crop. Most of the alfalfa produced in the county is grown on this association. Also, dairying and beef production are important to the economy of the area.

The farms range from 12 acres to 750 acres in size. They average 157 acres in size; 40 percent of them are larger than average.

The irregular topography in some areas makes terracing, stripcropping, and contour cultivation difficult. Although natural ponds occur in sinkholes, some constructed ponds do not hold water.

#### 5. Russellville-Crider-Dickson association

*Gently rolling, deep, moderately well drained or well drained soils in loess and residuum over limestone*

Broad ridgetops dominate in association 5. The elevation ranges from 500 to 570 feet. The side slopes along natural drains are ordinarily gently sloping or sloping but are strongly sloping in a few places. Most of the natural drains empty into larger streams. Some empty into underground reservoirs through sinkholes or depressions. Ponds and small lakes form in depressions that hold water. About 35 percent of the association consists of Russellville soils, about 25 percent of Crider soils, and about 10 percent of Dickson soils. The rest consists of Captina soils, which make up about 8 percent of the association, and of other minor soils. The association occupies about 6.5 percent of the county.

Russellville soils are on the ridgetops and side slopes. They have a well-defined fragipan about 10 inches thick that begins at a depth of about 30 inches, that is generally entirely in loess, and that overlies and in places extends into cherty limestone residuum. Crider soils also occur on ridgetops and side slopes but predominantly on side slopes, where the mantle of loess is about 30 inches thick. These soils have a redder subsoil than Russellville soils and lack a well-defined fragipan. Dickson soils are on ridgetops and gentle side slopes. They have a fragipan that begins at a depth of about 24 inches and directly overlies the limestone residuum, which is about 42 inches below the surface.

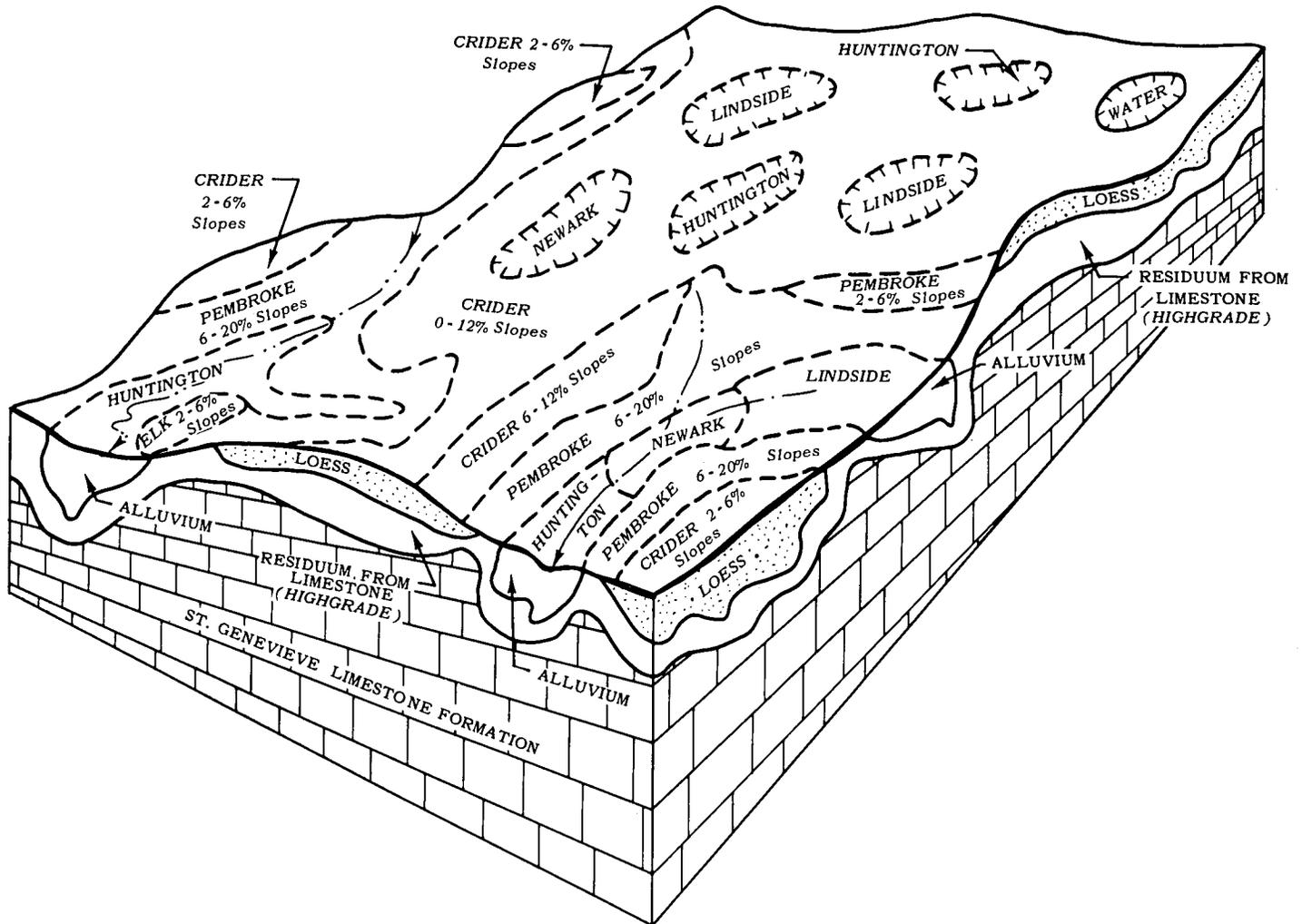


Figure 9.—Typical pattern of soils and underlying materials in association 4.

The minor soils in the association are Captina soils, which are on second bottoms and are similar to Dickson soils in drainage and in sequence and kinds of horizons; Newark, Lindside, Melvin, and Huntington soils, which occur along streams and in depressions; the well-drained Baxter soils, which occur on uplands in all parts of the association; and the well-drained Brandon soils, which developed in loess and in gravelly Coastal Plain material and make up about 2 percent of the acreage in the extreme southern part of the association. Figure 10 shows a typical pattern of soils and underlying materials in association 5.

Most of the acreage is cleared. The association is well suited to commercial farming and is commonly used for field crops, for dairying, and for livestock production (fig. 11). Spring planting on the moderately well drained soils may have to be delayed because of the fragipan and the resulting wetness. If alfalfa is grown on the moderately well drained soils, the stand is thinned by frost heaving, and after 2 or 3 years yields are low.

The farms in this association average 160 acres in size; 60 percent of them are smaller than average.

#### 6. Crider-Russellville-Baxter association

*Strongly rolling, deep, well-drained soils in loess and residuum over limestone*

Long, narrow ridgetops and strong side slopes dominate in association 6. The ridgetops, which originally extended along old fault lines in an east-west direction, have been dissected by streams that flow in many directions. Consequently, the present landscape is one of a series of ridgetops that run in various directions. As a result of extensive faulting, the elevation in the northernmost parts of this association ranges from 550 to 600 feet. The elevation in the southernmost parts ranges from 450 to 500 feet. About 40 percent of this association consists of Crider soils, about 37 percent of Russellville soils, and about 15 percent of Baxter soils. The rest consists of Brandon soils, which make up about 6 percent of the association, and of other minor soils. The association occupies about 4 percent of the county.

Crider soils are predominantly on side slopes but also occur on ridgetops. They have a mantle of loess that is about 30 inches thick and is somewhat mottled, and a

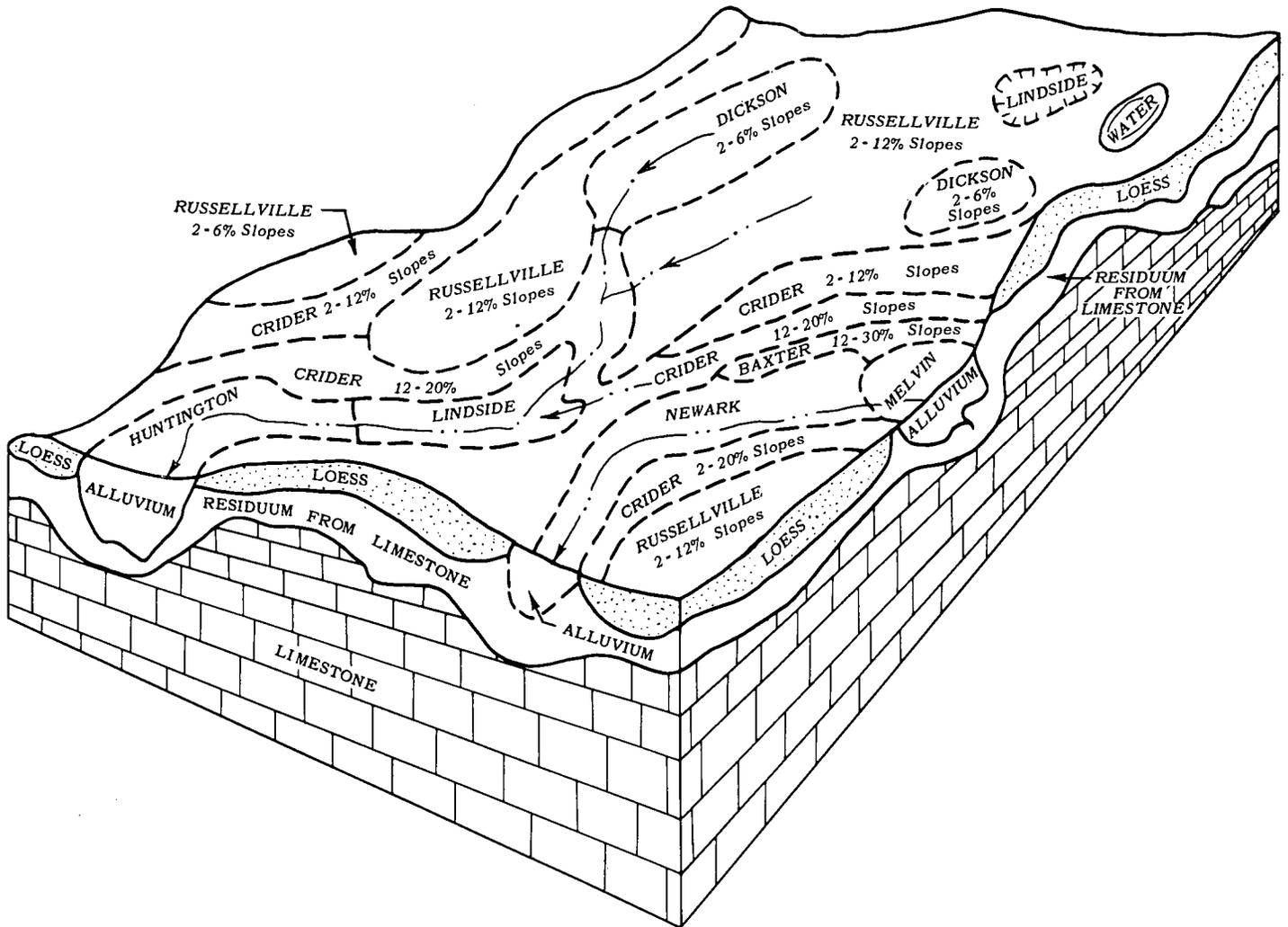


Figure 10.—Typical pattern of soils and underlying materials in association 5.

fragipan about 3 inches thick that directly overlies the limestone residuum. Russellville soils are predominantly on ridgetops but are also on side slopes. They have a mantle of loess about 38 inches thick and a well-defined fragipan at a depth of about 30 inches. Ordinarily, the fragipan is entirely in the loess, but in a few places it extends into cherty limestone residuum. Baxter soils are moderately steep or strongly sloping and have a cherty surface layer and subsoil.

Brandon soils, which are minor in the association, are in the westernmost parts and at the highest elevations (between 600 and 670 feet). These soils developed partly in loess and partly in gravelly Coastal Plain material. The average thickness of the loess is 30 inches. Also minor in the association are the somewhat poorly drained Newark soils and the moderately well drained Lindside soils, both of which are on bottom lands. Figure 12 shows a typical pattern of soils and underlying materials in association 6.

About a third of the acreage is wooded. The soils are well suited to trees. There are some commercial farms.



Figure 11.—Lespedeza pasture on Captina silt loam. Russellville soils are in the background, at the higher elevations.

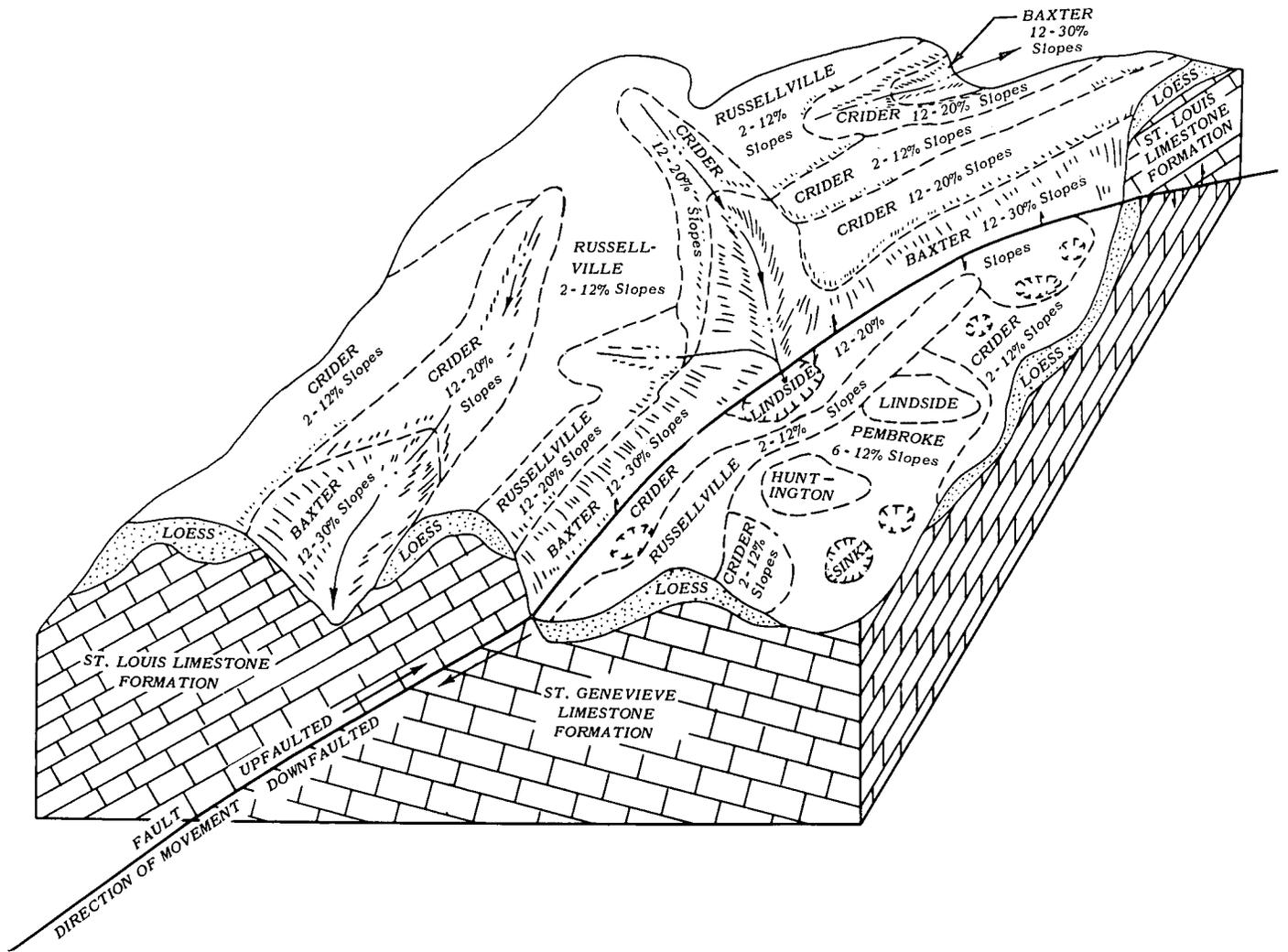


Figure 12.—Typical pattern of soils and underlying materials in association 6.

Most farmers depend on the sale of livestock and livestock products for their incomes, because the steep slopes are better suited to grass and legumes (fig. 13) than to cultivated crops. Some cultivated crops, including small acreages of tobacco, are grown on the more gentle slopes and on the bottom lands.



Figure 13.—Korean lespedeza on Crider silt loam.

The farms on this association average 154 acres in size; 40 percent of them are larger than average.

**7. Crider-Russellville-Pembroke association**

*Irregularly rolling, deep, well-drained soils in loess and residuum over limestone*

Short slopes and numerous sinkholes and depressions dominate in association 7. The gradient is predominantly strongly sloping but ranges from gently sloping to moderately steep. The underlying material is a limestone that can be dissolved in water. Sinkholes and depressions have formed in the filled-in areas where the limestone has been dissolved. The sinkholes ordinarily occupy only a few square feet, but some depressions occupy several acres. Ponds (fig. 14) and small lakes have formed where the underground outlets of the depressions have become clogged. There is some drainage into surface streams, but much of the drainage is through sinkholes and depressions into underground reservoirs. About 34 percent of this association consists of Crider soils, about 25 percent of Russellville soils, about 14 percent of Pembroke soils, and the rest of minor soils. The association occupies about 11 percent of the county.



Figure 14.—Small pond in depression. Crider soils are on the side slopes. Russellville soils are on the ridgetops.

There are areas of 300 to 600 acres in this association where one of the three major soils is dominant and occurs in nearly all positions on the landscape. In other areas Russellville soils occupy the gentle slopes, Crider soils the stronger slopes, and Pembroke soils the moderately steep slopes around sinkholes.

The upper part of Crider soils developed in loess, and the lower part in cherty limestone residuum. The average thickness of the loess is 30 inches. Some mottling occurs at this depth, but there is little or no fragipan development. Russellville soils, which also developed in loess and in limestone residuum, have a weak but compact fragipan that begins at a depth of about 30 inches and extends to about 40 inches. The average thickness of the loess in these soils is 40 inches. Pembroke soils lack a distinct mantle of loess but contain enough loess so that they have a friable subsoil. They have a darker brown surface layer and a redder subsoil than do either Crider or Russellville soils.

The minor soils in this association are Baxter soils, which are near some of the larger upland streams; Huntington, Lindside, and Newark soils, which are in depressions and along the larger streams on bottom lands; the well-drained Ashton and Elk soils, which are on terraces; and the moderately well drained Captina soils, which also are on terraces.

Most of the acreage is cleared and used for commercial farming. Livestock and livestock products are more important than field crops to the economy in this area. The soils are well suited to all crops commonly grown in the county, but the rolling, irregular topography makes it necessary to include several years of sod crops in the cropping sequence, in order to limit runoff and help control erosion.

## Descriptions of the Soils

This section describes the soil series and mapping units of Caldwell County. The approximate acreage and the proportionate extent of each mapping unit are given in table 1.

A general description of each soil series is given, and it is followed by brief descriptions of the mapping units in

that series. For full information on any one mapping unit, it is necessary to read the description of the soil series as well as the description of the mapping unit.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of the description of each mapping unit are the capability unit, the woodland group, and the wildlife group in which the mapping unit has been placed. The page on which each capability unit, each woodland group, and each wildlife group is described can be found readily by referring to the "Guide to Mapping Units" at the back of the report.

Soil scientists, engineers, students, and others who want detailed descriptions of soil series should turn to the section "Formation, Classification, and Morphology of the Soils." Many terms used in the soil descriptions and other sections of the report are defined in the Glossary.

## Ashton Series

The Ashton series consists of well-drained soils that developed in alluvium mixed with a small amount of loess. The alluvium washed mainly from soils of limestone origin and partly from soils of sandstone and shale origin. These soils are on low stream terraces or second bottoms.

Representative profile:

0 to 9 inches, dark-brown, friable silt loam; granular structure.  
9 to 39 inches, brown, friable heavy silt loam; blocky structure.  
39 to 48 inches, dark yellowish-brown, friable silt loam; a few pale-brown mottles.

In Caldwell County, Ashton soils occur as small areas near the larger streams. They are closely associated with Elk and Huntington soils. They have less distinct layers than Elk soils, but their subsoil is more evident than that in Huntington soils.

Ashton soils are high in natural fertility, very high in moisture-supplying capacity, and medium acid or strongly acid. They have good movement of air and water in the subsoil. They are easy to work and to keep in good tilth.

The total acreage in this county is small. Most of it has been cleared and is cultivated.

**Ashton silt loam, 0 to 4 percent slopes (AsB).**—This soil is on low terraces, mainly along Eddy Creek and its tributaries. The plow layer is dark-brown, friable silt loam about 9 inches thick. The subsoil is dark-brown, friable silt loam. In places there is some chert on the surface and within the profile.

This soil is well drained. It is medium in organic-matter content, is easy to till, and can be worked throughout a wide range of moisture content. Crops respond well to lime and fertilizer. Roots easily penetrate to a depth of 4 feet or more.

Erosion is only a minor problem. Consequently, this soil is suitable for continuous cultivation. It is well suited to all the crops commonly grown in the county, and if well managed it produces satisfactory yields. A few areas are flooded occasionally. (Capability unit I-3; woodland group 1)

## Baxter Series

The Baxter series consists of well-drained, strongly sloping and moderately steep upland soils that developed in cherty limestone.

TABLE 1.—Approximate acreage and proportionate extent of the soils

Soil	Area		Soil	Area	
	Acres	Percent		Acres	Percent
Ashton silt loam, 0 to 4 percent slopes	672	0.3	Melvin silt loam	1,212	0.5
Baxter cherty silt loam, 12 to 20 percent slopes, eroded	784	.4	Mullins silt loam	178	.1
Baxter cherty silt loam, 20 to 30 percent slopes	1,457	.6	Newark silt loam	7,418	3.3
Brandon silt loam, 12 to 20 percent slopes	512	.2	Pembroke silt loam, 2 to 6 percent slopes	382	.2
Brandon silt loam, 12 to 20 percent slopes, severely eroded	317	.1	Pembroke silt loam, 2 to 6 percent slopes, eroded	2,404	1.0
Caneyville silt loam, 6 to 12 percent slopes	414	.2	Pembroke silt loam, 6 to 12 percent slopes	224	.1
Caneyville silt loam, 12 to 20 percent slopes	435	.2	Pembroke silt loam, 6 to 12 percent slopes, eroded	5,179	2.3
Caneyville silty clay loam, 6 to 12 percent slopes, severely eroded	257	.1	Pembroke silt loam, 12 to 20 percent slopes, eroded	234	.1
Caneyville very rocky soils, 12 to 20 percent slopes	5,865	2.6	Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded	1,574	.7
Caneyville very rocky soils, 12 to 20 percent slopes, severely eroded	241	.1	Pembroke silty clay loam, 12 to 20 percent slopes, severely eroded	301	.1
Caneyville very rocky soils, 20 to 30 percent slopes	4,268	1.9	Quarries and dumps	100	( <sup>1</sup> )
Captina silt loam, 0 to 2 percent slopes	257	.1	Rock land, limestone	375	.2
Captina silt loam, 2 to 6 percent slopes	1,729	.8	Rock land, sandstone	2,128	.9
Captina silt loam, 2 to 6 percent slopes, eroded	922	.4	Russellville silt loam, 2 to 6 percent slopes	4,869	2.1
Captina silt loam, 6 to 12 percent slopes, eroded	289	.1	Russellville silt loam, 2 to 6 percent slopes, eroded	3,811	1.7
Collins silt loam	2,739	1.2	Russellville silt loam, 6 to 12 percent slopes	539	.2
Crider silt loam, 0 to 2 percent slopes	282	.1	Russellville silt loam, 6 to 12 percent slopes, eroded	3,643	1.6
Crider silt loam, 2 to 6 percent slopes	12,016	5.3	Russellville silt loam, 6 to 12 percent slopes, severely eroded	1,723	.8
Crider silt loam, 2 to 6 percent slopes, eroded	7,009	3.0	Russellville silt loam, 12 to 20 percent slopes, eroded	361	.2
Crider silt loam, 6 to 12 percent slopes	1,095	.5	Russellville silt loam, 12 to 20 percent slopes, severely eroded	280	.1
Crider silt loam, 6 to 12 percent slopes, eroded	9,180	4.1	Sharkey silt loam, overwash	187	.1
Crider silt loam, 6 to 12 percent slopes, severely eroded	399	.2	Sharkey silty clay loam, overwash	332	.1
Crider silt loam, 12 to 20 percent slopes	1,012	.4	Taft silt loam	300	.1
Crider silt loam, 12 to 20 percent slopes, eroded	4,666	2.0	Tilsit silt loam, 0 to 2 percent slopes	800	.4
Crider silty clay loam, 6 to 12 percent slopes, severely eroded	3,711	1.6	Tilsit silt loam, 2 to 6 percent slopes	5,752	2.6
Crider silty clay loam, 12 to 20 percent slopes, severely eroded	3,418	1.5	Tilsit silt loam, 2 to 6 percent slopes, eroded	2,784	1.2
Dekalb, Ramsey, and Muskingum stony soils, 12 to 20 percent slopes	1,383	.6	Tilsit silt loam, 6 to 12 percent slopes, eroded	363	.2
Dekalb, Ramsey, and Muskingum stony soils, 20 to 40 percent slopes	18,220	8.0	Vicksburg gravelly silt loam	1,657	.7
Dickson silt loam, 2 to 6 percent slopes	1,007	.4	Vicksburg silt loam	1,300	.6
Dickson silt loam, 2 to 6 percent slopes, eroded	589	.3	Waverly silt loam	697	.3
Elk silt loam, 0 to 2 percent slopes	127	.1	Wellston silt loam, 2 to 6 percent slopes	241	.1
Elk silt loam, 2 to 6 percent slopes	1,147	.5	Wellston silt loam, 6 to 12 percent slopes	1,208	.5
Falaya silt loam	6,769	2.9	Wellston silt loam, 6 to 12 percent slopes, eroded	996	.4
Fredonia silty clay loam, shallow, 6 to 12 percent slopes, eroded	548	.2	Wellston silt loam, 12 to 20 percent slopes	939	.4
Fredonia silty clay loam, shallow, 12 to 20 percent slopes, eroded	190	.1	Wellston silt loam, 12 to 20 percent slopes, eroded	5,037	2.2
Fredonia-Rock land complex, 6 to 20 percent slopes, eroded	449	.2	Wellston silty clay loam, 6 to 12 percent slopes, severely eroded	445	.2
Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes	1,563	.7	Wellston silty clay loam, 12 to 20 percent slopes, severely eroded	2,506	1.1
Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes, severely eroded	224	.1	Zanesville silt loam, 2 to 6 percent slopes	10,607	4.6
Gilpin, Litz, and Muskingum silt loams, 20 to 30 percent slopes	1,290	.6	Zanesville silt loam, 2 to 6 percent slopes, eroded	8,780	3.8
Gullied land	340	.1	Zanesville silt loam, 6 to 12 percent slopes	6,683	2.9
Hayter silt loam, 6 to 12 percent slopes	902	.4	Zanesville silt loam, 6 to 12 percent slopes, eroded	13,275	5.8
Hayter silt loam, 12 to 20 percent slopes	2,686	1.2	Zanesville silt loam, 6 to 12 percent slopes, severely eroded	3,517	1.5
Huntington gravelly silt loam	594	.3	Zanesville silt loam, 12 to 20 percent slopes, eroded	6,356	2.8
Huntington silt loam	7,310	3.2	Zanesville silt loam, 12 to 20 percent slopes, severely eroded	2,108	.9
Johnsburg silt loam	583	.3	Water	552	.2
Lindside silt loam	3,798	1.7			
Made land	47	( <sup>1</sup> )			
McGary silt loam	411	.2			
			Total	228,480	100.0

<sup>1</sup> Less than 0.1 percent.

### Representative profile:

- 0 to 12 inches, brown cherty silt loam.
- 12 to 16 inches, strong-brown or yellowish-red, friable cherty silty clay loam; blocky structure.
- 16 to 53 inches, dark-red, firm cherty silty clay mottled with yellow; strong blocky structure.
- 53 to 100 inches, mottled dark-red, reddish-yellow, and pale-brown, firm very cherty clay; strong blocky structure. About 50 percent of this layer is chert.

The chert fragments are 1 to 5 inches in diameter. The depth to the cherty limestone bedrock is ordinarily 10 feet or more.

In this county Baxter soils occur as the steeper parts of side slopes below narrow ridgetops, and as the steeper parts of slopes near sinkholes.

These soils are moderate in natural fertility and medium acid or strongly acid. They are easy to keep in good tilth but are somewhat difficult to till because they contain chert fragments.

Most of the acreage in this county is forested. Part of it is pastured, and only a small acreage is cultivated. The strongly sloping areas are suitable for limited cultivation, but the moderately steep slopes are not suitable for cultivation. All of these soils are suited to pasture and hay crops. Their potential for production of wood crops is high.

**Baxter cherty silt loam, 12 to 20 percent slopes, eroded (BcD2).**—About 40 percent of the acreage of this soil consists of short, irregular slopes near sinkholes and limestone basins. Erosion has removed more than half of the original surface layer from much of this soil. The present surface layer is a mixture of brown cherty silt loam from the original surface layer and of material from the subsoil. The subsoil is strong-brown or yellowish-red, friable cherty silty clay loam in the upper part and grades to firm, dark-red silty clay at a depth of about 12 inches. Chert fragments 1 to 5 inches in diameter make up 15 to 40 percent of the profile. Included in the areas mapped are spots where the slope is 6 to 12 percent, small severely eroded spots where the surface layer consists predominantly of subsoil material, and also a small acreage that is uneroded. The surface layer is loess in some small areas, mostly in those places where the upper part of the subsoil is strong brown.

This soil has a deep root zone. It is well drained and moderately high in moisture-supplying capacity. This soil is somewhat difficult to till because it contains chert fragments. It is low in organic-matter content and tends to crust after heavy rains, but crops respond well to lime and fertilizer. The movement of air and water is good in the subsoil.

The hazard of erosion is moderately severe. If cultivated crops are grown, measures that control runoff are needed. This soil is well suited to the common pasture and meadow crops if it is limed, fertilized, and otherwise well managed. (Capability unit IVE-3; woodland group 5)

**Baxter cherty silt loam, 20 to 30 percent slopes (BcE).**—The surface layer of this soil consists of about 2 inches of very dark grayish-brown cherty silt loam over about 10 inches of brown, friable cherty silt loam. The subsoil is yellowish-red cherty silty clay loam in the upper part and grades to red cherty silty clay at a depth of about 16 inches. Chert fragments 1 to 5 inches in diameter make up 15 to 40 percent of the profile. Included in the areas mapped are small acreages where the slope is 30 to 50 per-

cent, the profile is less well developed, and cherty limestone bedrock is at a depth of about 3 feet. Some areas in the west-central part of the county, particularly those on the uppermost third of slopes, are influenced by gravelly Coastal Plain material. Most areas are on the middle and lowest third of slopes.

This soil has a deep root zone. It is well drained and is moderately high in moisture-supplying capacity. It is somewhat difficult to till because of the slope and the chert fragments. The movement of air and water is good in the subsoil.

Most of this soil is wooded. Rapid runoff and a severe erosion hazard make it unsuitable for cultivation. It is suited to most of the common pasture and meadow plants if it is limed, fertilized, and otherwise well managed. (Capability unit VIe-1; woodland group 5)

### Brandon Series

The Brandon series consists of well-drained to excessively drained soils that developed in a thin mantle of loess over 1- to 30-foot deposits of acid Coastal Plain gravel.

#### Representative profile:

- 0 to 7 inches, brown, very friable silt loam.
- 7 to 9 inches, dark-brown, friable silt loam.
- 9 to 24 inches, yellowish-red, friable silty clay loam.
- 24 to 34 inches, yellowish-red, firm silty clay loam; few mottles of light grayish brown and gray; a little gravel.
- 34 to 48 inches, yellowish-brown and gray gravel, mostly less than 1 inch in diameter; interstitial material is red sandy loam or loam mottled with brown and gray.

Brandon soils occur in only two small areas in Caldwell County. They occupy side slopes and narrow ridgetops.

These soils are moderate or moderately low in natural fertility, moderately low to moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. Moisture and roots penetrate the subsoil. Moisture penetrates the gravel beds, except where they are cemented, but roots grow slowly in the gravel because the supply of plant nutrients is inadequate.

Most of the acreage has been cleared and is cultivated, but much of it has reverted to forest or is idle. Some areas have been cleared of brush and seeded for pasture. The potential for production of wood crops is moderate to high.

**Brandon silt loam, 12 to 20 percent slopes (BdD).**—The surface layer of this soil is brown silt loam 6 to 8 inches thick. The subsoil, a strong-brown silt loam in the upper part, grades to yellowish-red silty clay loam at a depth of about 10 inches. The lower part of the subsoil contains a little gravel and has a few mottles of light brownish gray. A weak and discontinuous fragipan, no more than 4 inches thick, also occurs in the lower part of the subsoil. Below the subsoil are beds of acid gravel. The depth to the gravel is most commonly about 30 inches but ranges from 20 to 40 inches. In places the gravel is weakly cemented. Included in the areas mapped are spots where the slope is less than 12 percent and spots where the soil is moderately eroded.

This soil is moderate in natural fertility, moderately high in moisture-supplying capacity, well drained, and strongly acid or very strongly acid. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Crops show good response to lime and fertilizer.

Most of the acreage is forested. Much of it has been cleared and cultivated in the past but has reverted to hardwoods.

Rapid runoff and a severe erosion hazard make this soil unsuitable for cultivated crops. Fair to satisfactory yields of most of the common pasture and meadow plants can be produced if lime and fertilizer are applied. Best suited are those plants that start to grow early in spring, before the moisture supply is depleted. The potential for production of wood crops is high. (Capability unit VIe-7; woodland group 12)

**Brandon silt loam, 12 to 20 percent slopes, severely eroded (BcD3).**—Erosion has removed most of the original surface layer from this soil. The present surface layer is a mixture of brown, strong-brown, and yellowish-red heavy silt loam. The subsoil, strong-brown silt loam in the uppermost 2 or 3 inches, is yellowish-red silty clay loam at a depth of about 9 inches. The lower part of the subsoil contains a little gravel and a few mottles of light brownish gray. Below the subsoil are beds of acid gravel. The depth to the gravel is most commonly about 24 inches but ranges from 16 to 36 inches. In places the gravel is weakly cemented. Included in the areas mapped are spots that have a slope of less than 12 percent but nevertheless are severely eroded.

This soil is moderately low in natural fertility, moderately low in moisture-supplying capacity, well drained to excessively drained, and very strongly acid. It is very low in organic-matter content and can be worked within only a narrow range of moisture content without clodding. Crusting interferes with the germination of seeds and the survival of seedlings, particularly if seeds are planted in spring.

Idle land, pasture, or wooded areas that consist of second-growth hardwoods make up most of the acreage. In recent years parts of the idle land and of wooded areas have been seeded for pasture.

Rapid runoff and a severe erosion hazard make this soil unsuitable for cultivated crops. The choice of pasture and meadow plants is restricted, but fair yields of some plants can be produced if the soil is limed, fertilized, and otherwise well managed. Best suited are those plants that start to grow early in spring, before the moisture supply is depleted. The potential for production of wood crops is moderate. (Capability unit VIIe-2; woodland group 6)

## Caneyville Series

The Caneyville series consists of soils that developed in residuum weathered from limestone, sandstone, and shale.

Representative profile:

- 0 to 1 inch, very dark grayish-brown loam or silt loam; common limestone outcrops and loose stones.
- 1 to 6 inches, brown, very friable loam or silt loam.
- 6 to 18 inches, brown to yellowish-red, firm silty clay or silty clay loam; pale-brown mottles.
- 18 to 22 inches, yellowish-brown, stiff clay; gray mottles.
- 22 to 28 inches, light yellowish-brown to olive-gray, very plastic clay; mottles of strong brown and olive yellow.
- 28 inches +, limestone bedrock.

The depth to bedrock ordinarily ranges from 1 to 3 feet or more, but outcrops of limestone and sandstone are com-

mon, particularly on the steeper slopes. In most areas the outcrops are predominantly limestone, but in a few areas they are about equally divided between sandstone and limestone.

Except where severely eroded, these soils are moderately high in natural fertility. They range from strongly acid to slightly acid in reaction. The intensity of acidity depends on the depth to limestone bedrock. Except where limestone is near the surface, the surface layer and the upper part of the subsoil are commonly strongly acid or medium acid.

Most of the acreage in this county is forested. Poor cutting practices and poor forest management have resulted in stands of only poor-quality hardwoods. The potential for production of wood crops is moderate or low. Where the slope is less than 12 percent, Caneyville soils are suitable for limited cultivation. If well managed, they produce fair to satisfactory yields of many pasture and meadow plants. Much of the acreage, however, is too rocky and too steep to permit the harvesting of hay and is suitable only for pasture, forest, or wildlife habitats.

**Caneyville silt loam, 6 to 12 percent slopes (CeC).**—This soil developed in residuum that weathered predominantly from limestone but partly from sandstone and shale. The surface layer is brown, friable silt loam about 6 inches thick. The subsoil is firm, brown to yellowish-red silty clay or silty clay loam mottled with pale brown. At a depth of about 20 inches, it grades to very firm, yellowish-brown clay that has many gray mottles. The depth to hard rock averages 2 feet but ranges from 1 foot to 3 feet. The bedrock is generally limestone, but in places it is sandstone or shale.

This soil is well drained, moderately high in moisture-supplying capacity, and commonly strongly acid or medium acid, except where limestone is near the surface. It is easy to till and can be worked throughout a wide range of moisture content without clodding or crusting.

The total acreage is small. Most of it is wooded. If this soil is limed, fertilized, and otherwise well managed, it is suitable for limited cultivation and produces satisfactory yields of all the common pasture and meadow plants. Its potential for production of wood crops is moderate. (Capability unit IVe-6; woodland group 8)

**Caneyville silt loam, 12 to 20 percent slopes (CeD).**—The surface layer of this soil is brown and friable. The subsoil is brown to yellowish-red, firm silty clay or silty clay loam mottled with pale brown. At a depth of about 18 inches, it grades to a very firm, yellowish-brown clay that has many gray mottles. Bedrock, which is generally limestone but may be sandstone or shale, is at a depth that is ordinarily about 2 feet but ranges from 1 foot to 3 feet.

This soil is well drained and moderately low in moisture-supplying capacity. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Except where limestone is near the surface, the surface layer and the upper part of the subsoil are commonly strongly acid or medium acid.

The total acreage is small. Most of it is wooded. Because of rapid runoff and a severe erosion hazard, this soil is not suitable for cultivated crops. If well managed,

it produces fair to satisfactory yields of most of the common pasture and meadow plants. Its potential for production of wood crops is moderate. (Capability unit VIe-1; woodland group 8)

**Caneyville silty clay loam, 6 to 12 percent slopes, severely eroded (C1C3).**—On more than 25 percent of the acreage, erosion has removed most of the original surface layer of this soil and has exposed the heavier, redder subsoil. The present surface layer in these areas is reddish-brown or yellowish-red silty clay loam. In areas that are not so severely eroded, the surface layer is brown silt loam and has splotches of reddish brown or yellowish red. The color, texture, and thickness of the subsoil vary within short distances. Most commonly, this layer is dark-brown or yellowish-red silty clay that is sticky and plastic when wet. The lower part generally has many gray mottles. The depth to bedrock is ordinarily about 24 inches but ranges from 6 inches to 30 inches. Included in the areas mapped are severely eroded spots where the slope is either more than 12 or less than 6 percent.

This soil is moderately low in natural fertility, low in moisture-supplying capacity, and well drained. It is very low in organic-matter content and can be tilled within only a narrow range of moisture content without clodding. Except where limestone is near the surface, the upper part of this soil is commonly strongly acid or medium acid.

Most of the acreage has been cleared and is cultivated. Much of it, however, has reverted to woodland or is idle.

Because of rapid runoff, a severe erosion hazard, and poor tilth, this soil is not suitable for cultivated crops. It is suited to a few pasture and meadow plants but produces only poor to fair yields even if well managed. Its potential for production of wood crops is low. The only species suitable for planting is redcedar. (Capability unit VIe-4; woodland group 9)

**Caneyville very rocky soils, 12 to 20 percent slopes (CmD).**—These soils are representative of the series. The surface layer is pale brown, except in the uppermost inch or two, where it is very dark grayish brown. Its texture is commonly loam or silt loam but ranges from silty clay loam to sandy loam. Outcrops of limestone and sandstone cover 10 to 25 percent of the surface. The color, texture, and thickness of the subsoil vary within short distances. Most commonly, this layer is dark-brown or yellowish-red silty clay that is sticky and plastic. The lower part generally has many gray mottles. Except where rock crops out on the surface, the depth to bedrock is ordinarily about 2 feet but ranges to 3 feet. Included in the areas mapped are tracts of Crider soils, which generally occur between natural drains. These soils have more strongly developed horizons and fewer rock outcrops than Caneyville soils do. Also included is a small acreage of Caneyville soils that have a slope of less than 12 percent. Much of this acreage is on narrow ridgetops.

These soils are moderately high in natural fertility, moderately low in moisture-supplying capacity, and well drained. Except where limestone is near the surface, they are commonly strongly acid or medium acid.

These soils are suited to most of the common hay and pasture plants. They are best suited to those plants that start to grow early in spring, before the moisture supply is depleted. The outcrops of bedrock make these soils unsuitable for cultivated crops and also interfere with harvesting of hay crops. The tillage necessary to prepare

pastures for seeding, however, is possible on more than 75 percent of the acreage. The potential for production of wood crops is moderate. (Capability unit VIIs-1; woodland group 8)

**Caneyville very rocky soils, 12 to 20 percent slopes, severely eroded (CmD3).**—On more than 25 percent of the acreage, erosion has removed the original surface layer of these soils and has exposed the heavier, redder subsoil. The present surface layer is silty clay loam or silty clay. In the slightly or moderately eroded spots that are included in the areas mapped, the surface layer is ordinarily loam or silt loam but in places is silty clay loam. Outcrops of limestone or sandstone cover 10 to 25 percent of the surface. The color, texture, and thickness of the subsoil vary within short distances. Most commonly, this layer is dark-brown or yellowish-red silty clay that is sticky and plastic. The lower part generally has many gray mottles. Except where rock crops out on the surface, the depth to bedrock is ordinarily about 2 feet, but depth ranges to as much as 3 feet.

These soils are moderately low in natural fertility and low in moisture-supplying capacity. They can be tilled within only a narrow range of moisture content without clodding. Except where limestone is near the surface, they are commonly strongly acid or medium acid.

The rock outcrops and the fine texture in the surface layer make tillage difficult. The soils are suited to only a limited number of hay and pasture plants. Their potential for production of wood crops is low. The only species suitable for planting is redcedar. (Capability unit VIIIs-2; woodland group 9)

**Caneyville very rocky soils, 20 to 30 percent slopes (CmE).**—For the most part, these soils occupy the middle and lower parts of long slopes, just below Dekalb, Ramsey, and Muskingum stony soils. The surface layer is pale brown, except in the uppermost inch or two, where it is very dark grayish brown. Its texture ranges from silty clay loam to sandy loam but is commonly loam or silt loam. Outcrops of limestone or sandstone cover 10 to 25 percent of the surface. The subsoil is commonly dark-brown or yellowish-red silty clay that is sticky and plastic. The lower part generally has many gray mottles. Except where rock crops out on the surface, the depth to shattered rock ordinarily is about 20 inches, but depth ranges to 30 inches. Included in the areas mapped are tracts of Caneyville very rocky soils that are severely eroded and tracts that have 30 to 50 percent slopes. Also included are spots of Crider soils, which are generally between natural drains and have fewer rock outcrops than Caneyville soils do.

These soils are moderately high in natural fertility and moderately low in moisture-supplying capacity. Except where limestone is near the surface, they are commonly strongly acid or medium acid.

Nearly all of the acreage is wooded. The rock outcrops and steep slopes make tillage difficult. These soils are suited to only a limited number of hay and pasture plants. Their potential for production of wood crops is moderate. (Capability unit VIIIs-2; woodland group 8)

## Captina Series

The Captina series consists of moderately well drained soils that developed in old alluvium. The alluvium washed mainly from soils that developed in loess over lime-

stone residuum and partly from soils that developed in loess over sandstone and shale residuum. These soils have a fragipan.

Representative profile:

- 0 to 7 inches, dark grayish-brown, very friable silt loam.
- 7 to 16 inches, yellowish-brown, friable heavy silt loam.
- 16 to 23 inches, yellowish-brown, friable heavy silt loam; mottles of pale brown and light gray.
- 23 to 26 inches, pale-brown, slightly compact and brittle silt loam; mottles of gray and yellow.
- 26 to 39 inches, compact and brittle silty clay loam; many mottles of pale brown, gray, and yellowish brown.
- 39 to 48 inches, gray, firm silty clay loam; many mottles of yellowish brown.

In Caldwell County, Captina soils occur as small areas on stream terraces. At a depth of more than 3 to 4 feet, they may be underlain by partly weathered old alluvium that consists of sand, silt, clay, and beds of gravel. The slope range is 0 to 12 percent.

Captina soils are moderately high or moderate in natural fertility and strongly acid or very strongly acid. Moisture and roots easily penetrate the subsoil to a depth of about 20 to 25 inches, where the fragipan begins.

Most of the acreage has been cleared and is cultivated.

**Captina silt loam, 0 to 2 percent slopes (CnA).**—The surface layer of this soil is dark grayish-brown, friable silt loam 7 to 10 inches thick. The subsoil is yellowish-brown, friable heavy silt loam in the upper part. Between the depths of 15 and 20 inches, it is pale-brown or light yellowish-brown, friable silt loam that has common, fine, faint mottles of brownish yellow and light brownish gray. The fragipan, which begins about 20 inches below the surface, is slightly compact and brittle, light-gray silt loam mottled with brownish yellow in the upper part, and compact and brittle, gray silty clay loam mottled with yellowish brown at a depth of about 25 inches. The fragipan has a gradual lower boundary and, at a depth of about 36 inches, grades to old alluvium, which commonly is gray silty clay loam mottled with yellowish brown, but in places is yellowish brown and is clayey to gravelly in texture.

This soil is moderately high in both moisture-supplying capacity and natural fertility. It is strongly acid or very strongly acid. The plow layer is easy to work and can be tilled throughout a wide range of moisture content without clodding or crusting. Crops show good response to lime and fertilizer. The fragipan restricts internal drainage. Consequently, the soil remains wet until late in spring, and planting has to be delayed. If used for pasture in spring, this soil is likely to become compacted.

Most of the acreage has been cleared and is used for cultivated crops in cropping sequences that include pasture and meadow plants and small grain. If well managed, this soil is suited to most crops commonly grown and produces satisfactory yields. It ordinarily produces satisfactory yields of alfalfa for 2 years. After that, the stand becomes thin and increasingly less productive, as a result of frost heaving and a shallow root zone. There is very little erosion hazard, but there is a slight wetness problem. The potential for production of wood crops is moderately high. (Capability unit IIw-1; woodland group 7)

**Captina silt loam, 2 to 6 percent slopes (CnB).**—This soil is representative of the series. The surface layer is dark grayish-brown, friable silt loam 6 to 8 inches thick. The subsoil is yellowish-brown, friable heavy silt loam that is mottled with pale brown and light brownish gray be-

tween the depths of 16 and 23 inches. The fragipan begins about 23 inches below the surface. The uppermost 3 to 5 inches of the pan is pale-brown, slightly compact, brittle silt loam mottled with gray and yellow. At a depth of about 26 inches, this grades to compact, brittle silty clay loam mottled with pale brown, gray, and yellowish brown. The fragipan has a gradual lower boundary and, at a depth of 36 to 48 inches, grades to old alluvium, which commonly is gray silty clay loam mottled with yellowish brown. In places the underlying material is yellowish brown and is clayey to gravelly in texture.

This soil is moderately high in both moisture-supplying capacity and natural fertility. It is strongly acid or very strongly acid. The plow layer is easy to work and can be tilled throughout a wide range of moisture content without clodding or crusting. Crops show good response to lime and fertilizer. Because of the fragipan, the soil remains wet until late in spring, and planting has to be delayed. If pastured, this soil is likely to become compacted.

Most of the acreage has been cleared and is used for cultivated crops in cropping sequences that include pasture and meadow plants and small grain. If well managed, this soil is suited to most crops commonly grown and produces satisfactory yields. It ordinarily produces satisfactory yields of alfalfa for 2 or 3 years. After that, the stand becomes thin and increasingly less productive, as a result of frost heaving and a shallow root zone. There is some runoff and a moderately low erosion hazard. The potential for production of wood crops is moderately high. (Capability unit IIe-6; woodland group 7)

**Captina silt loam, 2 to 6 percent slopes, eroded (CnB2).**—The surface layer of this soil is dark grayish-brown silt loam 4 to 6 inches thick. It has large blotches of yellowish brown, where plowing has mixed material from the subsoil with the original surface layer. The subsoil is yellowish-brown, friable heavy silt loam in the upper part and has some pale-brown mottles at a depth of about 13 inches. The brittle, compact fragipan begins about 19 inches below the surface. It is pale-brown silt loam in the uppermost 3 to 5 inches and silty clay loam mottled with pale brown, gray, and yellowish brown at a depth of about 23 inches. The lower part is more compact and brittle than the upper part. Between the depths of 36 and 48 inches, the fragipan grades to old alluvium, which is predominantly gray silty clay loam mottled with yellowish-brown but in places is yellowish brown and ranges from clayey to gravelly in texture. For the most part, the gradient is 4 to 6 percent.

This soil is moderate in natural fertility, moderately low in moisture-supplying capacity, and strongly acid or very strongly acid. It is low in organic-matter content and tends to crust after heavy rains, but crops respond well to lime and fertilizer. This soil is wet in winter and remains wet until late in spring; consequently, planting is sometimes delayed. If pastured in winter or early in spring, this soil is likely to become compacted.

Most of the acreage has been cleared and is used for cultivated crops in cropping sequences that include pasture and meadow plants and small grain. If well managed, this soil produces satisfactory yields of all crops commonly grown. It produces satisfactory yields of alfalfa for 2 or 3 years. After that, the stand becomes thin

and increasingly less productive, as a result of frost heaving. There is some runoff and a moderately low erosion hazard. The potential for production of wood crops is moderately high. (Capability unit IIe-6; woodland group 7)

**Captina silt loam, 6 to 12 percent slopes, eroded (CnC2).**—The surface layer of this soil is dark grayish-brown silt loam 4 to 6 inches thick. It has large blotches of yellowish brown, where plowing has mixed material from the subsoil with the original surface layer. The subsoil is yellowish-brown, friable heavy silt loam that has some pale-brown mottles at a depth of about 14 inches. The brittle, compact fragipan begins about 20 inches below the surface. It is pale-brown silt loam in the uppermost 3 inches, and silty clay loam mottled with pale brown, gray, and yellowish brown at a depth of about 24 inches. The lower part is more compact and brittle than the upper part. At a depth of about 36 inches, the fragipan grades to old alluvium. This alluvium is predominantly yellowish-brown silty clay loam with large gray mottles, but in places it is gray, has yellowish-brown mottles, and ranges from clayey to gravelly in texture.

This soil is moderate in natural fertility, moderately low in moisture-supplying capacity, and strongly acid or very strongly acid. It is low in organic-matter content and tends to crust after heavy rains, but crops respond well to lime and fertilizer. Although this soil is wet in winter, it has enough slope so that wetness seldom delays spring planting. If pastured in winter or in spring, however, the soil is likely to become compacted.

Most of the acreage has been cleared and is used for cultivated crops in cropping sequences that include pasture and meadow plants and small grain. If well managed, this soil produces fair yields of all the crops commonly grown in the county. It produces satisfactory yields of alfalfa for 2 or 3 years. After that, the stand becomes thin and increasingly less productive, as a result of frost heaving and a shallow root zone. There is some runoff and a moderate erosion hazard. The potential for production of wood crops is moderately high. (Capability unit IIIe-8; woodland group 7)

## Collins Series

The Collins series consists of moderately well drained soils on bottom lands. These soils formed in alluvium washed from soils that developed in thin loess over residuum weathered from sandstone, shale, and siltstone.

Representative profile:

- 0 to 10 inches, dark grayish-brown, friable silt loam.
- 10 to 25 inches, dark grayish-brown, friable silt loam; few mottles of pale brown.
- 25 to 48 inches, grayish-brown, friable silt loam; many mottles of light brownish gray.

Typically, Collins soils are almost free of mottles to a depth of 20 inches, have many pale-brown and light brownish-gray mottles below a depth of 20 inches, and are gray below a depth of 30 inches. There are a few sandy or clayey strata below a depth of 20 inches in some profiles, but the texture throughout the profile is generally silt loam. In places there are dark-brown or black, soft concretions below a depth of 20 inches.

Collins soils are moderately high in natural fertility, very high in moisture-supplying capacity, and strongly

acid. They are easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Roots and moisture easily penetrate to a depth of 4 feet or more. Crops show good response to lime and fertilizer.

Most of the acreage has been cleared and is used for cultivated crops. Some of it is used continuously for row crops, and part of it is used for row crops in cropping sequences that include pasture and meadow plants. Drainage may need to be provided for some deep-rooted crops, such as alfalfa.

**Collins silt loam (Co).**—This is a deep soil. Most of the acreage is along the Tradewater River and its larger tributaries, but about a third of it is on narrow bottoms along the smaller branches.

The surface layer is typically dark grayish-brown or brown silt loam about 10 inches thick. Ordinarily, it is underlain by silt loam that in the upper part is dark grayish brown or brown and has a few mottles of pale brown or brownish gray, and at a depth of 20 to 25 inches is grayish brown and has many mottles of light brownish gray.

If well managed, this soil is suitable for continuous cultivation and produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer.

Flooding that occurs late in spring is likely to delay plowing or planting and also is likely to damage crops that are growing in some low areas. There is little erosion hazard. (Capability unit I-2; woodland group 1)

## Crider Series

The Crider series consists of well-drained upland soils that developed in windblown material (loess) over residuum weathered from limestone.

Representative profile:

- 0 to 7 inches, dark-brown, very friable silt loam.
- 7 to 28 inches, dark-brown and reddish-brown, friable silty clay loam.
- 28 to 42 inches, yellowish-red, friable silty clay loam.
- 42 to 60 inches, red, firm silty clay; gray mottles.
- 60 to 74 inches, dark-red, very firm clay; reddish-gray mottles; few chert fragments.

The mantle of loess is ordinarily 18 to 42 inches thick but in places is as much as 50 inches thick. Where the underlying limestone is cherty, these soils ordinarily have, at a depth of 30 inches, a layer that is 30 to 90 percent chert and about 10 inches thick. In some areas these soils contain sandstone fragments.

Crider soils are on ridgetops, on side slopes, in areas of undulating topography, and in areas of irregular (karst) topography. Karst topography is characteristic of about 40 percent of the acreage. The slope range is 0 to 20 percent.

These soils are moderate to high in natural fertility, moderate to very high in moisture-supplying capacity, and medium acid to very strongly acid. Roots and moisture easily penetrate the subsoil to a depth of 4 feet or more.

Crider soils are extensive in Caldwell County. Most of the acreage has been cleared and is cultivated. These soils produce a large percentage of the alfalfa grown in the county. Also, they are well suited to pasture, and their potential for production of wood crops is high.

**Crider silt loam, 0 to 2 percent slopes (CrA).**—This soil developed in residuum weathered from high-grade limestone that contained little or no chert. The surface layer is dark-brown, friable silt loam about 9 inches thick. The subsoil is friable silty clay loam. It is dark brown or reddish brown to a depth of about 40 inches, where it grades to yellowish red and then becomes redder and more clayey with increasing depth.

This soil is high in natural fertility, very high in moisture-supplying capacity, and medium acid or strongly acid. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Crops show good response to lime and fertilizer.

Nearly all of the acreage has been cleared and is used for cultivated crops in cropping sequences that include meadow and pasture plants and small grain. If well managed, this soil is suited to all the crops commonly grown. It is not susceptible to erosion and has few or no limitations. (Capability unit I-3; woodland group 5)

**Crider silt loam, 2 to 6 percent slopes (CrB).**—The surface layer of this soil is brown to dark-brown, friable silt loam about 8 inches thick. The subsoil is friable silty clay loam. It is dark brown, reddish brown, or strong brown to a depth of about 30 inches, where it grades to yellowish red. Below a depth of 30 to 40 inches, the subsoil is red or yellowish-red silty clay loam or silty clay that becomes redder and more clayey with increasing depth. The limestone residuum underlying this soil is cherty in some places, particularly in soil associations 5, 6, and 7. The uppermost 10 inches of residuum may be 30 to 90 percent chert. The 3 to 5 inches above this cherty layer may be compact and brittle, like a fragipan, and slightly mottled.

This soil is high in natural fertility, very high in moisture-supplying capacity, and medium acid or strongly acid. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Crops show good response to lime and fertilizer.

Nearly all of the acreage has been cleared and is used in cropping sequences that include meadow and pasture plants and small grain. If well managed, this soil produces satisfactory yields of all the crops commonly grown. There is some runoff and a moderately low erosion hazard. (Capability unit IIe-1; woodland group 5)

**Crider silt loam, 2 to 6 percent slopes, eroded (CrB2).**—Erosion has removed enough of the original surface layer from this soil that the present surface layer is a mixture of the original surface layer and material from the subsoil. The present surface layer is brown to dark-brown, friable silt loam 4 to 6 inches thick. It is low in organic-matter content and is lighter colored and slightly finer textured than the surface layer of the uneroded Crider soils. The subsoil is friable silty clay loam. It is dark brown, strong brown, or reddish brown to a depth of about 27 inches, where it grades to yellowish red. Below a depth of 27 inches, the subsoil becomes redder, more clayey, and more firm with increasing depth. The limestone residuum underlying this soil is cherty in some areas; in fact, the uppermost 10 inches of residuum may be 30 to 90 percent chert. The 3 to 5 inches above this cherty layer may be compact and brittle, like a fragipan, and slightly mottled.

This soil is high in both natural fertility and moisture-supplying capacity. It is medium acid or strongly acid.

Because of the low organic-matter content, it tends to crust after heavy rains. Crops show good response to lime and fertilizer.

About a third of the acreage has irregular topography. Nearly all of the acreage has been cleared and is used for cultivated crops in cropping sequences that include meadow and pasture plants and small grain. If well managed, this soil produces satisfactory yields of all the crops commonly grown. The gradient is predominantly 4 to 6 percent. There is some runoff and a moderately low erosion hazard. (Capability unit IIe-1; woodland group 5)

**Crider silt loam, 6 to 12 percent slopes (CrC).**—The surface layer of this soil is brown or dark-brown, friable silt loam 6 to 8 inches thick. The subsoil is strong-brown, dark-brown, or reddish-brown, friable silty clay loam. The color commonly grades to yellowish red at a depth of about 30 inches. Between the depths of 23 and 30 inches, there may be pale-brown and gray mottles and a spotty, thin fragipan that is less than 4 inches thick. At a depth of about 30 inches, there is a layer of red silty clay or silty clay loam, mottled with pink and gray. This, in turn, lies over limestone residuum. This residuum is cherty in some areas; in fact, the uppermost 10 inches may be 30 to 90 percent chert. In places the residuum contains fragments of sandstone.

This soil is high in moisture-supplying capacity, moderately high or high in natural fertility, and strongly acid or very strongly acid. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. If well managed, it produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer.

About a third of the acreage has irregular topography. Much of the acreage has been cleared and is used for cultivated crops in cropping sequences that include pasture and meadow plants. This soil is suited to cultivated crops, but it has a moderate erosion hazard. Therefore, management that helps to reduce runoff and control erosion is needed. The potential for production of wood crops is high. (Capability unit IIIe-1; woodland group 5)

**Crider silt loam, 6 to 12 percent slopes, eroded (CrC2).**—Erosion has removed enough of the original surface layer from this soil that the present 4- to 6-inch surface layer, a dark-brown or brown, friable silt loam, is a mixture of the original surface layer and material from the subsoil. This layer is low in organic-matter content and is lighter colored and slightly finer textured than that of the uneroded Crider soils. The subsoil is friable silty clay loam. It is strong brown, dark brown, or reddish brown to a depth of about 25 inches, where it grades to yellowish red. Below a depth of 25 inches, the subsoil becomes redder, more clayey, and more firm with increasing depth. The limestone residuum underlying this soil is cherty in some areas; in fact, the uppermost 10 inches of residuum may be 30 to 90 percent chert. The 3 to 5 inches above this cherty layer may be compact and brittle, like a fragipan, and slightly mottled.

This soil is moderately high or high in both natural fertility and moisture-supplying capacity. It is medium acid or strongly acid. Because the surface layer is fine textured and low in organic-matter content, it tends to crust after heavy rains. Nevertheless, crops give good response to lime and fertilizer.

About 40 percent of the acreage has irregular topography. Nearly all of the acreage has been cleared and is used for cultivated crops in cropping sequences that include meadow and pasture plants and small grain. If well managed, this soil produces satisfactory yields of all the crops commonly grown. Management that reduces the moderate hazards of runoff and erosion is needed. (Capability unit IIIe-1; woodland group 5)

**Crider silt loam, 6 to 12 percent slopes, severely eroded (CrC3).**—This soil developed in residuum weathered from high-grade limestone that contained little or no chert. Erosion has removed most of the original surface layer from much of this soil. The present surface layer, a mixture of the original surface layer and material from the subsoil, is dark brown to reddish brown in color, and ranges from silt loam to silty clay loam in texture. The subsoil is dark-brown or reddish-brown silty clay loam to a depth of about 22 inches, where it grades to yellowish-red, friable silty clay loam. Below a depth of 22 inches, the subsoil becomes redder, more clayey, and more firm with increasing depth.

This soil is moderately high in both natural fertility and moisture-supplying capacity. It is medium acid or strongly acid. It can be worked within only a narrow range of moisture content without clodding. It is very low in organic-matter content and tends to crust, but crops give good response to lime and fertilizer. Crusting interferes with the germination of seeds and the survival of seedlings.

Nearly all of the acreage has been cleared and is used for cultivated crops in cropping sequences that include meadow and pasture plants and small grain. Because of poor tilth and susceptibility to erosion, this soil is not well suited to cultivated crops. If well managed, however, it produces satisfactory yields of meadow and pasture plants. Measures that improve tilth, reduce runoff, and help to control erosion are needed. (Capability unit IVe-9; woodland group 6)

**Crider silt loam, 12 to 20 percent slopes (CrD).**—The surface layer of this soil is brown, friable silt loam 6 to 8 inches thick. The subsoil is friable silty clay loam. It is strong brown in the upper part and grades to yellowish red at a depth of about 12 inches. Pale-brown and gray mottles may occur at a depth between 22 and 28 inches. At a depth of 28 inches there is a layer of red, firm silty clay or silty clay loam mottled with pink and gray. This, in turn, lies over limestone residuum. This residuum is generally cherty; in fact, the uppermost 10 inches may be 30 to 90 percent chert. In places the residuum contains fragments of sandstone or shale. Included in the areas mapped is a small acreage where the slope is 20 to 30 percent.

This soil is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Crops show good response to lime and fertilizer.

Most of the acreage is wooded. About half of it has irregular (karst) topography. Rapid runoff and a severe erosion hazard limit the suitability of this soil for cultivated crops. Satisfactory yields of most of the common pasture and meadow plants can be produced if the soil is well managed. The potential for production of wood crops is high. White pine, shortleaf pine, loblolly pine, black locust, black walnut, and yellow-poplar are suitable for planting. (Capability unit IVe-1; woodland group 5)

**Crider silt loam, 12 to 20 percent slopes, eroded (CrD2).**—The surface layer of this soil is brown, friable silt loam 4 to 6 inches thick. It has splotches of strong brown, where plowing has mixed this layer with material from the subsoil. The subsoil is strong-brown, friable silty clay loam and commonly grades to yellowish red at a depth of about 10 inches. Between the depths of 20 and 26 inches, there may be pale-brown and gray mottles. At a depth of about 26 inches, there is a layer of red, firm silty clay or silty clay loam mottled with pink and gray. This, in turn, lies over limestone residuum. This residuum is generally cherty; in fact, the uppermost 10 inches may be 30 to 90 percent chert. In places the residuum contains fragments of shale and sandstone.

This soil is moderately high in natural fertility and strongly acid or very strongly acid. It is low in organic-matter content and tends to crust after heavy rains.

About half of the acreage has irregular topography. Most of the acreage has been cleared and is used for cultivated crops, but some of it has reverted to forest or is idle. In recent years some areas have been cleared of brush and trees and seeded to pasture.

Because of rapid runoff and a high erosion hazard, this soil is suited only to limited cultivation. If well managed, it produces satisfactory yields of all the pasture and meadow plants commonly grown. Its potential for production of wood crops is high. White pine, shortleaf pine, loblolly pine, black locust, black walnut, and yellow-poplar are suitable for planting. (Capability unit IVe-1; woodland group 5)

**Crider silty clay loam, 6 to 12 percent slopes, severely eroded (CsC3).**—Erosion has removed practically all of the original surface layer from much of this soil. On more than 75 percent of the acreage, the present surface layer is yellowish-brown, friable silty clay loam. There are areas where this layer is a mixture of brown silt loam from the original surface layer and strong-brown or dark-brown material from the subsoil. The subsoil is strong-brown, dark-brown, or reddish-brown silty clay loam and grades to yellowish red at a depth of about 20 inches. Between depths of 18 and 25 inches, there may be pale-brown and gray mottles and a spotty, thin fragipan less than 4 inches thick. At a depth of about 25 inches, there is a layer of red, firm silty clay or silty clay loam mottled with pink and gray. The limestone residuum underlying this soil is generally cherty; in fact, the uppermost 10 inches may be 30 to 90 percent chert. In places this residuum contains sandstone fragments.

This soil is moderate in both natural fertility and moisture-supplying capacity. It is strongly acid or very strongly acid. It can be worked within only a narrow range of moisture content without clodding. It is very low in organic-matter content and tends to crust. Crusting interferes with the germination of seeds, particularly if they are planted in spring, and with the survival of seedlings.

About 60 percent of the acreage has irregular topography. Runoff is rapid, and the erosion hazard is moderately high. Erosion is difficult to control if there has been more than limited cultivation. This soil is suited to nearly all of the common pasture and meadow plants if it is limed, fertilized, mulched, and otherwise well managed. Its potential for production of wood crops is moderate. Short-

leaf pine and loblolly pine are suitable for planting. (Capability unit IVe-9; woodland group 6)

**Crider silty clay loam, 12 to 20 percent slopes, severely eroded** (CsD3).—Erosion has removed practically all of the original surface layer from much of this soil. On more than 75 percent of the acreage, the present surface layer is yellowish-brown, friable silty clay loam. There are areas where this layer is a mixture of brown silt loam from the original surface layer and strong-brown material from the subsoil. The subsoil is strong-brown silty clay loam in the uppermost 3 to 5 inches and grades to yellowish red at a depth of about 15 inches. Between the depths of 16 and 22 inches, there may be pale-brown and gray mottles. At a depth of about 22 inches, there is a layer of red, firm silty clay or silty clay loam mottled with pink and gray. The limestone residuum underlying this soil is generally cherty; in fact the uppermost 10 inches may be 30 to 90 percent chert.

This soil is moderate in natural fertility, moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. It can be worked within only a narrow range of moisture content without clodding. It is very low in organic-matter content and tends to crust. Crusting interferes with the germination of seeds and the survival of seedlings.

About a third of the acreage has irregular topography. Most of the acreage has been cleared and is used for cultivated crops, but some of it has reverted to forest or is idle. In recent years some areas have been cleared and seeded to pasture.

Because of rapid runoff and a high erosion hazard, this soil is not suited to cultivated crops. If well managed, it produces fair yields of most of the common pasture and meadow plants. Its potential for production of wood crops is moderate. Loblolly pine and shortleaf pine are suitable for planting. (Capability unit VIe-2; woodland group 6)

### Dekalb Series

The Dekalb series consists of excessively drained upland soils that developed in residuum weathered from sandstone, siltstone, and shale.

Representative profile:

- 0 to 2 inches, dark grayish-brown, very friable stony loam.
- 2 to 10 inches, light yellowish-brown, very friable loam.
- 10 to 36 inches, brownish-yellow, friable fine sandy loam grading to sandy loam; about 35 percent stones.
- 36 inches, sandstone bedrock.

Dekalb soils are stony, are strongly sloping to steep, and have weakly developed profiles. In Caldwell County, they are mapped as part of an undifferentiated group with Ramsey and Muskingum soils. A detailed description of Dekalb soils is given in the section "Formation, Classification, and Morphology of the Soils."

**Dekalb, Ramsey, and Muskingum stony soils, 12 to 20 percent slopes** (DmD).—Stones, strong slopes, a moderately high erosion hazard, and excessive drainage make these soils unsuitable for cultivated crops and hay crops and limit the choice of pasture plants. These soils are low in natural fertility and strongly acid or very strongly acid, but if well managed they produce fair to satisfactory yields of the few crops that are suited. Such crops show good response to lime and fertilizer.

Most of the acreage is forested. It is mainly in hardwoods of poor quality, but there is some scattered Virginia pine. The potential for production of wood crops is moderately high on the cool, north- and east-facing slopes and low on the hot, south- and west-facing slopes and on the narrow ridgetops. (Capability unit VIa-3; north- and east-facing slopes in woodland group 10, south- and west-facing slopes in woodland group 11)

**Dekalb, Ramsey, and Muskingum stony soils, 20 to 40 percent slopes** (Dmf).—Stones, steep slopes, low natural fertility, excessive drainage, and a high erosion hazard make these soils unsuitable for cultivation and limit the choice of pasture plants. If well managed, however, these soils produce fair yields of the crops that are suited. Such crops show good response to lime and fertilizer.

Most of the acreage is forested. It is mainly in hardwoods of poor quality, but there is some scattered Virginia pine. The potential for production of wood crops is moderately high on the cool, north- and east-facing slopes and low on the hot, south- and west-facing slopes and on the narrow ridgetops. (Capability unit VIIa-1; north- and east-facing slopes in woodland group 10, south- and west-facing slopes in woodland group 11)

### Dickson Series

The Dickson series consists of moderately well drained upland soils that developed in loess over residuum weathered from limestone. These soils have a fragipan.

Representative profile:

- 0 to 6 inches, brown, friable silt loam.
- 6 to 18 inches, yellowish-brown, friable silt loam to silty clay loam.
- 18 to 23 inches, yellowish-brown, friable silt loam; few, fine, distinct mottles of pale brown.
- 23 to 27 inches, mottled yellowish-brown, pale-brown, and light brownish-gray, slightly compact and brittle silt loam.
- 27 to 43 inches, mottled yellowish-brown, light-gray, and pale-brown, compact and brittle silt loam to silty clay loam.
- 43 to 72 inches, red, firm silty clay loam or silty clay; many, coarse, prominent mottles of pink and light gray.

In Caldwell County, Dickson soils occupy ridgetops and gentle side slopes. The slope range is 2 to 6 percent. There are a few sinkholes, limestone basins, and natural ponds.

Dickson soils are moderate or moderately high in natural fertility, moderately high to moderately low in moisture-supplying capacity, and strongly acid or very strongly acid. Moisture and roots easily penetrate the subsoil as far down as the fragipan.

Most of the acreage has been cleared and is cultivated.

**Dickson silt loam, 2 to 6 percent slopes** (DnB).—This soil is representative of the series. The surface layer is brown, friable silt loam 6 to 8 inches thick. The subsoil is yellowish-brown silt loam to silty clay loam that has some pale-brown mottles at a depth of about 18 inches. The brittle, compact fragipan, which begins about 23 inches below the surface, is mottled yellowish-brown, pale-brown, and light grayish-brown silt loam in the uppermost 3 to 5 inches. At a depth of about 27 inches, the fragipan becomes more brittle and more compact and grades to heavy silt loam or light silty clay loam. About 42 inches below the surface, there is a layer of red, firm silty clay loam or silty clay that lies over limestone residuum. This layer is generally cherty and contains some pink and gray mottles.

Included with the areas mapped are tracts of a nearly level Dickson silt loam, a few areas where the loess is 48 to 72 inches thick, and some small areas in the southern part of the county where the loess is less than 42 inches thick and overlies gravelly Coastal Plain material.

This soil is moderately high in both moisture-supplying capacity and natural fertility. It is strongly acid or very strongly acid. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. This soil is wet in winter and remains wet until late in spring; consequently, planting sometimes has to be delayed. If pastured in winter or early in spring, the soil is likely to become compacted.

Most of this soil has been cleared and is used for cultivated crops in cropping sequences that include some pasture and meadow crops. If well managed, it produces satisfactory yields of all the crops commonly grown. It produces good yields of alfalfa for 2 to 3 years. After that, the stand becomes thin and increasingly less productive, as a result of frost heaving. (Capability unit IIe-6; woodland group 7)

**Dickson silt loam, 2 to 6 percent slopes, eroded (DnB2).**—The surface layer of this soil is predominantly brown, friable silt loam 4 to 6 inches thick. It is splotched with yellowish brown where plowing has mixed material from the subsoil with the original surface layer. The subsoil is yellowish-brown silt loam to silty clay loam that has some pale-brown mottles at a depth of about 14 inches. The brittle, compact fragipan, which begins about 19 inches below the surface, is mottled yellowish-brown, pale-brown, and light grayish-brown silt loam in the uppermost 3 to 5 inches. At a depth of about 23 inches, it becomes more brittle and more compact and grades to heavy silt loam or light silty clay loam. About 36 inches below the surface, there is a layer of red, firm silty clay loam or silty clay that lies over limestone residuum. This red layer has some gray and pink mottles and may be cherty. Included in the areas mapped are spots where the loess is 48 to 60 inches thick, and a few spots in the southern part of the county where it is less than 42 inches thick over gravelly Coastal Plain material.

This soil is moderately low in moisture-supplying capacity, moderate in natural fertility, and strongly acid or very strongly acid. It is low in organic-matter content and tends to crust after heavy rains. This soil is wet in winter and remains wet until late in spring; sometimes the wetness delays spring planting. If pastured in winter or early in spring, this soil is likely to become compacted. Runoff is slow, and the hazard of erosion is moderately low.

Most of this soil has been cleared and is used for cultivated crops in cropping sequences that include some pasture and meadow crops. If well managed, it produces fair to satisfactory yields of all the crops commonly grown. It produces good yields of alfalfa for 2 or 3 years. After that, the stand becomes thin and increasingly less productive, as a result of frost heaving. (Capability unit IIe-6; woodland group 7)

## Elk Series

The Elk series consists of well-drained soils that developed in old alluvium. Most of the alluvium was

washed from soils that had developed in limestone residuum mixed with a small amount of loess, but part of it was washed from soils that had developed in sandstone and shale residuum likewise mixed with a small amount of loess.

Representative profile:

- 0 to 7 inches, dark-brown, very friable silt loam.
- 7 to 12 inches, strong-brown, friable heavy silt loam.
- 12 to 28 inches, dark-brown, firm silty clay loam.
- 28 to 40 inches, dark yellowish-brown, friable light silty clay loam; a few light brownish-gray mottles.
- 40 to 48 inches, reddish-brown, friable silty clay loam; brownish-gray and pale-brown mottles.

In Caldwell County, Elk soils occur as small areas along the larger streams.

These soils are high in natural fertility, high to very high in moisture-supplying capacity, and medium acid or strongly acid. They are easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Roots and moisture easily penetrate the subsoil to a depth of 4 feet or more.

Most of the acreage has been cleared and is used for cultivated crops.

**Elk silt loam, 0 to 2 percent slopes (EkA).**—The surface layer of this soil is dark-brown, friable silt loam 7 to 10 inches thick. The upper part of the subsoil is strong brown or dark brown and ranges from silt loam to silty clay loam. Below a depth of 15 inches, the subsoil is dark-brown, friable silty clay loam. Below a depth of 30 inches, it is yellowish brown and has a few gray mottles, or it is reddish brown. In some profiles the reddish-brown color begins at a depth of about 20 inches. This soil is ordinarily silty to a depth of more than 5 feet, but in spots it may contain gravel beds or sandy strata below a depth of 3 feet. In a few areas there is scattered chert on the surface and through the upper part of the subsoil.

This soil is very high in moisture-supplying capacity.

Nearly all of the acreage has been cleared and is used for cultivated crops in cropping sequences that include meadow and pasture plants and small grain. If well managed, this soil produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer. Because of the level topography, there is little hazard of erosion. Other hazards and limitations are slight. (Capability unit I-3; woodland group 1)

**Elk silt loam, 2 to 6 percent slopes (EkB).**—This soil is representative of the series. The surface layer is dark-brown, friable silt loam 6 to 9 inches thick. The upper part of the subsoil is strong brown or dark brown and ranges from silt loam to silty clay loam in texture. Below a depth of 15 inches, the subsoil is dark-brown, friable silty clay loam. Below a depth of 30 inches, it is yellowish brown and has a few light brownish-gray mottles, or it is reddish brown. In some profiles the reddish-brown color begins at a depth of about 20 inches. This soil is ordinarily silty to a depth of more than 5 feet, but in spots it may contain gravel beds or sandy strata below a depth of 3 feet. In a few areas there is scattered chert on the surface and through the upper part of the subsoil. Included in the areas mapped is a small acreage that is moderately eroded, where material from the subsoil has been mixed with the original surface layer, and a few tracts where the slope is more than 6 percent.

This soil is high in moisture-supplying capacity.

Nearly all of the acreage has been cleared and is used for cultivated crops in cropping sequences that include meadow and pasture plants and small grain. If well managed, this soil produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer. There is a moderately low erosion hazard. Consequently, if the soil is used for cultivated crops, measures to help control erosion are needed. (Capability unit IIe-1; woodland group 1)

### Falaya Series

The Falaya series consists of somewhat poorly drained soils on bottom lands. These soils formed in alluvium washed from soils that developed in thin loess over residuum weathered from sandstone, shale, and siltstone.

Representative profile:

- 0 to 8 inches, dark grayish-brown, very friable silt loam; a few dark-brown and grayish-brown mottles.
- 8 to 24 inches, grayish-brown to light olive-brown, friable silt loam; a few yellowish-red and dark-brown mottles.
- 24 to 48 inches, gray, friable silt loam; yellowish-brown and dark-brown mottles.

The texture throughout the profile is ordinarily silt loam, but sandy or clayey strata may occur below a depth of 2 feet. Small, dark-brown or black, soft concretions commonly occur in the layers below the surface layer.

In Caldwell County, Falaya soils occur mainly along the Tradewater River and its larger tributaries and to a lesser extent along its smaller branches.

These soils are moderately high in natural fertility, very high in moisture-supplying capacity, and strongly acid or very strongly acid. These soils are easy to keep in good tilth. They can be worked throughout a wide range of moisture content but are sometimes too wet to support equipment until late in spring or early in summer. If adequately drained, they allow good movement of air and water. Otherwise, aeration and root growth are restricted by a high water table.

**Falaya silt loam (Fc).**—The surface layer of this soil is dark grayish-brown, friable silt loam that has a few dark-brown and grayish-brown mottles. It is about 8 inches thick. It is underlain by friable silt loam that in the upper part is grayish brown or light olive brown and has a few yellowish-red and dark-brown mottles, and at a depth of 18 to 24 inches is gray and has yellowish-brown and dark-brown mottles.

If adequately drained and otherwise well managed, this soil is suitable for continuous cultivation and produces satisfactory yields of most of the crops commonly grown. Crops show good response to lime and fertilizer. Most of the acreage along the larger streams is subject to overflow, which delays spring plowing and planting and is likely to damage growing crops. There is little erosion hazard.

About a fourth of the acreage is wooded. The potential for production of wood crops is high. (Capability unit IIw-4; woodland group 2)

### Fredonia Series

The Fredonia series consists of well-drained upland soils. These soils developed in residuum weathered from high-grade limestone that contains little or no chert.

Representative profile:

- 0 to 6 inches, dark reddish-brown, friable silty clay loam.
- 6 to 28 inches, dark-red or dusky-red, very firm clay; strong, blocky structure.
- 28 inches, hard, massive, high-grade limestone.

The Fredonia soils in Caldwell County are closely associated with Pembroke and Crider soils. They are shallower to bedrock than those soils and have a finer texture and a firmer consistence.

These soils are high in natural fertility, moderately low to high in moisture-supplying capacity, and slightly acid, neutral, or mildly alkaline. The slope range is 4 to 20 percent. The gently sloping areas are suitable for limited cultivation. The steeper, rockier areas are not suitable for cultivation but are suitable for pasture. The total acreage is small.

**Fredonia silty clay loam, shallow, 6 to 12 percent slopes, eroded (FdC2).**—The surface layer of this soil is dark reddish-brown silty clay loam 4 to 7 inches thick. The subsoil is dark-red or dusky-red, firm clay that has strong, blocky structure. Limestone crops out in a few places but is ordinarily between 24 and 36 inches below the surface. Included in the areas mapped are spots where the surface layer is brown or yellowish-red silt loam, the upper part of the subsoil is yellowish-red silty clay, and limestone is at a depth of less than 36 inches. Also included are many spots where the subsoil grades to mottled gray and brown, very firm clay 4 to 8 inches above the limestone; spots that have a slope of less than 6 percent; and a small acreage that is severely eroded.

This soil is moderately high in moisture-supplying capacity and slightly acid or neutral.

Practically all of the acreage has been cleared and cultivated, but part of it has reverted to woodland. About 35 percent of the acreage has irregular topography.

Because of rock outcrops, a shallow root zone, and difficulty in controlling runoff and erosion, this soil is not well suited to cultivated crops. Also, it can be worked within only a narrow range of moisture content. If well managed, however, it produces satisfactory yields of most of the pasture and meadow plants commonly grown. Such plants show good response to fertilizer. The potential for production of wood crops is low. Measures that reduce runoff and help to control erosion are needed. (Capability unit IVE-6; woodland group 9)

**Fredonia silty clay loam, shallow, 12 to 20 percent slopes, eroded (FdD2).**—The surface layer of this soil is dark reddish-brown silty clay loam 4 to 7 inches thick. The subsoil is dark-red or dusky-red, firm clay that has strong blocky structure. Limestone crops out in a few places but is ordinarily at a depth of 20 to 30 inches. Included in the areas mapped are spots where the surface layer is brown or yellowish-red silt loam, the upper part of the subsoil is yellowish-red silty clay, and limestone is less than 30 inches below the surface. Also included are many spots where the subsoil grades to mottled gray and brown, very firm clay 4 to 8 inches above the limestone.

This soil is moderately low in moisture-supplying capacity. It can be worked within only a narrow range of moisture content without clodding.

Practically all of the acreage has been cleared and cultivated, but much of it has reverted to woodland.

Rapid runoff, rock outcrops, a moderately high erosion hazard, and the fine texture of the surface layer make this soil unsuitable for cultivation. Under good management, fair yields of many of the common pasture and meadow plants can be produced. Such plants show good response to fertilizer. The potential for production of wood crops is low. (Capability unit VIe-1; woodland group 9)

**Fredonia-Rock land complex, 6 to 20 percent slopes, eroded (FrD2).**—This complex consists of a shallow Fredonia soil and areas of Rock land. The Fredonia soil makes up 50 to 60 percent of the acreage.

The surface layer of the Fredonia soil is reddish-brown silty clay loam 4 to 7 inches thick. The subsoil is commonly dark-red or dusky-red, firm clay that has strong, blocky structure. Limestone crops out in a few places but is most commonly at a depth of 20 to 30 inches. This soil is high in natural fertility, moderately low in moisture-supplying capacity, and slightly acid to mildly alkaline.

Limestone crops out in many places throughout the areas of Rock land. The soil between the outcrops has the characteristics of Fredonia soils.

This complex is not suitable for either cultivated crops or meadow crops, but part of it has been cleared and is used as pasture. If well managed, the Fredonia acreage provides a moderate amount of grazing.

Most of the acreage is wooded. The potential for production of wood crops is low. (Fredonia soil: capability unit VIe-1; woodland group 9; wildlife group 3. Rock land: capability unit VIe-1; woodland group 15)

## Gilpin Series

The Gilpin series consists of strongly sloping to steep, well-drained to excessively drained upland soils. These soils developed partly in windblown silt and fine sand and partly in residuum weathered from sandstone, shale, and siltstone.

### Representative profile:

- 0 to 2 inches, very dark grayish-brown, very friable silt loam.
- 2 to 6 inches, yellowish-brown, friable silt loam.
- 6 to 20 inches, strong-brown to reddish-yellow, friable to firm silty clay loam.
- 20 to 24 inches, brown to yellowish-red, firm clay loam; about 30 percent sandstone fragments.
- 24 to 40 inches, silty or clayey material with increasing percentage of shale or sandstone fragments. Bedrock usually occurs at a depth between 24 and 40 inches.

In Caldwell County, Gilpin soils are mapped as part of an undifferentiated group with Litz and Muskingum soils. A detailed description of Gilpin soils is given in the section "Formation, Classification, and Morphology of the Soils."

**Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes (GmD).**—These soils are moderate in natural fertility, moderately low to moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. Included in the areas mapped are eroded spots and spots where the slope is less than 12 percent.

Strong slopes, rapid runoff, and a moderately high erosion hazard make these soils suitable for only limited cultivation. Erosion control is needed if cultivated crops are grown. These soils are well suited to pasture and meadow plants and, if well managed, produce satisfactory yields of those commonly grown. Such crops respond to lime and fertilizer. Also, these soils are suited to woodland. The potential for production of wood crops is mod-

erately high on the north- and east-facing slopes and low on the south- and west-facing slopes and the narrow ridgetops. (Gilpin soils: capability unit IVe-4; north- and east-facing slopes in woodland group 10, south- and west-facing slopes in woodland group 11; wildlife group 2. Litz soils: capability unit VIe-8; north- and east-facing slopes in woodland group 10, south- and west-facing slopes in woodland group 11; wildlife group 2. Muskingum soils: capability unit IVe-4; north- and east-facing slopes in woodland group 10, south- and west-facing slopes in woodland group 11)

**Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes, severely eroded (GmD3).**—Erosion has removed most of the original surface layer from these soils. In many places the present surface layer is now the original subsoil material. Included in the areas mapped are uneroded spots, spots where the slope is less than 12 percent, and spots where the slope is more than 20 percent.

These soils are moderately low or low in natural fertility, low in moisture-supplying capacity, and strongly acid or very strongly acid.

Nearly all of the acreage has been cleared and cultivated, but much of it has reverted to woodland or is now idle.

Strong slopes, rapid runoff, severe erosion, and droughtiness make these soils unsuitable for cultivated crops and limit the choice of pasture and meadow plants. If well managed, these soils produce fair yields of some of the pasture and meadow plants commonly grown. These plants respond to lime and fertilizer. The potential for production of wood crops is low. (Gilpin soils: capability unit VIe-9; woodland group 11. Litz soils: capability unit VIIe-2; woodland group 11. Muskingum soils: capability unit VIe-9; woodland group 11)

**Gilpin, Litz, and Muskingum silt loams, 20 to 30 percent slopes (GmE).**—These soils are moderate in natural fertility, moderately low to moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. Some spots are eroded.

Steep slopes, rapid runoff, and a severe erosion hazard make these soils unsuitable for cultivation. Part of the acreage has been cleared and cultivated, but much of it has reverted to woodland. If well managed, these soils produce satisfactory yields of many of the pasture and meadow plants commonly grown. These plants respond to lime and fertilizer. The potential for production of wood crops is moderately high on the north- and east-facing slopes, and low on the south- and west-facing slopes and the narrow ridgetops. (Gilpin soils: capability unit VIe-7; north- and east-facing slopes in woodland group 10, south- and west-facing slopes in woodland group 11. Litz soils: capability unit VIe-8; north- and east-facing slopes in woodland group 10, south- and west-facing slopes in woodland group 11. Muskingum soil: capability unit VIe-8; north- and east-facing slopes in woodland group 10, south- and west-facing slopes in woodland group 11)

## Gullied Land

**Gullied land (Gu)** occurs throughout the county, generally as strong to moderately steep slopes that have been poorly managed. It consists of soils so severely damaged by erosion that their profiles have been destroyed, they are nonarable, and their reclamation for row crops or im-

proved pasture, although feasible in places, is difficult and not economically practical.

The soil material between the gullies is generally acid, but in places in the gullies alkaline parent material is exposed.

This land has been abandoned and for the most part has reverted to forest. Most of the acreage that is now forested is stabilized. (Capability unit VIIe-4; woodland group 15)

### Hayter Series

The Hayter series consists of well-drained soils that developed in old local alluvium. The alluvium washed from upland soils that developed in loess over residuum weathered from acid sandstone and shale, or in loess over residuum weathered from interbedded limestone, sandstone, and shale. These soils are on foot slopes.

Representative profile:

- 0 to 6 inches, dark-brown, very friable silt loam.
- 6 to 11 inches, brown, friable heavy silt loam.
- 11 to 22 inches, brown, friable silty clay loam.
- 22 to 45 inches, brown to yellowish-red, friable heavy silt loam; a few mottles of brown, pale brown, light brownish gray, and very dark grayish brown.
- 45 to 62 inches, yellowish-red, friable silty clay loam; common mottles of light brown, very dark grayish brown, and gray.

In this county, Hayter soils are just downslope from the steeper Caneyville soils and the Dekalb, Ramsey, and Muskingum stony soils. The slope range is 6 to 20 percent.

These soils are moderately high in natural fertility, high in moisture-supplying capacity, and strongly acid or very strongly acid.

Most of the acreage has been cleared and cultivated, but much of it has reverted to forest.

**Hayter silt loam, 6 to 12 percent slopes (H<sub>a</sub>C).**—This soil is representative of the series. The surface layer is dark yellowish-brown or brown silt loam 5 to 7 inches thick. The subsoil is dark-brown to reddish-brown, friable heavy silt loam to a depth of about 11 inches and dark-brown, friable silty clay loam between the depths of 11 and 22 inches. Below a depth of 22 inches, it is dark-brown, yellowish-red, or yellowish-brown, friable heavy silt loam mottled in places with light brownish-gray and dark brownish-gray mottles. In places a weak fragipan 3 to 7 inches thick has developed in the lower part of the subsoil. The parent material, which begins at a depth of 3 to 4 feet, is yellowish red to yellowish brown and is commonly mottled with gray, light brown, and dark grayish brown. Ordinarily, this material is silt loam or silty clay loam and contains sandstone and shale fragments. The depth to bedrock ranges from 3 to 12 feet but is most commonly more than 6 feet. In most areas there are a few small sandstone and shale fragments in the surface layer and upper part of the subsoil, and in a few areas, most of which are less than 1 acre in size, there are stones on the surface.

Most of the acreage has been cleared and cultivated, but much of it has reverted to woodland.

This soil is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. If well managed, it produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer. Roots and moisture easily penetrate to a depth of 4 feet or more.

If this soil is used for cultivated crops, measures that limit runoff and help to control erosion are needed. The potential for production of wood crops is high. (Capability unit IIIe-1; woodland group 14)

**Hayter silt loam, 12 to 20 percent slopes (H<sub>a</sub>D).**—The surface layer of this soil is dark yellowish-brown or brown silt loam 5 to 7 inches thick. The subsoil is dark-brown, friable heavy silt loam to a depth of about 10 inches and dark-brown, friable heavy silty clay loam between the depths of 10 and 20 inches. Below a depth of 22 inches, it is dark-brown, yellowish-red, or yellowish-brown, friable heavy silt loam mottled in places with light brownish gray and dark brownish gray. The parent material, which begins at a depth of 3 to 4 feet, is yellowish red to yellowish brown and is commonly mottled with gray, light brown, and dark grayish brown. Ordinarily, this material is silt loam or silty clay loam and contains sandstone and shale fragments. The depth to bedrock ranges from 3 to 12 feet but is most commonly more than 5 feet. In most areas there are a few small sandstone and shale fragments in the surface layer and upper part of the subsoil, and in a few areas, most of which are less than 1 acre in size, there are stones on the surface.

Most of the acreage has been cleared and cultivated, but much of it has reverted to woodland.

This soil is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Nevertheless, because of a moderately severe erosion hazard, it is suitable for only limited cultivation. If well managed, it produces satisfactory yields of all the pasture and meadow plants commonly grown. These plants show good response to lime and fertilizer. Roots and moisture easily penetrate to a depth of 4 feet or more. If this soil is used for cultivated crops, measures that reduce runoff and help to control erosion are needed. The potential for production of wood crops is high. (Capability unit IVe-1; woodland group 14)

### Huntington Series

The Huntington series consists of well-drained soils on bottom lands. These soils formed in alluvium washed from soils that developed partly in loess and partly in residuum weathered from limestone or from a mixture of limestone, sandstone, and shale.

Representative profile:

- 0 to 7 inches, dark-brown, very friable silt loam; granular structure.
- 7 to 36 inches, dark-brown, friable silt loam; granular to weak blocky structure.
- 36 to 48 inches, dark grayish-brown to brown, friable silt loam; mottles of light brownish gray.

In places there are thin strata of silty clay loam below a depth of 24 inches. There may be mottles below a depth of 30 inches.

Huntington soils are commonly slightly acid or neutral but are medium acid or strongly acid in places. They are easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Roots and moisture easily penetrate these soils to a depth of 4 feet or more.

Huntington soils are some of the most productive soils in the county. Most of the acreage has been cleared and is cultivated. Part of it is used continuously for cultivated

crops, and the rest is used for cultivated crops in cropping sequences that include meadow and pasture plants and small grain.

**Huntington gravelly silt loam (Hg).**—The surface layer of this soil is dark-brown gravelly silt loam 7 to 10 inches thick. The underlying soil is similar to the surface layer in color and texture but is friable and in places is more than 60 percent gravel. The gravel consists mainly of sandstone fragments but also contains fragments of shale, limestone, and chert. Thin strata of silty clay loam may occur. Below a depth of 24 inches, there may be light brownish-gray mottles.

This soil is high in natural fertility and moderately high in moisture-supplying capacity. It is commonly slightly acid or neutral but is strongly acid in places. In some areas the intensity of the acidity varies greatly within short distances.

Much of the acreage is wooded. If well managed, this soil produces satisfactory yields of all the crops commonly grown. Such crops show good response to lime and fertilizer. This soil is slightly droughty, and the gravel interferes with tillage, but there is no erosion hazard or limitation caused by wetness. (Capability unit IIs-1; woodland group 1)

**Huntington silt loam (Hn).**—This is a deep, productive soil. The largest areas are near the larger streams, but most of the acreage is along small streams and in depressions.

This soil is representative of the series. The surface layer is dark-brown, friable silt loam 7 to 10 inches thick. The underlying soil is similar to the surface layer but may have weak, subangular blocky structure. Also, there may be thin strata of silty clay loam. Below a depth of 30 inches, this soil may be dark grayish brown or brown and have a few light brownish-gray mottles, or it may be dark brown to a depth of 5 feet or more. In a few areas it has scattered gravel on the surface and throughout the profile, but for the most part it is free of gravel to a depth of 48 inches.

This soil is high in natural fertility and very high in moisture-supplying capacity. It is commonly slightly acid or neutral but is medium acid in places.

Nearly all of the acreage has been cleared and is cultivated. If well managed, this soil produces satisfactory yields of all the crops commonly grown. Crops show good response to fertilizer, and crops that require an alkaline soil respond to lime. Except for overflow, which is infrequent and seldom occurs during the growing season, there are no hazards or limitations. (Capability unit I-1; woodland group 1)

## Johnsburg Series

The Johnsburg series consists of somewhat poorly drained upland soils that developed partly in loess and partly in residuum weathered from sandstone and shale. These soils have a fragipan.

Representative profile:

- 0 to 6 inches, dark grayish-brown, very friable silt loam; a few mottles of light brownish gray.
- 6 to 9 inches, mottled grayish-brown, pale-brown, and yellow, friable silt loam.
- 9 to 18 inches, yellow or olive-yellow, friable silt loam; many mottles of light gray.

18 to 24 inches, gray, slightly compact and brittle silt loam; many coarse mottles of strong brown.

24 to 36 inches, gray, compact and brittle silty clay loam; many mottles of strong brown.

36 to 48 inches, mottled strong-brown and light-gray silty clay loam.

There are small, dark-brown to black, soft and hard concretions on the surface and throughout the profile.

Johnsburg soils are moderately low in natural fertility, moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. They are low in organic-matter content. Roots and moisture penetrate as far down as the fragipan. The total acreage is small.

**Johnsburg silt loam (Jb).**—This is a nearly level soil that occurs mainly as small areas on broad ridgetops. A small acreage occupies stream terraces.

The surface layer is dark grayish-brown, friable silt loam about 9 inches thick. It has a few mottles of light brownish gray. In places the lowest 3 inches of this layer is mottled grayish brown, pale brown, and yellow. The subsoil is yellow or olive-yellow, friable heavy silt loam that has many mottles of light gray. The dense, compact layer, which is commonly at a depth of about 18 inches, is gray and has strong-brown mottles. It is slightly compact and brittle silt loam in the uppermost 4 to 8 inches and compact and brittle silty clay loam at a depth of about 24 inches. There are small, dark-brown and black, soft and hard concretions on the surface and throughout the profile.

This soil is easy to till, but tillage often has to be delayed because of wetness. Also, because of its shallow root zone, this soil is droughty during extended dry periods. Consequently, the choice of crops is limited. Only those crops tolerant of both wetness and droughtiness show good response to lime and fertilizer. The excess water can be removed by means of surface drainage from some areas but not from others. The potential for production of wood crops is moderately high. (Capability unit IIIw-1; woodland group 4)

## Lindside Series

The Lindside series consists of deep, moderately well drained soils on bottom lands. These soils formed in alluvium washed from soils that developed in limestone residuum, from soils that developed in thin loess over limestone residuum, and from soils that developed in thin loess over residuum weathered from a mixture of limestone, sandstone, and shale.

Representative profile:

- 0 to 8 inches, brown, very friable silt loam.
- 8 to 21 inches, brown, friable silt loam; a few mottles of pale brown and grayish brown.
- 21 to 36 inches, mottled brown, dark yellowish-brown, pale-brown, and grayish-brown, friable silt loam; a few small, dark-brown and black concretions.
- 36 to 48 inches, light-gray, friable silt loam; mottles of reddish yellow, grayish brown, and dark brown.

Lindside soils are almost free of mottles to a depth of 20 inches but have many pale-brown and grayish-brown mottles between the depths of 20 and 30 inches. These soils may be gray below a depth of 30 inches. The texture throughout the profile is generally silt loam, but thin sandy and clayey strata may occur below a depth of 20 inches. Also, there may be dark-brown or black, soft concretions below a depth of 20 inches.

Most of the acreage in this county is along small streams and in depressions, but the larger areas are along the larger streams.

Lindside soils are high in natural fertility and very high in moisture-supplying capacity. They are commonly slightly acid or neutral but may be strongly acid in places. Roots and moisture easily penetrate to a depth of 4 feet or more.

Most of the acreage has been cleared and is cultivated. Part of it is used continuously for cultivated crops, and the rest is used for cultivated crops in cropping sequences that include meadow and pasture plants and small grain.

**Lindside silt loam (ld).**—The surface layer of this soil is brown or dark-brown, friable silt loam about 8 inches thick. It is underlain by friable silt loam that in the upper part is brown or dark brown and has a few grayish-brown mottles and at a depth of 20 to 25 inches is mottled brown, dark yellowish brown, pale brown, and grayish brown. Below a depth of 3 feet, this soil is commonly light-gray, friable silt loam and has mottles of reddish yellow, grayish brown, and dark brown.

This soil can be used continuously for cultivated crops. If well managed, it produces satisfactory yields of all the crops commonly grown. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Occasionally, flooding late in spring may delay plowing and planting or damage growing crops in some low-lying areas. Drainage may be needed for some deep-rooted crops, such as alfalfa. The plow layer is medium in organic-matter content. Crops show good response to lime and fertilizer. There is no erosion hazard. (Capability unit I-2; woodland group 1)

## Litz Series

The Litz series consists of upland soils that are strongly sloping to steep and well drained to excessively drained. These soils developed in windblown silt and fine sand over residuum weathered from sandstone, shale, and siltstone.

Representative profile:

- 0 to 3 inches, very dark grayish-brown, very friable silt loam.
- 3 to 8 inches, yellowish-brown, very friable silt loam.
- 8 to 15 inches, strong-brown, friable light silty clay loam; sandstone and shale fragments.
- 15 inches, shattered sandstone, siltstone, and shale fragments.

The depth to bedrock ranges from 15 to 30 inches.

In Caldwell County, Litz soils are mapped as part of an undifferentiated unit with Gilpin and Muskingum soils. A detailed description of Litz soils is given in the section "Formation, Classification, and Morphology of the Soils."

## Made Land

**Made land (Mc)** occurs most commonly in and around urban areas. It consists of areas that have been filled with earth, trash, or both, and then leveled. This land has been so altered that no attempt was made to classify it according to source of soil material. Its use for agricultural purposes is of questionable value. (Not assigned to a capability unit; woodland group 15)

## McGary Series

The McGary series consists of somewhat poorly drained soils on stream terraces. These soils developed in slack-water deposits of clay and silt.

Representative profile:

- 0 to 7 inches, brown to pale-brown, friable silt loam.
- 7 to 12 inches, mottled gray, yellowish-brown, and light brownish-gray, firm silty clay loam.
- 12 to 27 inches, yellowish-brown, firm clay; gray and light brownish-gray mottles.
- 27 to 50 inches, mottled gray, strong-brown, and yellowish-brown, plastic clay or silty clay.

McGary soils occur in the northeastern corner of Caldwell County, on second bottoms along the Tradewater River.

These soils are moderately low in natural fertility and moderately high in moisture-supplying capacity. They are medium acid or strongly acid in the surface layer and upper part of the subsoil, but at a depth of 24 to 46 inches, they are neutral to moderately alkaline. In many places these soils have lime concentrations below a depth of 36 inches.

The surface layer is fairly easy to work, but it tends to clod and crust if tilled when too wet. Wetness frequently delays tillage. The roots of plants that tolerate some wetness can penetrate to a depth of 3 feet or more. The clayey texture of the subsoil slows the movement of air and water.

The total acreage is small. About a third of it is wooded. The rest is used for cultivated crops in cropping sequences that include some pasture and meadow plants.

**McGary silt loam (Mc).**—The surface layer of this soil is brown to pale-brown, friable silt loam. The uppermost 4 to 6 inches of the subsoil is mottled gray, yellowish-brown, and light brownish-gray silty clay loam. Between the depths of about 12 inches and 27 inches, the subsoil is yellowish-brown, firm silty clay mottled with gray and light brownish gray. Below a depth of about 27 inches, it grades to mottled gray, strong-brown, and yellowish-brown clay or silty clay. Included in the areas mapped are tracts where the soils are better drained than McGary soils and a tract where the soils are more poorly drained. All of these soils developed in clayey slack-water sediments.

The surface layer is low in organic-matter content, but crops generally show good response to lime and fertilizer, particularly crops that tolerate wetness. Some crops are damaged by lack of water during extended dry periods. Overflow sometimes delays tillage and damages growing crops. (Capability unit IIIw-1; woodland group 3)

## Melvin Series

The Melvin series consists of poorly drained soils on bottom lands. These soils developed in alluvium washed from soils that developed in thin loess over limestone residuum and in thin loess over residuum weathered from a mixture of limestone, sandstone, and shale.

Representative profile:

- 0 to 6 inches, grayish-brown, friable silt loam; many mottles of pale brown and gray.
- 6 to 21 inches, mottled light brownish-gray, brown, and gray, friable silt loam.
- 21 to 72 inches, gray, friable heavy silt loam; mottles of pale brown, yellowish brown, and very dark gray.

There are commonly many dark-brown or black, soft concretions below the surface layer. In places strata of clay loam occur at a depth below 20 inches.

Most of the acreage in this county is along the larger streams, but there are small areas of these soils in depressions and along small branches.

Melvin soils are very high in moisture-supplying capacity and moderate in natural fertility. They are ordinarily slightly acid or neutral but in places are medium acid. They are low in organic-matter content.

About half of the acreage is wooded. The part that is cleared is used for cultivated crops in cropping sequences that include some pasture and meadow crops. The acreage along the larger streams is subject to overflow, which sometimes occurs during the growing season. When the water table is low, these soils are easily penetrated by roots and moisture. Their potential for production of wood crops is high, if the trees are of species that tolerate wetness.

**Melvin silt loam (Me).**—The surface layer of this soil is grayish-brown silt loam that has many mottles of pale brown and gray. The upper part of the subsoil is mottled light brownish-gray, brown, and gray, friable silt loam. At a depth of about 20 inches, this grades to gray heavy silt loam that has mottles of yellowish brown and dark gray. Included in the areas mapped is a small acreage of poorly drained soils that have a fragipan. Ordinarily, the fragipan is weakly developed.

This soil is easy to till. If adequately drained and well managed, it produces good yields of many of the crops commonly grown. Crops show good response to fertilizer. Crops that require an alkaline soil respond to lime. If not adequately drained, this soil is suited only to crops that tolerate wetness. Flooding or wetness often delays tillage and damages growing crops on low areas. Both tile drainage and surface drainage can be used to remove excess water. (Capability unit IIIw-5; woodland group 2)

## Mullins Series

The Mullins series consists of poorly drained upland soils that developed partly in loess over limestone residuum and partly in loess over residuum weathered from sandstone, shale, and limestone. These soils have a fragipan.

Representative profile:

- 0 to 6 inches, grayish-brown or dark grayish-brown, friable silt loam; gray mottles.
- 6 to 9 inches, light brownish-gray, friable silt loam; mottles of gray and yellowish brown.
- 9 to 18 inches, light brownish-gray or light-gray, friable silty clay loam; yellow mottles.
- 18 to 24 inches, light-gray slightly compact and brittle silty clay loam; yellow mottles.
- 24 to 42 inches, light olive-gray, compact and brittle silty clay loam or silty clay; mottles of brownish yellow and strong brown.
- 42 to 48 inches, light olive-gray, friable silty clay loam; very dark brown stains and concretions.

Small, dark-brown or black, soft or hard concretions commonly occur on the surface and throughout the profile.

These soils occur as small areas in this county. The total acreage is small.

Mullins soils are low in both natural fertility and moisture-supplying capacity. They are also low in organic-matter content and are very strongly acid. The potential for production of wood crops is moderately high.

**Mullins silt loam (Mu).**—The surface layer of this soil is grayish-brown, dark grayish-brown, or light brownish-gray, friable silt loam mottled with gray and yellowish brown. The upper part of the subsoil is light brownish-gray or light gray, friable silty clay loam mottled with yellow. The fragipan, which begins at a depth of about 18 inches, is light-gray or light olive-gray, compact and brittle silty clay loam mottled with yellow and strong brown. It becomes more compact and brittle with increasing depth. The uppermost 4 to 8 inches of the pan ranges to silt loam in texture; the lower part ranges to silty clay.

This soil is easy to work, but it is wet. Consequently, tillage often has to be delayed. Also, because of low moisture-supplying capacity, this soil is droughty during extended dry periods. Ordinarily, the response to lime and fertilizer is only fair for many of the crops commonly grown but good for those crops that tolerate wetness and droughtiness. Surface drainage is effective in some areas but not in others. (Capability unit IVw-1; woodland group 4)

## Muskingum Series

The Muskingum series consists of well-drained and excessively drained upland soils that developed in residuum weathered from sandstone, siltstone, and shale. Both stony silt loams and silt loams were mapped in this county.

Representative profile of a stony silt loam:

- 0 to 4 inches, dark-brown, very friable stony silt loam.
- 4 to 22 inches, yellowish-brown, friable stony silt loam.
- 22 to 42 inches, yellowish-brown, friable to firm light silty clay loam; about 35 percent sandstone and shale fragments.
- 42 inches, shattered sandstone, siltstone, and shale bedrock.

Representative profile of a silt loam:

- 0 to 4 inches, dark-brown, very friable silt loam.
- 4 to 40 inches, yellowish-brown, friable to firm silt loam; sandstone, shale, and siltstone fragments range from 15 percent by volume in the upper part to 35 percent in the lower part.
- 40 inches +, shattered sandstone, siltstone, and shale.

In Muskingum silt loam, the depth to bedrock is between 20 and 40 inches.

Muskingum soils are strongly sloping to steep and have weakly developed profiles. In Caldwell County, they are mapped as part of undifferentiated groups with Dekalb and Ramsey soils and with Gilpin and Litz soils. The Dekalb, Ramsey, and Muskingum group is described under the heading of "Dekalb Series." The Gilpin, Litz, and Muskingum group is described under the heading "Gilpin Series." A detailed description of Muskingum soils is given in the section "Formation, Classification, and Morphology of the Soils."

## Newark Series

The Newark series consists of somewhat poorly drained soils on bottom lands. These soils formed in alluvium washed from soils that developed in thin loess over residuum weathered from high-grade limestone and cherty limestone, from soils that developed in limestone residuum, and from soils that developed in thin loess over residuum weathered from a mixture of limestone, sandstone, and shale.

**Representative profile:**

- 0 to 6 inches, dark grayish-brown, friable silt loam.
- 6 to 10 inches, dark grayish-brown, friable silt loam; a few mottles of grayish brown.
- 10 to 18 inches, grayish-brown, friable silt loam; common mottles of brown.
- 18 to 24 inches, mottled grayish-brown, dark grayish-brown, and strong-brown, friable silt loam.
- 24 to 48 inches, gray, friable silt loam; dark grayish-brown mottles; yellowish-brown mottles below a depth of 36 inches.

Newark soils commonly have little mottling in the surface layer, but they are heavily mottled below a depth of 7 inches and may be predominantly gray below a depth of 24 inches. The texture throughout the profile is most commonly silt loam, but below a depth of 2 feet there may be sandy or clayey strata. Small, soft, dark-brown or black concretions commonly occur in the layers below the surface layer.

Most of the acreage in this county is along the larger streams, but a considerable acreage occurs in depressions and along small branches.

Newark soils are moderately high in natural fertility and very high in moisture-supplying capacity. They are ordinarily slightly acid or neutral but may be medium acid or strongly acid in places.

These soils are easy to keep in good tilth. They can be worked throughout a wide range of moisture content but in some years are too wet to support equipment until late in spring or early in summer. The acreage along many of the larger streams is subject to overflow during the growing season, but less frequently than in winter and spring.

About a third of the acreage is wooded. The potential for production of wood crops is high.

**Newark silt loam (Ne).**—The surface layer of this soil is dark grayish-brown, friable silt loam. The upper part of the subsoil is dark grayish-brown, friable silt loam mottled with grayish brown. At a depth of about 10 inches, the subsoil is predominantly grayish brown and has mottles of brown, dark grayish brown, and strong brown. Below a depth of about 24 inches, it is gray, friable silt loam mottled with dark grayish brown.

Included in the areas mapped are spots where the surface layer is very dark-brown to black silty clay loam and the subsoil is dark grayish-brown, firm silty clay loam in the upper part and grades to gray silty clay or clay at a depth of about 24 inches.

This soil is easy to till. If well managed, it can be used continuously for cultivated crops. Adequately drained areas produce satisfactory yields of the crops commonly grown. Crops show good response to fertilizer. Crops that require an alkaline soil respond to lime. There is no erosion hazard. If adequately drained, this soil allows good movement of air and water. Otherwise, aeration and root growth are restricted by a high water table in winter and spring. Surface and tile drains can be used to lower the water table and reduce wetness. (Capability unit IIw-4; woodland group 2)

**Pembroke Series**

The Pembroke series consists of fertile upland soils that are deep and well drained. These soils developed in residuum weathered from high-grade limestone mixed with

a small amount of loess. The loess has made the soil friable, but generally it cannot be recognized as a separate layer.

**Representative profile:**

- 0 to 8 inches, dark-brown, very friable silt loam.
- 8 to 11 inches, reddish-brown, friable silty clay loam.
- 11 to 36 inches, yellowish-red or red, friable silty clay loam.
- 36 to 72 inches, dark-red, firm silty clay loam that grades to silty clay or clay at a depth of about 50 inches.

Limestone that is high in calcium carbonate and contains little or no chert commonly occurs at a depth of 4 to 10 feet. In places it may be at a depth of more than 10 feet.

The areas of these soils in Caldwell County are less than 490 feet in elevation. The slope range is 2 to 20 percent.

Pembroke soils are high or moderately high in natural fertility, very high to moderately high in moisture-supplying capacity, and strongly acid or medium acid. Roots and moisture easily penetrate the subsoil to a depth of 4 feet or more.

Most of the acreage has been cleared and is used for cultivated crops in cropping sequences that include some meadow and pasture plants and small grain. About half of the acreage has irregular, or karst, topography.

**Pembroke silt loam, 2 to 6 percent slopes (PbB).**—This soil is representative of the series. The surface layer is dark-brown or reddish-brown, friable silt loam. The subsoil is yellowish-red or red, friable silty clay loam. In a few areas thin strata of calcareous sandstone occur at a depth of about 3 feet. Limestone bedrock is generally at a depth of more than 5 feet. Locally, this soil is on old, high stream terraces and has a slightly redder, finer textured, and firmer subsoil than is typical.

This soil is very high in moisture-supplying capacity and high in natural fertility. It is easy to till and can be worked throughout a wide range of moisture content without clodding or crusting.

This soil is well suited to all of the crops commonly grown in the county, and, if limed and fertilized, produces satisfactory yields. About half of the acreage has irregular topography. Runoff is medium, and the hazard of erosion is moderately low. The potential for production of wood crops is high. (Capability unit IIe-1; woodland group 5)

**Pembroke silt loam, 2 to 6 percent slopes, eroded (PbB2).**—The present surface layer of this soil, for the most part a mixture of the original surface layer and material from the subsoil, is predominantly dark-brown to reddish-brown silt loam. In some small, severely eroded areas, which make up less than 25 percent of the acreage, the surface layer is reddish-brown to yellowish-red silt loam or silty clay loam. The subsoil is yellowish-red or red, friable silty clay loam. In a few areas this soil is underlain by thin strata of calcareous sandstone. Limestone bedrock is generally at a depth of more than 5 feet. Locally, this soil is on old, high stream terraces and has a slightly redder, finer textured, and firmer subsoil than is typical. The slope range is mainly 4 to 6 percent.

This soil is high in both moisture-supplying capacity and natural fertility. Except for the severely eroded spots, it is easy to till and can be worked throughout a wide range of moisture content. It is low in organic-matter content, however, and is likely to crust.

This soil is well suited to all of the crops commonly grown in the county, and, if limed and fertilized, produces satisfactory yields. Measures that reduce runoff and help to control erosion are needed if cultivated crops are grown. Almost half of the acreage has irregular topography. Only a small acreage is wooded. The potential for production of wood crops is high. (Capability unit IIe-1; woodland group 5)

**Pembroke silt loam, 6 to 12 percent slopes (PbC).**—The surface layer of this soil is dark-brown or reddish-brown silt loam. The subsoil is yellowish-red or red, friable silty clay loam. In a few areas thin strata of calcareous sandstone occur at a depth of about 3 feet. Limestone bedrock is generally at a depth of more than 5 feet.

This soil is high in both moisture-supplying capacity and natural fertility. It is easy to till and can be worked throughout a wide range of moisture content without clodding or crusting.

This soil is well suited to all of the crops commonly grown in the county and, if limed and fertilized, produces satisfactory yields. Measures that help to control erosion are needed if cultivated crops are grown. About 80 percent of the acreage has irregular topography. The potential for production of wood crops is high. (Capability unit IIIe-1; woodland group 5)

**Pembroke silt loam, 6 to 12 percent slopes, eroded (PbC2).**—The surface layer of this soil, for the most part a mixture of the original surface layer and material from the subsoil, is predominantly dark-brown to reddish-brown silt loam. In some severely eroded spots, which make up less than 25 percent of the acreage, the surface layer is reddish-brown to yellowish-red, friable silt loam or silty clay loam. In a few areas strata of calcareous sandstone occur at a depth of about 3 feet. Locally, this soil has developed on old, high stream terraces and has a finer textured and firmer subsoil than is typical.

This soil is high in both moisture-supplying capacity and natural fertility. Except for the severely eroded spots, it is easy to till and can be worked throughout a wide range of moisture content without clodding. It is low in organic-matter content, however, and is likely to crust.

This soil is well suited to all of the crops commonly grown in the county and, if limed and fertilized, produces satisfactory yields. Measures that help to control erosion are needed if cultivated crops are grown. About 60 percent of the acreage has irregular topography. Only a small acreage is wooded. The potential for production of wood crops is high. (Capability unit IIIe-1; woodland group 5)

**Pembroke silt loam, 12 to 20 percent slopes, eroded (PbD2).**—The present surface layer of this soil, for the most part a mixture of the original surface layer and material from the subsoil, is dark-brown to reddish-brown silt loam. In the severely eroded spots, which make up less than 25 percent of the acreage, the surface layer is reddish-brown to yellowish-red silt loam or silty clay loam. The subsoil is yellowish-red or red, friable silty clay loam. Limestone bedrock is generally at a depth of more than 5 feet. Included in the areas mapped are tracts of Crider soils, the upper part of which contains a distinct layer of loess.

This soil is high in moisture-supplying capacity and moderately high in natural fertility. Except for the se-

verely eroded spots, it is easy to till and can be worked throughout a wide range of moisture content. It is low in organic-matter content, however, and is likely to crust.

Runoff is rapid, and the hazard of erosion is moderately high. Consequently, this soil should not be used for row crops. If cultivated, it requires measures that help to control erosion. It is suited to all of the pasture and meadow plants commonly grown in the county. About 20 percent of the acreage has irregular topography. The potential for production of wood crops is high. (Capability unit IVe-1; woodland group 5)

**Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded (PcC3).**—Erosion has removed most of the original surface layer from this soil. On more than 25 percent of the acreage, the present surface layer consists almost entirely of subsoil material. It is reddish-brown to yellowish-red silty clay loam. In areas where part of the original surface layer remains and is mixed with subsoil material, this layer is reddish-brown heavy silt loam. The subsoil is yellowish-red or red, friable silty clay loam. Limestone bedrock is generally at a depth of more than 5 feet.

This soil is high in moisture-supplying capacity and moderately high in natural fertility. It can be worked within only a narrow range of moisture content without clodding. It is very low in organic-matter content and is likely to crust. Crusting interferes with the germination of seeds and the survival of seedlings.

Runoff is rapid, and controlling erosion is difficult if cultivated crops are grown. If limed, fertilized, mulched, and otherwise well managed, this soil is suited to nearly all of the pasture and meadow plants commonly grown in the county. About 60 percent of the acreage has irregular topography. The potential for production of wood crops is moderate. Shortleaf pine and loblolly pine are suitable for planting. (Capability unit IVe-9; woodland group 6)

**Pembroke silty clay loam, 12 to 20 percent slopes, severely eroded (PcD3).**—On more than 25 percent of the acreage, the present surface layer of this soil consists almost entirely of subsoil material. It is reddish-brown to yellowish-red silty clay loam. In areas where part of the original surface layer remains and has been mixed with subsoil material, this layer is reddish-brown silt loam. The subsoil is yellowish-red or red, friable silty clay loam. Limestone is generally at a depth of more than 5 feet. Included in the areas mapped are tracts of Crider soils, the upper part of which contains a distinct layer of loess.

This soil is moderately high in both moisture-supplying capacity and natural fertility. It can be worked within only a narrow range of moisture content without clodding. It is very low in organic-matter content and is likely to crust. Crusting interferes with the germination of seeds and the survival of seedlings.

Runoff is rapid, and the erosion hazard is severe. Consequently, this soil is not suited to row crops. If limed, fertilized, mulched, and otherwise well managed, it is suited to most of the pasture and meadow plants commonly grown in the county. About 70 percent of the acreage has irregular topography. The potential for production of wood crops is moderate. Shortleaf pine and loblolly pine are suitable for planting. (Capability unit VIe-2; woodland group 6)

## Quarries and Dumps

There are two commercial limestone quarries in this county; one is near Cedar Bluff, and the other is near Fredonia Valley. Quarries and dumps (Qd) consists of the excavations made in quarrying limestone, the piles of merchantable rock, and the piles of waste rock. The size of the quarries is fairly stable, for most of the rock is quarried underground. The size of the piles of merchantable rock varies from time to time. The piles of waste rock are fairly stable. Most of the waste accumulated when the quarries were opened, and little has been added in recent years. Some trees are growing in the waste rock areas. (Not assigned to a capability unit; woodland group 15)

## Ramsey Series

The Ramsey series consists of excessively drained upland soils that developed in residuum weathered from sandstone, siltstone, and shale.

Representative profile:

- 0 to 3 inches, dark grayish-brown, very friable stony silt loam.
- 3 to 12 inches, yellowish-brown, very friable stony silt loam.
- 12 to 16 inches, yellowish-brown, friable stony sandy loam.
- 16 inches, sandstone bedrock.

Ramsey soils are stony, are strongly sloping to steep, and have weakly developed profiles. In Caldwell County, they are mapped as part of an undifferentiated group with Dekalb and Muskingum soils. This group is described under the heading "Dekalb Series." A detailed description of Ramsey soils is given in the section "Formation, Classification, and Morphology of the Soils."

## Rock Land, Limestone

**Rock land, limestone** (Ro) consists of areas in which limestone outcrops are so common that the use of farm machinery is impractical. Ordinarily, these outcrops are 10 to 30 feet apart and cover 25 to 90 percent of the surface. Most commonly, the slope range is 12 to 30 percent. The soil material between the rock ledges is similar to that of Fredonia soils.

This land type is suited only to woodland. It is not suitable for cultivation. Parts of the less sloping areas can be used as pasture. Most of the acreage is wooded. The dominant species is redcedar. (Capability unit VIIIs-5; woodland group 15)

## Rock Land, Sandstone

**Rock land, sandstone** (Rs) consists of areas in which sandstone outcrops and loose sandstone of various sizes cover 25 to 90 percent of the surface. Also, there are many vertical cliffs 30 to 60 feet in height. In places a series of two or three vertical cliffs occur, and 25 to 90 percent of the area between these cliffs is made up of outcrops and loose stones. The slope range is ordinarily 20 to 50 percent, but in places the slope is less than 20 percent.

Nearly all of the acreage is wooded. None of it is suitable for cultivation, for the use of farm machinery is impossible. Very little is suitable for pasture. The forests consist predominantly of Virginia pine and small,

slow-growing hardwoods. Post oak and hickory are the dominant hardwood species. Upland oak, yellow-poplar, and Virginia pine grow well on the lower parts of the northern and eastern slopes. (Capability unit VIIIs-5; woodland group 15)

## Russellville Series

The Russellville series consists of well drained and moderately well drained upland soils that developed in loess over residuum weathered from limestone. These soils have a weak fragipan.

Representative profile:

- 0 to 9 inches, brown, friable silt loam.
- 9 to 14 inches, brown, friable heavy silt loam.
- 14 to 24 inches, strong-brown, friable silty clay loam.
- 24 to 32 inches, yellowish-brown, friable silty clay loam; a few pale-brown mottles.
- 32 to 37 inches, pale-brown, slightly compact and brittle silt loam; mottles of yellowish brown and strong brown.
- 37 to 42 inches, brown, compact and moderately brittle heavy silt loam; many mottles of light brownish gray and pale brown.
- 42 to 80 inches, dark-red, firm silty clay or silty clay loam; mottles and streaks of gray and brown. The amount of chert ranges from none to abundant.

These soils are in the west-central and southwestern parts of the county. The slope range is 2 to 20 percent.

Russellville soils are strongly acid or very strongly acid. According to the degree of erosion and steepness of slope, they differ in such qualities as natural fertility, moisture-supplying capacity, and workability. Roots and moisture easily penetrate the subsoil as far down as the fragipan.

**Russellville silt loam, 2 to 6 percent slopes** (RuB).— This soil is representative of the series. The surface layer is dark-brown, friable silt loam 6 to 9 inches thick. The subsoil is dark-brown or strong-brown, friable heavy silt loam to silty clay loam. It is ordinarily heavy silt loam in the uppermost few inches and light silty clay loam in the lower part. At a depth of about 2 feet, the subsoil grades to yellowish brown in color and most commonly has a few pale-brown mottles. The fragipan is at a depth of about 32 inches. The uppermost 2 to 5 inches of the pan is pale-brown silt loam. At a depth of about 37 inches, this grades to compact, moderately brittle heavy silt loam mottled with brown and brownish gray. The pan becomes more compact and brittle with increasing depth. It has a gradual lower boundary. About 42 inches below the surface, there is a layer of dark-red, firm silty clay or silty clay loam. The amount of chert in this layer ranges from none to abundant. Mottles and streaks of gray and brown are common. In some small spots the depth to this red clayey material is 4 feet or more. The loess is ordinarily 24 to 42 inches thick, but in two small areas it is 42 to 48 inches thick and overlies gravelly Coastal Plain material.

This soil is high in both natural fertility and moisture-supplying capacity. It is strongly acid or very strongly acid. It is easy to keep in good tilth and can be cultivated throughout a wide range of moisture content without clodding or crusting.

Most of the acreage has been cleared and is used for cultivated crops in cropping sequences that include pasture

and meadow plants and small grains. If well managed, this soil produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer.

Although they may be thinned by frost heaving, alfalfa stands generally remain productive 3 to 5 years, depending on the fertility of the soil and the severity of the winters. The erosion hazard is moderately low. Measures that reduce the hazards of runoff and erosion are needed if cultivated crops are grown. (Capability unit IIe-10; woodland group 7)

**Russellville silt loam, 2 to 6 percent slopes, eroded (RuB2).**—On much of the acreage, the surface layer of this soil is yellowish-brown, friable silt loam 4 to 6 inches thick. It is a mixture of brown silt loam, a remnant of the original surface layer, and strong-brown or dark-brown heavy silt loam, which was originally subsoil material. There are some uneroded spots. Also, there are spots eroded to the degree that the present surface layer consists almost entirely of subsoil material. These severely eroded spots make up less than 25 percent of the acreage. The subsoil is dark-brown or strong-brown, friable silty clay loam. At a depth of about 21 inches, it grades to yellowish brown in color and most commonly has a few pale-brown mottles. The fragipan, which is at a depth of about 28 inches, is pale-brown, compact and brittle silt loam that has brownish-gray and brown mottles. The pan has a gradual lower boundary. About 36 inches below the surface, there is a layer of dark-red, firm silty clay or silty clay loam. The amount of chert in this layer ranges from none to abundant. Mottles and streaks of grayish brown are common. In places the depth to this red clayey material is 4 feet or more. The thickness of the loess varies greatly within short distances. In two small areas the loess is 42 to 48 inches thick and overlies gravelly Coastal Plain material.

This soil is moderately high in natural fertility, high in moisture-supplying capacity, and strongly acid or very strongly acid. It is easy to work but is low in organic-matter content and tends to crust after heavy rains.

Most of the acreage has been cleared and is used for cultivated crops in cropping sequences that include some pasture and meadow plants and small grain. If well managed, this soil produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer. The yields may be somewhat lower than those on the uneroded Russellville soils. If fertility and weather conditions are favorable, this soil produces good yields of alfalfa for 3 to 5 years. After that, the stand is likely to become thin, as a result of frost heaving. For the most part, the slope range is 4 to 6 percent. The erosion hazard is moderately low. Measures that reduce the hazards of runoff and erosion are needed. (Capability unit IIe-10; woodland group 7)

**Russellville silt loam, 6 to 12 percent slopes (RuC).**—The surface layer of this soil is dark-brown, friable silt loam 6 to 8 inches thick. The subsoil is dark-brown or strong-brown, friable heavy silt loam to silty clay loam. It is ordinarily heavy silt loam in the uppermost few inches and light silty clay loam in the lower part. At a depth of about 2 feet, the subsoil grades to yellowish brown in color and commonly has a few pale-brown mottles. The fragipan, which is at a depth of about 30 inches, is pale-brown, compact and brittle silt loam mottled with

brown and grayish brown. It has a gradual lower boundary. About 40 inches below the surface, there is a layer of dark-red, firm silty clay or silty clay loam. The amount of chert in this layer ranges from none to abundant. Mottles and streaks of gray and brown are common. In spots the depth to this red clayey material is 4 feet or more. The thickness of the loess varies greatly within short distances. In two small areas the loess is 42 to 46 inches thick and overlies Coastal Plain material, most of which is gravelly.

This soil is high in both natural fertility and moisture-supplying capacity. It is strongly acid or very strongly acid. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting.

Much of the acreage is wooded. The cleared areas are used for cultivated crops in cropping sequences that include some meadow and pasture plants. If well managed, this soil produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer. Although they may be thinned by frost heaving, alfalfa stands generally remain productive for 3 to 5 years, depending on the fertility of the soil and the severity of the winters. The erosion hazard is moderate. Measures that reduce the hazard of runoff and erosion are needed if cultivated crops are grown. (Capability unit IIIe-2; woodland group 7)

**Russellville silt loam, 6 to 12 percent slopes, eroded (RuC2).**—On much of the acreage, the surface layer of this soil is yellowish-brown, friable silt loam 4 to 6 inches thick. It is a mixture of brown silt loam, which is the remnant of the original surface layer, and strong-brown or dark-brown heavy silt loam, which was originally subsoil material. There are some uneroded spots. Also, there are spots eroded to the degree that the present surface layer consists almost entirely of subsoil material. These severely eroded spots make up less than 25 percent of the acreage. The subsoil is dark-brown or strong-brown, friable silty clay loam. At a depth of about 21 inches, it grades to yellowish brown in color and commonly has a few pale-brown mottles. The fragipan, which is at a depth of about 27 inches, is pale-brown, compact and brittle silt loam that has brownish-gray and brown mottles. The pan has a gradual lower boundary. About 36 inches below the surface, there is a layer of dark-red, firm silty clay or silty clay loam. The amount of chert in this layer ranges from none to abundant. Mottles and streaks of gray and brown are common. In places the depth to this red clayey material is 4 to 5 feet. The thickness of the loess varies greatly within short distances. In two small areas the loess is 42 to 46 inches thick and overlies gravelly Coastal Plain material.

This soil is moderately high in both natural fertility and moisture-supplying capacity. It is strongly acid or very strongly acid. It is easy to work but is low in organic-matter content and tends to crust after heavy rains.

Most of the acreage has been cleared and is used for cultivated crops in cropping sequences that include some pasture and meadow plants. If well managed, this soil produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer. The yields are likely to be lower than those on the uneroded Russellville soils. Although they may be thinned by frost heaving, alfalfa stands generally remain produc-

tive 3 to 5 years, depending on the fertility of the soil and the severity of the winters.

The erosion hazard is moderate. Measures that reduce the hazard of runoff and erosion are needed if cultivated crops are grown. (Capability unit IIIe-2; woodland group 7)

**Russellville silt loam, 6 to 12 percent slopes, severely eroded (RuC3).**—Erosion has removed practically all of the original surface layer from much of this soil. On more than 75 percent of the acreage, the present surface layer is yellowish-brown heavy silt loam. In spots it is a mixture of brown silt loam, which is the remnant of the original surface layer, and strong-brown or dark-brown silt loam, which was originally material from the upper part of the subsoil. The subsoil is dark-brown or strong-brown, friable silty clay loam. At a depth of about 18 inches, it grades to yellowish brown in color and most commonly has a few pale-brown mottles. The fragipan, which is at a depth of about 2 feet, is pale-brown, compact and brittle silt loam that has brownish-gray and brown mottles. The pan has a gradual lower boundary. About 33 inches below the surface, there is a layer of dark-red, firm silty clay or silty clay loam. The amount of chert in this layer ranges from none to abundant. Mottles and streaks of gray and brown are common. In places the depth to this red clayey material is 4 to 5 feet. The thickness of the loess varies greatly within short distances. In two small areas it is 42 to 46 inches thick and overlies gravelly Coastal Plain material.

This soil is moderate in natural fertility, moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. It is susceptible to crusting, which interferes with germination of seeds and the survival of seedlings, particularly those planted in spring.

Because of rapid runoff and a moderately high erosion hazard, the limitations and risks of damage to this soil are severe if row crops are grown. If well managed, this soil is suited to most of the pasture and meadow plants commonly grown. Such plants show good response to lime and fertilizer. Although they may be thinned by frost heaving, alfalfa stands generally remain productive 3 to 5 years, depending on the fertility of the soil and the severity of the winters. Measures that reduce the hazard of runoff and erosion are needed if cultivated crops are grown. The potential for production of wood crops is moderate. (Capability unit IVe-14; woodland group 6)

**Russellville silt loam, 12 to 20 percent slopes, eroded (RuD2).**—On much of the acreage, the surface layer of this soil is yellowish-brown, friable silt loam 4 to 6 inches thick. It is a mixture of brown silt loam, which is the remnant of the original surface layer, and strong-brown or dark-brown heavy silt loam, which was originally subsoil material. There are some uneroded spots. Also, there are spots eroded to the degree that the present surface layer consists almost entirely of subsoil material. These severely eroded spots make up less than 25 percent of the acreage. At a depth of about 20 inches, the subsoil grades to yellowish brown in color and commonly has a few pale-brown mottles. The fragipan, which is at a depth of about 27 inches, is pale-brown, compact and brittle silt loam that has brownish-gray and brown mottles. The pan has a gradual lower boundary. About 36

inches below the surface, there is a layer of dark-red, firm silty clay or silty clay loam. The amount of chert in this layer ranges from none to abundant. Mottles and streaks of gray and brown are common. In places the depth to this red clayey material is 4 to 5 feet. The thickness of the loess varies greatly within short distances. In two small areas the loess is 42 to 46 inches thick and overlies gravelly Coastal Plain material.

This soil is moderately high in both natural fertility and moisture-supplying capacity. It is strongly acid or very strongly acid. It is easy to work but is low in organic-matter content and tends to crust after heavy rains.

Most of the acreage has been cleared and is used for cultivated crops, but part of it either has reverted to woodland or is idle. In recent years some of the wooded areas have been cleared and seeded to pasture.

The moderately high erosion hazard is a severe limitation, and erosion control is needed if row crops are grown. If well managed, this soil produces satisfactory yields of most of the pasture and meadow plants commonly grown. Such plants show good response to lime and fertilizer. Although they may be thinned by frost heaving, alfalfa stands generally remain productive 3 to 5 years, depending on the fertility of the soil and the severity of the winters. The potential for production of wood crops is moderately high. (Capability unit IVe-3; woodland group 7)

**Russellville silt loam, 12 to 20 percent slopes, severely eroded (RuD3).**—Erosion has removed practically all of the original surface layer from much of this soil. The present surface layer is yellowish-brown heavy silt loam. There are small areas where the surface layer is a mixture of brown silt loam, which is the remnant of the original surface layer, and strong-brown or dark-brown silt loam, which is material from the upper part of the subsoil. At a depth of about 17 inches, the subsoil grades to yellowish brown in color and commonly has a few pale-brown mottles. The fragipan, which is at a depth of about 2 feet, is pale-brown, compact and brittle silt loam that has brownish-gray and brown mottles. It has a gradual lower boundary. About 32 inches below the surface, there is a layer of dark-red firm silty clay or silty clay loam. The amount of chert in this layer ranges from none to abundant. Mottles and streaks of gray and brown are common. In places the depth to this red clayey material is 4 to 5 feet. The thickness of the loess varies greatly within short distances. In one small area the loess is between 42 and 46 inches thick and overlies gravelly Coastal Plain material.

This soil is moderate in natural fertility, moderately low in moisture-supplying capacity, and strongly acid or very strongly acid. It is susceptible to crusting, which interferes with the germination of seeds and the survival of seedlings, particularly those planted in spring.

This soil is not suited to cultivated crops because of rapid runoff and a high erosion hazard. If well managed, it is suited to most of the pasture and meadow plants commonly grown. Such plants show good response to lime and fertilizer. Although they may be thinned by frost heaving, alfalfa stands generally remain productive 3 to 5 years, depending on the fertility of the soil and the severity of the winters. The potential for the production of wood crops is moderate. (Capability unit VIe-2; woodland group 6)

## Sharkey Series

The Sharkey series consists of dark-colored, poorly drained, medium acid to alkaline soils on bottom lands. These soils formed in fine-textured, slack-water deposits. Representative profile:

- 0 to 5 inches, dark-gray to dark grayish-brown, firm silty clay loam.
- 5 to 9 inches, dark grayish-brown, firm silty clay loam; mottles of yellowish brown and gray.
- 9 to 48 inches, dark-gray, very plastic clay; mottles of yellowish brown, grayish brown, and reddish brown.

These soils are in the northeastern corner of Caldwell County. They are frequently flooded. The total acreage is small, and about two-thirds of it is wooded.

Sharkey soils are high in natural fertility and are very high or high in moisture-supplying capacity. The movement of air and water is slow because of the clayey texture, but roots of plants that tolerate wetness penetrate to a depth of 4 feet or more.

**Sharkey silt loam, overwash (Sk).**—The surface layer of this soil is dark grayish-brown silt loam mottled with gray and light brownish gray. It ranges from 8 to 18 inches in thickness. This layer overlies dark-gray, very firm silty clay or clay mottled with yellowish brown, grayish brown, and reddish brown. This material may be several feet thick. The surface layer is commonly medium acid or slightly acid, but in the thickest spots it may be strongly acid. The underlying layers are slightly acid to alkaline. Most commonly, the reaction does not become alkaline above a depth of 3 feet.

This soil is very high in moisture-supplying capacity. It is easy to work, but cultivation often has to be delayed because of wetness.

This soil receives some overflow but is seldom flooded during the growing season. About half of the acreage is wooded. Most of the cleared acreage, which for the most part is inadequately drained, is used for corn and soybeans. Pasture and meadow plants are grown occasionally. Little fertilizer is used because of the wetness hazard, but yields are fair to satisfactory in some years. The potential for production of wood crops is high. (Capability unit IIIw-7; woodland group 2)

**Sharkey silty clay loam, overwash (So).**—This soil is representative of the series. The surface layer is dark-gray or dark grayish-brown, firm silty clay loam mottled with yellowish brown and gray. It overlies dark-gray, firm clay mottled with yellowish brown, grayish brown, and reddish brown. This underlying material is several feet thick. The surface layer is commonly medium acid or slightly acid. The underlying layer is slightly acid to mildly alkaline. Generally, the reaction is not alkaline at a depth of 2 feet or less.

This soil is high in moisture-supplying capacity. It can be worked within only a narrow range of moisture content without clodding.

This soil is frequently flooded. About three-fourths of the acreage is wooded, and about a third of this acreage is at the lowest elevation and is swampy. Most of the cleared acreage, which for the most part is inadequately drained, is used for corn and soybeans. Pasture and meadow plants are grown occasionally. Little fertilizer is used because of the wetness hazard. Nevertheless, in some years yields

are moderate to good. Except in the swampy areas, the potential for production of wood crops is high. (Capability unit IIIw-7; woodland group 2)

## Taft Series

The Taft series consists of somewhat poorly drained soils on stream terraces. These soils developed in alluvium that washed from areas of thin loess over limestone residuum. They have a fragipan.

Representative profile:

- 0 to 5 inches, grayish-brown to dark grayish-brown, friable silt loam.
- 5 to 10 inches, yellowish-brown or brown, friable silt loam; mottles of light brownish gray.
- 10 to 14 inches, light yellowish-brown, friable heavy silt loam; mottles of pale brown and light brownish gray.
- 14 to 20 inches, yellowish-brown heavy silt loam; many mottles of yellowish brown, pale brown, and light gray.
- 20 to 44 inches, mottled light-gray, yellowish-brown, and yellow, compact and brittle silty clay loam or silt loam.
- 44 to 48 inches, light-gray, firm silty clay loam or silt loam; mottles of yellowish brown.

Small, dark-brown to black, soft and hard concretions commonly occur on the surface and throughout the profile.

These soils occur in most parts of the county. The areas and the total acreage are small. Taft soils are moderately low in natural fertility, moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. They are low in organic-matter content. Roots and moisture penetrate as far down as the fragipan.

**Taft silt loam (Tc).**—The surface layer of this soil is grayish-brown or dark grayish-brown, friable silt loam. The upper part of the subsoil is light yellowish brown or brown and has many mottles of light brownish gray. The fragipan, which is 16 to 20 inches or more below the surface, is compact and brittle, mottled light-gray, yellowish-brown, and yellow silty clay loam or silt loam. The pan interferes with the movement of water and restricts root growth. The slope is ordinarily less than 2 percent, but in a few spots included in the areas mapped, it is as much as 4 percent.

This soil is strongly acid. It is easy to till, but wetness often delays tillage. If rainfall is well distributed and not too heavy, many of the common crops respond to lime and fertilizer, but if rainfall is heavy, only crops tolerant of wetness can be grown. Excess water can be removed by means of surface drainage from some areas but not from others. The potential for production of wood crops is moderately high. (Capability unit IIIw-1; woodland group 4)

## Tilsit Series

The Tilsit series consists of moderately well drained upland soils. The upper part of the profile developed in loess, and the lower part in residuum weathered from sandstone, shale, and siltstone. These soils have a fragipan.

Representative profile:

- 0 to 8 inches, dark grayish-brown, friable silt loam.
- 8 to 17 inches, yellowish-brown, friable silt loam or silty clay loam.
- 17 to 22 inches, yellowish-brown, friable heavy silt loam; mottles of light brownish gray.

22 to 26 inches, mottled yellowish-brown and light brownish-gray, compact and slightly brittle silt loam.

26 to 38 inches, light brownish-gray, compact and brittle silty clay loam; many mottles of yellowish brown and light gray.

38 to 53 inches, yellowish-brown, compact silty clay loam; mottles of light brownish gray.

The layer of loess is ordinarily 32 to 42 inches thick, but in some areas it is more than 48 inches thick. A few dark-brown or black, hard and soft concretions commonly are in the layers below the surface layer, and in some areas concretions occur within the surface layer.

In Caldwell County, these soils occupy broad ridgetops and gentle side slopes. The slope range is 0 to 12 percent.

Tilsit soils are strongly acid or very strongly acid. For the most part, they are easy to till and can be worked throughout a wide range of moisture content without clodding or crusting. Moisture and roots easily penetrate the subsoil as far down as the fragipan. Because of the pan, these soils are wet until late in spring. Tillage has to be delayed until the soils are dry enough to support equipment. If used for pasture when wet, these soils become compacted.

Most of the acreage has been cleared and is used for cultivated crops in cropping sequences that include some pasture and meadow plants and small grain.

**Tilsit silt loam, 0 to 2 percent slopes (TmA).**—The surface layer of this soil is dark grayish-brown, friable silt loam 7 to 10 inches thick. The upper part of the subsoil is yellowish brown and friable and has some light brownish-gray mottles. The fragipan, which is at a depth of about 20 inches, is brittle and compact in the uppermost 3 to 5 inches and is mottled with yellowish brown and light brownish gray. Below this, it is light brownish-gray silty clay loam mottled with yellowish brown and light gray. The pan becomes more compact with increasing depth. At a depth of 36 to 42 inches, it grades to residuum weathered from sandstone, shale, and siltstone. The residuum is commonly yellowish-brown, compact silty clay loam. In places it grades to fine sandy clay loam at a depth of 4 to 6 feet. Generally, there are dark-brown or black, soft and hard concretions in the layers below the surface layer, and in some areas concretions occur within the surface layer.

This soil is moderately high in both natural fertility and moisture-supplying capacity. If well managed, it produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer. Alfalfa stands ordinarily remain productive for 2 or 3 years. After that, they are likely to become thin, as a result of frost heaving. There is little erosion hazard, but there is a slight wetness limitation. (Capability unit IIw-1; woodland group 7)

**Tilsit silt loam, 2 to 6 percent slopes (TmB).**—This soil is representative of the series. The surface layer is dark grayish-brown, friable silt loam 6 to 8 inches thick. The upper part of the subsoil is yellowish-brown silt loam or silty clay loam. At a depth of about 17 inches, the subsoil is yellowish brown and friable and has some light brownish-gray mottles. The fragipan, which is at a depth of about 22 inches, is brittle and compact in the upper part and is mottled with yellowish brown and light brownish gray. In the lower part it is light brownish-gray silty clay loam mottled with yellowish brown and light gray. The pan becomes more compact with increasing depth.

At a depth of 36 to 42 inches, it grades to residuum weathered from sandstone, shale, and siltstone. The residuum is commonly yellowish-brown, compact silty clay loam. In places it grades to fine sandy clay loam at a depth of 4 or 5 feet. Generally, there are dark-brown or black, soft and hard concretions in the layers below the surface layer, and in places concretions occur within the surface layer.

This soil is moderately high in both natural fertility and moisture-supplying capacity. If well managed, it produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer. Alfalfa stands ordinarily remain productive for 2 or 3 years. After that, they are likely to become thin, as a result of frost heaving. There is some runoff and a moderately low erosion hazard. (Capability unit IIe-6; woodland group 7)

**Tilsit silt loam, 2 to 6 percent slopes, eroded (TmB2).**—The surface layer of this soil, a mixture of the original surface layer and material from the subsoil, is 4 to 6 inches thick, is brown or dark grayish brown, and has blotches of yellowish brown. The upper part of the subsoil is yellowish-brown silt loam or silty clay loam. At a depth of about 14 inches, the subsoil is yellowish brown and friable and has some light brownish-gray mottles. The fragipan, which is at a depth of about 19 inches, is brittle and compact silt loam mottled with yellowish brown and light brownish gray. This material grades to more compact, light brownish-gray silty clay loam mottled with yellowish brown and light gray. At a depth of 32 to 42 inches, the pan grades to residuum weathered from sandstone, shale, and siltstone. The residuum generally is compact silty clay loam, though in places it grades to fine sandy clay loam at a depth of 4 or 5 feet. Dark-brown or black, soft and hard concretions are common in the layers below the surface layer. Included in the areas mapped are a few spots that are severely eroded.

This soil is moderate in natural fertility and moderately low in moisture-supplying capacity. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content. This soil is low in organic-matter content, however, and tends to crust. Also, if too wet when worked, it is likely to clod in the severely eroded spots. Yields are somewhat lower than those on the un-eroded Tilsit soils, but if this soil is well managed, it produces satisfactory yields of all crops commonly grown. Crops show good response to lime and fertilizer. Alfalfa stands ordinarily are productive for 2 or 3 years. After that, they are likely to become thin, as a result of frost heaving. For the most part, the slope is 4 to 6 percent. There is some runoff and a moderately low erosion hazard. Erosion control is needed if cultivated crops are grown. (Capability unit IIe-6; woodland group 7)

**Tilsit silt loam, 6 to 12 percent slopes, eroded (TmC2).**—The surface layer of this soil, a mixture of the original surface layer and material from the subsoil, is brown or dark grayish-brown silt loam 4 to 6 inches thick. It has blotches of yellowish brown. In a few severely eroded spots, the subsoil is exposed. The upper part of the subsoil is yellowish-brown silt loam or silty clay loam. At a depth of about 14 inches, the subsoil is yellowish brown and friable and has some light brownish-gray mottles. The fragipan, which is at a depth of about 19 inches, is brittle and compact silt loam mottled with yellowish brown

and light brownish gray. It becomes more compact with increasing depth and grades to light brownish-gray silty clay loam mottled with yellowish brown and light gray. At a depth of 32 to 42 inches, the pan grades to residuum weathered from sandstone, shale, and siltstone. The residuum generally is compact silty clay loam. In places it becomes fine sandy clay loam at a depth of 4 or 5 feet. Ordinarily, there are dark-brown or black, hard and soft concretions.

This soil is moderate in natural fertility and moderately low in moisture-supplying capacity. It is easy to till and can be worked throughout a wide range of moisture content. This soil is low in organic-matter content, however, and tends to crust. Also, if too wet when worked, it is likely to clod in the severely eroded spots. Yields are lower than those on the uneroded Tilsit soils. If well managed, this soil produces fair yields of the crops commonly grown. Crops show good response to lime and fertilizer. Alfalfa stands ordinarily are productive for 2 or 3 years. After that, they are likely to become thin, as a result of frost heaving. Runoff and a moderate erosion hazard are limitations. Effective control measures are needed. (Capability unit IIIe-8; woodland group 7)

## Vicksburg Series

The Vicksburg series consists of well-drained to excessively drained soils on bottom lands. These soils formed in alluvium washed from soils that developed in thin loess over residuum weathered from sandstone, shale, and siltstone.

Representative profile:

- 0 to 6 inches, dark yellowish-brown, friable silt loam.
- 6 to 34 inches, dark yellowish-brown, yellowish-brown, or dark grayish-brown, friable silt loam.
- 34 to 48 inches, pale-brown, friable loam or silt loam; mottles of dark brown and yellowish red.

The texture throughout the profile is predominantly silt loam. In places there are sandy or clayey strata below a depth of 2 feet. These soils are free of mottles to a depth of 30 inches. They may become gray below a depth of 3 feet.

Most of the acreage of Vicksburg soils in this county occurs as narrow bottoms along the smaller branches. There are some larger areas along the larger streams, and these are subject to overflow. The overflow seldom damages growing crops.

Vicksburg soils are strongly acid. They are easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Roots and moisture easily penetrate to a depth of 4 feet or more.

**Vicksburg gravelly silt loam (Vb).**—This soil is well drained to excessively drained. The surface layer is brown gravelly silt loam 7 to 10 inches thick. The underlying material, which is much like the surface layer, is brown or yellowish-brown gravelly silt loam. In places the surface layer is underlain by strata of gravelly silty clay loam or sandy loam. Below a depth of 24 to 30 inches, there may be gravel beds that contain little soil material in the interstices. In places there are light brownish-gray mottles below a depth of 24 inches. The gravel consists mostly of sandstone fragments, but partly of shale and siltstone fragments.

This soil is moderately high in both natural fertility and moisture-supplying capacity. If well managed, it produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer. This soil is slightly droughty, but there is no erosion hazard or wetness limitation. Gravel interferes somewhat with tillage and dulls tillage implements. Much of the acreage is wooded. (Capability unit IIc-1; woodland group 1)

**Vicksburg silt loam (Vc).**—This is a deep, well-drained soil. It is representative of the series. The surface layer is brown or dark yellowish-brown, friable silt loam. It is underlain by dark yellowish-brown, yellowish-brown, or dark grayish-brown, friable silt loam. Below a depth of 3 feet, the color is pale brown or gray in some places. Sandy or clayey strata occur below a depth of 20 inches in some places.

This soil is high in natural fertility and very high in moisture-supplying capacity. If well managed, it produces satisfactory yields of all the crops commonly grown. Crops show good response to lime and fertilizer. There is no erosion hazard. (Capability unit I-1; woodland group 1)

## Waverly Series

The Waverly series consists of deep, poorly drained soils on bottom lands. These soils developed in alluvium washed mainly from soils that developed in loess and residuum weathered from sandstone and shale.

Representative profile:

- 0 to 1 inch, dark-brown silt loam; common, fine, distinct mottles of pale brown.
- 1 to 8 inches, light brownish-gray silt loam; many mottles of dark yellowish brown.
- 8 to 48 inches, light-gray silt loam; a few reddish-yellow mottles and dark-brown concretionary stains; many dark-brown concretions.

In this county, Waverly soils occur as small areas along the Tradewater River and its tributaries. They are closely associated with Falaya soils, but they are at a slightly lower elevation and are flooded for longer periods than those soils.

Waverly soils are very high in moisture-supplying capacity, moderate in natural fertility, and very strongly acid. They are low in organic-matter content. If adequately drained, they produce satisfactory yields of most crops commonly grown in the county. If not adequately drained, they are suited only to pasture and meadow plants that grow well on wet soils. They are well suited to bottom-land hardwoods. The total acreage is small. Much of it is wooded.

**Waverly silt loam (Wa).**—Most of this soil is on bottom lands and is subject to flooding. Some is on low terraces and has a weakly developed fragipan. In cultivated areas the surface layer is light brownish-gray, friable silt loam mottled with yellowish brown. In areas that have not been cultivated the surface layer is typically dark-brown or dark grayish-brown, friable silt loam mottled with pale brown. The subsoil is light brownish-gray or gray silt loam mottled with brown and yellow. With increasing depth, the gray becomes more extensive.

This soil is generally waterlogged in winter and spring. Occasional flooding late in spring, in addition to the natu-

ral wetness, often delays plowing and planting and damages growing crops. Crops show good response to lime and fertilizer if this soil is adequately drained. Both tile drainage and surface drainage can be used to remove the excess water. (Capability unit IIIw-5; woodland group 2)

## Wellston Series

The Wellston series consists of well-drained upland soils that developed in thin loess over residuum weathered from sandstone, shale, and siltstone.

Representative profile:

- 0 to 8 inches, brown, very friable silt loam.
- 8 to 11 inches, brown, friable heavy silt loam.
- 11 to 26 inches, brown to yellowish-red, friable silty clay loam.
- 26 to 32 inches, yellowish-red, friable sandy clay loam.
- 32 to 40 inches, variegated strong-brown, yellowish-red, and pale-brown sandy clay loam; small sandstone fragments.

The mantle of loess can be identified to a depth of 2 feet or more, but it is thinner and less distinct than that on the associated Zanesville soils. The bedrock is generally sandstone, but in places it is siltstone, or shale, or a mixture of the three. The depth to bedrock ranges from 2 to 6 feet.

Much of the acreage of Wellston soils in Caldwell County has been cleared and cultivated in the past. Some of it has reverted to woodland. The areas closely associated with stony and rocky soils, such as Muskingum, Dekalb, Litz, Ramsey, and Caneyville soils, have never been cleared.

Wellston soils are strongly acid or very strongly acid. Moisture and roots easily penetrate all the way down to bedrock.

The gently sloping and sloping areas are suited to all of the crops commonly grown. The strongly sloping areas are not well suited to cultivated crops, but they are well suited to pasture and meadow plants, and their potential for production of wood crops is moderately high.

**Wellston silt loam, 2 to 6 percent slopes (WeB).**—This soil is representative of the series. The surface layer is dark grayish-brown or brown, friable silt loam 6 to 8 inches thick. The upper part of the subsoil is dark-brown or yellowish-red to reddish-brown silt loam or silty clay loam. At a depth of about 11 inches, the subsoil is yellowish-red or strong-brown, friable silty clay loam. Below a depth of about 26 inches is a zone that is ordinarily yellowish-red fine sandy clay loam mottled with strong brown and pale brown. The depth to bedrock is generally more than 3 feet. Included in the areas mapped is a small acreage eroded to the degree that the present surface layer is a mixture of the original surface layer and material from the subsoil.

This soil is moderately high in natural fertility and high in moisture-supplying capacity. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting.

A large acreage is wooded. This soil is suited to all of the crops commonly grown and produces satisfactory yields if well managed. Crops show good response to lime and fertilizer. There is some runoff and a moderately low erosion hazard. Conservation measures are needed if cultivated crops are grown. (Capability unit IIe-9; woodland group 13)

**Wellston silt loam, 6 to 12 percent slopes (WeC).**—The surface layer of this soil is dark grayish-brown or brown, friable silt loam 6 to 8 inches thick. The upper part of the subsoil is dark-brown or yellowish-red to reddish-brown silt loam or silty clay loam. Between the depths of 11 and 26 inches, the subsoil is yellowish-red or strong-brown, friable silty clay loam. Below a depth of 26 inches is a zone that is ordinarily yellowish-red fine sandy clay loam mottled with strong brown and pale brown. In most places the depth to bedrock is more than 3 feet.

This soil is moderately high in both natural fertility and moisture-supplying capacity. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting.

Much of the acreage is wooded. This soil is suited to all of the crops commonly grown and produces satisfactory yields if well managed. Crops show good response to lime and fertilizer. There is some runoff and a moderate erosion hazard. Conservation measures are needed if cultivated crops are grown. (Capability unit IIIe-7; woodland group 13)

**Wellston silt loam, 6 to 12 percent slopes, eroded (WeC2).**—The surface layer of this soil, a mixture of the original surface layer and material from the subsoil, is dark grayish-brown or brown, friable silt loam that has blotches of yellowish red to reddish brown. This layer is 4 to 6 inches thick. The subsoil is yellowish-red or strong-brown, friable silty clay loam. Below a depth of 2 feet is a zone that is ordinarily yellowish-red fine sandy clay loam mottled with strong brown and pale brown. The depth to bedrock is generally more than 3 feet.

This soil is moderately high in both natural fertility and moisture-supplying capacity. It is easy to keep in good tilth and can be cultivated throughout a wide range of moisture content without clodding or crusting. This soil is low in organic-matter content and tends to crust after heavy rains, but crops show good response to lime and fertilizer.

Most of the acreage has been cleared and cultivated, but some of it has reverted to woodland. This soil is suited to all of the crops commonly grown and produces satisfactory yields if well managed. Yields tend to be lower than those on the uneroded Wellston soils. There is some runoff and a moderate erosion hazard. Conservation practices are needed if cultivated crops are grown. (Capability unit IIIe-7; woodland group 13)

**Wellston silt loam, 12 to 20 percent slopes (WeD).**—The surface layer of this soil is dark grayish-brown or brown, friable silt loam 6 to 8 inches thick. The upper part of the subsoil is dark brown or yellowish red to reddish brown in color and ranges from silt loam to silty clay loam in texture. Between the depths of 11 and 26 inches, the subsoil is yellowish-red or strong-brown, friable silty clay loam. At a depth of about 26 inches is a zone that is ordinarily yellowish-red fine sandy clay loam mottled with strong brown and pale brown. The depth to bedrock is generally more than 3 feet.

This soil is moderately high in both natural fertility and moisture-supplying capacity. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting.

Much of the acreage occurs as small areas that are closely associated with Muskingum, Dekalb, Litz, Ramsey,

and Caneyville stony and rocky soils. A large acreage is wooded. If well managed, this soil is well suited to all of the pasture and meadow plants commonly grown. It can be used for cultivated crops occasionally, but conservation measures are needed. Crops show good response to lime and fertilizer. Runoff is rapid, and the erosion hazard is moderately high. (Capability unit IVE-4; woodland group 13)

**Wellston silt loam, 12 to 20 percent slopes, eroded (WeD2).**—The surface layer of this soil, a mixture of the original surface layer and material from the subsoil, is dark grayish-brown or brown, friable silt loam that has blotches of yellowish red or reddish brown. This layer is 4 to 6 inches thick. The subsoil is yellowish-red or strong-brown, friable silty clay loam. At a depth of about 2 feet is a zone that is ordinarily yellowish-red fine sandy clay loam mottled with strong brown and yellowish brown. The depth to bedrock is generally more than 3 feet.

This soil is moderately high in both natural fertility and moisture-supplying capacity. It is easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. This soil is low in organic-matter content and tends to crust after heavy rains, but crops show good response to lime and fertilizer.

Most of the acreage has been cleared and cultivated, but some of it has reverted to woodland. This soil is not well suited to cultivated crops, but if it is well managed, it produces satisfactory yields of all the pasture and meadow plants commonly grown. Runoff is rapid, and the erosion hazard is moderately high. Conservation measures are needed if cultivated crops are grown. (Capability unit IVE-4; woodland group 13)

**Wellston silty clay loam, 6 to 12 percent slopes, severely eroded (WnC3).**—The surface layer of this soil is yellowish-brown or strong-brown silty clay loam. In some places it is splotched with red. In part of the area the present surface layer is a mixture of the original brown surface layer and the strong-brown or yellowish-red material from the subsoil. The subsoil is friable silty clay loam. The lower part of it is ordinarily yellowish-red fine sandy clay loam mottled with strong brown and pale brown. The depth to bedrock ranges from 1½ to 6 feet but is generally more than 2 feet.

This soil is moderately low in both natural fertility and moisture-supplying capacity. It can be worked within only a somewhat narrow range of moisture content without clodding. It is very low in organic-matter content and tends to crust. Crusting interferes with the germination of seeds and the survival of seedlings.

Most of the acreage has been cleared and cultivated, but some of it either has reverted to woodland or is idle. Cultivated crops are poorly suited. They should be grown only occasionally, and they necessitate effective conservation measures. Most of the commonly grown pasture and meadow plants do well. Crops show good response to lime and fertilizer. Runoff is rapid, and the erosion hazard is moderately high. (Capability unit IVE-9; woodland group 6)

**Wellston silty clay loam, 12 to 20 percent slopes, severely eroded (WnD3).**—On more than 75 percent of the acreage, the surface layer of this soil is yellowish-brown or strong-brown light silty clay loam splotched with yellowish red. On the rest of the acreage, it is silt loam in

texture and is a mixture of the original brown surface layer and the strong-brown or yellowish-red material from the subsoil. The subsoil is friable silty clay loam. Below a depth of approximately 20 inches is a zone that is ordinarily yellowish-red fine sandy clay loam mottled with strong brown and pale brown. The depth to bedrock ranges from 1½ to 6 feet but is generally more than 2 feet.

This soil is moderately low in both natural fertility and moisture-supplying capacity. It can be worked within only a narrow range of moisture content without clodding. It is very low in organic-matter content and tends to crust. Crusting interferes with the germination of seeds and the survival of seedlings.

Most of the acreage has been cleared and cultivated, but some of it either has reverted to woodland or is idle. This soil is not suited to cultivated crops because of the high erosion hazard. If well managed, it is suited to most of the pasture and meadow plants commonly grown. (Capability unit VIe-2; woodland group 6)

## Zanesville Series

The Zanesville series consists of well drained and moderately well drained upland soils that developed in loess and residuum weathered from sandstone, shale, and siltstone, and in some areas from limestone also. These soils have a fragipan.

Representative profile:

- 0 to 7 inches, brown, very friable silt loam.
- 7 to 22 inches, strong-brown, friable light silty clay loam.
- 22 to 28 inches, strong-brown or yellowish-brown, friable light silty clay loam.
- 28 to 31 inches, yellowish-brown, slightly compact and brittle silt loam; many pale-brown mottles.
- 31 to 37 inches, light brownish-gray, compact and brittle heavy silt loam; many yellowish-brown, grayish-brown, and light-gray mottles.
- 37 to 80 inches, strong-brown or yellowish-brown, compact heavy silt loam; many mottles of light brownish gray. Sand grains are visible, and the percentage increases slightly with depth.

These are the most extensive soils in the county. The slope range is 2 to 20 percent. The loess is ordinarily 24 to 40 inches thick, but in spots within each area of these soils it is more than 48 inches thick. The depth to bedrock ranges from about 2 to more than 4 feet.

Zanesville soils are strongly acid to very strongly acid. They vary in such qualities as natural fertility, moisture-supplying capacity, and workability. The amount of variation depends on the degree of erosion and the steepness of slopes. Roots and moisture easily penetrate as far down as the fragipan.

**Zanesville silt loam, 2 to 6 percent slopes (ZcB).**—This soil is representative of the series. The surface layer is brown silt loam 6 to 8 inches thick. The subsoil is strong brown or yellowish brown in color and ranges from silt loam to silty clay loam in texture. The mottled gray and yellow, compact and brittle fragipan is about 30 inches below the surface and is 8 to 10 inches thick. It is underlain by residuum derived from sandstone, shale, and siltstone, and in some areas from limestone also. The residuum varies in color and texture but is generally strong brown or yellowish brown and is compact in many places.

This soil is high in moisture-supplying capacity and moderately high in natural fertility. It is easy to till and can be worked throughout a wide range of moisture content.

This soil is well suited to all of the crops commonly grown and produces satisfactory yields if well managed. Crops show good response to lime and fertilizer. Although they may be thinned by frost heaving, alfalfa stands generally remain productive 3 to 5 years, depending on the fertility of the soils and the severity of the winters. There is some runoff and a moderately low erosion hazard. Conservation measures are needed if cultivated crops are grown. The potential for production of wood crops is moderately high. (Capability unit IIe-10; woodland group 13)

**Zanesville silt loam, 2 to 6 percent slopes, eroded (ZaB2).**—Erosion has removed part of the original surface layer from this soil. The present surface layer is a mixture of the original surface layer and material from the subsoil. On most of the area it is brown silt loam splotched with yellowish brown. In severely eroded spots, which make up less than 25 percent of the acreage, the yellowish-brown or strong-brown heavy silt loam subsoil is exposed. The fragipan, which is about 26 inches below the surface, is gray and compact and is about 10 inches thick. It is underlain by residuum weathered from sandstone, shale, and siltstone and in some areas from limestone also. This residuum varies in color and texture but is generally strong-brown or yellowish-brown silt loam, sandy loam, or silty clay loam mottled with gray. The residuum is compact in many places.

This soil is moderately high in both natural fertility and moisture-supplying capacity. It is low in organic-matter content, but crops show good response to lime and fertilizer. Yields are likely to be lower than those on the uneroded Zanesville soils. If limed, fertilized, and otherwise well managed, this soil is suited to practically all of the crops commonly grown. Although they may be thinned by frost heaving, alfalfa stands generally remain productive for 3 to 5 years, depending on the fertility of the soil and the severity of the winters. There is an erosion hazard, though it is not severe. Conservation measures are needed if row crops are grown. (Capability unit IIe-10; woodland group 13)

**Zanesville silt loam, 6 to 12 percent slopes (ZaC).**—The surface layer of this soil is brown silt loam 6 to 8 inches thick. The subsoil is strong brown to yellowish brown in color and ranges from silt loam to silty clay loam in texture. The fragipan, which is about 30 inches below the surface, is mottled gray and yellow, compact, and 8 to 10 inches thick. It is underlain by residuum derived from sandstone, shale, and siltstone, and in some areas from limestone also. This residuum varies in color and texture but is generally yellowish-brown silt loam, sandy loam, or silty clay loam mottled with gray. It is compact in many places.

This soil is high in moisture-supplying capacity and moderately high in natural fertility. It is easy to till and can be worked throughout a wide range of moisture content.

If limed, fertilized, and otherwise well managed, this soil is well suited to practically all the common crops. Crops show good response to lime and fertilizer. Although they may be thinned by frost heaving, alfalfa stands generally remain productive 3 to 5 years, depending on the fertility of the soils and the severity of the winters. The erosion hazard is moderate. Consequently, conservation measures are needed if cultivated crops are grown.

The potential for production of wood crops is moderately high. (Capability unit IIIe-2; woodland group 13)

**Zanesville silt loam, 6 to 12 percent slopes, eroded (ZaC2).**—Erosion has removed part of the original surface layer from this soil. The present surface layer is a mixture of the original surface layer and material from the subsoil. In spots, it consists mostly of subsoil material. On most of the area, the surface layer is brown silt loam mixed with yellowish-brown heavy silt loam. In the more severely eroded spots, which make up less than 25 percent of the acreage, it is yellowish-brown or strong-brown heavy silt loam. The subsoil is strong-brown or yellowish-brown in color and ranges from silt loam to silty clay loam in texture. The fragipan, which is about 2 feet below the surface, is gray and yellow, compact, and about 8 to 10 inches thick. The pan is underlain by residuum derived from sandstone, siltstone, and shale, and in some areas residuum from limestone also. The residuum varies in color and texture but is generally yellowish-brown silt loam, sandy loam, or silty clay loam mottled with gray. It is compact in many places.

This soil is moderately high in both natural fertility and moisture-supplying capacity. It is low in organic-matter content, but crops show good response to lime and fertilizer. This soil tends to crust. Crusting interferes with the germination of seeds and the survival of seedlings.

If limed, fertilized, and otherwise well managed, this soil is well suited to practically all of the crops commonly grown in the county. Yields are likely to be lower than those on the uneroded Zanesville soils. Although they may be thinned by frost heaving, alfalfa stands generally remain productive 3 to 5 years, depending on the fertility of the soil and the severity of the winters. The erosion hazard is moderate, and conservation measures are needed if cultivated crops are grown. The potential for production of wood crops is moderately high. (Capability unit IIIe-2; woodland group 13)

**Zanesville silt loam, 6 to 12 percent slopes, severely eroded (ZaC3).**—Erosion has removed practically all of the original surface layer from much of this soil. The present surface layer, a mixture of the original surface layer and material from the subsoil, ranges from yellowish-brown silt loam or light silty clay loam to brown silt loam and strong-brown heavy silt loam. The fragipan, which is at a depth of about 20 inches, is gray mottled with yellow, compact, and 8 to 10 inches thick. It is underlain by residuum derived from sandstone, siltstone, and shale, and in some areas from limestone also. The residuum varies in color and texture but is generally yellowish-brown silt loam, sandy loam, or silty clay loam mottled with gray. It is compact in many places.

This soil is moderately low in both natural fertility and moisture-supplying capacity. It is very low in organic-matter content, but crops show good response to lime and fertilizer. This soil tends to crust, and the crusting interferes with the germination of seeds and the survival of seedlings.

Rapid runoff and a moderately high erosion hazard make this soil poorly suited to cultivated crops. If limed, fertilized, and otherwise well managed, this soil is suited to most of the pasture and meadow plants commonly grown. Although they may be thinned by frost heaving, alfalfa stands generally remain productive 3 to 5 years, depending on the fertility of the soil and the severity of the winters.

Conservation measures are needed if cultivated crops are grown. The potential is low for production of oaks and moderate for production of pines. (Capability unit IVE-14; woodland group 6)

**Zanesville silt loam, 12 to 20 percent slopes, eroded (ZcD2).**—Erosion has removed part of the original surface layer from this soil. The present surface layer is a mixture of the original surface layer and material from the subsoil. In most of the area the surface layer is brown silt loam mixed with yellowish-brown heavy silt loam. In spots it is yellowish-brown or strong-brown heavy silt loam or light silty clay loam. The undisturbed subsoil material is strong-brown or yellowish-red silt loam or silty clay loam. The compact fragipan, which is about 2 feet below the surface, is gray mottled with yellow and is 6 to 9 inches thick. The residuum below the pan was derived from sandstone, siltstone, and shale and in some areas from limestone also. It varies in color and texture but is generally yellowish-brown silt loam, sandy loam, or silty clay loam mottled with gray. It is compact in many places.

This soil is moderately high in both natural fertility and moisture-supplying capacity. It is low in organic-matter content, but crops show good response to lime and fertilizer. This soil tends to crust, and the crusting interferes with the germination of seeds and the survival of seedlings.

If limed, fertilized, and otherwise well managed, this soil is suited to practically all of the common crops. Because of strong slopes, rapid runoff, and a moderately high erosion hazard, it is suitable for only limited cultivation. Conservation measures are needed if cultivated crops are grown. This soil is well suited to pasture and meadow plants. Although they may be thinned by frost heaving, alfalfa stands generally remain productive 3 to 5 years, depending on the fertility of the soil and the severity of the winter. The potential for production of wood crops is moderately high. (Capability unit IVE-3; woodland group 13)

**Zanesville silt loam, 12 to 20 percent slopes, severely eroded (ZcD3).**—Erosion has removed practically all of the original surface layer from much of this soil. The present surface layer is predominantly yellowish brown in color and ranges from silt loam to silty clay loam in texture. On a large part of the acreage, it is a mixture of brown silt loam from the original surface layer and strong-brown material from the subsoil. The compact fragipan, which is at a depth of about 20 inches, is gray mottled with yellow and is 8 to 10 inches thick. The pan is underlain by residuum derived from sandstone, shale, and siltstone, and in some areas from limestone also. This residuum varies in color and texture but is generally yellowish-brown silt loam, sandy loam, or silty clay loam mottled with gray. It is compact in many places.

This soil is moderately low in both natural fertility and moisture-supplying capacity. It is very low in organic-matter content, but crops show good response to lime and fertilizer. Also, this soil is droughty, and it tends to crust. Droughtiness and crusting interfere with the germination of seeds, particularly those planted in spring.

Rapid runoff and a high erosion hazard make this soil unsuitable for cultivated crops. If limed, fertilized, and otherwise well managed, this soil is suited to most of the pasture and meadow plants commonly grown. Its poten-

tial is low for production of oaks, and moderate for production of pines. (Capability unit VIe-2; woodland group 6)

## *Use of Soils for Crops and Pasture*

In this section, management of the soils of Caldwell County is discussed, the capability classification used by the Soil Conservation Service is explained, and the soils of the county are grouped according to their suitability for crops. Also given in this section are estimated yields of the principal crops under high-level management.

Suggestions in this section are general. For advice about specific management of individual soils, consult the local staffs of the Soil Conservation Service, the Agricultural Extension Service, or the Agricultural Experiment Station.

## **General Principles of Soil Management**

Most of the soils in Caldwell County are naturally acid and have a medium or low supply of the basic plant nutrients. Ordinarily, the response to lime and fertilizer is good. The amounts to be applied depend on past cropping, on the type of soil, on the crops to be grown, and on the level of yield desired, but they should be based largely on the results of laboratory analysis of soil samples. If possible, the samples for testing should consist of a single soil type. Information and instructions on collecting samples and testing can be obtained from a local representative of the Soil Conservation Service or from the county extension agent.

Tillage tends to destroy the structure of soils such as those in Caldwell County and therefore should be limited to only the necessary operations. Puddling and crusting after heavy rains, which are typical of the many silty soils in this county, tend to reduce the amount of water that infiltrates and thereby to increase the hazards of runoff and erosion. Puddling and crusting can be controlled by the kind of tillage that leaves crop residues on the surface or mixed with the surface layer. Residues on the surface break the force of raindrops and help retard sealing and evaporation. Soils high in clay are likely to be cloddy and hard to work unless they are cultivated within only a narrow range of moisture content. In some soils that are frequently plowed to the same depth, compact layers develop just below the plow layer. These compact layers, or plowpans, are less likely to develop if the depth of plowing is changed from time to time.

One of the most important problems in Caldwell County is controlling runoff and reducing the hazard of erosion. Sheet and gully erosion account for large losses of organic matter and plant nutrients. If cultivated, all of the sloping soils in the county are subject to erosion. Suitable crop rotations, contour cultivation, terraces, stripcropping, diversions, grassed waterways, minimum tillage, and proper use of crop residues are effective in the control of runoff and erosion.

The most common method of removing excess water from the wet soils in this county is by means of open ditches. A more expensive method, and a more satisfactory one under certain conditions, is by means of tile drains. Neither method can be used unless suitable outlets are available. Ordinarily, the soils that have a clay-

pan or a fragipan are difficult to drain. Tile drains are generally not effective in pan soils. Open ditches are effective only if they intercept water moving laterally on top of the pan. Even if drained, some wet soils are not responsive. Pan soils are less productive of a crop like corn, for example, than well-drained soils. If fertilized and limed, the deep, permeable, wet soils are generally highly productive after they are adequately drained. For advice about laying out a properly designed drainage system, consult the local representative of the Soil Conservation Service.

## Capability Groups of Soils

The capability classification is a grouping that shows, in a general way, how suitable soils 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, the subclass, and the 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 interferes 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.

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 are subject to little or no erosion but have other limitations that restrict 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 for making many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIe-2.

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.

In Caldwell County, the capability units were numbered on a statewide basis. Because not all the capability units in the State are represented in this county, the numbering of the units may not be consecutive. The eight classes in the capability system, and the subclasses and units in this county, are described in the list that follows.

**Class I.** Soils that have few limitations that restrict their use.

Unit I-1.—Deep, well-drained, nearly level soils on bottom lands.

Unit I-2.—Moderately well drained, nearly level soils on bottom lands.

Unit I-3.—Deep, well-drained, nearly level and gently sloping soils on terraces and uplands.

**Class II.** Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.

Subclass IIe. Soils subject to moderate erosion if they are not protected.

Unit IIe-1.—Deep, well-drained, gently sloping soils on terraces and uplands.

Unit IIe-6.—Moderately well drained, gently sloping soils on terraces and uplands; fragipan.

Unit IIe-9.—Moderately deep or deep, well-drained, gently sloping soils underlain by sandstone and shale.

Unit IIe-10.—Well drained to moderately well drained, gently sloping soils on uplands; fragipan.

Subclass IIw. Soils that have moderate limitations because of excess water.

Unit IIw-1.—Moderately well drained, nearly level soils on terraces and uplands; fragipan.

Unit IIw-4.—Somewhat poorly drained, nearly level soils on bottom lands.

Subclass IIs.—Soils that have moderate limitations of moisture capacity or tilth.

Unit IIs-1.—Well-drained to excessively drained, nearly level gravelly soils on bottom lands.

**Class III.** Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.

Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.

Unit IIIe-1.—Deep, well-drained, sloping soils on terraces and uplands.

Unit IIIe-2.—Well drained to moderately well drained, sloping soils on uplands; fragipan.

Unit IIIe-7.—Moderately deep or deep, well-drained, sloping soils underlain by sandstone and shale.

Unit IIIe-8.—Moderately well drained, sloping eroded soils; fragipan.

Subclass IIIw. Soils that have severe limitations because of excess wetness.

Unit IIIw-1.—Somewhat poorly drained, nearly level soils on terraces and uplands; fragipan or clayey subsoil.

Unit IIIw-5.—Poorly drained, nearly level soils on bottom lands.

Unit IIIw-7.—Dark-colored, poorly drained, nearly level soils on bottom lands; derived from clayey slack-water deposits.

**Class IV.** Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

**Subclass IVe.** Soils subject to very severe erosion if they are cultivated and not protected.

**Unit IVe-1.**—Deep, well-drained, strongly sloping soils.

**Unit IVe-3.**—Well drained or moderately well drained, strongly sloping, eroded soils on uplands.

**Unit IVe-4.**—Shallow or moderately deep, well-drained, strongly sloping soils on uplands; underlain by sandstone and shale.

**Unit IVe-6.**—Shallow or moderately deep, sloping soils on uplands; clayey subsoil; underlain by limestone, sandstone, and shale.

**Unit IVe-9.**—Deep, well-drained, sloping, severely eroded soils on uplands.

**Unit IVe-14.**—Well drained to moderately well drained, sloping, severely eroded soils on uplands; fragipan.

**Subclass IV-w.** Soils that have very severe limitations for cultivation, because of excess water.

**Unit IVw-1.**—Shallow, gray, poorly drained, level soils on terraces and uplands; fragipan.

**Class V.** Soils not likely to erode that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover. There are no class V soils in Caldwell County.

**Class VI.** Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.

**Subclass VIe.** Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.

**Unit VIe-1.**—Shallow to deep, strongly sloping or moderately steep soils on uplands; underlain by limestone, sandstone, and shale.

**Unit VIe-2.**—Moderately deep or deep, strongly sloping, severely eroded soils on uplands.

**Unit VIe-4.**—Shallow, sloping, severely eroded soils on uplands; clayey subsoil.

**Unit VIe-7.**—Well-drained, strongly sloping or moderately steep soils on uplands; underlain by Coastal Plain gravel.

**Unit VIe-8.**—Shallow or moderately deep, well-drained, strongly sloping or moderately steep soils on uplands; underlain by sandstone and shale.

**Unit VIe-9.**—Shallow, strongly sloping, severely eroded soils on uplands; underlain by sandstone and shale.

**Subclass VIs.** Soils generally unsuitable for cultivation and limited for other uses by their moisture capacity, stones, or other features.

**Unit VIs-1.**—Shallow, rocky, sloping or strongly sloping soils on uplands; heavy clayey subsoil; underlain by limestone, sandstone, and shale.

**Unit VIs-3.**—Shallow, stony, strongly sloping soils on uplands; underlain by sandstone and shale.

**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.

**Subclass VIIe.** Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.

**Unit VIIe-2.**—Well-drained to excessively drained, strongly sloping, severely eroded soils; underlain by Coastal Plain gravel.

**Unit VIIe-4.**—Gullied land.

**Subclass VIIs.** Soils very severely limited by moisture capacity, stones, or other soil features.

**Unit VIIs-1.**—Shallow, stony, excessively drained, moderately steep or steep soils on uplands; underlain by sandstone and shale.

**Unit VIIs-2.**—Shallow, rocky, excessively drained, strongly sloping or moderately steep, severely eroded soils on uplands; underlain by limestone, sandstone, and shale.

**Unit VIIs-5.**—Areas that are 25 to 90 percent loose stones and outcrops of sandstone and limestone.

**Class VIII.** Soils and landforms that, without reclamation, have limitations that preclude their use for commercial production of plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes. There are no class VIII soils in Caldwell County.

## Management by Capability Units

A description of each capability unit is given in the following pages. Each description lists the soils in that unit and describes the characteristics and qualities of the soils, their suitability for crops, the major limitations or hazards, and effective management practices. Suitability of the soils for crops at high-level management is described. High-level management is that needed to get yields such as those shown in table 2.

### Capability unit 1-1

This unit consists of deep, well-drained, nearly level soils on bottom lands. These soils are—

Huntington silt loam.  
Vicksburg silt loam.

These soils are high in natural fertility, very high in moisture-supplying capacity, and strongly acid to neutral. They are easy to cultivate and can be worked throughout a wide range of moisture content without clodding or crusting. Roots and moisture penetrate to a depth of 4 feet or more.

These soils are well suited to all of the crops commonly grown. Under high-level management, they produce satisfactory yields of corn, small grain, soybeans, tobacco, alfalfa, red clover, lespedeza, orchardgrass, timothy, red-top, and fescue. Lime and fertilizer are needed. The amount to be applied is best determined through soil tests.

There are few hazards or limitations. If cultivated crops are grown every year, measures that maintain fertility and supply organic matter are needed. In places, diversions are needed for protection against runoff and overwash from adjacent slopes. Some areas are flooded occasionally but generally for only a short time and seldom during the growing season.

**Capability unit I-2**

This unit consists of moderately well drained, nearly level soils on bottom lands. These soils are—

Collins silt loam.  
Lindside silt loam.

These soils are high or moderately high in natural fertility, very high in moisture-supplying capacity, and strongly acid to neutral. They are easy to cultivate and can be worked throughout a wide range of moisture content without clodding or crusting. Roots and moisture easily penetrate to a depth of 4 feet or more during dry periods but are impeded by a high water table during wet periods. At times the water table is only 20 inches below the surface.

These soils are well suited to all of the crops commonly grown. Under high-level management, they produce satisfactory yields of corn, small grain, soybeans, tobacco, alfalfa, red clover, lespedeza, orchardgrass, timothy, red-top, and fescue. Lime and fertilizer are needed. The amounts to be applied are best determined through soil tests.

If cultivated crops are grown every year, measures that maintain fertility and supply organic matter are needed. For some crops, wetness is a slight hazard. Drainage that lowers the water table must be provided for high yields of a crop like alfalfa. In places, diversions are needed for protection against runoff and overwash from adjacent hillsides. Some areas are flooded occasionally, but generally for only a short time and seldom during the growing season.

**Capability unit I-3**

This unit consists of deep, well-drained, nearly level and gently sloping soils on uplands and terraces. These soils are—

Ashton silt loam, 0 to 4 percent slopes.  
Crider silt loam, 0 to 2 percent slopes.  
Elk silt loam, 0 to 2 percent slopes.

These soils are high in natural fertility, very high in moisture-supplying capacity, and slightly acid to strongly acid. They are easy to cultivate and can be worked throughout a wide range of moisture content without clodding or crusting. Roots and moisture easily penetrate to a depth of 4 feet or more.

These soils are well suited to all of the crops commonly grown. Under high-level management, they produce satisfactory yields of corn, small grain, soybeans, tobacco, alfalfa, red clover, lespedeza, orchardgrass, timothy, red-top, and fescue. Fertilizer and lime are needed. The amount to be applied is best determined through soil tests.

These are productive soils. There are few hazards or limitations. If cultivated crops are grown every year, measures that maintain fertility and supply organic matter are needed.

**Capability unit II-1**

This unit consists of deep, well-drained, gently sloping soils on uplands and terraces. These soils are—

Crider silt loam, 2 to 6 percent slopes.  
Crider silt loam, 2 to 6 percent slopes, eroded.  
Elk silt loam, 2 to 6 percent slopes.  
Pembroke silt loam, 2 to 6 percent slopes.  
Pembroke silt loam, 2 to 6 percent slopes, eroded.

These soils are high in natural fertility, high or very high in moisture-supplying capacity, and medium acid to very strongly acid. They are easy to cultivate and can be worked throughout a wide range of moisture content without clodding. The eroded soils are low in organic-matter content and tend to crust after heavy rains. Roots and moisture easily penetrate to a depth of 4 feet or more.

These soils are well suited to all of the crops commonly grown. Under high-level management, they produce satisfactory yields of corn, small grain, soybeans, tobacco, alfalfa, red clover, lespedeza, orchardgrass, timothy, red-top, and fescue. Lime and fertilizer are needed. The amount to be applied is best determined through soil tests.

About 12 percent of the acreage has irregular (karst) topography. Runoff is moderate, and the erosion hazard is moderately low. On slopes up to 100 feet long, erosion can be controlled by including sod crops in the cropping sequence and leaving crop residues on the surface. A suggested cropping system consists of corn, a cover crop, corn, and then 2 years of meadow crops. All residues from the corn crops should be left on the surface. Grassed waterways also are advisable. On slopes longer than 100 feet, contour cultivation, terracing, and stripcropping are needed also.

**Capability unit II-6**

This unit consists of moderately well drained, gently sloping soils on uplands and terraces. These soils have a mottled, brittle, compact fragipan. They are—

Captina silt loam, 2 to 6 percent slopes.  
Captina silt loam, 2 to 6 percent slopes, eroded.  
Dickson silt loam, 2 to 6 percent slopes.  
Dickson silt loam, 2 to 6 percent slopes, eroded.  
Tilsit silt loam, 2 to 6 percent slopes.  
Tilsit silt loam, 2 to 6 percent slopes, eroded.

These soils are moderate or moderately high in natural fertility, moderately low to moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. They are easy to cultivate and can be worked throughout a wide range of moisture content. The eroded soils are likely to crust after heavy rains, because they are low in organic-matter content and their plow layer is slightly more clayey than that of the uneroded soils. Roots and moisture easily penetrate as far down as the fragipan. These soils are waterlogged during the rainy seasons, particularly in winter and early in spring.

These soils are suited to most crops grown in the county. Under high-level management, they produce satisfactory yields of tobacco, corn, small grain, Kentucky 31 fescue, white clover, Korean lespedeza, sericea lespedeza, orchardgrass, timothy, alsike clover, and alfalfa. Alfalfa stands are thinned by frost heaving but generally remain productive 2 or 3 years. Crops show good response to lime and fertilizer.

Runoff is moderate, and the erosion problem is moderate. Wetness is an additional limitation. These soils are easily damaged if pastured when wet, in winter or early in spring. On slopes up to 100 feet long, erosion can be controlled by including sod crops in the cropping sequence and leaving crop residues on the surface. A suggested cropping system consists of corn, a cover crop, corn, and then 2 years of meadow crops. All residues from the corn crops should be left on the surface. Grassed waterways and contour cultivation also are advisable. On slopes

longer than 100 feet, terracing and stripcropping are needed also.

#### **Capability unit IIe-9**

The one soil in this unit, Wellston silt loam, 2 to 6 percent slopes, is a moderately deep or deep upland soil that is well drained and gently sloping. It overlies sandstone and shale.

This soil is moderately high in natural fertility, high in moisture-supplying capacity, and strongly acid or very strongly acid. It is easy to keep in good tilth and can be cultivated throughout a wide range of moisture content without clodding or crusting. Roots and moisture easily penetrate as far down as bedrock.

This soil is well suited to most crops commonly grown. Under high-level management, it produces satisfactory yields of corn, soybeans, small grain, fescue, redbud, lespedeza, tobacco, alfalfa, orchardgrass, and timothy.

There is some runoff and a moderately low erosion hazard. On slopes up to 100 feet long, erosion can be controlled by including sod crops in the cropping sequence and leaving crop residues on the surface. A suggested cropping system consists of 1 year of corn and 2 years of meadow crops. All residues from the corn crop should be left on the surface. Grassed waterways and contour tillage also are advisable. On slopes longer than 100 feet, terracing and stripcropping are needed also.

#### **Capability unit IIe-10**

This unit consists of well drained or moderately well drained, gently sloping soils on uplands. These soils have a fragipan. They are—

- Russellville silt loam, 2 to 6 percent slopes.
- Russellville silt loam, 2 to 6 percent slopes, eroded.
- Zanesville silt loam, 2 to 6 percent slopes.
- Zanesville silt loam, 2 to 6 percent slopes, eroded.

These soils are high or moderately high in natural fertility, high or moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. They are easy to cultivate and can be worked throughout a wide range of moisture content without clodding. The eroded soils are likely to crust after heavy rains, because they are low in organic-matter content and their plow layer is slightly more clayey than that of the uneroded soils. Roots and moisture penetrate as far down as the fragipan.

These soils are well suited to all of the crops commonly grown. Under high-level management, they produce satisfactory yields of corn, soybeans, small grain, fescue, redbud, lespedeza, tobacco, orchardgrass, timothy, and alfalfa. Although alfalfa stands may be thinned by frost heaving, they generally remain productive 3 to 5 years, depending on the fertility of the soil and the severity of the winters. Crops show good response to lime and fertilizer.

There is some runoff and a moderately low erosion hazard. On slopes up to 100 feet long, erosion can be controlled by including sod crops in the cropping sequence and leaving crop residues on the surface. A suggested cropping system consists of corn, a cover crop, corn, and then 2 years of meadow crops. All residues from the corn crops should be left on the surface. Grassed waterways and contour tillage also are advisable. On slopes longer than 100 feet, terracing and stripcropping are needed also.

#### **Capability unit IIw-1**

This unit consists of moderately well drained, nearly level soils on uplands and terraces. These soils have a mottled, brittle, compact fragipan. They are—

- Captina silt loam, 0 to 2 percent slopes.
- Tilsit silt loam, 0 to 2 percent slopes.

These soils are moderately high in natural fertility, moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. They are easy to cultivate and can be worked throughout a wide range of moisture content without clodding or crusting. Roots and moisture easily penetrate as far down as the fragipan. These soils are waterlogged during the rainy seasons, particularly in winter and early in spring.

These soils are well suited to most crops commonly grown. Under high-level management, they produce satisfactory yields of corn, soybeans, small grain, fescue, redbud, lespedeza, tobacco, orchardgrass, timothy, and alfalfa. Although alfalfa stands may be thinned by frost heaving, they generally remain productive for 2 or 3 years, depending on the fertility of the soil and the severity of the winters. Lime and fertilizer are needed. The amount to be applied is best determined through soil tests.

There is a slight limitation caused by wetness but no erosion hazard. In some years tillage has to be delayed until late in spring. Also, these soils are easily damaged if pastured when wet. Under average management, the cropping system should consist of 2 years of row crops and 1 year of a pasture or meadow crop. Under high-level management, cultivated crops can be grown every year. Lime and fertilizer are needed. The amount to be applied is best determined through soil tests. Also needed are cover crops, proper use of crop residues, and other measures listed under high-level management in the section "Estimated Yields."

#### **Capability unit IIw-4**

This unit consists of somewhat poorly drained, nearly level soils on bottom lands. These soils are—

- Falaya silt loam.
- Newark silt loam.

These soils are moderately high in natural fertility, very high in moisture-supplying capacity, and strongly acid to neutral. They are easy to cultivate and can be worked throughout a wide range of moisture content without clodding or crusting. Roots and moisture easily penetrate to a depth of 4 feet or more during the dry periods but are impeded by a high water table during the wet seasons.

Unless a complete drainage system is installed, these soils generally produce only fair yields of corn, soybeans, redbud, timothy, alsike clover, Kobe lespedeza, and Korean lespedeza. If adequately drained, they produce satisfactory yields of corn, wheat, tobacco, orchardgrass, red clover, timothy, lespedeza, and alfalfa, and excellent yields of soybeans, fescue, and redbud. In spots, it is difficult to provide adequate drainage for alfalfa.

There is a limitation caused by wetness but no erosion hazard. Unless drainage is provided, crops are likely to fail. Under high-level management, cultivated crops can be grown every year. Lime and fertilizer are needed. The amount to be applied is best determined through soil tests. Also needed are cover crops, proper use of crop

residues, and other measures listed under high-level management in the section "Estimated Yields."

#### **Capability unit IIa-1**

This unit consists of well-drained to excessively drained, nearly level gravelly soils on bottom lands. These soils are—

Huntington gravelly silt loam.  
Vicksburg gravelly silt loam.

These soils are moderately high or high in natural fertility, moderately high in moisture-supplying capacity, and strongly acid to neutral. They are easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Roots and moisture penetrate easily. Gravel interferes with tillage and dulls implements.

Under less than high-level management, these soils are not well suited to bluegrass, orchardgrass, timothy, alfalfa, Ladino clover, tobacco, and soybeans. Under high-level management, they produce satisfactory yields of these crops and of corn, small grain, lespedeza, bermudagrass, fescue, redtop, red clover, alsike clover, and sweetclover.

There is no erosion hazard. Under high-level management, cultivated crops can be grown every year. Cover crops, proper use of crop residues, and other measures that build up and maintain the supply of organic matter are needed.

#### **Capability unit IIIe-1**

This unit consists of deep, well-drained, sloping soils on uplands and terraces. These soils are—

Crider silt loam, 6 to 12 percent slopes.  
Crider silt loam, 6 to 12 percent slopes, eroded.  
Hayter silt loam, 6 to 12 percent slopes.  
Pembroke silt loam, 6 to 12 percent slopes.  
Pembroke silt loam, 6 to 12 percent slopes, eroded.

These soils are high or moderately high in natural fertility, high or moderately high in moisture-supplying capacity, and medium acid or strongly acid. They are easy to cultivate and can be worked throughout a wide range of moisture content without clodding. The eroded soils are low in organic-matter content and tend to crust after heavy rains. Roots and moisture easily penetrate to a depth of 4 feet or more.

These soils are well suited to all the crops commonly grown. Under high-level management, they produce satisfactory yields of corn, small grain, soybeans, tobacco, alfalfa, red clover, lespedeza, orchardgrass, timothy, redtop, and fescue. Lime and fertilizer are needed. The amounts to be applied are best determined through soil tests.

About half of the acreage has short, irregular slopes. Runoff is medium, and the erosion hazard is moderate. On slopes up to 90 feet long, erosion can be controlled by growing sod crops three-fourths of the time and leaving crop residues on the surface. A suggested cropping system consists of 1 year of corn and 3 years of meadow crops. All residues from the corn crop should be left on the surface. Grassed waterways also are advisable. On slopes longer than 90 feet, contour tillage, terracing, strip-cropping, and more sod crops are needed.

#### **Capability unit IIIe-2**

This unit consists of well drained to moderately well drained, sloping soils on uplands. These soils have a fragipan. They are—

Russellville silt loam, 6 to 12 percent slopes.  
Russellville silt loam, 6 to 12 percent slopes, eroded.  
Zanesville silt loam, 6 to 12 percent slopes.  
Zanesville silt loam, 6 to 12 percent slopes, eroded.

These soils are moderately high in natural fertility, high or moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. They are easy to cultivate and can be worked throughout a wide range of moisture content without clodding. The eroded soils are likely to crust, because they are low in organic-matter content and their plow layer is slightly more clayey than that of the uneroded soils. Roots and moisture easily penetrate as far down as the fragipan.

These soils are well suited to all the crops commonly grown. Under high-level management, they produce satisfactory yields of corn, small grain, fescue, redtop, lespedeza, tobacco, orchardgrass, timothy, and alfalfa. Alfalfa stands are thinned by frost heaving but generally remain productive for 3 to 5 years, the actual period depending on the fertility of the soil and the severity of the winters. Crops show good response to lime and fertilizer.

Runoff is medium, and the erosion hazard is moderate. On slopes up to 90 feet long, erosion can be controlled by growing sod crops three-fourths of the time and leaving crop residues on the surface. A suggested cropping system consists of 1 year of corn and 3 years of meadow crops. All residues from the corn crop should be left on the surface. Grassed waterways and contour tillage also are advisable. On slopes longer than 90 feet, terracing, strip-cropping, and more sod crops are needed.

#### **Capability unit IIIe-7**

This unit consists of moderately deep or deep, well-drained, sloping soils that overlie sandstone and shale. These soils are—

Wellston silt loam, 6 to 12 percent slopes.  
Wellston silt loam, 6 to 12 percent slopes, eroded.

These soils are moderately high in natural fertility, moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. They are easy to keep in good tilth and can be cultivated throughout a wide range of moisture content without clodding. The eroded soils are likely to crust, because they are low in organic-matter content and their plow layer is slightly more clayey than that of the uneroded soils. Roots and moisture penetrate as far down as bedrock.

These soils are well suited to the crops commonly grown. Under less than high-level management, they produce only fair yields of corn, soybeans, small grain, Kentucky 31 fescue, redtop, Korean lespedeza, and sericea lespedeza. Under high-level management, they produce satisfactory yields of these crops and of tobacco, alfalfa, orchardgrass, and timothy.

Runoff is medium, and the erosion hazard is moderate. On slopes up to 90 feet long, erosion can be controlled by growing sod crops three-fourths of the time and leaving crop residues on the surface. A suggested cropping system consists of 1 year of corn and 3 years of meadow crops.

All residues from the corn crop should be left on the surface. Grassed waterways and contour tillage also are advisable. On slopes longer than 90 feet, terracing, strip-cropping, and more sod crops are needed.

### **Capability unit IIIe-8**

This unit consists of moderately well drained, sloping, eroded soils. These soils have a fragipan. They are—

Captina silt loam, 6 to 12 percent slopes, eroded.  
Tilsit silt loam, 6 to 12 percent slopes, eroded.

These soils are moderate in natural fertility, moderately low in moisture-supplying capacity, and strongly acid or very strongly acid. They are fairly easy to keep in good tilth, but tillage sometimes has to be delayed until the soil is dry enough to support equipment. These soils are low in organic-matter content and tend to crust after heavy rains. They are waterlogged during the rainy seasons, particularly in winter and early in spring. Roots and moisture easily penetrate as far down as the fragipan.

Under less than high-level management, these soils produce fair yields of corn, soybeans, small grain, fescue, Korean lespedeza, Kobe lespedeza, and sericea lespedeza. Under high-level management, they also produce fair yields of tobacco, Kentucky 31 fescue, orchardgrass, timothy, alfalfa, red clover, alsike clover, and Ladino clover. Alfalfa stands are thinned by frost heaving but generally remain productive for 3 to 5 years.

Runoff is medium, and the erosion hazard is moderate. The fragipan, which slows the downward movement of water and roots, makes wetness a slight limitation and restricts the root zone. Pastures are easily damaged by the trampling of livestock in winter and spring. On slopes up to 80 feet long, erosion can be controlled by growing sod crops three-fourths of the time and leaving crop residues on the surface. A suggested cropping system is 1 year of corn and 3 years of meadow crops. All residues from the corn crop should be left on the surface. Grassed waterways and contour tillage also are advisable. On slopes longer than 80 feet, terracing, strip-cropping, and more sod crops are needed.

### **Capability unit IIIw-1**

This unit consists of somewhat poorly drained, nearly level soils on uplands and terraces. These soils have either a fragipan or a heavy clayey subsoil. They are—

Johnsburg silt loam.  
McGary silt loam.  
Taft silt loam.

These soils are moderately low in natural fertility and moderately high in moisture-supplying capacity. Johnsburg and Taft soils are strongly acid or very strongly acid. McGary soils are strongly acid or medium acid in the uppermost part, but they are nearly neutral below a depth of 24 inches and are commonly moderately alkaline below a depth of 42 inches. All of these soils are low in organic-matter content. They are easy to work, but tillage often has to be delayed because of wetness. The fragipan or clayey subsoil slows the downward movement of air and water.

These soils are too wet to be well suited to many of the crops commonly grown. Kentucky 31 fescue, reedtop, reed canarygrass, alsike clover, Ladino clover, Kobe lespedeza, and Korean lespedeza show good response to lime and



**Figure 15.**—Fair or poor stand of corn on Johnsburg silt loam. Crabgrass is growing because the soil was too wet to be cultivated at the proper time.

fertilizer. Satisfactory yields of these crops can be produced under high-level management. If rainfall is favorable, the response is also good for corn, soybeans, tobacco, small grain, red clover, orchardgrass, and timothy. If rainfall is too heavy or occurs during the wrong part of the growing season, poor yields of these crops are produced, even under high-level management (fig. 15).

There is no erosion hazard. Wetness is the major limitation. Generally, draining these soils is not practical, for they are not well suited to many crops. They have a shallow root zone and slow internal drainage. It is most important to build up and maintain the supply of organic matter if cultivated crops are grown. Under high-level management, the most intensive use should be 1 year of a cultivated crop and 1 year of a meadow or pasture crop.

### **Capability unit IIIw-5**

This unit consists of poorly drained, nearly level soils on bottom lands. These soils are—

Melvin silt loam.  
Waverly silt loam.

These soils are moderate in natural fertility, very high in moisture-supplying capacity, and very strongly acid to neutral. When dry enough to support equipment, they are easy to work. During the dry periods, roots and moisture easily penetrate to a depth of 4 feet or more, but during the wet seasons, the water table is at or near the surface.

These soils are not well suited to alfalfa, bermudagrass, bluegrass, bromegrass, orchardgrass, or timothy. If adequately drained, they produce satisfactory yields of corn, small grain, soybeans, tobacco, Kobe lespedeza, Korean lespedeza, Kentucky 31 fescue, reedtop, red clover,

alsike clover, and Ladino clover. These crops show good response to lime and fertilizer.

There is no erosion hazard. Overflow and wetness are the major limitations. If adequate outlets are available, these soils can be drained well enough so that they are well suited to many of the crops commonly grown. There are no restrictive layers. Consequently, water moves downward at a moderate rate if the water table can be lowered. Under high-level management, which includes adequate drainage, protection from overflow, and use of cover crops and crop residues, cultivated crops can be grown every year. Lime and fertilizer are needed. The amount to be applied is best determined through soil tests.

#### **Capability unit IIIw-7**

This unit consists of dark-colored, poorly drained, nearly level soils on bottom lands. These soils were derived from fine-textured slack-water deposits. They are—

- Sharkey silt loam, overwash.
- Sharkey silty clay loam, overwash.

These soils are high in natural fertility, very high or high in moisture-supplying capacity, and medium acid or slightly acid to alkaline. Generally, they are medium acid or slightly acid in the surface layer and are not alkaline above a depth of 2 feet. The movement of air and water is slow because of the clayey texture. Roots of water-tolerant plants penetrate to a depth of 4 feet or more.

Most of the acreage is wooded, and because of frequent flooding, part of it resembles a swamp. Little of the cleared acreage is adequately drained. The part that is adequately drained is suited to soybeans and corn. Soybeans is the main crop. Pasture and meadow crops can be grown occasionally.

Wetness is the major limitation. The water table is high much of the time. Also, the clayey texture of these soils slows the downward movement of water. Drainage is practicable if adequate outlets are available, but much of the acreage lacks such outlets. In most places the surface layer is moderately fine textured and can be tilled within only a narrow range of moisture content without clodding. Under high-level management, which includes adequate drainage, cultivated crops can be grown every year.

#### **Capability unit IVe-1**

This unit consists of deep, well-drained, strongly sloping soils. These soils are—

- Crider silt loam, 12 to 20 percent slopes.
- Crider silt loam, 12 to 20 percent slopes, eroded.
- Hayter silt loam, 12 to 20 percent slopes.
- Pembroke silt loam, 12 to 20 percent slopes, eroded.

These soils are high or moderately high in natural fertility and medium acid to very strongly acid. They can be worked throughout a wide range of moisture content without clodding. The eroded soils are low in organic-matter content and are likely to crust after heavy rains. Roots and moisture easily penetrate to a depth of 4 feet or more.

These soils can be used for all the crops commonly grown. Under high-level management, they produce satisfactory yields of corn, small grain, soybeans, tobacco,

alfalfa, Kobe lespedeza, Korean lespedeza, sericea lespedeza, fescue, orchardgrass, redtop, timothy, red clover, alsike clover, Ladino clover, and sweetclover.

About half of the acreage has short, irregular slopes. Runoff is rapid, and the erosion hazard is moderately high. Cultivated crops should be grown only occasionally. On slopes up to 40 feet long, erosion can be controlled by growing sod crops at least three-fourths of the time and leaving crop residues on the surface. A suggested cropping system is 1 year of corn, 1 year of small grain, and 3 years of meadow crops. All residues from the corn crop should be left on the surface. Grassed waterways and contour cultivation also are advisable. On slopes longer than 40 feet, strip cropping, diversions, and more sod crops are needed.

#### **Capability unit IVe-3**

This unit consists of well drained or moderately well drained, strongly sloping, eroded soils on uplands. These soils are—

- Baxter cherty silt loam, 12 to 20 percent slopes, eroded.
- Russellville silt loam, 12 to 20 percent slopes, eroded.
- Zanesville silt loam, 12 to 20 percent slopes, eroded.

The Russellville and Zanesville soils have a weak but definite fragipan. All of the soils in this unit are moderate or moderately high in natural fertility, moderately high in moisture-supplying capacity, and very strongly acid to medium acid. Except for the Baxter soil, in which chert fragments interfere with tillage, they are easy to work. They are low in organic-matter content and are likely to crust after heavy rains. In the Russellville and Zanesville soils, roots and moisture penetrate as far down as the fragipan.

Under less than high-level management, these soils are suited only to bermudagrass, fescue, Korean lespedeza, and sericea lespedeza. Under high-level management, they produce satisfactory yields of corn, small grain, tobacco, alfalfa, fescue, orchardgrass, redtop, timothy, red clover, Ladino clover, sweetclover, Kobe lespedeza, and sericea lespedeza. Crops show good response to lime and fertilizer.

Runoff is rapid, and the erosion hazard is moderately high. Cultivated crops should be grown only occasionally. On short slopes of no more than 16 percent gradient, erosion can be controlled by growing sod crops at least three-fourths of the time and leaving crop residues on the surface. A suggested cropping system is 1 year of corn, 1 year of small grain, and 3 years of meadow crops. All residues from the corn crop should be left on the surface. Grassed waterways, contour cultivation, and minimum tillage also are advisable. On steeper and longer slopes, strip cropping, diversions, and more sod crops are needed.

#### **Capability unit IVe-4**

This unit consists of shallow or moderately deep, well-drained, strongly sloping soils on uplands. These soils overlie sandstone and shale. They are—

- Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes (Gilpin and Muskingum soils).
- Wellston silt loam, 12 to 20 percent slopes
- Wellston silt loam, 12 to 20 percent slopes, eroded.

These soils are moderate or moderately high in natural fertility, moderately low to moderately high in moisture-

supplying capacity, and strongly acid or very strongly acid. They are easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding. The eroded soils are low in organic-matter content and are likely to crust after heavy rains.

Under less than high-level management, these soils are suited only to bermudagrass, Kentucky 31 fescue, Korean lespedeza, and sericea lespedeza. Under high-level management, they are well suited to most crops commonly grown. They produce fair to satisfactory yields of corn, small grain, tobacco, alfalfa, fescue, orchardgrass, redtop, timothy, red clover, Ladino clover, sweetclover, Kobe lespedeza, and sericea lespedeza. Crops show good response to lime and fertilizer.

Runoff is rapid, and the erosion hazard is moderately high or high. Cultivated crops should be grown only occasionally. On slopes up to 50 feet long and of no more than 16 percent gradient, erosion can be controlled by growing sod crops most of the time. A suggested cropping system consists of corn, small grain, and then 4 years of meadow crops. All residues from the corn crop should be left on the surface. Grassed waterways, minimum tillage, and contour cultivation also are advisable. On steeper and longer slopes, stripcropping, diversion terraces, and more sod crops are needed.

#### **Capability unit IVe-6**

This unit consists of shallow or moderately deep, sloping soils on uplands. These soils have a clayey subsoil and overlie limestone, sandstone, and shale. They are—

Caneyville silt loam, 6 to 12 percent slopes.

Fredonia silty clay loam, shallow, 6 to 12 percent slopes, eroded.

These soils are high or moderately high in natural fertility and moderately high in moisture-supplying capacity. In reaction, they range from strongly acid to neutral, depending on the depth to limestone bedrock. The Caneyville soil is easy to till and can be worked throughout a wide range of moisture content without clodding or crusting. The Fredonia soil can be cultivated within only a somewhat narrow range of moisture content without clodding. Also, it tends to crust after heavy rains.

Under less than high-level management, these soils are suited only to fescue, Korean lespedeza, and sericea lespedeza. Under high-level management, they are well suited to most crops commonly grown and produce fair yields of corn, small grain, soybeans, tobacco, alfalfa, Kobe lespedeza, fescue, bermudagrass, bluegrass, orchardgrass, red clover, and sweetclover. Crops show good response to fertilizer and, in most areas, to lime.

Runoff is rapid, and the erosion hazard is moderately high. Cultivated crops should be grown only occasionally. On slopes up to 80 feet long, erosion can be controlled by growing sod crops at least three-fourths of the time. A suggested cropping system is 1 year of corn and 3 years of meadow crops. All residues from the corn crop should be left on the surface. Grassed waterways and contour cultivation also are advisable. On slopes longer than 80 feet, stripcropping, terracing, and more sod crops are needed.

#### **Capability unit IVe-9**

This unit consists of deep, well-drained, sloping, severely eroded soils on uplands. These soils are—

Crider silty clay loam, 6 to 12 percent slopes, severely eroded.

Crider silt loam, 6 to 12 percent slopes, severely eroded.

Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded.

Wellston silty clay loam, 6 to 12 percent slopes, severely eroded.

These soils are moderately low to moderately high in natural fertility, moderately low to high in moisture-supplying capacity, and medium acid to very strongly acid. They can be worked within only a narrow range of moisture content without clodding. They are very low in organic-matter content and are likely to crust. Crusting interferes with the germination of seeds and the survival of seedlings, particularly those planted in spring.

Under less than high-level management, these soils are suited only to bermudagrass, fescue, and sericea lespedeza. Under high-level management, they are well suited to most crops commonly grown and produce satisfactory yields of corn, small grain, soybeans, tobacco, redtop, timothy, fescue, orchardgrass, red clover, sweetclover, alfalfa, Korean lespedeza, Kobe lespedeza, and sericea lespedeza. Lime and fertilizer are needed. The supply of organic matter should be increased by utilizing crop residues and by growing green-manure crops.

Infiltration is slow, runoff is medium, and the erosion hazard is moderately high. Cultivated crops should be grown only occasionally. On slopes up to 90 feet long, erosion can be controlled by growing sod crops at least three-fourths of the time. A suggested cropping system is 1 year of corn and 3 years of meadow crops. All residues from the corn crop should be left on the surface. Grassed waterways and contour cultivation also are advisable. On slopes longer than 90 feet, stripcropping, terracing, and more sod crops are needed.

#### **Capability unit IVe-14**

This unit consists of well drained to moderately well drained, sloping, severely eroded soils on uplands. These soils have a fragipan. They are—

Russellville silt loam, 6 to 12 percent slopes, severely eroded.

Zanesville silt loam, 6 to 12 percent slopes, severely eroded.

These soils are moderately low to moderately high in natural fertility, moderately low to moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. They can be worked within only a somewhat narrow range of moisture content without clodding. They are low in organic-matter content and tend to crust. Crusting interferes with the germination of seeds and the survival of seedlings, particularly those planted in spring.

Under less than high-level management, these soils are suited only to bermudagrass, fescue, Korean lespedeza, and sericea lespedeza. Under high-level management, they are suited to many of the crops commonly grown and produce fair to satisfactory yields of corn, small grain, soybeans, tobacco, sweetclover, Korean lespedeza, sericea lespedeza, red clover, and alfalfa. It is sometimes difficult, however, to get good stands of red clover and alfalfa. Alfalfa stands are thinned by frost heaving but generally are productive 3 or 4 years. Lime and fertilizer are needed. The supply of organic matter can be increased by utilizing crop residues and by growing green-manure crops.

Infiltration is slow, runoff is medium, and the erosion hazard is moderately high. Cultivated crops should be

grown only occasionally. On slopes up to 80 feet long, erosion can be controlled by growing sod crops at least three-fourths of the time. A suggested cropping system is 1 year of corn, 1 year of small grain, and 3 years of meadow crops. All residues from the corn crop should be left on the surface. Grassed waterways and contour cultivation also are advisable. On slopes longer than 80 feet, stripcropping, terracing, and more sod crops are needed.

#### **Capability unit IVw-1**

The one soil in this unit, Mullins silt loam, is a shallow, gray, poorly drained, level soil on uplands and terraces. It has a fragipan.

This soil is low in natural fertility, low in moisture-supplying capacity, and very strongly acid. It is low in organic-matter content. This soil is easy to work, but tillage often has to be delayed because of wetness.

This soil is too wet for many of the crops commonly grown. Under high-level management, it produces fair to satisfactory yields of fescue, redtop, reed canarygrass, alsike clover, Ladino clover, Kobe lespedeza, and Korean lespedeza. These crops generally show good response to lime and fertilizer. This soil also produces fair to satisfactory yields of corn and soybeans if rainfall is not too heavy and occurs at the right time during the growing season. These crops frequently fail in wet years, even under high-level management (fig. 16).

There is no erosion hazard. Wetness is the major limitation. Because of slow internal drainage and the position of this soil on the landscape, installing a drainage system is generally not practical. Increasing the supply of organic matter, however, is important. Because of the uncertainty in predicting the amount of rainfall during any growing season, there is considerable risk of crop failure. Even under high-level management, this soil should not be cultivated more than once every 3 years.

#### **Capability unit VIe-1**

This unit consists of shallow to deep, strongly sloping or moderately steep soils on uplands. These soils overlie limestone, sandstone, and shale. They are—



**Figure 16.**—Corn crop failure on Mullins silt loam. Crabgrass is abundant in the field because the soil was too wet to be cultivated at the proper time. Spanish needle is the flowering weed. Compare with figure 15, which shows corn growing in another part of the same field.

Baxter cherty silt loam, 20 to 30 percent slopes.  
Caneyville silt loam, 12 to 20 percent slopes.  
Fredonia silty clay loam, shallow, 12 to 20 percent slopes, eroded.

These soils are high to moderate in natural fertility and moderately low to moderately high in moisture-supplying capacity. Their reaction ranges from strongly acid to neutral, depending on the depth to limestone. The Caneyville soil is easy to cultivate. The Baxter soil contains chert fragments that interfere with tillage. The Fredonia soil can be worked within only a narrow range of moisture content because of its low organic-matter content and moderately fine textured surface layer.

Runoff is very rapid, and the erosion hazard is high. Consequently, these soils are not suited to cultivated crops. Under average management, they are well suited only to bermudagrass, fescue, Korean lespedeza, and sericea lespedeza. Under high-level management, they are well suited also to bluegrass, Kentucky 31 fescue, orchardgrass, redtop, red clover, and sweetclover and are fairly well suited to timothy, alfalfa, and Kobe lespedeza. Crops show good response to fertilizer and, in most areas, to lime.

#### **Capability unit VIe-2**

This unit consists of moderately deep or deep, strongly sloping, severely eroded soils on uplands. These soils are—

Crider silty clay loam, 12 to 20 percent slopes, severely eroded.  
Pembroke silty clay loam, 12 to 20 percent slopes, severely eroded.  
Russellville silt loam, 12 to 20 percent slopes, severely eroded.  
Wellston silty clay loam, 12 to 20 percent slopes, severely eroded.  
Zanesville silt loam, 12 to 20 percent slopes, severely eroded.

These soils are moderately low to moderately high in natural fertility, moderately low to moderately high in moisture-supplying capacity, and very strongly acid to medium acid. They can be worked within only a narrow range of moisture content without clodding. Because of their moderately fine textured surface layer and very low organic-matter content, they are susceptible to crusting. Crusting interferes with the germination of seeds and the survival of seedlings, particularly those planted in spring.

Infiltration is slow, runoff is very rapid, and the erosion hazard is high. Consequently, these soils are not suited to cultivated crops. Under less than high-level management, they are well suited only to fescue and sericea lespedeza. Under high-level management, they are well suited also to bermudagrass, Kentucky 31 fescue, redtop, and Korean lespedeza and are fairly well suited to orchardgrass, timothy, alfalfa, and sweetclover. Lime and fertilizer are needed. Also, the supply of organic matter should be increased by utilizing crop residues, by growing green-manure crops, and by mulching bare spots with manure, straw, or hay.

#### **Capability unit VIe-4**

The one soil in this unit, Caneyville silty clay loam, 6 to 12 percent slopes, severely eroded, is a shallow upland soil that is sloping, is severely eroded, and has a clayey subsoil.

This soil is moderately low in natural fertility and low in moisture-supplying capacity. Unless the limestone bedrock is near the surface, it is generally strongly acid or medium acid in the upper part. This soil is very low in organic-matter content and can be tilled within only a nar-

row range of moisture content without clodding. Also, it is susceptible to crusting, which interferes with the germination of seeds and the survival of seedlings, particularly those planted in spring.

Infiltration is slow, runoff is rapid, and the erosion hazard is high. Consequently, this soil is not suitable for cultivated crops. Moreover, its shallow root zone, very low organic-matter content, moderately low fertility, and moderately low moisture-supplying capacity make it unsuitable for many of the pasture and meadow crops commonly grown. Under less than high-level management, this soil is well suited only to fescue and sericea lespedeza. Under high-level management, it is well suited also to bluegrass and is fairly well suited to bermudagrass, orchardgrass, redtop, sweetclover, red clover, and Korean lespedeza. Lime and fertilizer are needed. Also, the supply of organic matter should be increased by utilizing crop residues, by growing green-manure crops, and by mulching bare spots with manure, straw, or hay.

#### **Capability unit VIe-7**

This unit consists of well-drained, strongly sloping and moderately steep soils on uplands. These soils overlie Coastal Plain gravel. They are—

- Brandon silt loam, 12 to 20 percent slopes.
- Gilpin, Litz, and Muskingum silt loams, 20 to 30 percent slopes (Gilpin soils only).

These soils are moderate in natural fertility, moderately low to moderately high in moisture-supplying capacity, and strongly acid or very strongly acid. They are easy to keep in good tilth and can be worked throughout a wide range of moisture content without clodding or crusting. Roots and moisture easily penetrate as far down as shattered rock.

Rapid runoff and a high erosion hazard make these soils unsuitable for cultivated crops. Under less than high-level management, they are well suited only to fescue, Korean lespedeza, and sericea lespedeza. Under high-level management, they are well suited also to bermudagrass, redtop, timothy, and Kobe lespedeza and are fairly well suited to bluegrass, orchardgrass, alfalfa, Ladino clover, red clover, and sweetclover. These crops show good response to lime and fertilizer.

#### **Capability unit VIe-8**

This unit consists of shallow or moderately deep, well-drained, strongly sloping and moderately steep soils on uplands. These soils overlie sandstone and shale. They are—

- Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes (Litz soils only).
- Gilpin, Litz, and Muskingum silt loams, 20 to 30 percent slope (Litz and Muskingum soils only).

These soils are moderate in natural fertility, low or moderately low in moisture-supplying capacity, and strongly acid or very strongly acid. They are easy to keep in good tilth. Roots and moisture easily penetrate as far down as bedrock or very firm clay.

Very rapid runoff and a high erosion hazard make these soils unsuitable for cultivated crops. Moreover, the shallow root zone makes them unsuitable for many of the pasture and meadow crops commonly grown. Under less than high-level management, these soils are well suited

only to fescue, redtop, Korean lespedeza, and sericea lespedeza. Under high-level management, they are well suited not only to these crops, but also to bermudagrass, Kentucky 31 fescue, timothy, red clover, and Kobe lespedeza and are fairly well suited to bluegrass, orchardgrass, alfalfa, and Ladino clover. Many of these crops show good response to lime and fertilizer.

#### **Capability unit VIe-9**

This unit consists of Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes, severely eroded (Gilpin and Muskingum soils only). These are shallow, strongly sloping, severely eroded soils on uplands. They overlie sandstone and shale.

These soils are low in natural fertility, low in moisture-supplying capacity, and strongly acid or very strongly acid. Roots and moisture easily penetrate as far down as bedrock or very firm clay.

Slow infiltration, rapid runoff, and a high erosion hazard make these soils unsuitable for cultivated crops. Moreover, low fertility and low moisture-supplying capacity make them unsuitable for many of the pasture and meadow crops commonly grown. Under less than high-level management, these soils are suited only to fescue and sericea lespedeza. Under high-level management, they are suited also to bermudagrass, redtop, and Korean lespedeza. Crops that require little moisture, or crops that grow early in spring or late in fall when moisture is adequate, show good response to lime and fertilizer. The supply of organic matter should be increased by utilizing the crop residues, by growing green-manure crops, and by mulching bare spots with manure, straw, or hay.

#### **Capability unit VIi-1**

This unit consists of shallow, rocky, sloping or strongly sloping soils on uplands. These soils have a heavy clayey subsoil and overlie limestone, sandstone, and shale. They are—

- Caneyville very rocky soils, 12 to 20 percent slopes.
- Fredonia-Rock land complex, 6 to 20 percent slopes, eroded.

These soils are moderately high or high in natural fertility, moderately low in moisture-supplying capacity, and medium acid to slightly alkaline. The rocky surface makes tillage difficult.

Shallowness and rockiness are the major limitations. Also, the erosion hazard is high. These soils are not suitable for cultivation. Moreover, the areas of Rock land are not suitable for meadow crops because harvesting is difficult. Under less than high-level management, these soils are well suited only to fescue, Korean lespedeza, and sericea lespedeza. Under high-level management, most of them are suited also to bermudagrass, Kentucky 31 fescue, orchardgrass, redtop, timothy, Ladino clover, red clover, sweetclover, and Kobe lespedeza. Some of these crops show good response to fertilizer, and, on much of the acreage, to lime also.

#### **Capability unit VIi-3**

This unit consists of Dekalb, Ramsey, and Muskingum stony soils, 12 to 20 percent slopes. These are shallow upland soils that are stony and strongly sloping. They overlie sandstone and shale.

These soils are moderate in natural fertility, moderately low in moisture-supplying capacity, and strongly acid or very strongly acid. They are difficult to work because of the stones. Roots and moisture easily penetrate as far down as bedrock or very firm clay.

Stoniness and shallowness are the major limitations. Also, the erosion hazard is moderately high. These soils are not suitable for cultivated crops, and in places they are unsuitable for meadow crops because the stones make harvesting difficult. Under less than high-level management, these soils are well suited only to Korean lespedeza and sericea lespedeza and are fairly well suited to bermudagrass, fescue, and redtop. Under high-level management, they are well suited to all of these crops.

#### **Capability unit VIIe-2**

This unit consists of well-drained to excessively drained, strongly sloping, severely eroded soils that overlie Coastal Plain gravel. These soils are—

Brandon silt loam, 12 to 20 percent slopes, severely eroded.  
Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes, severely eroded (Litz soils only).

These soils are moderately low or low in natural fertility, moderately low or low in moisture-supplying capacity, and very strongly acid. They are very low in organic-matter content and can be worked within only a narrow range of moisture content without clodding. Also, these soils are susceptible to crusting, which interferes with the germination of seeds and the survival of seedlings, particularly those planted in spring. Roots and moisture easily penetrate the subsoil.

Shallowness, slow infiltration, rapid runoff, and a very high erosion hazard make these soils unsuitable for cultivated crops. Under less than high-level management, they are well suited only to Korean lespedeza and sericea lespedeza. Under high-level management, they are well suited also to fescue, redtop, and sweetclover and are fairly well suited to bermudagrass and bluegrass. Some crops that require little moisture or that grow early in spring and late in fall show good response to lime and fertilizer. The supply of organic matter should be increased by growing green-manure crops, by utilizing crop residues, and by mulching bare spots with manure, straw, or hay.

#### **Capability unit VIIe-4**

This unit consists of Gullied land. The areas have been so cut by gullies that they are nonarable. The gullies are so deep that they cannot be crossed with farm machinery.

Reclamation is difficult and expensive. The gullies must be filled in and leveled, generally with bulldozers or other large machinery, and large amounts of fertilizer and lime must be applied. A few of the small gullies can be reclaimed with farm machinery. It is seldom economical to reclaim large areas of Gullied land, but it is feasible to fill in and level small gullies that have formed within an otherwise arable field.

Much of this land type has been stabilized by hardwoods that have reseeded naturally. Some of it could be planted to pine. Bermudagrass, fescue, redtop, Korean lespedeza, and sericea lespedeza are suitable for planting, and they help to stabilize gullied areas that have been fertilized and otherwise well managed. These crops can also be grown on gullied areas that have been filled in and leveled and that are now under high-level management.

#### **Capability unit VIIs-1**

This unit consists of Dekalb, Ramsey, and Muskingum stony soils, 20 to 40 percent slopes. These are moderately steep and steep upland soils that are shallow, stony, and excessively drained. They overlie sandstone and shale.

These soils are moderately high to very low in natural fertility and strongly acid or very strongly acid. The moisture capacity is very low on the upper part of the south- and west-facing slopes, and moderately high on the north- and east-facing slopes and the lower part of the south- and west-facing slopes. The stones and steep slopes make these soils difficult to work. Roots and moisture easily penetrate as far down as bedrock or very firm clay.

Shallowness, stoniness, and a high or very high erosion hazard are the major limitations. These soils are not suitable for cultivated crops. In most places they are not suitable for meadow crops because harvesting with machinery is impossible. Under high-level management, bermudagrass, fescue, redtop, Kobe lespedeza, Korean lespedeza, and sericea lespedeza can be grown for pasture.

#### **Capability unit VIIs-2**

This unit consists of shallow, rocky, excessively drained, strongly sloping or moderately steep soils on uplands. These soils overlie limestone, sandstone, and shale. In places they are severely eroded. These soils are—

Caneyville very rocky soils, 12 to 20 percent slopes, severely eroded.  
Caneyville very rocky soils, 20 to 30 percent slopes.

The severely eroded soils are moderately low in natural fertility and low in moisture-supplying capacity. The uneroded or only slightly eroded soils are moderately high in natural fertility and moderately low in moisture-supplying capacity. Except where limestone is near the surface, all of these soils are medium acid to strongly acid. They are difficult to work because of rock outcrops, steep slopes, and, in places, a clayey surface layer.

Steepness, slow permeability, slow infiltration, and a high erosion hazard make these soils unsuitable for cultivated crops and ordinarily for meadow crops also, because harvesting with machinery is impossible. Under high-level management, bermudagrass, Kentucky 31 fescue, redtop, Korean lespedeza, and sericea lespedeza can be grown for pasture.

#### **Capability unit VIIs-5**

This unit consists of Rock land, limestone, and Rock land, sandstone. Loose stones and outcrops of either limestone or sandstone make up 25 to 90 percent of each land type. Generally, limestone crops out on slopes of 6 to 20 percent, and sandstone crops out on slopes steeper than 20 percent. There are many vertical cliffs 30 to 60 feet high. In some areas there is a series of two or three almost vertical cliffs that are 10 to 30 feet high, and loose stones and outcrops make up 25 to 90 percent of the acreage between them.

The rocky and stony surface is the major limitation. The steep slopes and the shallowness of the soil material over bedrock cause rapid runoff and a very high erosion hazard. It is impossible to use any type of farm machinery. Consequently, neither of these land types is suitable for crops. Redcedar is the predominant vegetation in

areas of Rock land, limestone. Virginia pine and small, slow-growing hardwoods grow in areas of Rock land, sandstone. Upland oaks, yellow-poplar, and Virginia pine grow well on the north- and east-facing slopes in some areas that are at a low elevation.

### Estimated Yields

Estimates of yields of the principal crops grown in Caldwell County are shown in table 2. The estimates are averages for a long period of time, on nonirrigated soils under high-level management. In estimating yields for soils on bottom lands, it is assumed there is no overflow hazard. The effects of flooding must be considered locally. High-

level management includes (1) use of suitable, high-yielding crop varieties; (2) proper seeding rates, proper planting dates, and efficient harvesting methods; (3) control of weeds, insects, and plant diseases; (4) shallow cultivation of row crops; (5) fertilization in accordance with the needs determined through soil tests; (6) adequate liming; (7) crop rotations that help to control erosion, maintain soil structure, and replenish the supply of organic matter; (8) drainage for naturally wet soils; (9) use of cover crops and crop residues; (10) contour tillage, terracing, strip-cropping, grassed waterways, and other applicable conservation measures; and (11) protection from overgrazing and the use of all applicable management practices for pasture land.

TABLE 2.—*Estimated average acre yields of the principal crops under high-level management*

[Yields are based on average rainfall over a long period. Absence of figure indicates the crop is not suited to the soil or is not commonly grown. Not listed are the miscellaneous land types, which are unsuitable for growing crops]

Soil	Corn	Wheat	Soybeans	Tobacco	Hay				Pasture
					Alfalfa and grass	Red clover and grass		Lespedeza	
						1st year	2d year		
	<i>Bu.</i>	<i>Bu.</i>	<i>Bu.</i>	<i>Lbs.</i>	<i>Tons</i>	<i>Tons</i>	<i>Tons</i>	<i>Tons</i>	<i>Animal-unit-days</i> <sup>1</sup>
Ashton silt loam, 0 to 4 percent slopes.....	105	40	35	2, 200	4. 0	1. 1	3. 0	2. 1	195
Baxter cherty silt loam, 12 to 20 percent slopes, eroded.....	65	25	25	1, 300	2. 7	1. 0	2. 7	1. 4	160
Baxter cherty silt loam, 20 to 30 percent slopes.....					2. 8				155
Brandon silt loam, 12 to 20 percent slopes.....					2. 7	. 8	2. 0	1. 5	150
Brandon silt loam, 12 to 20 percent slopes, severely eroded.....									105
Caneyville silt loam, 6 to 12 percent slopes....	60	20	20	1, 600	2. 6	. 8	2. 2	1. 4	125
Caneyville silt loam, 12 to 20 percent slopes....		15			2. 5	. 8	2. 1	1. 4	120
Caneyville silty clay loam, 6 to 12 percent slopes, severely eroded.....		20		1, 000	1. 8	. 5	1. 5	. 9	85
Caneyville very rocky soils, 12 to 20 percent slopes.....					2. 4	. 8	2. 0	1. 3	120
Caneyville very rocky soils, 12 to 20 percent slopes, severely eroded.....									80
Caneyville very rocky soils, 20 to 30 percent slopes.....									110
Captina silt loam, 0 to 2 percent slopes.....	80	30	30	1, 950	2. 5	1. 1	2. 8	2. 0	175
Captina silt loam, 2 to 6 percent slopes.....	80	30	30	2, 000	2. 5	1. 1	2. 8	2. 0	170
Captina silt loam, 2 to 6 percent slopes, eroded.....	70	25	25	1, 750	2. 2	. 9	2. 5	1. 9	160
Captina silt loam, 6 to 12 percent slopes, eroded.....	60	20	20	1, 600	2. 1	. 9	2. 3	1. 8	155
Collins silt loam.....	95	35	35	2, 100	3. 5	1. 1	3. 0	2. 0	190
Crider silt loam, 0 to 2 percent slopes.....	100	40	35	2, 150	4. 0	1. 1	3. 0	2. 0	190
Crider silt loam, 2 to 6 percent slopes.....	100	40	35	2, 150	3. 9	1. 1	3. 0	2. 0	185
Crider silt loam, 2 to 6 percent slopes, eroded.....	90	35	30	2, 000	3. 6	1. 1	3. 0	1. 9	180
Crider silt loam, 6 to 12 percent slopes.....	90	35	30	1, 950	3. 5	1. 1	3. 0	2. 0	180
Crider silt loam, 6 to 12 percent slopes, eroded.....	80	35	30	1, 800	3. 4	1. 1	3. 0	1. 9	170
Crider silt loam, 6 to 12 percent slopes, severely eroded.....	70	30	25	1, 550	2. 9	1. 0	2. 6	1. 5	145
Crider silt loam, 12 to 20 percent slopes.....	85	30		1, 750	3. 2	1. 1	3. 0	1. 9	175
Crider silt loam, 12 to 20 percent slopes, eroded.....	75	25		1, 650	3. 0	1. 0	2. 8	1. 8	165
Crider silty clay loam, 6 to 12 percent slopes, severely eroded.....	65	25	25	1, 550	2. 7	1. 0	2. 6	1. 6	145
Crider silty clay loam, 12 to 20 percent slopes, severely eroded.....		20			2. 7	. 9	2. 5	1. 5	140
Dekalb, Ramsey, and Muskingum stony soils, 12 to 20 percent slopes.....									110
Dekalb, Ramsey, and Muskingum stony soils, 20 to 40 percent slopes.....									

See footnote at end of table.

TABLE 2.—Estimated average acre yields of the principal crops under high-level management—Continued

Soil	Corn	Wheat	Soybeans	Tobacco	Hay			Pasture	
					Alfalfa and grass	Red clover and grass			Lespedeza
						1st year	2d year		
	Bu.	Bu.	Bu.	Lbs.	Tons	Tons	Tons	Tons	Animal-unit-days <sup>1</sup>
Dickson silt loam, 2 to 6 percent slopes	80	30	30	1,800	2.4	1.1	2.8	1.9	171
Dickson silt loam, 2 to 6 percent slopes, eroded	70	25	25	1,600	2.1	.9	2.5	1.7	155
Elk silt loam, 0 to 2 percent slopes	105	40	35	2,200	4.0	1.1	3.0	2.0	190
Elk silt loam, 2 to 6 percent slopes	100	40	35	2,200	3.9	1.1	3.0	2.0	185
Falaya silt loam	85	30	35	1,750	2.8	.9	2.3	2.0	180
Fredonia silty clay loam, shallow, 6 to 12 percent slopes, eroded	60	25	20	1,350	2.9	1.0	2.3	1.3	125
Fredonia silty clay loam, shallow, 12 to 20 percent slopes, eroded					2.8	.8	2.2	1.2	125
Fredonia-Rock land complex, 6 to 20 percent slopes, eroded									125
Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes	55	20	20	1,150	2.7	.9	2.5	1.5	140
Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes, severely eroded		10			1.8	.6	1.7	1.0	95
Gilpin, Litz, and Muskingum silt loams, 20 to 30 percent slopes					2.5	.9	2.4	1.4	130
Hayter silt loam, 6 to 12 percent slopes	85	35	30	1,800	3.6	1.1	3.0	1.9	180
Hayter silt loam, 12 to 20 percent slopes	80	30	30	1,650	3.5	1.1	3.0	1.9	175
Huntington gravelly silt loam	90	35	30	1,800	3.9	1.1	3.0	2.0	180
Huntington silt loam	110	45	40	2,200	4.0	1.1	3.0	2.0	195
Johnsburg silt loam	45	15	20	1,400				1.4	155
Lindside silt loam	100	35	35	2,000	3.5	1.1	3.0	2.0	195
McGary silt loam	50	20	20	1,500		.8	1.9	1.9	155
Melvin silt loam	70	25	30	1,550				1.8	170
Mullins silt loam	35		15	1,200				1.4	145
Newark silt loam	85	30	35	1,750	3.1	.9	2.5	1.8	185
Pembroke silt loam, 2 to 6 percent slopes	100	40	35	2,200	3.9	1.1	3.0	2.0	180
Pembroke silt loam, 2 to 6 percent slopes, eroded	90	35	30	2,050	3.6	1.1	3.0	2.0	180
Pembroke silt loam, 6 to 12 percent slopes	95	40	35	2,050	3.6	1.1	3.0	2.0	180
Pembroke silt loam, 6 to 12 percent slopes, eroded	85	35	30	1,850	3.4	1.1	3.0	1.9	170
Pembroke silt loam, 12 to 20 percent slopes, eroded	75	30	25	1,700	3.3	1.1	3.0	1.8	165
Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded	70	25	25	1,750	2.9	1.0	2.6	1.6	145
Pembroke silty clay loam, 12 to 20 percent slopes, severely eroded		20			2.8	.9	2.5	1.5	140
Russellville silt loam, 2 to 6 percent slopes	90	40	30	2,100	3.5	1.1	3.0	2.0	185
Russellville silt loam, 2 to 6 percent slopes, eroded	80	35	30	1,900	3.2	1.1	3.0	2.0	180
Russellville silt loam, 6 to 12 percent slopes	90	35	30	1,900	3.3	1.1	3.0	2.0	180
Russellville silt loam, 6 to 12 percent slopes, eroded	80	30	25	1,750	3.1	1.1	3.0	1.9	170
Russellville silt loam, 6 to 12 percent slopes, severely eroded	60	20	20	1,550	2.5	1.0	2.6	1.6	145
Russellville silt loam, 12 to 20 percent slopes, eroded	70	25	25	1,500	3.0	1.1	3.0	1.8	165
Russellville silt loam, 12 to 20 percent slopes, severely eroded		15			2.4	.9	2.5	1.5	140
Sharkey silt loam, overwash	80		30			1.1	3.0	1.9	165
Sharkey silty clay loam, overwash	80		30			1.1	3.0	1.9	160
Taft silt loam	55	15	20	1,500				1.7	155
Tilsit silt loam, 0 to 2 percent slopes	70	25	30	1,850	2.1	.9	2.3	1.8	155
Tilsit silt loam, 2 to 6 percent slopes	75	25	30	1,900	2.2	.9	2.4	1.8	155
Tilsit silt loam, 2 to 6 percent slopes, eroded	65	25	25	1,650	1.8	.8	2.0	1.7	145
Tilsit silt loam, 6 to 12 percent slopes, eroded	55	20	20	1,500	1.7	.7	1.9	1.6	120
Vicksburg gravelly silt loam	85	35	30	1,700	3.9	1.1	3.0	2.0	190
Vicksburg silt loam	105	40	35	2,200	4.0	1.1	3.0	2.0	195
Waverly silt loam	65	20	25	1,550		.7	1.8	1.7	175
Wellston silt loam, 2 to 6 percent slopes	85	35	30	1,950	3.3	1.1	3.0	1.9	165
Wellston silt loam, 6 to 12 percent slopes	80	30	30	1,800	3.1	1.1	2.9	1.8	160

See footnote at end of table.

TABLE 2.—*Estimated average acre yields of the principal crops under high-level management—Continued*

Soil	Corn	Wheat	Soybeans	Tobacco	Hay				Pasture
					Alfalfa and grass	Red clover and grass		Lespedeza	
						1st year	2nd year		
	Bu.	Bu.	Bu.	Lbs.	Tons	Tons	Tons	Tons	Animal-unit-days <sup>1</sup>
Wellston silt loam, 6 to 12 percent slopes, eroded.....	70	30	25	1, 650	2. 9	1. 0	2. 7	1. 7	150
Wellston silt loam, 12 to 20 percent slopes.....	70	30	-----	1, 650	3. 0	1. 1	2. 8	1. 7	155
Wellston silt loam, 12 to 20 percent slopes, eroded.....	60	25	-----	1, 400	2. 8	1. 0	2. 6	1. 6	145
Wellston silty clay loam, 6 to 12 percent slopes, severely eroded.....	50	20	20	1, 450	2. 3	. 8	2. 2	1. 3	120
Wellston silty clay loam, 12 to 20 percent slopes, severely eroded.....	-----	15	-----	-----	2. 2	. 8	2. 1	1. 3	115
Zanesville silt loam, 2 to 6 percent slopes.....	85	30	30	1, 950	2. 9	1. 1	3. 0	2. 0	180
Zanesville silt loam, 2 to 6 percent slopes, eroded.....	75	25	30	1, 750	2. 7	1. 1	2. 9	1. 9	175
Zanesville silt loam, 6 to 12 percent slopes.....	80	30	30	1, 800	2. 8	1. 1	3. 0	1. 9	175
Zanesville silt loam, 6 to 12 percent slopes, eroded.....	70	25	25	1, 650	2. 5	1. 1	2. 8	1. 8	165
Zanesville silt loam, 6 to 12 percent slopes, severely eroded.....	50	20	20	1, 450	2. 0	. 9	2. 3	1. 5	135
Zanesville silt loam, 12 to 20 percent slopes, eroded.....	65	25	25	1, 500	2. 5	1. 0	2. 5	1. 6	160
Zanesville silt loam, 12 to 20 percent slopes, severely eroded.....	-----	15	-----	-----	1. 9	. 8	2. 2	1. 5	135

<sup>1</sup> Animal-unit-days represents the number of days of grazing per acre for one animal unit (1 cow, 1 horse, or 1 mule; 3 steers or 2

yearlings; 5 sheep; or 4 brood sows or 20 shoats) without injury to the pasture.

## Woodland <sup>1</sup>

At the time of settlement, nearly all of Caldwell County was forested. The deep limestone soils supported white oak, northern red oak, yellow-poplar, black walnut, and other desirable hardwoods. The shallow limestone soils supported eastern redcedar of good quality and a wide variety of hardwoods of fair to poor quality. The deeper soils in the sandstone areas supported mainly white oak and yellow-poplar, and the shallower ones supported scarlet oak, chestnut oak, and Virginia pine, all of fair to good quality. On the lowlands were stands of good-quality pin oak, cottonwood, sweetgum, and other species commonly found on wetlands in the central hardwood region.

Except for the steep, rough parts of the sandstone and limestone areas and the poorly drained parts of the lowlands and uplands (a total of about 33,000 acres), nearly all of the county has been cleared. A large area in the sandstone-shale section has reverted to woodland. The limestone section is predominantly open land interspersed with small woodlands.

Fire protection is adequate, but little attention is directed toward good forest management. No epidemic

<sup>1</sup> This section was written by WILLIAM M. MORRILL, woodland conservationist, Soil Conservation Service, and E. V. HUFFMAN, assistant State soil scientist, Soil Conservation Service.

attacks of insects or diseases that seriously damage trees have occurred recently in the county.

Good markets exist for logs and pulpwood of fair to good quality.

## Woodland Groups

The following pages give information concerning the use and management of the soils as woodland. This information is based on studies made in the field and on the results of research. To simplify the presentation of the information, the soils have been placed in 15 woodland suitability groups. Each group consists of soils that produce similar kinds of wood crops under similar management, require similar kinds of conservation treatment if the vegetation is in similar condition, and are similar in potential productivity.

The interpretations on which the groupings are based are potential productivity for wood crops, species to be favored in existing woodland, species to be preferred for planting, and major limitations affecting management. Interpretations were made for each soil and are summarized in table 3 by groups of soils.

The potential productivity of each of more than 200 sites was determined. The sites are in Caldwell County and in adjacent counties where the soils are comparable. Each site was selected to represent a specific kind of forest stand

growing on a recognized kind of soil. The study was confined as nearly as possible to well-stocked, naturally occurring, even-aged, managed forest stands that had not been adversely affected by fire, by grazing, by insects, or by diseases. At each site the age and height of 2 to 4 of the tallest (dominant or codominant) trees in the stand were determined. The age and height of these trees were used to calculate the site index, which is considered to be the best available indicator of potential productivity. Site index refers to the average total height of the dominant and codominant trees in a stand at 50 years or some other specified age.

Forest research has provided average growth and yield information, by site index classes, for many tree species or forest types. Through these published data, it is possible to translate average site indexes into predictions of growth and yield. The predictions may be made in different common units of wood measurements, such as board feet, cubic feet, or cords per acre, for specified kinds of forest stands. References to the data used in this survey are given in table 3.

Field measurements were not available for all of the important tree species and forest types on all of the soils. Consequently, some of the productivity information given in table 3 was inferred from data relating to similar soils. The data obtained from the individual sites are available in the State office of the Soil Conservation Service.

The species to be favored in existing woodland are listed in order of their priority in table 3. Factors that combine to indicate the apparent priority are the site index, the quality of the trees, and the density of the natural stands. The species listed are those that generally should be favored in woodland management operations, such as harvest cutting, weeding, and improvement cutting.

The species to be preferred for planting are also listed in order of their priority in table 3.

The erosion hazard is rated according to the risk of erosion in well-managed woodland that is not protected by special practices. Generally, the hazard is rated *slight* on slopes of 0 to 6 percent, *moderate* on slopes of 6 to 12 percent, and *severe* on slopes of more than 12 percent. This general rule is modified if slope length or soil characteristics, or both, modify the effect of slope. Woodland erosion can be minimized by adjusting the rotation age and cutting cycles, by carefully constructing and maintaining roads, trails, and landings, and by using special techniques in management.

The ratings for equipment limitation indicate the degree to which soil characteristics restrict the use of conventional equipment for harvesting and planting wood crops, constructing roads, controlling fires, and controlling unwanted vegetation. Slope, texture, stoniness, and drainage are among the characteristics that may make it necessary to use different kinds of equipment, to vary the method of operation, or to restrict the season when equipment is used. The limitation is *slight* if there is little or no restriction on the type of equipment or on the time of year that the equipment can be used. The limitation is *moderate* if slopes are moderately steep, if heavy equipment is restricted by seasonal wetness, or if the use of equip-

ment damages the tree roots to some extent. Equipment limitation is *severe* if many types of equipment cannot be used, if the time equipment cannot be used is more than 3 months a year, and if the use of equipment severely damages roots of trees and the structure and stability of the soil. The limitation is severe on moderately steep and steep soils that are stony and have rock outcrops. It is also severe on wet bottom lands and low terraces in winter or early in spring.

The ratings for plant competition reflect the degree to which undesirable trees, vines, shrubs, and other plants invade a site when openings are made in the canopy. It also reflects the degree to which undesirable plants hinder the establishment and growth of desirable seedlings, either naturally occurring or planted. Competition is *slight* if unwanted plants do not prevent adequate natural regeneration and early growth or restrict the normal development of planted trees. Competition is *moderate* if the invaders delay but do not prevent the establishment of a normal, fully stocked stand. Competition is *severe* if it prevents adequate restocking, by either natural regeneration or planting, without intensive site preparation and special maintenance practices.

The ratings for seedling mortality refer to the expected loss of naturally occurring or planted tree seedlings as a result of unfavorable soil characteristics, when plant competition is not a factor. The ratings are based on the number of seedlings lost as compared with the number that must survive to restock the area adequately. Mortality is *slight* if not more than 25 percent of the seedlings die. It is *moderate* if 25 to 50 percent of the seedlings die. Mortality is *severe* if more than 50 percent of the seedlings die. Replanting, special seedbed preparation, and superior planting techniques are needed to insure adequate restocking of areas where mortality is severe.

#### Woodland group 1

This group consists of well drained and moderately well drained soils on flood plains and stream terraces. These soils are—

AsB	Ashton silt loam, 0 to 4 percent slopes.
Co	Collins silt loam.
EkA	Elk silt loam, 0 to 2 percent slopes.
EkB	Elk silt loam, 2 to 6 percent slopes.
Hg	Huntington gravelly silt loam.
Hn	Huntington silt loam.
Ld	Lindside silt loam.
Vb	Vicksburg gravelly silt loam.
Vc	Vicksburg silt loam.

The potential productivity is high for pin oak, cottonwood, sweetgum, and yellow-poplar. Intensive management is justified.

Plant competition is severe because available moisture is abundant during the growing season. Low-quality trees that tolerate shade become established in the understory of saw-log stands. When the overstory is removed by logging, these shade-tolerant trees usually prevent desirable kinds of trees from becoming established unless intensive weeding treatment is applied. Interplanting or conversion planting generally is not feasible. Trees planted in open fields generally need to be cultivated at least once.

TABLE 3.—Woodland

[No interpretations are given for group 15, which consists of

Woodland group	Potential productivity	
	Species and site index <sup>1</sup>	Estimated annual growth <sup>2</sup>
		<i>Bd. ft. per acre</i>
1. Level and gently sloping, well drained and moderately well drained silty soils on flood plains and stream terraces. These soils are subject to overflow. In places they are gravelly. (AsB, Co, EkA, EkB, Hg, Hn, Ld, Vb, Vc.)	Pin oak: 98 ± 4..... Cottonwood: 110 to 120..... Sweetgum: 85 to 95..... Yellow-poplar: 107 ± 5.....	485 930 440 625
2. Poorly drained and somewhat poorly drained silty and clayey soils on flood plains. Ponded at times. (Fa, Me, Ne, Sk, So, Wa.)	Pin oak: 97 ± 8..... Cottonwood: 106 ± 10..... Sweetgum: 95 ± 7.....	475 745 495
3. Level, somewhat poorly drained silty soil on stream terraces. This soil has a clay subsoil. (Mc.)	Shumard oak: 65 to 75.....	195
4. Level, poorly drained and somewhat poorly drained silty soils on uplands and terraces. These soils have a fragipan at a depth of 10 to 16 inches. (Jb, Mu, Ta.)	Upland oak: 70 to 80.....	240
5. Gently sloping and sloping, uneroded to moderately eroded, well-drained silty soils on uplands. These soils have a moderately clayey subsoil. All are of loess and limestone origin except Baxter soils, which developed in cherty limestone. (BcD2, BcE, CrA, CrB, CrB2, CrC, CrC2, CrD, CrD2, PbB, PbB2, PbC, PbC2, PbD2.)	Yellow-poplar: 97 ± 7..... Upland oak: 90 ± 5..... Virginia pine: 70 ± 6..... Redcedar: 40 to 50.....	515 400 ( <sup>3</sup> ) ( <sup>3</sup> )
6. Sloping and strongly sloping, deep, well-drained, severely eroded, moderately clayey soils on uplands. These soils are of loess and limestone origin. (BdD3, CrC3, CsC3, CsD3, PcC3, PcD3, RuC3, RuD3, WnD3, WnD3, ZaC3, ZaD3.)	Upland oak: 45 to 55..... Virginia pine: 60 to 70..... Redcedar: 35 to 40.....	65 ( <sup>3</sup> ) ( <sup>3</sup> )
7. Level to sloping, moderately well drained and well drained, uneroded to moderately eroded silty soils. These soils have a fragipan at a depth of 24 to 28 inches. (CnA, CnB, CnB2, CnC2, DnB, DnB2, RuB, RuB2, RuC, RuC2, RuD2, TmA, TmB, TmB2, TmC2.)	Upland oak: 76 ± 4.....	250
8. Sloping to moderately steep, silty upland soils that are well drained and have a clayey subsoil. These soils are of mixed sandstone, shale, and limestone origin. In places the surface is very rocky and bedrock is at a depth of only 15 inches. (CeC, CeD, CmD, CmE.)	Upland oak: 55 to 65..... Redcedar: 35 to 40.....	120 ( <sup>3</sup> )
9. Sloping and strongly sloping, eroded to severely eroded clayey soils on uplands. These soils are of limestone origin. In most places they are very rocky and shallow. (C1C3, CmD3, FdC2, FdD2, FrD2.)	Upland oak: 45 to 55..... Redcedar: 30 to 35.....	65 ( <sup>3</sup> )
10. Strongly sloping to steep, well-drained to excessively drained loamy soils on uplands; cool, or northern and eastern, aspects. <sup>4</sup> These soils are of sandstone and shale origin. (DmD, DmF, GmD, GmE.)	Upland oak: 71 ± 6..... Virginia pine: 65 to 75.....	205 ( <sup>3</sup> )
11. Strongly sloping to steep, well-drained to somewhat excessively drained, moderately deep to shallow loamy soils on narrow ridges and on side slopes on uplands; hot, or southern and western, aspects. <sup>5</sup> These soils are of sandstone and shale origin. Many are very stony. A few are severely eroded. (DmD, DmF, GmD, GmD3, GmE.)	Upland oak: 57 ± 6..... Virginia pine: 55 to 65.....	100 ( <sup>3</sup> )
12. Sloping and strongly sloping, well-drained silty soil underlain by gravel at a depth of 30 inches. This soil is of loess origin. (BdD.)	Upland oak: 72 ± 3.....	215
13. Gently sloping to strongly sloping, well-drained, uneroded to moderately eroded, deep and moderately deep loamy soils. These soils are of loess, sandstone, and shale origin. Bedrock or a fragipan is at a depth of 30 inches. (WeB, WeC, WeC2, WeD, WeD2, ZaB, ZaB2, ZaC, ZaC2, ZaD2.)	Upland oak: 67 ± 6..... Virginia pine: 74 ± 3.....	170 ( <sup>3</sup> )
14. Sloping to strongly sloping, well-drained loamy soils on foot slopes. These soils are predominantly of sandstone and shale origin. (HaC, HaD.)	Upland oak: 75 to 80..... Virginia pine: 70 to 80..... Yellow-poplar: 105 to 115.....	265 ( <sup>3</sup> ) 660

<sup>1</sup> At age 30 years for cottonwood, and at 50 for all other species. Indexes for cottonwood, sweetgum, the upland oaks, and Virginia pine based on information in publications (2, 3, 6, 7) listed in Literature Cited, page 103. Indexes for redcedar based on unpublished data supplied by the Tennessee Valley Authority. Indexes for yellow-poplar based on unpublished data compiled in 1957 by W. T. Doolittle, Southeast Forest Experiment Station. If four or more measurements were available, an average and the standard deviations were calculated; if less than four measurements were available, the range was used.

<sup>2</sup> In board feet of sawtimber per acre, according to International ¼-inch rule. Based on published data (5, 6) and on evaluations

groups

land types that are unsuitable for growing trees commercially]

Species to favor—		Major limitations			
In existing woodland	For planting	Erosion hazard	Equipment limitation	Plant competition	Seedling mortality
Cottonwood, sweetgum, pin oak, yellow-poplar.	Cottonwood, sweetgum, pin oak, yellow-poplar.	Slight.....	Moderate.....	Severe.....	Slight.
Cottonwood, sweetgum, pin oak...	Cottonwood, sweetgum, pin oak, silver maple.	Slight.....	Severe.....	Severe.....	Slight.
Shumard oak.....	Shumard oak.....	Slight.....	Moderate to severe.	Moderate to severe.	Slight.
Black oak, red maple, silver maple, southern red oak.	Black oak, southern red oak, red maple, silver maple.	Slight.....	Moderate.....	Severe.....	Slight.
Yellow-poplar, black walnut, white oak, basswood, black cherry, sugar maple, white ash, northern red oak.	White pine, shortleaf pine, loblolly pine, black locust, yellow-poplar, black walnut.	Moderate to severe.	Moderate to severe.	Moderate to severe.	Slight.
Virginia pine, redcedar, black oak, white oak.	Loblolly pine, shortleaf pine....	Severe.....	Severe.....	Slight.....	Moderate to severe.
Black oak, white oak, red maple, Virginia pine.	Loblolly pine, shortleaf pine, white pine.	Moderate to severe.	Slight.....	Moderate to severe.	Slight.
Black oak, white oak, redcedar....	Loblolly pine, shortleaf pine....	Moderate to severe.	Moderate to severe.	Moderate.....	Slight.
Redcedar.....	Redcedar.....	Severe.....	Severe.....	Slight.....	Moderate to severe.
White oak, black oak, southern red oak.	Loblolly pine, shortleaf pine, white pine.	Severe.....	Severe.....	Severe.....	Severe.
Black oak, chestnut oak, scarlet oak, Virginia pine.	Shortleaf pine, loblolly pine....	Severe.....	Severe.....	Slight.....	Severe.
Black oak, white oak, Virginia pine, scarlet oak, southern red oak.	Shortleaf pine, loblolly pine, white pine.	Severe.....	Moderate.....	Moderate to severe.	Slight.
Black oak, white oak, Virginia pine..	Shortleaf pine, loblolly pine, white pine.	Moderate to severe.	Moderate to severe.	Severe.....	Slight.
Virginia pine, black oak, white oak, yellow-poplar.	White pine, shortleaf pine, loblolly pine, yellow-poplar, black walnut, black locust.	Moderate to severe.	Moderate.....	Severe.....	Slight.

by the SCS. Estimates are for cottonwoods up to the age of 30 and for other species up to the age of 60, in well-stocked, even-aged, managed stands.

<sup>3</sup> No growth information.

<sup>4</sup> Azimuth bearings from 340° to 124° degrees.

<sup>5</sup> Azimuth bearings from 124° to 340° degrees.

Equipment limitations are moderate because of periods of seasonal wetness that last for a total of about 2 months each year.

#### Woodland group 2

This group consists of poorly drained and somewhat poorly drained soils on flood plains. These soils are—

Fa	Falaya silt loam.
Me	Melvin silt loam.
Ne	Newark silt loam.
Sk	Sharkey silt loam, overwash.
So	Sharkey silty clay loam, overwash.
Wo	Waverly silt loam.

The potential productivity is high for pin oak, cottonwood, and sweetgum. Intensive management is justified.

Plant competition is severe because available moisture is abundant during the growing season. Low-quality trees that tolerate shade become established in the understory of saw-log stands. When the overstory is removed by logging, these shade-tolerant trees usually prevent desirable kinds of trees from becoming established unless intensive weeding treatment is applied. Interplanting or conversion planting generally is not feasible. Trees planted in open fields generally need to be cultivated at least once.

Equipment limitations are severe because of periods of seasonal wetness that last for a total of more than 3 months each year.

#### Woodland group 3

The one soil in this group, McGary silt loam (Mc), is a somewhat poorly drained soil on stream terraces. It has a clay subsoil.

The potential productivity is moderate for Shumard oak. It justifies only moderately intensive management. Post oak commonly grows on this soil. Its site index is about 50.

Plant competition is moderate to severe because of the favorable amount of moisture in this soil during the growing season.

Equipment limitations are moderate to severe because of periods of seasonal wetness that last for a total of about 3 months each year.

#### Woodland group 4

This group consists of poorly drained and somewhat poorly drained soils on uplands and terraces. These soils have a fragipan. They are—

Jb	Johnsburg silt loam.
Mu	Mullins silt loam.
Ta	Taft silt loam.

The potential productivity is moderately high for upland oak. Intensive management is justified.

Plant competition is severe because of the favorable amount of moisture in the soil during the growing season. Low-quality trees that tolerate shade commonly become established in the understory of saw-log stands. When the overstory is removed by logging, these shade-tolerant trees usually prevent desirable kinds of trees from becoming established satisfactorily. One or more weeding operations are commonly required to insure the dominance of trees that are desirable for wood crops. Interplanting or conversion planting generally is not feasible, because of the intensive weeding requirements. Com-

petition with newly planted trees ordinarily is severe on open land that has been abandoned for 2 or more years after use for crops or pasture.

Equipment limitations are moderate because of periods of seasonal wetness that last for a total of about 2 months each year.

#### Woodland group 5

This group consists of upland soils that are well drained and have a moderately clayey subsoil. These soils are—

BcD2	Baxter cherty silt loam, 12 to 20 percent slopes, eroded.
BcE	Baxter cherty silt loam, 20 to 30 percent slopes.
CrA	Crider silt loam, 0 to 2 percent slopes.
CrB	Crider silt loam, 2 to 6 percent slopes.
CrB2	Crider silt loam, 2 to 6 percent slopes, eroded.
CrC	Crider silt loam, 6 to 12 percent slopes.
CrC2	Crider silt loam, 6 to 12 percent slopes, eroded.
CrD	Crider silt loam, 12 to 20 percent slopes.
CrD2	Crider silt loam, 12 to 20 percent slopes, eroded.
PbB	Pembroke silt loam, 2 to 6 percent slopes.
PbB2	Pembroke silt loam, 2 to 6 percent slopes, eroded.
PbC	Pembroke silt loam, 6 to 12 percent slopes.
PbC2	Pembroke silt loam, 6 to 12 percent slopes, eroded.
PbD2	Pembroke silt loam, 12 to 20 percent slopes, eroded.

The potential productivity is high for yellow-poplar, upland oak, Virginia pine, and redcedar. Intensive management is justified.

Plant competition is moderate to severe because of the amount of available moisture in the soil during the growing season. Low-quality trees that tolerate shade commonly become established in the understory of saw-log stands. When the overstory is removed by logging, these shade-tolerant trees usually prevent desirable kinds of trees from becoming established satisfactorily. One or more weeding operations usually are required to insure the dominance of trees that are desirable for wood crops. Interplanting or conversion planting generally is not feasible because of the intensive weeding requirements. Competition with newly planted trees ordinarily is severe on open land that has been abandoned for 2 or more years after use for crops or pasture.

Equipment limitations are severe on slopes of more than 20 percent, where the use of farm-type equipment is limited. Track-type equipment is required for efficient harvesting.

The erosion hazard is moderate to severe on slopes of more than 6 percent, mainly because of soil texture. As the slopes become steeper, the hazard becomes more severe. Because these soils tend to gully readily when they receive concentrated runoff, special attention needs to be given to the location, construction, and maintenance of roads and skid trails.

#### Woodland group 6

This group consists of deep, well-drained soils on uplands. These soils are—

BdD3	Brandon silt loam, 12 to 20 percent slopes, severely eroded.
CrC3	Crider silt loam, 6 to 12 percent slopes, severely eroded.
CsC3	Crider silty clay loam, 6 to 12 percent slopes, severely eroded.
CsD3	Crider silty clay loam, 12 to 20 percent slopes, severely eroded.
PcC3	Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded.
PcD3	Pembroke silty clay loam, 12 to 20 percent slopes, severely eroded.

RuC3	Russellville silt loam, 6 to 12 percent slopes, severely eroded.
RuD3	Russellville silt loam, 12 to 20 percent slopes, severely eroded.
WnC3	Wellston silty clay loam, 6 to 12 percent slopes, severely eroded.
WnD3	Wellston silty clay loam, 12 to 20 percent slopes, severely eroded.
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded.
ZaD3	Zanesville silt loam, 12 to 20 percent slopes, severely eroded.

The potential productivity is moderate for upland oak and Virginia pine and moderately high for redcedar. Moderately intensive management is justified.

Equipment limitations are severe. The steep, rough terrain limits the use of farm-type equipment. Track-type equipment is required for efficient harvesting.

The hazard of gully erosion is severe because of the presence of channels that were cut by past erosion. Because these soils tend to gully readily when they receive concentrated runoff, special attention needs to be given to the location, construction, and maintenance of roads and skid trails.

Seedling mortality is moderate to severe. Short periods of drought, 2 to 3 weeks long, early in the growing season cause moderate to severe losses of newly planted trees. Naturally occurring seedlings normally become established too slowly to provide adequate cover.

#### Woodland group 7

This group consists of moderately well drained and well drained soils that have a fragipan. These soils are—

CnA	Captina silt loam, 0 to 2 percent slopes.
CnB	Captina silt loam, 2 to 6 percent slopes.
CnB2	Captina silt loam, 2 to 6 percent slopes, eroded.
CnC2	Captina silt loam, 6 to 12 percent slopes, eroded.
DnB	Dickson silt loam, 2 to 6 percent slopes.
DnB2	Dickson silt loam, 2 to 6 percent slopes, eroded.
RuB	Russellville silt loam, 2 to 6 percent slopes.
RuB2	Russellville silt loam, 2 to 6 percent slopes, eroded.
RuC	Russellville silt loam, 6 to 12 percent slopes.
RuC2	Russellville silt loam, 6 to 12 percent slopes, eroded.
RuD2	Russellville silt loam, 12 to 20 percent slopes, eroded.
TmA	Tilsit silt loam, 0 to 2 percent slopes.
TmB	Tilsit silt loam, 2 to 6 percent slopes.
TmB2	Tilsit silt loam, 2 to 6 percent slopes, eroded.
TmC2	Tilsit silt loam, 6 to 12 percent slopes, eroded.

The potential productivity is moderately high for upland oak. Intensive management is justified.

Plant competition is moderate to severe because of the favorable soil-moisture relationships during the growing season. Low-quality trees that tolerate shade commonly become established in the understory of saw-log stands. When the overstory is removed by logging, these shade-tolerant trees usually prevent desirable kinds of trees from becoming established satisfactorily. One or more weeding operations are required to insure the dominance of trees that are desirable for wood crops. Interplanting or conversion planting generally is not feasible, because of intensive weeding requirements. Competition with newly planted trees ordinarily is severe on open land that has been abandoned for 2 or more years after use for crops or pasture.

The erosion hazard is moderate to severe on slopes of more than 6 percent, mainly because of soil texture. As the slopes become steeper, the hazard becomes more severe. Because these soils tend to gully readily when they receive

concentrated runoff, special attention needs to be given to the location, construction, and maintenance of roads and skid trails.

#### Woodland group 8

This group consists of upland soils that are moderately deep to shallow, are well drained, and have a clayey subsoil. These soils are—

CeC	Caneyville silt loam, 6 to 12 percent slopes.
CeD	Caneyville silt loam, 12 to 20 percent slopes.
CmD	Caneyville very rocky soils, 12 to 20 percent slopes.
CmE	Caneyville very rocky soils, 20 to 30 percent slopes.

The potential productivity is moderate for upland oak and redcedar. It justifies only moderately intensive management.

Plant competition is moderate because of the favorable soil-moisture relationships during the growing season. Low-quality trees that tolerate shade commonly become established in the understory of saw-log stands. When the overstory is removed by logging, these shade-tolerant trees usually prevent desirable kinds of trees from becoming established satisfactorily. One or more weeding operations are usually required to insure the dominance of trees that are desirable for wood crops. Interplanting or conversion planting generally is not feasible, because of intensive weeding requirements. Competition with newly planted trees ordinarily is severe on open land that has been abandoned for 2 or more years after use for crops or pasture.

Equipment limitations are severe on slopes of more than 20 percent. Rocks and steep, rough terrain limit the use of farm-type equipment. Track-type equipment is required for efficient harvesting.

The erosion hazard is severe on slopes of more than 12 percent, mainly because of the steep slope and the soil texture. Because these soils tend to gully readily when they receive concentrated runoff, special attention needs to be given to the location, construction, and maintenance of roads and skid trails.

#### Woodland group 9

This group consists of shallow clayey soils on uplands. These soils are—

CiC3	Caneyville silty clay loam, 6 to 12 percent slopes, severely eroded.
CmD3	Caneyville very rocky soils, 12 to 20 percent slopes, severely eroded.
FdC2	Fredonia silty clay loam, shallow, 6 to 12 percent slopes, eroded.
FdD2	Fredonia silty clay loam, shallow, 12 to 20 percent slopes, eroded.
FrD2	Fredonia-Rock land complex, 6 to 20 percent slopes, eroded (Fredonia soils).

The potential productivity is low for upland oak and moderately low for redcedar. It justifies only low-intensity management.

Equipment limitations are severe. Rocks and steep, rough terrain limit the use of farm-type equipment. Track-type equipment is required for efficient harvesting.

The erosion hazard is severe because of the presence of channels that were cut by erosion. Because these soils tend to gully readily when they receive concentrated runoff, special attention needs to be given to the location, construction, and maintenance of roads and skid trails.

Seedling mortality is moderate to severe. Short periods of drought, 2 to 3 weeks long, early in the growing season cause moderate to severe losses of newly planted trees. Naturally occurring seedlings normally become established too slowly to provide adequate cover.

#### **Woodland group 10**

This group consists of the northern and eastern exposures of four groups of upland soils. These soils are well drained to excessively drained. The southern and western exposures of these soils are in group 11. The mapping units that include these areas are—

- DmD Dekalb, Ramsey, and Muskingum stony soils, 12 to 20 percent slopes.
- DmF Dekalb, Ramsey, and Muskingum stony soils, 20 to 40 percent slopes.
- GmD Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes.
- GmE Gilpin, Litz, and Muskingum silt loams, 20 to 30 percent slopes.

The potential productivity is moderately high for upland oak and Virginia pine. Intensive management is justified.

Plant competition is severe because of the favorable soil-moisture relationships during the growing season. Low-quality trees that tolerate shade commonly become established in the understory of saw-log stands. When the overstory is removed by logging, these shade-tolerant trees usually prevent desirable kinds of trees from becoming established satisfactorily. One or more weeding operations usually are required to insure the dominance of trees that are desirable for wood crops. Interplanting or conversion planting generally is not feasible because of intensive weeding requirements. Competition with newly planted trees ordinarily is severe on open land that has been abandoned for 2 or more years after use for crops or pasture.

Equipment limitations are severe. Rocks and steep, rough terrain limit the use of farm-type equipment. Track-type equipment and power winches are required for efficient harvesting.

The erosion hazard is severe, mainly because of the steep slopes. Because these soils tend to erode readily when they receive concentrated runoff, special attention needs to be given to the location, construction, and maintenance of roads and skid trails.

#### **Woodland group 11**

This group consists of the southern and western exposures of five groups of upland soils. Drainage is good or somewhat excessive. The northern and eastern exposures of these soils are in group 10. The mapping units that include these areas are—

- DmD Dekalb, Ramsey, and Muskingum stony soils, 12 to 20 percent slopes.
- DmF Dekalb, Ramsey, and Muskingum stony soils, 20 to 40 percent slopes.
- GmD Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes.
- GmD3 Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes, severely eroded.
- GmE Gilpin, Litz, and Muskingum silt loams, 20 to 30 percent slopes.

The potential productivity is low for upland oak and Virginia pine. It justifies only low-intensity management.

Equipment limitations are severe. Rocks and steep, rough terrain limit the use of farm-type equipment. Track-type equipment and power winches are required for efficient harvesting.

The erosion hazard is severe, mainly because of the steep slopes and the shallowness of the soils. Because these soils tend to erode readily when they receive concentrated runoff, special attention needs to be given to the location, construction, and maintenance of roads and skid trails.

Seedling mortality is severe. Short periods of drought, 2 to 3 weeks long, early in the growing season cause moderate to severe losses of newly planted trees. Naturally occurring seedlings normally become established too slowly to provide adequate cover.

#### **Woodland group 12**

The one soil in this group, Brandon silt loam, 12 to 20 percent slopes (BcD), is a well-drained upland soil that is underlain by gravel at a depth of about 30 inches.

The potential productivity is moderately high for upland oak. Intensive management is justified.

Plant competition is moderate to severe because of the favorable soil-moisture relationships during the growing season. Low-quality trees that tolerate shade commonly become established in the understory of saw-log stands. When the overstory is removed by logging, these shade-tolerant trees usually prevent desirable kinds of trees from becoming established satisfactorily. One or more weeding operations usually are required to insure the dominance of trees that are desirable for wood crops. Interplanting or conversion planting generally is not feasible, because of intensive weeding requirements. Competition with newly planted trees ordinarily is severe on open land that has been abandoned for 2 or more years after use for crops or pasture.

Equipment limitations are moderate. The steep slopes limit the use of farm-type equipment. Track-type equipment is required for efficient harvesting.

The erosion hazard is severe because of the steep slopes. Because these soils tend to erode readily when they receive concentrated runoff, special attention needs to be given to the location, construction, and maintenance of roads and skid trails.

#### **Woodland group 13**

This group consists of well drained and moderately well drained, deep and moderately deep soils. These soils are—

- WeB Wellston silt loam, 2 to 6 percent slopes.
- WeC Wellston silt loam, 6 to 12 percent slopes.
- WeC2 Wellston silt loam, 6 to 12 percent slopes, eroded.
- WeD Wellston silt loam, 12 to 20 percent slopes.
- WeD2 Wellston silt loam, 12 to 20 percent slopes, eroded.
- ZaB Zanesville silt loam, 2 to 6 percent slopes.
- ZaB2 Zanesville silt loam, 2 to 6 percent slopes, eroded.
- ZaC Zanesville silt loam, 6 to 12 percent slopes.
- ZaC2 Zanesville silt loam, 6 to 12 percent slopes, eroded.
- ZaD2 Zanesville silt loam, 12 to 20 percent slopes, eroded.

The potential productivity is moderately high for upland oak and Virginia pine. Intensive management is justified.

Plant competition is severe because of the favorable soil-moisture relationships during the growing season. Low-quality trees that tolerate shade commonly become established in the understory of saw-log stands. When the

overstory is removed by logging, these shade-tolerant trees usually prevent desirable kinds of trees from becoming established satisfactorily. One or more weeding operations are usually required to insure the dominance of trees that are desirable for wood crops. Interplanting or conversion planting generally is not feasible, because of intensive weeding requirements. Competition with newly planted trees ordinarily is severe on open land that has been abandoned for 2 or more years after being used for crops or pasture.

Equipment limitations are moderate to severe on slopes of more than 12 percent. The steep, rough terrain limits the use of farm-type equipment. Track-type equipment is required for efficient harvesting.

The erosion hazard is moderate to severe because of the steep slopes. Because these soils tend to erode readily when they receive concentrated runoff, special attention needs to be given to the location, construction, and maintenance of roads and skid trails.

#### Woodland group 14

This group consists of deep, well-drained soils on foot slopes. These soils are—

- HaC Hayter silt loam, 6 to 12 percent slopes.
- HaD Hayter silt loam, 12 to 20 percent slopes.

The potential productivity is high for upland oak, yellow-poplar, and Virginia pine. Intensive management is justified.

Plant competition is severe because of the favorable soil-moisture relationships during the growing season. Low-quality trees that tolerate shade commonly become established in the understory of saw-log stands. When the overstory is removed by logging, these shade-tolerant trees usually prevent desirable kinds of trees from becoming established satisfactorily. One or more weeding operations usually are required to insure the dominance of trees that are desirable for wood crops. Interplanting or conversion planting generally is not feasible, because of intensive weeding requirements. Competition with newly planted trees ordinarily is severe on open land that has been abandoned for more than 2 years after use for crops or pasture.

Equipment limitations are moderate on slopes of more than 12 percent. The steep, rough terrain limits the use of farm-type equipment. Track-type equipment is required for efficient harvesting.

The erosion hazard is moderate to severe because of the steep slopes. Because these soils tend to erode readily when they receive concentrated runoff, special attention needs to be given to the location, construction, and maintenance of roads and skid trails.

#### Woodland group 15

This group consists of areas of extremely rocky land and areas in which the soil profile has been destroyed and the soils cannot be identified. These land types vary in origin and physiography, in characteristics of the soil material, in moisture-supplying capacity, and in requirements for conservation treatment. On-site inspection is required before specific interpretations can be made. These land types are—

- FrD2 Fredonia-Rock land complex, 6 to 20 percent slopes, eroded (Rock land only).
- Gu Gullied land.
- Ma Made land.
- Qd Quarries and dumps.
- Ro Rock land, limestone.
- Rs Rock land, sandstone.

Gullied land consists of areas scarred by deep and moderately deep gullies. The original soil remains only in narrow strips between the gullies. The potential productivity is very low. Shortleaf pine, loblolly pine, and Virginia pine may be planted where the soil material is sufficiently acid. In time, they will provide ground cover. Redcedar will grow where the soil material is limy but raw marl is not exposed. Scarcity of moisture and active erosion contribute to severe seedling mortality. The use of a mulch helps to establish trees. The use of equipment is severely restricted. The erosion hazard is severe. Posts, poles, and pulpwood can be produced on Gullied land, but generally it is inadvisable to attempt the production of sawtimber.

Made land consists of areas where construction or land-moving operations have greatly altered the soil profile. Woodland interpretations can be provided only after on-site inspection.

Quarries and dumps are not suitable for woodland.

Rock land, limestone, and Rock land, sandstone, are areas where outcrops of limestone and sandstone cover 25 to 90 percent of the surface. The potential productivity is low or very low. The erosion hazard, plant mortality, and equipment limitations are severe. The degree of competition varies. Sparse stands of redcedar mixed with poor-quality oaks may occur on Rock land, limestone. Eastern redcedar may be planted here if there is sufficient soil material. Shortleaf pine, loblolly pine, and Virginia pine may be planted on Rock land, sandstone, if the soil material is suitable. Existing stands of oaks and hickories are sparsely stocked and of fair to poor quality. Growth is slow, but posts, poles, or pulpwood may be produced in a long rotation.

### Wildlife <sup>2</sup>

The wildlife resources of Caldwell County and their relationship to the soil associations shown on the general soil map are considered in this section.

Associations 1 and 3 are similar in the kinds of wildlife they support. Association 1 is an area of broad, gently rolling ridges. Association 3 is one of narrow ridgetops and long, steep side slopes. For the most part, the gently sloping soils in these associations and some of the soils on bottom lands are in cultivated crops and pasture, and the steeper soils and the rest of the bottom land soils are in woodland. The principal species of wildlife on these associations are bobwhite quail, cottontail rabbit, raccoon, skunk, opossum, red fox, gray squirrel, and white-tailed deer. Much less common are fox squirrel, mink, muskrat, mourning dove, and duck. Bobwhite quail, cottontail rabbits, mourning doves, red foxes, and skunks most commonly occur where grainfields and grassland are interspersed with woodland and brush. Gray squirrels, white-

<sup>2</sup> This section was written by WILLIAM H. CASEY, biologist, Soil Conservation Service.

tailed deer, and opossum thrive in heavily wooded areas. Fox squirrels and raccoons are attracted to the heavily wooded bottom lands; mink and muskrats occupy banks along drainageways; and ducks congregate on inundated soils along the Tradewater River.

Association 2 is an area of steep escarpments made up mostly of shallow, rocky soils; 90 percent of it is wooded. Although most of the resident wildlife in the county is found on this association at one time or another, the principal species are gray squirrel and white-tailed deer. Deer are most numerous in areas near restocking points where they have been released.

Associations 4, 5, and 7 also are similar in characteristics and in the kinds of wildlife they support. Association 4 is an area of gently undulating topography. Part of it drains into surface streams, and the rest into sinkholes. Association 5 is an area of broad ridgetops and gentle slopes. Association 7 is one of typical karst topography. The gently sloping parts of these associations are in cultivated crops, the stronger slopes are in pasture, and the steep slopes are in woodland. Cottontail rabbit, mourning dove, skunk, opossum, red fox, and raccoon are the principal species of wildlife on these associations. Skunks, opossums, and red foxes are distributed evenly throughout these areas. Mourning doves and rabbits are attracted to fields that are cropped or pastured, and raccoons are most numerous on the wooded slopes. Significant numbers of mink, muskrats, and ducks are found along Eddy Creek in association 4.

Association 6 is an area of long, narrow ridgetops and strong side slopes. The ridgetops are mostly in cultivated crops, and the strong side slopes are in pasture. The steepest parts of this association are in woodland. Cottontail rabbit, opossum, skunk, red fox, gray squirrel, and mourning dove are the principal wildlife species. Doves and rabbits are probably the most plentiful in agricultural areas. Squirrels are abundant in woodlands. Opossums, skunks, and red foxes are distributed fairly evenly throughout the association.

## Engineering <sup>3</sup>

Soils engineering deals with soils as structural materials and as foundation materials upon which structures are built. Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, sewage disposal systems, and many other engineering structures. The properties most important to engineers are permeability to water, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, and degree of acidity or alkalinity. Topography, depth to water table, and depth to bedrock also are important.

Information in this report can be used to:

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.

2. Make preliminary estimates of soil properties in planning for conservation of soil and water, including the planning of systems for surface drainage and internal drainage and systems for water storage and water supply.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting highway, airport, pipeline, and cable locations and in planning detailed investigations at the selected locations.
4. Locate probable sources of sand and gravel for use in construction.
5. Correlate performance of engineering structures with types of soil, to develop information that will be useful in planning the design and maintenance of engineering structures.
6. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
7. Supplement other published information, such as maps, reports, and aerial photographs, that is used in preparation of engineering reports for a specific area or areas.
8. Develop preliminary estimates for construction purposes pertinent to a particular area.

With the use of the soil map for identification, the engineering interpretations reported here can be useful for many purposes. It should be emphasized that they may not eliminate the need for sampling and testing at the site of specific engineering works that involve heavy loads and those that require excavations deeper than the depths of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some terms used by soil scientists may not be familiar to engineers. Other soil science terms may have different meanings in engineering and related fields. The Glossary at the back of this report defines the meaning of many special terms as they are used by soil scientists. Other parts of the report, particularly the section "Descriptions of the Soils," give information that is useful in determining the engineering properties of soils in a particular area.

## Engineering and Agricultural Classification of Soils

Two systems of classifying soils for engineering purposes are in general use. One was developed by the American Association of State Highway Officials (AASHO) (1),<sup>4</sup> and the other, called the Unified system (11), by the U.S. Army Corps of Engineers and the Bureau of Reclamation. The bases for the engineering classifications differ from the bases for the textural classifications used by the Department of Agriculture.

Estimated classifications of all soils in Caldwell County according to all three of these systems are given in table 4, which begins on page 62.

<sup>3</sup> This section was written by WILLIAM M. ADAMS, civil engineer, SCS, in collaboration with E. V. HUFFMAN, assistant State soil scientist, SCS.

<sup>4</sup> Italic numbers in parentheses refer to Literature Cited, page 103.

The Unified soil classification system, developed by the Corps of Engineers, U.S. Army, and the U.S. Bureau of Reclamation, is based on the classification of soils according to their texture, their plasticity, and their performance as engineering construction material. The properties that form the basis of soil identification are (1) percentage of gravel, sand, and fines (fines are particles that will pass through a number 200 sieve); (2) grain-size distribution; and (3) plasticity and compressibility characteristics. The soils are divided into three classes: coarse-grained soils, fine-grained soils, and highly organic soils.

In coarse-grained soils, 50 percent or less of the soil material consists of particles small enough to pass through a number 200 sieve (0.074 millimeter). Coarse-grained soils are subdivided into gravels (G) and sands (S). The gravels are those in which the greater percentage of the coarse fraction (particles too large to pass through a number 200 sieve) consists of particles large enough to be retained on a number 4 sieve (4.76 millimeters), and the sands are those in which the greater portion consists of particles small enough to pass through a number 4 sieve. The soils in each of these two groups are further classified on the basis of the amount of fines and of grain-size distribution. The Unified symbols for gravel soils are GW (well-graded), GP (poorly graded), GM (silty), and GC (clayey); those for sands are SW (well graded), SP (poorly graded), SM (silty), and SC (clayey).

In fine-grained soils, more than 50 percent of the soil material consists of particles small enough to pass through a number 200 sieve. Fine-grained soils are subdivided into silts (M) and clays (C), depending on their liquid limit and plasticity index. Each of these groups is further subdivided according to whether the liquid limit is relatively low (L) or high (H). The Unified symbols for silts are ML and MH; those for clays are CL and CH. Also in the fine-grained group are two classes of soils that contain organic matter. The symbol OL identifies soils that are of low plasticity and have a liquid limit of less than 50. The symbol OH identifies soils that are of medium to high plasticity and have a liquid limit greater than 50.

The highly organic soils generally are highly compressible and have characteristics that make them undesirable for construction purposes. They are identified by the symbol Pt.

The system developed by the American Association of State Highway Officials (AASHTO) is an engineering property classification based on field performance in highways. Soils of about the same general load-carrying capacity and service are grouped together. There are seven basic groups, from A-1 through A-7. The symbol A-1 designates the best soils for road subgrades, and A-7 designates the poorest. The basic groups have been divided into subgroups identified by group index numbers from 0 to 20. Increasing values of the group index indicate reduction of load-carrying capacity of the subgrade and reflect the combined effect of increasing liquid limit and plasticity index and decreasing percentage of coarse material. The group index is shown in parentheses following the soil group symbol. A-6(8) is an example.

The seven basic groups are divided into two major classes: granular soils, in which 35 percent or less of the

soil material consists of particles small enough to pass through a number 200 sieve; and silt-clay soils, in which more than 35 percent consists of particles small enough to pass through a number 200 sieve.

The soils of groups A-1, A-2, and A-3 are granular. A-1 soils are well-graded mixtures of coarse to fine particles and have a nonplastic or only slightly plastic soil binder. A-2 soils may be poorly graded and may have inferior binder material. Group A-1 and A-2 may be subdivided according to the characteristics of the binder material. A-3 soils are sands that are deficient in binder and in coarse material.

The soils of groups A-4, A-5, A-6, and A-7 are silty or clayey, depending on the plasticity index. If the plasticity index is 10 or less, the soil is silty; if it is more than 10, the soil is clayey. A-4 soils are composed predominantly of silt and contain only moderate to small amounts of sticky colloidal clay. When dry, they provide a firm riding surface, with little rebound after loading. When they have absorbed water rapidly, they expand and lose stability. They are subject to frost heaving. A-5 soils are similar to A-4 soils, except that some are very poorly graded and have elastic properties and very low stability. A-6 soils are composed predominantly of clay and contain moderate to small amounts of coarse material. They have good bearing capacity when compacted to the maximum practical density, but they lose this capacity when they absorb moisture. A-7 soils are composed predominantly of clay, but they are elastic because they contain silt particles of uniform size, organic matter, mica flakes, or lime. At certain moisture contents, they deform quickly under load and rebound when the load is removed. Group A-7 may be subdivided according to the characteristics of the binder material.

The U.S. Department of Agriculture system of classifying soils according to texture is primarily for agricultural use, but texture is also of importance in engineering. It refers to the relative proportions of the various sized individual soil grains in a mass of soil. Classes of soil texture are based on different combinations of sand (particles 2.0 millimeters to 0.05 millimeter in diameter), silt (0.05 to 0.002 millimeter), and clay (less than 0.002 millimeter). The basic classes, in order of increasing proportions of the fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. Those classes with the term "sand" in the name are subdivided according to whether the sand is very fine, fine, coarse, or very coarse. "Gravelly" refers to soils that contain pebbles up to 3 inches in diameter, and "stony" to soils that contain stones more than 10 inches in diameter. Shaly soils contain flattened fragments of shale that are less than 6 inches long along the longer axis. Flaggy soils contain relatively thin fragments, 6 to 15 inches long, of sandstone, limestone, slate, or shale.

## Soil Properties and Engineering Interpretations

Table 4, which begins on page 62, gives descriptions of the soils mapped in Caldwell County and estimates of specified properties of each soil that are significant in engineering.

TABLE 4.—*Brief descriptions of soils and*

Map symbol	Soil	Description
AsB	Ashton silt loam, 0 to 4 percent slopes.	Well-drained soils on low stream terraces. Subject to infrequent flooding. Depth to rock 5 to 15 feet. Depth to seasonal high water table 4 to 6 feet.
BcD2	Baxter cherty silt loam, 12 to 20 percent slopes, eroded.	Well-drained, strongly sloping and moderately steep soils. Depth to rock 2½ to 10 feet. Seasonal high water table does not occur.
BcE	Baxter cherty silt loam, 20 to 30 percent slopes.	
BdD	Brandon silt loam, 12 to 20 percent slopes.	Well-drained soils on ridgetops and the upper part of slopes. Depth to rock more than 10 feet. Seasonal high water table does not occur.
BdD3	Brandon silt loam, 12 to 20 percent slopes, severely eroded.	
CeC	Caneyville silt loam, 6 to 12 percent slopes.	Well-drained and somewhat excessively drained, sloping to moderately steep soils. Depth to limestone or sandstone bedrock 1 foot to more than 3 feet. Outcrops of limestone and sandstone on the very rocky soils. Seasonal high water table does not occur.
CeD	Caneyville silt loam, 12 to 20 percent slopes.	
CiC3	Caneyville silty clay loam, 6 to 12 percent slopes, severely eroded.	
CmD	Caneyville very rocky soils, 12 to 20 percent slopes.	
CmD3	Caneyville very rocky soils, 12 to 20 percent slopes, severely eroded.	
CmE	Caneyville very rocky soils, 20 to 30 percent slopes.	
CnA	Captina silt loam, 0 to 2 percent slopes.	Moderately well drained soils on stream terraces. Fragipan at depth of 18 to 28 inches. Depth to rock 4 to 10 feet or more. Depth to seasonal high water table 1 foot to 1½ feet.
CnB	Captina silt loam, 2 to 6 percent slopes.	
CnB2	Captina silt loam, 2 to 6 percent slopes, eroded.	
CnC2	Captina silt loam, 6 to 12 percent slopes, eroded.	
Co	Collins silt loam.	Moderately well drained soils on natural levees along the larger streams. Subject to flooding. Depth to rock 5 to 10 feet or more. Depth to seasonal high water table 1½ to 2½ feet.
CrA	Crider silt loam, 0 to 2 percent slopes.	Well-drained soils on uplands. Depth to limestone bedrock 5 to 10 feet or more. Seasonal high water table does not occur.
CrB	Crider silt loam, 2 to 6 percent slopes.	
CrB2	Crider silt loam, 2 to 6 percent slopes, eroded.	
CrC	Crider silt loam, 6 to 12 percent slopes.	
CrC2	Crider silt loam, 6 to 12 percent slopes, eroded.	
CrC3	Crider silt loam, 6 to 12 percent slopes, severely eroded.	
CrD	Crider silt loam, 12 to 20 percent slopes.	
CrD2	Crider silt loam, 12 to 20 percent slopes, eroded.	
CsC3	Crider silty clay loam, 6 to 12 percent slopes, severely eroded.	
CsD3	Crider silty clay loam, 12 to 20 percent slopes, severely eroded.	
DmD	Dekalb, Ramsey, and Muskingum stony soils, 12 to 20 percent slopes.	
DmF	Dekalb, Ramsey, and Muskingum stony soils, 20 to 40 percent slopes.	Ramsey: Excessively drained, strongly sloping to steep soils on uplands. Sandstone at depth of 1 foot to 1½ feet. Seasonal high water table does not occur. Muskingum: Well-drained and somewhat excessively drained, strongly sloping to steep soils on uplands. Interbedded sandstone and shale at depth of 3 to 4 feet. Seasonal high water table does not occur.
DnB	Dickson silt loam, 2 to 6 percent slopes.	Moderately well drained, nearly level and gently sloping soils on uplands. Fragipan at depth of 18 to 26 inches. Depth to limestone bedrock 5 to 7 feet. Depth to seasonal high water table 1 foot to 1½ feet.
DnB2	Dickson silt loam, 2 to 6 percent slopes, eroded.	
EkA	Elk silt loam, 0 to 2 percent slopes.	Well-drained, nearly level and gently sloping soils on stream terraces. Beds of gravel at depth of more than 4 feet in places. Depth to limestone bedrock 5 to 10 feet or more. Depth to seasonal high water table 4 to 10 feet.
EkB	Elk silt loam, 2 to 6 percent slopes.	

*their estimated physical properties*

Depth from surface (typical)	Classification			Permeability	Available water capacity	Reaction
	USDA texture	Unified	AASHO			
<i>In.</i>				<i>In. per hr.</i>	<i>In. per in. of soil</i>	<i>pH</i>
0 to 9	Silt loam	ML	A-4 or A-6	2.0 to 5.0	0.22	6.1 to 6.5.
9 to 24	Silt loam	ML or CL	A-4 or A-6	0.8 to 2.0	0.22	5.6 to 6.0.
24 to 48+	Silt loam	ML or CL	A-6	0.8 to 2.0	0.22	5.6 to 6.0.
0 to 12	Cherty silt loam	ML	A-4	2.0 to 5.0	0.15	5.1 to 6.0.
12 to 16	Cherty silty clay loam	CL	A-7	0.8 to 2.0	0.13	5.1 to 6.0.
16 to 53	Cherty silty clay	CH	A-7	0.8 to 2.0	0.11	5.1 to 6.0.
0 to 9	Silt loam	ML-CL	A-4 or A-6	0.8 to 2.0	0.22	5.1 to 5.5.
9 to 24	Silty clay loam	CL or ML-CL	A-6 or A-7	0.8 to 2.0	0.19	5.1 to 5.5.
24 to 34	Silty clay loam	CL	A-4 or A-6	0.8 to 2.0	0.16	4.5 to 5.0.
34 to 48+	Gravelly sandy loam	GC or SP-SM	A-2 or A-4	5.0 to 10.0	0.07	4.5 to 5.5.
0 to 6	Silt loam	ML	A-4 or A-6	0.8 to 2.0	0.18	4.5 to 5.0.
6 to 18	Silty clay loam	CL or ML-CL	A-6 or A-7-6	0.8 to 2.0	0.19	5.1 to 6.0.
18 to 22	Clay	CH	A-7	0.2 to 0.8	0.14	5.1 to 6.0.
22+	Clay or silty clay	CL or CH	A-7	0.2 to 0.8	0.14 to 0.16	5.6 to 6.5.
0 to 7	Silt loam	ML or CL	A-4	0.8 to 2.0	0.22	6.1 to 6.5.
7 to 26	Silt loam	ML or CL	A-4 or A-6	0.8 to 2.0	0.22	4.5 to 5.5.
26 to 48+	Silty clay loam	CL	A-6 or A-7	0.05 to 0.2	0.19	4.5 to 5.5.
0 to 10	Silt loam	ML or CL	A-4	0.8 to 2.0	0.22	5.1 to 5.5.
10 to 48+	Silt loam, sandy loam, or silty clay loam.	CL, ML, or SM	A-2, A-4, or A-6.	0.8 to 2.0	0.12 to 0.22	5.1 to 5.5.
0 to 12	Silt loam	ML or CL	A-4	0.8 to 2.0	0.22	5.6 to 6.0.
12 to 29	Silty clay loam	CL, ML, or CH	A-7	0.8 to 2.0	0.19	5.1 to 6.0.
29 to 60	Silty clay loam	CL, ML-CL	A-7	0.8 to 2.0	0.19	5.1 to 5.5.
60+	Silty clay	CL or CH	A-7	0.2 to 0.8	0.16	6.1 to 6.5.
0 to 10	Silt loam or loam	ML-CL or SM	A-4	2.0 to 5.0	0.18 to 0.22	5.1 to 5.5.
10 to 24	Fine sandy loam	ML, GM, or GC	A-2 or A-4	2.0 to 5.0	0.12	4.5 to 5.5.
24 to 36	Sandy loam	SM, ML, or GM	A-6, A-4	2.0 to 5.0	0.15	4.5 to 5.5.
36 to 56	Clay	CH	A-7	0.8 to 0.2	0.05 to 0.12	4.5 to 5.5.
0 to 3	Stony silt loam	ML	A-4	2.0 to 5.0	0.14	4.5 to 5.0.
3 to 12	Stony silt loam	ML	A-4	2.0 to 5.0	0.14	4.5 to 5.0.
12 to 16	Stony sandy loam	GM or GC	A-2	5.0 to 10.0	0.08	4.5 to 5.0.
0 to 10	Stony silt loam	ML or CL	A-4 or A-6	0.8 to 2.0	0.15	5.1 to 5.5.
10 to 22	Stony silt loam	ML or CL	A-4 or A-6	0.8 to 2.0	0.15	5.1 to 5.5.
22 to 42	Stony silty clay loam	ML, CL, or GC	A-4 or A-2	0.8 to 2.0	0.12	5.1 to 5.5.
0 to 9	Silt loam	ML	A-4 or A-6	0.8 to 2.0	0.22	5.1 to 6.0.
9 to 23	Silt loam or silty clay loam	ML or CL	A-6	0.8 to 2.0	0.19 to 0.22	4.5 to 5.5.
23 to 46	Silt loam or silty clay loam	ML or CL	A-6	0.05 to 0.2	0.19 to 0.22	4.5 to 5.5.
46 to 72+	Silty clay	CL or CH	A-7	0.05 to 0.2	0.14	4.5 to 5.5.
0 to 12	Silt loam	ML	A-4	0.8 to 2.0	0.22	5.6 to 6.0.
12 to 40	Silty clay loam	CL	A-6	0.8 to 2.0	0.19	5.1 to 5.5.
40 to 48+	Silty clay loam	CL	A-7	0.8 to 2.0	0.19	5.6 to 6.0.

TABLE 4.—*Brief descriptions of soils and*

Map symbol	Soil	Description
Fa	Falaya silt loam.	Somewhat poorly drained soils along the Tradewater River and the larger branches and creeks. Subject to flooding. Depth to rock 10 feet or more. Depth to seasonal high water table 0 to 1 foot.
FdC2	Fredonia silty clay loam, shallow, 6 to 12 percent slopes, eroded.	Well-drained soils on uplands. Depth to rock 2 to 3 feet. Seasonal high water table does not occur.
FdD2	Fredonia silty clay loam, shallow, 12 to 20 percent slopes, eroded.	
FrD2	Fredonia-Rock land complex, 6 to 20 percent slopes, eroded.	
GmD	Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes.	Gilpin: Well-drained, strongly sloping to steep soils on uplands. Depth to soft shale bedrock 1½ to 3½ feet. Seasonal high water table does not occur.
GmD3	Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes, severely eroded.	
GmE	Gilpin, Litz, and Muskingum silt loams, 20 to 30 percent slopes.	
		Litz: Excessively drained, strongly sloping to steep soils on uplands. Limestone, shale, or sandstone at depth of 1 foot to 4 feet. Seasonal high water table does not occur.
		Muskingum: Well drained and somewhat excessively drained, strongly sloping to steep soils on uplands. Interbedded sandstone, siltstone, and shale at depth of 3 to 4 feet. Seasonal high water table does not occur.
Gu	Gullied land.	(No estimates of properties given, because areas are unsuitable for engineering uses.)
HaC	Hayter silt loam, 6 to 12 percent slopes.	Well-drained soils on foot slopes. Surface is gravelly in a few small areas. Depth to rock 5 to 12 feet. Depth to seasonal high water table 5 to 10 feet.
HaD	Hayter silt loam, 12 to 20 percent slopes.	
Hg	Huntington gravelly silt loam.	Well-drained soils near the channels of the larger branches and creeks in the part of the county underlain by limestone. Subject to occasional flooding. Depth to rock more than 10 feet. Depth to seasonal high water table 3 to 4 feet.
Hn	Huntington silt loam.	
Jb	Johnsburg silt loam.	Somewhat poorly drained, nearly level soils on uplands. Fragipan at depth of 18 to 24 inches. Depth to rock 4 to 6 feet. Depth to seasonal high water table 1 foot to 1½ feet.
Ld	Lindside silt loam.	Moderately well drained soils near channels of the larger branches and streams. Subject to flooding. Depth to rock 5 to 20 feet. Depth seasonal high water table 1½ to 2½ feet.
Ma	Made land.	(No estimates of properties, because areas are unsuitable for engineering uses.)
Mc	McGary silt loam.	Somewhat poorly drained soils on the flood plain of the Tradewater River in the northeastern part of the county. Subject to flooding. Layer of impervious clay at depth of 16 to 24 inches. Depth to rock more than 10 feet. Depth to seasonal high water table 1 foot to 2 feet.
Me	Melvin silt loam.	Poorly drained soils on the low parts of flood plains along the larger creeks. Subject to flooding. Depth to rock 3 to 8 feet. Depth to seasonal high water table 0 to 1 foot.
Mu	Mullins silt loam.	Poorly drained soils on upland flats and at the head of drainageways. Fragipan at depth of 12 to 18 inches. Depth to rock 4 to 6 feet. Depth to seasonal high water table 0 to 1 foot.
Ne	Newark silt loam.	Somewhat poorly drained soils mainly on the flood plain of Donaldson Creek. Subject to flooding. Depth to limestone bedrock 6 to 10 feet or more. Depth to seasonal high water table 0 to 1 foot.
PbB	Pembroke silt loam, 2 to 6 percent slopes.	Well-drained, gently sloping to moderately steep soils on uplands. Depth to limestone bedrock about 6 feet. Seasonal high water table does not occur.
PbB2	Pembroke silt loam, 2 to 6 percent slopes, eroded.	
PbC	Pembroke silt loam, 6 to 12 percent slopes.	
PbC2	Pembroke silt loam, 6 to 12 percent slopes, eroded.	

their estimated physical properties—Continued

Depth from surface (typical)	Classification			Permeability	Available water capacity	Reaction
	USDA texture	Unified	AASHO			
<i>In.</i> 0 to 8..... 8 to 48+.....	Silt loam..... Silt loam.....	CL or ML..... CL or ML.....	A-4 or A-6..... A-4 or A-6.....	<i>In. per hr.</i> 0.8 to 2.0..... 0.8 to 2.0.....	<i>In. per in. of soil</i> 0.22..... 0.22.....	<i>pH</i> 6.1 to 6.5..... 4.5 to 5.5.....
0 to 6..... 6 to 28.....	Silty clay loam..... Clay.....	CL..... CH.....	A-6 or A-7..... A-7.....	0.2 to 0.8..... 0.2 to 0.8.....	0.19..... 0.14.....	6.1 to 7.3..... 6.1 to 7.3.....
0 to 6..... 6 to 20..... 20 to 23..... 23 to 42.....	Silt loam..... Silty clay loam..... Sandy clay..... Silty clay.....	ML or CL..... CL or ML..... SM or SC..... CL or SC.....	A-4 or A-6..... A-6 or A-7..... A-4 or A-6..... A-6 or A-7.....	0.8 to 2.0..... 0.8 to 2.0..... 0.8 to 2.0..... 0.8 to 2.0.....	0.22..... 0.19..... 0.15..... 0.16.....	5.1 to 5.5..... 4.5 to 5.0..... 4.5 to 5.0..... 4.5 to 5.0.....
0 to 8..... 8 to 14+.....	Silt loam..... Silty clay loam.....	ML or CL..... CL or ML.....	A-4 or A-6..... A-6 or A-7.....	0.8 to 2.0..... 0.8 to 2.0.....	0.22..... 0.19.....	4.5 to 5.5..... 4.5 to 5.0.....
0 to 10..... 10 to 22..... 22 to 42.....	Stony silt loam..... Stony silt loam..... Stony silty clay loam.....	ML or CL..... ML or CL..... ML, CL, or GC.....	A-4 or A-6..... A-4 or A-6..... A-4 or A-2.....	0.8 to 2.0..... 0.8 to 2.0..... 0.8 to 2.0.....	0.15..... 0.15..... 0.12.....	5.1 to 5.5..... 5.1 to 5.5..... 5.1 to 5.5.....
0 to 11..... 11 to 22..... 22 to 45..... 45 to 62+.....	Silt loam..... Silty clay loam..... Silt loam..... Silty clay loam.....	ML or CL..... MH, CL, or CH..... MH, CL, or CH..... MH, CL, or CH.....	A-4 or A-6..... A-6..... A-6..... A-6.....	0.8 to 2.0..... 0.8 to 2.0..... 0.8 to 2.0..... 0.8 to 2.0.....	0.22..... 0.19..... 0.22..... 0.19.....	6.1 to 6.5..... 5.1 to 5.5..... 4.5 to 5.0..... 4.5 to 5.0.....
0 to 18..... 18 to 48+.....	Silt loam..... Silt loam.....	CL or ML..... CL or ML.....	A-4 or A-6..... A-4 or A-6.....	0.8 to 2.0..... 0.8 to 2.0.....	0.22..... 0.16 to 0.22.....	6.6 to 7.3..... 6.6 to 7.3.....
0 to 9..... 9 to 24..... 24 to 48.....	Silt loam..... Silt loam..... Silty clay loam.....	ML-CL..... CL or ML..... CL or ML.....	A-4..... A-6..... A-6 or A-7.....	0.8 to 2.0..... 0.2 to 0.8..... 0.05 to 0.2.....	0.22..... 0.22..... 0.19.....	4.5 to 5.5..... 4.5 to 5.0..... 4.5 to 5.0.....
0 to 8..... 8 to 36..... 36 to 48.....	Silt loam..... Silt loam..... Silt loam or loam.....	ML or CL..... ML or CL..... ML or CL.....	A-4 or A-6..... A-6..... A-6.....	0.8 to 2.0..... 0.8 to 2.0..... 0.8 to 2.0.....	0.22..... 0.22..... 0.18 to 0.22.....	6.1 to 7.3..... 6.1 to 7.3..... 6.1 to 7.3.....
0 to 7..... 7 to 12..... 12 to 27..... 27 to 50.....	Silt loam..... Silty clay loam..... Silty clay..... Clay.....	ML or CL..... CL or ML..... CL or CH..... CH.....	A-6..... A-7..... A-7..... A-7.....	0.8 to 2.0..... 0.2 to 0.8..... 0.05 to 0.2..... 0.05 to 0.2.....	0.22..... 0.19..... 0.16..... 0.14.....	5.1 to 6.0..... 5.1 to 6.0..... 5.6 to 6.0..... 6.6 to 7.8.....
0 to 6..... 6 to 21..... 21 to 72+.....	Silt loam..... Silt loam..... Silt loam.....	ML or CL..... ML or CL..... CL.....	A-4 or A-6..... A-6..... A-6.....	0.8 to 2.0..... 0.2 to 0.8..... 0.2 to 0.8.....	0.22..... 0.22..... 0.22.....	6.1 to 7.3..... 6.1 to 7.3..... 6.1 to 6.5.....
0 to 9..... 9 to 24..... 24 to 30..... 30 to 42..... 42 to 48+.....	Silt loam..... Silty clay loam..... Silty clay loam or silty clay..... Clay..... Silty clay loam.....	ML or CL..... CL or ML..... CL or CH..... CH..... CL or CH.....	A-4 or A-6..... A-7..... A-7..... A-7..... A-7.....	0.2 to 0.8..... 0.05 to 0.2..... 0.05 to 0.2..... 0.05 to 0.2..... 0.05 to 0.2.....	0.22..... 0.19..... 0.16 to 0.19..... 0.14..... 0.19.....	4.5 to 5.5..... 4.5 to 5.0..... 4.5 to 5.0..... 4.5 to 5.0..... 4.5 to 5.0.....
0 to 6..... 6 to 36+.....	Silt loam..... Silt loam.....	ML or CL..... CL or ML.....	A-4 or A-6..... A-4 or A-6.....	0.8 to 2.0..... 0.8 to 2.0.....	0.22..... 0.22.....	6.1 to 6.5..... 6.1 to 6.5.....
0 to 8..... 8 to 50..... 50 to 60..... 60 to 72.....	Silt loam..... Silty clay loam..... Silty clay..... Silty clay or clay.....	ML or CL..... CL or CH..... CL or CH..... CL or CH.....	A-4 or A-6..... A-7..... A-7..... A-7.....	0.8 to 2.0..... 0.8 to 2.0..... 0.8 to 2.0..... 0.2 to 0.8.....	0.22..... 0.19..... 0.16..... 0.14 to 0.16.....	5.6 to 6.5..... 5.1 to 5.5..... 5.6 to 6.0..... 5.6 to 6.0.....

TABLE 4.—*Brief descriptions of soils and*

Map Symbol	Soil	Description
PbD2 PcC3 PcD3	Pembroke silt loam—Continued Pembroke silt loam, 12 to 20 percent slopes, eroded. Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded. Pembroke silty clay loam, 12 to 20 percent slopes, severely eroded.	
Qd	Quarries and dumps.	(No estimates of properties, because areas are unsuitable for engineering uses.)
Ro Rs	Rock land, limestone. Rock land, sandstone.	(No estimates of properties, because areas are unsuitable for engineering uses.)
RuB RuB2 RuC RuC2 RuC3 RuD2 RuD3	Russellville silt loam, 2 to 6 percent slopes. Russellville silt loam, 2 to 6 percent slopes, eroded. Russellville silt loam, 6 to 12 percent slopes. Russellville silt loam, 6 to 12 percent slopes, eroded. Russellville silt loam, 6 to 12 percent slopes, severely eroded. Russellville silt loam, 12 to 20 percent slopes, eroded. Russellville silt loam, 12 to 20 percent slopes, severely eroded.	Well-drained, gently sloping to strongly sloping soils on uplands. Fragi-pan at a depth of 24 to 34 inches. Depth to rock 5 to 6 feet. Depth to seasonal high water table 1½ to 3 feet.
Sk So	Sharkey silt loam, overwash. Sharkey silty clay loam, overwash.	Poorly drained soils of the slack-water areas along the Tradewater River in the northeastern corner of the county. Subject to flooding. Depth to rock 2½ to more than 4 feet. Depth to seasonal high water table 0 to 1 foot.
Ta	Taft silt loam.	Somewhat poorly drained, nearly level soils on stream terraces. Fragi-pan at depth of 14 to 18 inches. Depth to rock 5 to 12 feet or more. Depth to seasonal high water table 1 foot to 1½ feet.
TmA TmB TmB2 TmC2	Tilsit silt loam, 0 to 2 percent slopes. Tilsit silt loam, 2 to 6 percent slopes. Tilsit silt loam, 2 to 6 percent slopes, eroded. Tilsit silt loam, 6 to 12 percent slopes, eroded.	Moderately well-drained, nearly level to moderately sloping soils on uplands. Fragi-pan at depth of 18 to 24 inches. Depth to sandstone bedrock 5 to 10 feet. Depth to seasonal high water table 1 foot to 1½ feet.
Vb	Vicksburg gravelly silt loam.	Well-drained soils on flood plains of the larger creeks. Subject to flooding. Depth to rock 5 to 10 feet or more. Depth to seasonal high water table 3 to 4 feet.
Vc	Vicksburg silt loam.	Well-drained soils on flood plains of the larger creeks. Subject to flooding. Depth to rock 5 to 10 feet or more. Depth to seasonal high water table 3 to 4 feet.
Wa	Waverly silt loam.	Poorly drained, level or nearly level soil on flood plains. Subject to flooding. Depth to rock more than 10 feet. Depth to seasonal high water table 0 to 1 foot.
WeB WeC WeC2 WeD WeD2 WnC3 WnD3	Wellston silt loam, 2 to 6 percent slopes. Wellston silt loam, 6 to 12 percent slopes. Wellston silt loam, 6 to 12 percent slopes, eroded. Wellston silt loam, 12 to 20 percent slopes. Wellston silt loam, 12 to 20 percent slopes, eroded. Wellston silty clay loam, 6 to 12 percent slopes, severely eroded. Wellston silty clay loam, 12 to 20 percent slopes, severely eroded.	Well-drained soils on ridgetops, benches, and slopes in the uplands. Depth to sandstone and shale bedrock 2 to 6 feet. Seasonal high water table does not occur.
ZaB ZaB2 ZaC ZaC2 ZaC3 ZaD2 ZaD3	Zanesville silt loam, 2 to 6 percent slopes. Zanesville silt loam, 2 to 6 percent slopes, eroded. Zanesville silt loam, 6 to 12 percent slopes. Zanesville silt loam, 6 to 12 percent slopes, eroded. Zanesville silt loam, 6 to 12 percent slopes, severely eroded. Zanesville silt loam, 12 to 20 percent slopes, eroded. Zanesville silt loam, 12 to 20 percent slopes, severely eroded.	Moderately well drained, gently sloping to strongly sloping soils on uplands. Fragi-pan at a depth of 24 to 34 inches. Sandstone, siltstone, or shale bedrock at depth of 4 to 6 feet. Depth to seasonal high water table 1½ to 3 feet.

*their estimated physical properties—Continued*

Depth from surface (typical)	Classification			Permeability	Available water capacity	Reaction
	USDA texture	Unified	AASHO			
<i>In.</i>				<i>In. per hr.</i>	<i>In. per in. of soil</i>	<i>pH</i>
0 to 14	Silt loam	ML or CL	A-4	0.8 to 2.0	0.22	5.1 to 6.0.
14 to 32	Silty clay loam	ML or CL	A-7	0.8 to 2.0	0.19	4.5 to 5.5.
32 to 42	Silt loam	ML or CL	A-6	0.05 to 0.2	0.22	4.5 to 5.5.
42 to 80	Silty clay	CH	A-7	0.2 to 0.8	0.16	4.5 to 5.5.
0 to 5	Silt loam or silty clay loam	ML or CL	A-6	0.2 to 0.8	0.19 to 0.22	5.6 to 6.5.
5 to 9	Silty clay loam	ML or CL	A-7	0.2 to 0.8	0.19	5.6 to 6.5.
9 to 48+	Clay	ML, CL, or CH	A-7	0.05 to 0.2	0.14	6.1 to 7.8.
0 to 14	Silt loam	ML or CL	A-6	0.8 to 2.0	0.22	5.1 to 6.0.
14 to 48+	Silty clay loam	CL	A-6 or A-7	0.05 to 0.2	0.19	4.5 to 5.5.
0 to 8	Silt loam	ML or CL	A-4	0.8 to 2.0	0.22	5.6 to 6.0.
8 to 22	Silt loam	ML or CL	A-6	0.8 to 2.0	0.22	4.5 to 5.5.
22 to 38	Silty clay loam	CL	A-7 or A-6	0.05 to 0.2	0.19	4.5 to 5.0.
38 to 68+	Silty clay loam to sandy clay loam.	ML or CL	A-7 or A-6	0.8 to 2.0	0.17	4.5 to 5.0.
0 to 6	Silt loam	ML or CL	A-4 or A-6	2.0 to 5.0	0.22	5.1 to 5.5.
6 to 38	Silt loam	ML or CL	A-4 or A-6	2.0 to 5.0	0.22	5.1 to 5.5.
38 to 48	Silt loam or fine sandy loam	ML or SM	A-2, A-4, or A-6	2.0 to 5.0	0.12 to 0.22	5.1 to 5.5.
0 to 6	Silt loam	ML or CL	A-4 or A-6	0.8 to 2.0	0.22	5.1 to 5.5.
6 to 38	Silt loam	ML or CL	A-4 or A-6	0.8 to 2.0	0.22	5.1 to 5.5.
38 to 48	Silt loam or fine sandy loam	ML or SM	A-2, A-4, or A-6	0.8 to 2.0	0.12 to 0.22	5.1 to 5.5.
0 to 8	Silt loam	ML or CL	A-4 or A-6	0.8 to 2.0	0.22	4.5 to 5.0.
8 to 48+	Silt loam	ML or CL	A-4 or A-6	0.8 to 2.0	0.22	4.5 to 5.0.
0 to 11	Silt loam	ML or CL	A-4 or A-6	0.8 to 2.0	0.22	5.1 to 5.5.
11 to 26	Silty clay loam	CL	A-6 or A-7	0.8 to 2.0	0.19	4.5 to 5.0.
26 to 32	Sandy clay loam	CL	A-4 or A-6	0.8 to 2.0	0.17	4.5 to 5.0.
32 to 40+	Fine sandy clay loam	CL	A-4 or A-6	0.8 to 2.0	0.17	4.5 to 5.0.
0 to 7	Silt loam	ML or CL	A-4	0.8 to 2.0	0.22	6.1 to 6.5.
7 to 28	Silty clay loam	CL or ML	A-6 or A-7	0.8 to 2.0	0.19	5.1 to 6.0.
28 to 37	Silt loam	CL or ML	A-6	0.05 to 0.2	0.22	4.5 to 5.5.
37 to 80	Silt loam	CL	A-6	0.8 to 2.0	0.22	4.5 to 5.5.

Permeability, as used in this table, relates only to the movement of water downward through the undisturbed soil material. Rates are based on estimates made by soil scientists familiar with the properties of the soils.

Available water capacity refers to that part of the water in the soil that can be taken up by plants at rates significant to their growth. The estimates are based on experiments made on soils in Tennessee and Kentucky.

Depth to seasonal high water table refers to the depth to the water level late in winter and early in spring.

Table 5, which begins on page 70, presents estimates of the suitability of the soils for specified engineering purposes and of the degree and kind of their limitation for buildings and sewage-disposal areas, and brief statements of the features that adversely affect the use of the soils for the engineering practices listed.

Except for Brandon soils, all of the soils in the county are unsuitable as a source of sand and gravel. Brandon soils are rated "fair;" gravel is below a depth of 4 feet in places.

The workability of a soil as construction material depends largely on the texture and moisture content of the soil material, the number of bedrock outcrops, and the depth to the water table at the time of construction. When wet, clay soils are difficult to handle, to compact, and to dry to the desired moisture content; hence they are rated "poor."

Potential frost action depends on the texture of the soil, the depth to the water table during the freezing period, and the length of time the temperature is below freezing. Silts and fine sands that have a high water table are rated "high."

The shrink-swell potential is an indication of the volume change to be expected with a change in moisture content. This potential is based primarily on the amount and type of clay in the soil. In general, soils classified as CH and A-7 have a high shrink-swell potential. Sand and gravel, soils having only small amounts of slightly plastic fines, and most other nonplastic to slightly plastic soil material have a low shrink-swell potential.

## Engineering Test Data

Soil samples taken from 14 soil profiles in the county were tested in accordance with standard procedures to help evaluate the soils for engineering purposes. Table 6 gives the results of these tests.

In the moisture-density test, soil material is compacted into a mold several times, each time at a successively higher moisture content, with a constant compactive effort. The dry density (unit weight) of the soil material increases as the moisture content increases, until the "optimum moisture content" is reached. After that, the dry density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed "Maximum dry density." Moisture-density data is important in earthwork because, as a rule, optimum stability is obtained with the least amount of compactive effort when the soil is at approximately the optimum moisture content.

The mechanical analysis, by which the relative proportions of the different sizes of particles in the soil sample were determined, was made by combined sieve and hydrometer methods. Clay content (percentage of particles

smaller than 0.002 millimeter) was obtained by the hydrometer method.

Liquid limit and plasticity index indicate the effect of water on the consistence of the soil material. As the moisture content of a very dry clayey soil increases, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil is plastic.

## Formation, Classification, and Morphology of the Soils

The purpose of this section is to describe the environment under which the soils of Caldwell County formed and to relate it to the characteristics of the soils. The first part deals with the factors involved in the formation of the soils. The second explains briefly the system of soil classification and shows the classification of the soils of Caldwell County by series and higher categories. The last part describes in detail a profile typical of each series.

### Factors of Soil Formation

Soil is a function of parent material, climate, living organisms, relief, and time. The nature of the soil at any point on the earth depends on the combination of these factors at that point. All five factors come into play in the genesis of every soil. The relative importance of each differs from place to place. In extreme cases, one factor may dominate in the formation of the soil and fix most of its properties. An example is parent material that consists of pure quartz sand. Little can happen to quartz sand, and most soils derived from it have faint horizons. Even in quartz sand, however, distinct profiles can be formed under certain types of vegetation if the topography is low and flat and the water table is high.

In the following pages, the five major factors of soil formation are discussed in relation to their effects on the soils of Caldwell County.

### Climate

Caldwell County has the humid, temperate type of climate characteristic of the south-central part of the United States. The climate is described in the section "General Nature of the County."

There is little variation in climate within the county, so its effect on soil development has been nearly uniform. The slight variations that affect soil formation result from differences in relief.

As is typical in areas that have a humid, temperate climate, many of the soils of the county are strongly weathered, highly leached, and acid. The high rainfall results in rather intense leaching and movement of soluble and colloidal materials downward in the soil. Because the soil is frozen for only short periods and to very slight depth,

weathering and translocation of materials continue almost without interruption.

### **Living organisms**

The native vegetation, like the climate, was fairly uniform and is relatively unimportant in accounting for differences among soils of the county. However, the vegetation has had a strong influence on the common characteristics of the soils.

The first settlers in the county found a dense stand of upland hardwoods in the northern and eastern sections of the county, but much of the southern and western sections was treeless, though abounding in grass. This was part of the area known as the Barrens. The lack of trees was due not to lack of soil fertility or to a difference in climate but to the fact that Indians had burned the area frequently in order to provide better conditions for hunting buffalo. Although the Barrens were without trees for more than a hundred years, soils throughout the county have characteristics normally associated with soils that formed under forest vegetation. Woodland cover is conducive to acid leaching, to development of strongly leached A2 horizons, and to a generally low organic-matter content.

The main differences in the kinds of trees in the forested areas appear to have been associated with drainage. Oak, maple, hickory, birch, yellow-poplar, and chestnut made up 80 percent of the pioneer forest. The hardwoods of best quality grew on the deeper, better drained, gently rolling to strongly sloping soils. Hardwoods of fair quality grew on the steep, shallow, rocky soils, along with some Virginia pine at higher elevations where sandstone was near the surface, and some high-quality redcedar where limestone was at or near the surface. The lowlands along the Tradewater River and Donaldson Creek supported stands of pin oak, cottonwood, sweetgum, and other species that are commonly found on wet land in the central hardwood region.

The influence of grassland vegetation on the soils of this county has been slight. Soils that have a thick, dark-colored surface horizon are believed to have been strongly influenced by grass. Wet-land soils such as those of the Sharkey, Waverly, and Melvin series, have thick, dark-colored A horizons that are probably the result of a mixed vegetation consisting of trees and swamp grasses.

Not much is known of the fungi and other forms of microlife, but these undoubtedly influenced soil formation. The greatest activity of earthworms and other small animals is in the uppermost few inches of the soil. Mixing of soil material and additions of organic matter by rodents and earthworms are important but are not directly measurable in the development of the soils.

The complex of living organisms in the county has been drastically changed as a result of man's activity. The clearing of forests, the cultivation of fields, the introduction of new species of plants, and artificial drainage of wet areas will affect the rate and direction of soil development in the future. Some of the results of man's activities, such as accelerated erosion, are already evident, but other results may not become apparent for many years.

### **Parent material**

Differences among the soils of Caldwell County are attributable mainly to differences in parent material. Several different sources of parent material can be identified:

loess; high-grade limestone; cherty limestone; mixed limestone, sandstone, and shale; mixed sandstone, siltstone, and shale; alluvium; slope wash (local alluvium and colluvium); gravelly material of the Coastal Plain; and calcareous sandstone. Table 7 in the section "Classification of the Soils" shows the combination of these various materials in which the soils of each series developed.

Loess (windblown silty material) is the most extensive of the several kinds of parent material. Deposits of loess covered most of the upland areas that have slopes of less than 20 percent. These deposits were commonly between 25 and 40 inches thick, but ranged in thickness from little or nothing to as much as 70 inches in spots. Loess was important because it formed the topmost layer of material in which soil development took place.

Soils that developed in residuum weathered from cherty limestone, sandstone, and shale are moderate in natural fertility, and those derived from limestone are more fertile than the others. A deposit of loess over the residuum tends to equalize fertility. Soils that formed in loess underlain by gravelly material of the Coastal Plain are somewhat lower in natural fertility than other soils in the county.

Fragipans have formed in much of the acreage of soils that developed in loess over sandstone residuum, in loess over shale residuum, in loess over a mixture of residuum derived from limestone, sandstone, and shale, and in loess over cherty limestone residuum. Fragipans are less likely to occur in the soils underlain by limestone than in the others. Generally, the fragipans have formed in the loess. In some places the fragipans extend into the residuum.

Cherty limestone is the oldest of the rocks underlying the loess, high-grade limestone is the next oldest, the mixtures of limestone, sandstone, and shale are next, and then the shale.<sup>5</sup> The gravelly Coastal Plain material is the youngest of the underlying materials. The soils that developed over the oldest materials show the most evidence of weathering and soil development.

### **Relief**

The relief in Caldwell County is varied. The maximum difference in elevation between the valleys and the adjacent hill crests is about 200 feet. The slope ranges from nearly level to very steep.

Relief affects soil characteristics primarily by influencing the amount of rainfall that runs off the surface and the amount that enters and stays in the soil. Soils on steep slopes are likely to be shallow because much of the rainfall runs off and carries soil with it. Also, since so little of the water enters and moves down through the soils, the effects of leaching and of translocation of clays and colloidal material are slight. Ramsey, Muskingum, Dekalb, Litz, and Gilpin soils are examples of soils that are almost entirely on strong to steep slopes, where soil-developing processes are thus slowed. Wellston and Zanesville soils are examples of soils on gentle to strong slopes. On these slopes there is some surface runoff, but more of the rainfall enters the soil, there is less soil loss through erosion, and the downward percolation of water encourages soil development. Tilsit soils are level to moderately sloping. More of the rainfall enters these soils, and reduction of iron compounds and other soil-forming processes cause

<sup>5</sup> WELLER, STUART, and SUTTON, A. H. GEOLOGIC MAP OF WESTERN KENTUCKY FLUORS PAR DISTRICT. 1951.

TABLE 5.—*Engineering*

Series and map symbols	Suitability for topsoil	Workability as construction material	Compaction characteristics	Suitability for road subgrade when not subject to frost action	Potential frost action	Shrink-swell potential	Features affecting highway location
Ashton----- (AsB).	Fair or good.	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Low or moderate.	Frost action; flood hazard in low areas.
Baxter----- (BcD2, BcE).	Poor-----	Poor to good.	Poor to good.	Poor or fair.	Medium or high.	Moderate or high.	Frost action; steep slopes; shallowness to bedrock in places.
Brandon----- (BdD, BdD3).	Poor or fair.	Fair or good.	Fair or good.	Poor to good.	Low to high.	Low or moderate.	Frost action; steep slopes.
Caneyville----- (CeC, CeD, C1C3, CmD, CmD3, CmE).	Poor-----	Poor to good.	Poor to good.	Poor or fair.	Medium or high.	Moderate or high.	Frost action; steep slopes; shallowness; rocks; plastic subsoil in places.
Captina----- (CnA, CnB, CnB2, CnC2).	Fair or good.	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Moderate	Seasonal high water table; frost action.
Collins----- (Co).	Fair or good.	Fair or good.	Poor to good.	Poor to good.	Low to high.	Low or moderate.	Flood hazard; seasonal high water table; possible frost action.
Crider----- (CrA, CrB, CrB2, CrC, CrC2, CrC3, CrD, CrD2, CsC3, CsD3).	Good-----	Poor to good.	Poor to good.	Poor or fair.	Medium or high.	Moderate or high.	Frost action-----
Dekalb----- (DmD, DmF).	Poor-----	Fair or good.	Poor to good.	Poor to good.	Low to high.	Low or moderate.	Steep slopes; frost action; shallowness to bedrock in places.
Dickson----- (DnB, DnB2).	Fair or good.	Poor or fair.	Poor to good.	Poor or fair.	Moderate or high.	Moderate or high.	Seasonal high water table; frost action.

See footnotes at end of table.

*interpretations*

Degree and kind of limitation for—		Soil features that adversely affect suitability for engineering practices					
Locations for low buildings <sup>1</sup>	Domestic sewage-disposal areas <sup>2</sup>	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
		Reservoir area	Embankment				
Moderate. Severe in low areas subject to flooding.	Moderate. Severe in low areas subject to flooding.	Possible seepage.	Possible piping.	Not applicable.	No unfavorable features.	No unfavorable features.	No unfavorable features.
Moderate. Soil-moisture changes may crack foundations. Some steep slopes.	Moderate. Moderate permeability. Severe where soil is shallow to bedrock.	Excessive seepage.	Poor compaction characteristics.	Not applicable.	Steep slopes	Not applicable.	Steep slopes.
Moderate. Steep slopes.	Severe. Steep slopes.	Excessive seepage.	No unfavorable features.	Not applicable.	Steep slopes	Not applicable.	Droughtiness; low fertility.
Severe. Shallow soils; soil-moisture changes may crack foundations.	Severe. Shallow soils; possibility of contamination of ground water in cavernous bedrock.	Shallow soils; cavernous bedrock in places.	Poor compaction characteristics in subsoil.	Not applicable.	Not applicable in severely eroded areas. Elsewhere, no unfavorable features.	Shallowness; steep slopes.	Shallowness.
Moderate. Seasonal high water table.	Severe. Seasonal high water table; slow permeability.	No unfavorable features.	No unfavorable features.	Fragipan at depth of 18 to 28 inches. Only surface drainage feasible.	Slowly permeable fragipan at depth of 18 to 28 inches.	No unfavorable features.	Wetness, caused by side-slope seepage.
Severe. Flood hazard.	Severe. Flood hazard.	Permeable subsoil.	Hazard of piping.	No unfavorable features.	No unfavorable features.	No unfavorable features.	No unfavorable features.
Moderate. Soil-moisture changes may crack foundations.	Severe. Moderately slow permeability; possibility of contamination of ground water through cracks and crevices in bedrock.	Crevice bedrock.	Poor compaction characteristics in subsoil in places.	Not applicable.	Not applicable in severely eroded areas. Elsewhere, no unfavorable features.	Steep slopes and severe erosion in places.	No unfavorable features.
Moderate. Severe where shallow to bedrock or steep.	Severe. Soils shallow to bedrock; steep slopes.	Excessive seepage.	Limited amount of suitable material.	Not applicable.	Not applicable.	Not applicable.	Steep slopes.
Moderate. Seasonal high water table; soil-moisture changes may crack foundations.	Severe. Seasonal high water table; slow permeability.	No unfavorable features.	Poor compaction characteristics in subsoil in places.	Fragipan at depth of 18 to 26 inches. Only surface drainage feasible.	Slowly permeable fragipan at depth of 18 to 26 inches.	No unfavorable features.	Wetness in places, caused by side-slope seepage.

TABLE 5.—*Engineering*

Series and map symbols	Suitability for topsoil	Workability as construction material	Compaction characteristics	Suitability for road subgrade when not subject to frost action	Potential frost action	Shrink-swell potential	Features affecting highway location
Elk..... (EkA, EkB).	Good.....	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Moderate.....	Frost action.....
Falaya..... (Fa).	Fair.....	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Moderate.....	Seasonal high water table; flood hazard; frost action.
Fredonia..... (FdC2, FdD2, FrD2).	Poor.....	Poor.....	Poor to good.	Poor or fair.	Medium or high.	Medium or high.	Shallowness to bedrock; frost action; plastic subsoil; steep slopes in places.
Gilpin..... (GmD, GmD3, GmE).	Poor.....	Fair or good.	Fair or good.	Poor to good.	Low to high.	Low or moderate.	Steep slopes; shallowness; possible frost action.
Gullied land..... (Gu).	( <sup>3</sup> ).....						
Hayter..... (HaC, HaD).	Fair.....	Poor to good.	Very poor to good.	Poor or fair.	Medium or high.	Moderate.....	Frost action; steep slopes in places.
Huntington..... (Hg, Hn).	Excellent.....	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Moderate.....	Frost action; flood hazard.
Johnsburg..... (Jb).	Fair.....	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Moderate.....	Seasonal high water table; frost action.
Lindside..... (Ld).	Excellent.....	Poor to good.	Poor to good.	Poor or fair.	Medium or high.	Moderate.....	Seasonal high water table; flood hazard; frost action.
Litz..... (GmD, GmD3, GmE).	Poor.....	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Moderate.....	Steep slopes; frost action; shallowness.
Made land..... (Ma).	( <sup>3</sup> ).....						
McGary..... (Mc).	Poor or fair.	Poor to good.	Poor to good.	Poor or fair.	Medium or high.	Moderate or high.	High water table; flood hazard; frost action; plastic subsoil.
Melvin..... (Me).	Fair.....	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Moderate.....	High water table; flood hazard; frost action; shallowness.

See footnotes at end of table.

*interpretations—Continued*

Degree and kind of limitation for—		Soil features that adversely affect suitability for engineering practices					
Locations for low buildings <sup>1</sup>	Domestic sewage-disposal areas <sup>2</sup>	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
		Reservoir area	Embankment				
Slight.....	Moderate. Moderate permeability.	No unfavorable features.	No unfavorable features.	Not applicable.	No unfavorable features.	No unfavorable features.	No unfavorable features.
Severe. Flood hazard.	Severe. Flood hazard.	Permeable subsoil.	Some hazard of piping.	No unfavorable features.	No unfavorable features.	Seasonal high water table.	Seasonal high water table.
Severe. Soils shallow to bedrock; soil-moisture changes may crack foundations.	Severe. Soils shallow to bedrock.	Crevice bedrock in places.	Poor compaction characteristics and poor stability.	Not applicable.	Not applicable.	Not applicable.	Steep slopes and shallowness.
Severe. Soils shallow to bedrock.	Severe. Soils shallow to bedrock.	Possible subsoil seepage.	Limited amount of suitable material.	Not applicable.	Not applicable.	Not applicable.	Steep slopes.
<hr style="border-top: 1px dashed black;"/>							
Moderate. Steep slopes in places.	Moderate. Moderate permeability; steep slopes in places.	Possible subsoil seepage.	Very poor compaction characteristics in places.	Not applicable.	No unfavorable characteristics.	Terraces not applicable on steeper slopes.	Steep slopes.
Severe. Flood hazard.	Severe. Flood hazard.	Permeability; excess seepage.	Hazard of piping.	Not applicable.	Moderate or moderately rapid permeability.	No unfavorable characteristics.	No unfavorable characteristics.
Severe. Somewhat poor drainage.	Severe. Seasonal high water table; slow permeability.	No unfavorable features.	No unfavorable features.	Fragipan at depth of 18 to 24 inches. Only surface drainage feasible.	Slowly or very slowly permeable fragipan at depth of 18 to 24 inches.	Fragipan and seasonal high water table.	Fragipan and seepage from side slopes.
Severe. Flood hazard.	Severe. Flood hazard.	Permeability; seepage.	Slight hazard of piping.	No unfavorable features.	Moderate or moderately rapid permeability.	No unfavorable features.	No unfavorable features.
Severe. Soils shallow to bedrock.	Severe. Soils shallow to bedrock.	No unfavorable features.	Limited amount of suitable material.	Not applicable.	Not applicable.	Terraces not applicable.	Steep slopes.
<hr style="border-top: 1px dashed black;"/>							
Severe. Flood hazard.	Severe. Flood hazard.	No unfavorable features.	Poor stability. Material excellent for cores.	Impervious clay subsoil. Only surface drainage feasible.	Very slow permeability at depth of 16 to 24 inches.	Wetness.....	Wetness.
Severe. Flood hazard.	Severe. Flood hazard.	Seepage.....	Some hazard of piping.	No unfavorable features.	Not applicable.	Seasonal high water table.	Seasonal high water table.

TABLE 5.—*Engineering*

Series and map symbols	Suitability for topsoil	Workability as construction material	Compaction characteristics	Suitability for road subgrade when not subject to frost action	Potential frost action	Shrink-swell potential	Features affecting highway location
Mullins----- (Mu).	Poor-----	Poor to good.	Poor to good.	Poor or fair.	Medium or high.	Moderate-----	High water table; frost action.
Muskingum----- (DmD, DmF, GmD, GmD3, GmE).	Poor-----	Fair or good.	Poor to good.	Poor to good.	Medium or high.	Low or moderate.	Steep slopes; shallowness; frost action.
Newark----- (Ne).	Good-----	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Moderate-----	High water table; flood hazard; frost action.
Pembroke----- (PbB, PbB2, PbC, PbC2, PbD2, PcC3, PcD3).	Fair-----	Poor to good.	Poor to good.	Poor or fair.	Medium or high.	Moderate or high.	Frost action; steep slopes in places.
Quarries and dumps----- (Qd).	( <sup>3</sup> )-----	-----	-----	-----	-----	-----	-----
Ramsey----- (DmD, DmF).	Unsuitable--	Fair or good.	Good-----	Fair or good.	Low or medium.	Low or moderate.	Steep slopes; shallowness to bedrock.
Rock land----- (FrD2, Ro, Rs).	( <sup>3</sup> )-----	-----	-----	-----	-----	-----	-----
Russellville----- (RuB, RuB2, RuC, RuC2, RuC3, RuD2, RuD3).	Fair-----	Poor to good.	Poor to good.	Poor or fair.	Medium or high.	Moderate or high.	Seasonal high water table; frost action; steep slopes in places.
Sharkey----- (Sk, So)	Poor-----	Poor or fair.	Poor or fair.	Poor or fair.	Medium or high.	High-----	High water table; flood hazard; shallowness to bedrock; frost action; highly plastic subsoil.
Taft----- (Ta).	Good-----	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Moderate-----	Seasonal high water table; frost action.

See footnotes at end of table.

*interpretations—Continued*

Degree and kind of limitation for—		Soil features that adversely affect suitability for engineering practices					
Locations for low buildings <sup>1</sup>	Domestic sewage-disposal areas <sup>2</sup>	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
		Reservoir area	Embankment				
Severe. Poor drainage.	Severe. Poor drainage; slow permeability.	No unfavorable features.	Poor compaction characteristics.	Fragipan at depth of 12 to 18 inches. Only surface drainage feasible.	Not applicable.	Seasonal high water table.	Fragipan at depth of 12 to 18 inches.
Severe. Soils shallow and steep.	Severe. Soils shallow and steep.	Steep slopes...	Limited amount of soil material.	Not applicable.	Not applicable.	Steep slopes and many stones.	Steep slopes and many stones.
Severe. Flood hazard.	Severe. High water table and flood hazard.	Excessive seepage in subsoil.	Some hazard of piping.	No unfavorable features.	No unfavorable features.	Seasonal high water table.	Seasonal high water table.
Moderate. Soil-moisture changes may crack foundations.	Severe. Moderately slow permeability.	No unfavorable features.	Poor compaction characteristics in places.	Not applicable.	Not applicable in severely eroded areas. Elsewhere, no unfavorable features.	Terraces not applicable on steeper slopes. Elsewhere, no unfavorable features.	Steep slopes and severe erosion in places.
Severe. Soils shallow and steep.	Severe. Soils shallow and steep.	Excessive seepage.	Limited amount of soil material.	Not applicable.	Not applicable.	Not applicable.	Not applicable.
Moderate. Soil-moisture changes may crack foundations.	Severe. Slowly permeable fragipan at a depth of 24 to 36 inches.	No unfavorable features.	Poor workability below depth of 4 feet. Material at that depth excellent for cores.	Not applicable.	Slowly or very slowly permeable at depth of 24 to 36 inches.	Terraces not applicable on steeper slopes. Elsewhere, no unfavorable features.	No unfavorable features.
Severe. Flood hazard. Soil-moisture changes may crack foundations.	Severe. Flood hazard.	No unfavorable features.	Poor workability and stability. Material excellent for cores.	Slowly permeable subsoil.	No unfavorable features.	Poor workability and seasonal high water table.	Flood hazard.
Severe. Somewhat poor drainage.	Severe. Seasonal high water table; slow permeability.	No unfavorable features.	No unfavorable features.	Fragipan at depth of 14 to 18 inches. Only surface drainage feasible.	Slowly or very slowly permeable fragipan at depth of 14 to 18 inches.	Fragipan at depth of 14 to 18 inches.	Seepage from side slopes.

TABLE 5.—*Engineering*

Series and map symbols	Suitability for topsoil	Workability as construction material	Compaction characteristics	Suitability for road subgrade when not subject to frost action	Potential frost action	Shrink-swell potential	Features affecting highway location
Tilsit ----- (TmA, TmB, TmB2, TmC2).	Fair-----	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Moderate-----	Seasonal high water table; frost action.
Vicksburg ----- (Vb, Vc).	Fair or good.	Fair or good.	Poor to good.	Poor to good.	Low to high.	Low or moderate.	Flood hazard; frost action.
Waverly ----- (Wa).	Poor-----	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Low-----	Flood hazard; seasonal high water table; frost action.
Wellston ----- (WeB, WeC, WeC2, WeD, WeD2, WnC3, WnD3).	Fair-----	Fair or good.	Fair or good.	Poor or fair.	Medium or high.	Moderate-----	Steep slopes; shallowness in places; frost action.
Zanesville ----- (ZaB, ZaB2, ZaC, ZaC2, ZaC3, ZaD2, ZaD3).	Fair or good.	Fair or good.	Poor to good.	Poor or fair.	Medium or high.	Moderate-----	Seasonal high water table; steep slopes in places; frost action.

<sup>1</sup> Buildings restricted to less than 3 stories and 6-foot basements. All areas that have slopes of more than 20 percent are considered severely limited.

*interpretations*—Continued

Degree and kind of limitation for—		Soil features that adversely affect suitability for engineering practices					
Locations for low buildings <sup>1</sup>	Domestic sewage-disposal areas <sup>2</sup>	Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
		Reservoir area	Embankment				
Moderate. Seasonal high water table.	Severe. Seasonal high water table; slow permeability.	No unfavorable features.	Some hazard of piping.	Fragipan at depth of 18 to 24 inches. Only nearly level areas need surface drainage.	Slowly or very slowly permeable fragipan at depth of 18 to 24 inches.	No unfavorable features.	Seepage from side slopes.
Severe. Flood hazard.	Severe. Flood hazard.	Permeable subsoil.	Hazard of piping.	Not applicable.	No unfavorable features.	No unfavorable features.	No unfavorable features.
Severe. Flood hazard.	Severe. Flood hazard.	Excessive seepage in subsoil.	No unfavorable features.	No unfavorable features.	Not applicable.	Not applicable.	No unfavorable features.
Moderate where moderately deep over rock. Severe where shallow over rock.	Moderate. Moderate permeability. Severe where soils are shallow.	No unfavorable features.	No unfavorable features.	Not applicable.	Not applicable in severely eroded areas. Elsewhere, no unfavorable features.	Terraces not applicable in steep, severely eroded areas.	Steep slopes and severe erosion in places.
Moderate. Seasonal high water table.	Severe. Slowly permeable fragipan at depth of 24 to 34 inches.	No unfavorable features.	No unfavorable features.	Not applicable.	Not applicable in severely eroded areas. Elsewhere, no unfavorable features.	Terraces not applicable in steep, severely eroded areas.	Steep slopes and severe erosion in places.

<sup>2</sup> All areas that have slopes of more than 12 percent are considered severely limited.

<sup>3</sup> No engineering interpretations.

TABLE 6.—*Engineering*

[Tests performed by the Bureau of Public Roads (BPR) in accordance with standard

Soil name and location of sample	Parent material	Bureau of Public Roads report No.	Depth from surface	Horizon	Moisture-density data		Mechanical analysis <sup>1</sup>	
					Maximum dry density	Optimum moisture	Estimated percentage discarded in field sampling	
							Larger than 3 in.	3 in. to 1 in.
Crider silt loam: 2 miles SW. of Hopson (modal).	Loess over limestone and sandstone.	S31435	<i>Inches</i> 0 to 7	Ap	<i>Lb. per cu. ft.</i> 104	<i>Percent</i> 16	-----	-----
		S31436	10 to 30	B21	108	18	-----	-----
		S31437	50 to 78	B2b	101	22	2	18
1 mile N. of Remit.....	Loess over limestone.	S31456	1 to 11	A2	107	16	-----	-----
		S31457	14 to 32	B2	105	19	-----	-----
		S31458	32 to 40	B3m	109	17	-----	-----
		S31459	40 to 62+	B2b	103	21	3	12
1 mile W. of Crider and 5 feet S. of Adamson Cemetery (modal).	Loess over limestone.	S31412	1 to 8	A2	105	17	-----	-----
		S31413	12 to 31	B21	104	20	-----	-----
		S31414	42 to 60	B2b	110	17	-----	-----
1 mile E. of Princeton, on W. Ky. Agr. Expt. Sta.	Loess over limestone.	S31415	0 to 7	Ap	105	16	-----	-----
		S31416	7 to 20	B21t	109	18	-----	-----
		S31417	28 to 42	11B22t	110	17	-----	-----
Dekalb stony silt loam: 1 mile E. of Princeton, on W. Ky. Agr. Expt. Sta. (modal).	Sandstone.	S31433	1 to 9	A2	116	11	4	6
		S31434	9 to 25	C	119	10	12	28
1 mile NW. of Needmore (parent material partly shale).	Sandstone and shale (Pottsville formation).	S31442	1 to 14	A2	108	16	2	6
		S31443	14 to 30	C1	119	13	3	22
		S31444	30 to 56	C2	99	21	-----	-----
Pembroke silt loam: 1 mile NW. of Cobb (modal)...	Limestone.	S31453	1 to 8	A2	105	15	-----	-----
		S31454	10 to 24	B21	102	21	-----	-----
		S31455	54 to 76+	C	100	22	-----	-----
1 mile E. of Princeton, on W. Ky. Agr. Expt. Sta.	Limestone.	S31418	1 to 7	A2	107	17	-----	-----
		S31419	7 to 40	B2	104	19	-----	-----
		S31420	46 to 61	C	98	23	-----	-----
Russellville silt loam: 2 miles W. of Hopson (modal)	Limestone.	S31449	2 to 8	A2	105	17	-----	-----
		S31450	11 to 26	B2	104	20	-----	-----
		S31451	29 to 46	B3m2	106	18	-----	-----
		S31452	46 to 68+	B2b	97	24	8	22
1 mile E. of Princeton, on W. Ky. Agr. Expt. Sta.	Limestone.	S31421	0 to 6	Ap	104	17	-----	-----
		S31422	6 to 25	B2	107	18	-----	-----
		S31423	29 to 44	B3m2	112	16	-----	-----
		S31424	44 to 60	Cb	100	23	-----	-----
Tilsit silt loam: 1 mile E. of Princeton, on W. Ky. Agr. Expt. Sta.	Loess over limestone and sandstone.	S31425	4 to 9	A2	105	18	-----	-----
		S31426	14 to 21	B22	105	18	-----	-----
		S31427	25 to 40	B3m2	104	19	-----	-----
		S31428	40 to 54	Clg	110	17	-----	-----
1 mile NW. of Needmore.....	Loess over limestone.	S31445	0 to 8	Ap	105	17	-----	-----
		S31446	8 to 16	B2	108	17	-----	-----
		S31447	20 to 30	B3m2	102	19	-----	-----
		S31448	30 to 58	Clg	108	17	-----	-----

See footnotes at end of table.

test data

procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis <sup>1</sup> —Continued														Liquid limit	Plastic- ity index	Classification	
Percentage passing sieve <sup>2</sup>										Percentage smaller than <sup>2</sup> —						AASHO	Unified <sup>3</sup>
3- in.	1½- in.	1- in.	¾- in.	⅜- in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
						100	99	99	98	96	66	21	15	27	4	A-4(8)-----	ML-CL.
									100	98	75	36	29	43	20	A-7-6(13)-----	CL.
98		79	79	78	78	78	75	74	71	70	59	41	35	56	32	A-7-6(18)-----	CH.
									100	99	98	68	24	26	4	A-4(8)-----	ML-CL.
									100	99	98	75	39	46	21	A-7-6(14)-----	ML-CL.
									100	99	96	94	71	37	14	A-6(10)-----	ML-CL.
97		77	76	76	76	75	74	73	58	56	46	37	33	43	23	A-7-6(11)-----	CL.
									100	99	97	70	25	28	4	A-4(8)-----	ML-CL.
									100	98	77	39	32	51	25	A-7-6(16)-----	CH.
						100	99	98	94	92	71	35	29	41	18	A-7-6(11)-----	CL.
									100	99	98	71	26	28	6	A-4(8)-----	ML-CL.
									100	99	98	77	38	41	18	A-7-6(11)-----	CL.
						100	99	98	96	94	71	38	30	41	19	A-7-6(12)-----	CL.
96		85	85	85	85	85	85	84	43	42	29	12	7	17	2	A-4(2)-----	SM.
88		58	57	56	55	55	54	54	31	31	22	8	5	15	1	A-2-4(0)-----	GM.
84		64	63	62	62	60	59	58	55	53	39	13	9	26	5	A-4(6)-----	ML-CL.
97		73	68	57	46	38	33	33	28	27	20	12	8	31	11	A-2-6(0)-----	GC.
						100	97	96	93	91	81	71	60	62	34	A-7-6(20)-----	CH.
									100	97	97	66	21	25	3	A-4(8)-----	ML.
									100	99	98	77	44	52	27	A-7-6(17)-----	CH.
						100	99	99	94	92	77	53	47	60	36	A-7-6(20)-----	CH.
									100	99	97	69	32	35	12	A-6(9)-----	ML-CL.
									100	99	98	76	42	50	25	A-7-6(16)-----	CL.
					100	97	94	93	88	86	70	51	46	65	41	A-7-6(20)-----	CH.
									100	98	98	74	28	31	7	A-4(8)-----	ML-CL.
									100	99	98	79	38	43	18	A-7-6(12)-----	ML-CL.
									100	99	98	74	32	39	15	A-6(10)-----	ML-CL.
92		64	61	60	59	57	56	56	55	94	46	34	29	64	41	A-7-6(16)-----	CH.
									100	97	95	68	23	30	6	A-4(8)-----	ML-CL.
									100	98	97	75	38	42	19	A-7-6(12)-----	CL.
									100	99	88	86	64	36	16	A-6(10)-----	CL.
	100	98	97	95	93	91	90	89	76	74	63	50	45	58	37	A-7-6(20)-----	CH.
						100	99	98	94	93	70	28	20	31	8	A-4(8)-----	ML-CL.
						100	98	97	96	95	74	38	29	42	18	A-7-6(12)-----	ML-CL.
						100	99	99	97	96	76	36	30	45	21	A-7-6(13)-----	CL.
						100	99	98	91	89	66	30	23	34	14	A-6(10)-----	CL.
									100	97	96	23	16	29	6	A-4(8)-----	ML-CL.
						100	98	97	95	94	72	31	23	35	11	A-6(8)-----	ML-CL.
						100	99	99	98	98	76	39	32	46	23	A-7-6(14)-----	CL.
									100	96	95	71	31	38	18	A-6(11)-----	CL.

TABLE 6.—*Engineering*

Soil name and location of sample	Parent material	Bureau of Public Roads report No.	Depth from surface	Horizon	Moisture-density data		Mechanical analysis <sup>1</sup>	
					Maximum dry density	Optimum moisture	Estimated percentage discarded in field sampling	
							Larger than 3 in.	3 in. to 1 in.
			<i>Inches</i>		<i>Lb. per cu. ft.</i>	<i>Percent</i>		
Zanesville silt loam: 1 mile E. of Princeton, on W. Ky. Agr. Expt. Sta.	Loess over sandstone (Chester formation).	S31429	1 to 7	A2	103	17		
		S31430	11 to 19	B21	105	19		
		S31431	29 to 35	B3m2	108	17		
		S31432	35 to 56	C	111	16		
1 mile NW. of Needmore-----	Loess over sandstone (Pottsville formation).	S31438	0 to 9	Ap	107	17		
		S31439	9 to 22	B21	108	18		
		S31440	31 to 37	B3m2	106	18		
		S31441	37 to 80	C	115	15		

<sup>1</sup> Mechanical analysis according to AASHO Designation: T 88—57 (1). Results by this procedure may differ somewhat from results 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 diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

the lower part of the solum to have grayish colors and to be brittle and slowly permeable to water and air. Tilsit soils, even if level, almost invariably have a convex surface.

Johnsburg and Mullins soils are examples of somewhat poorly drained and poorly drained, nearly level soils that have a concave surface. Nearly all the rain that falls on these soils infiltrates, and many areas receive drainage from adjoining convex slopes. The grayish colors and the brittle, slowly permeable layers are likely to be nearer the surface than they are in the Tilsit soils, and the slowly permeable layers restrict the movement of air and water. Waverly and Melvin soils are examples of poorly drained, level soils on bottom lands where the water table stands at or near the surface. There are no restrictive layers in these soils to prevent movement of air and water, but the level relief and the position of the soils on the landscape cause the accumulation of excess water, which reduces the iron compounds and makes the soils gray.

Relief modifies the effects of climate, even though temperature and rainfall are about the same over the entire county. Runoff from sloping areas collects in flat or depressional areas, so, in effect, the level soils have a wetter climate than the sloping soils. The amount of solar radiation an area receives depends on slope and aspect. North-facing slopes, for example, stay frozen longer than south-facing slopes, and high mountains are colder than valleys.

### Time

Differences in length of time of soil formation are responsible for most of the soil differences not attributable to differences in parent material or relief. The soils of the county range from very young to old. Even now, most of the areas along drainageways or on bottom lands receive fresh sediments frequently.

The best criteria for judging the age of a soil are the relative thickness and degree of development of the horizons. Upland soils on level to strong slopes underlain by limestone or sandstone and shale show moderate or strong horizon development and must be judged as "old." Shallow, steep soils derived from sandstone and shale must be judged as "young", since they have few and thin horizons and are not highly leached. The greatest differences in age can be seen among the soils that developed in alluvium and slope wash. These soils range from very young to old. For example, the Huntington, Ashton, and Elk soils are thought to consist of similar parent materials, yet the Huntington soils are only weakly developed if at all, the Ashton soils are on low terraces and have weakly developed horizons, and the Elk soils, which are on the higher terraces, have well-developed horizons.

### Classification of the Soils

Soils are placed in narrow classes to permit the organization and application of knowledge about their behavior within farms or counties. They are placed in broad classes to facilitate study and comparison of large areas. In the comprehensive system of soil classification used in the United States, soils are placed in six categories. Beginning with the most inclusive, the categories are the order, the suborder, the great soil group, the family, the series, and the type.

There are three orders and many types. The suborder and family categories have never been fully developed and thus have been little used. Attention has been concentrated on the classification of soils into types and series within counties or comparable areas and to the subsequent grouping of series into great soil groups and orders.

test data—Continued

Mechanical analysis 1—Continued														Liquid limit	Plasticity index	Classification	
Percentage passing sieve 2—									Percentage smaller than 2—				AASHO			Unified 3	
3-in.	1½-in.	1-in.	¾-in.	⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.		0.002 mm.			
-----	-----	-----	-----	-----	-----	-----	-----	100	98	97	71	25	16	25	3	A-4(8)-----	ML.
-----	-----	-----	-----	-----	-----	-----	-----	100	99	97	78	41	33	42	18	A-7-6(12)---	ML-CL.
-----	-----	-----	-----	-----	100	99	99	95	93	70	28	23	36	13	A-6(9)-----	ML-CL.	
-----	-----	-----	-----	-----	-----	100	99	89	87	65	30	25	35	16	A-6(10)-----	CL.	
-----	-----	-----	-----	-----	-----	-----	100	99	95	93	67	21	16	28	5	A-4(8)-----	ML-CL.
-----	-----	-----	-----	-----	-----	-----	-----	100	98	98	75	37	29	40	17	A-6(11)-----	CL.
-----	-----	-----	-----	-----	-----	-----	-----	100	97	96	73	34	28	42	19	A-7-6-(12)---	CL.
-----	-----	-----	-----	-----	-----	-----	-----	100	86	84	61	27	22	31	12	A-6(9)-----	CL.

2 Based on total material. Laboratory test data corrected for amount discarded in field sampling.

3 SCS and BPR have agreed to consider that all soils having plasticity indexes within 2 points of the A-line are to be given a borderline classification. An example of borderline classification obtained by this use is ML-CL.

The broadest category in the classification system is the order. There are three orders—zonal, intrazonal, and azonal. The zonal order is made up of soils that have evident, genetically related horizons that reflect the dominant influence of climate and living organisms in their formation. The intrazonal order consists of soils that have evident, genetically related horizons that reflect the dominant influence of a local factor of topography or parent material over the effect of climate and living organisms. The azonal order consists of soils that lack distinct, genetically developed horizons, commonly because of youth, resistant parent material, steep topography, or all three (9).

Table 7 shows the order and great soil group to which each series in Caldwell County belongs. It also gives distinguishing characteristics of the soils of each series.

A soil series consists of soils that developed from a particular kind of parent material and that have genetic horizons similar as to differentiating characteristics, except for the texture of the surface soil, and as to arrangement in the soil profile (9).

A soil type is a subdivision of a soil series. The subdivision is made on the basis of differences in the texture of the surface layer. Different types exist within a given series chiefly for the following reasons: (1) Local differences in texture of the surface soil, caused by local differences in the parent material of alluvial soils. Examples are Huntington silt loam and Huntington fine sandy loam. (2) Differences in texture of the surface soil related to degree of accelerated soil erosion. Examples are Pembroke silt loam, which is uneroded, and Pembroke silty clay loam, which is severely eroded. (3) Presence or absence of rocks, stones, or gravel in the surface layer. Examples are Caneyville silt loam and Caneyville very rocky soils.

A soil type may consist of several mapping units, or soil phases. In Caldwell County, soil types have been divided into mapping units mainly on the basis of variations in slope and degree of erosion.

**Zonal order**

The zonal order consists of soils that have evident, genetically related horizons that reflect the dominant influence of climate and living organisms in their formation. The Red-Yellow Podzolic soils, Gray-Brown Podzolic soils, Reddish-Brown Lateritic soils, and Sols Bruns Acides are the great soil groups that represent the zonal order in Caldwell County. More than half of the soil series of Caldwell County are in these great soil groups.

The Red-Yellow Podzolic soils have distinct, leached A horizons and B horizons of clay accumulation. They are strongly leached, acid in reaction, low in exchangeable bases, low in organic-matter content, and low in mineral plant nutrients. The Gray-Brown Podzolic soils also have distinct A horizons and B horizons of clay accumulation. They are less strongly leached and have more exchangeable cations and a higher base saturation than the Red-Yellow Podzolic soils. Also, they have been less affected by movement of silica compounds, and iron has not accumulated in the B horizon to the extent that it occurs as segregated iron, as it does in the Red-Yellow Podzolic soils (8). Red-Yellow Podzolic soils were derived from siliceous parent materials; Reddish-Brown Lateritic soils develop, within the same physiographic regions, from material that contains more calcium and ferromagnesium minerals (10).

The Sols Bruns Acides are characterized by a B horizon in which there is a slight accumulation of silicate clay and some segregation of oxides and clays, but no appreciable eluviation and illuviation. These soils form mostly in moderately acidic parent materials (8), and in Caldwell County they are strongly sloping to steep.

**RED-YELLOW PODZOLIC SOILS**

Red-Yellow Podzolic soils are strongly leached, acid in reaction, low in exchangeable cations and base saturation, and low in content of organic matter and mineral plant

TABLE 7.—Classification of soil series into higher categories, and significant characteristics of each series

Order, great soil group, and soil series	Topographic position	Drainage class	Slope range	Parent material	Degree of profile development <sup>1</sup>
<b>ZONAL ORDER</b> Red-Yellow Podzolic group: Representative—					
Baxter.....	Upland.....	Well drained and somewhat excessively drained.	<i>Percent</i> 12 to 30.....	Residuum from cherty limestone.	Strong.
Brandon.....	Upland.....	Well drained.....	12 to 20.....	Loess over Coastal-Plain gravel.	Moderate.
Crider.....	Upland.....	Well drained.....	2 to 12.....	Loess over residuum from high-grade limestone, from cherty limestone, or from a mixture of limestone, sandstone, and shale, in which limestone was predominant.	Moderate.
Hayter.....	Foot slope.....	Well drained.....	6 to 20.....	Alluvium and colluvium derived partly from loess and partly from residuum weathered from sandstone, limestone, and shale.	Moderate and weak.
With fragipan— Captina.....	Terrace.....	Moderately well drained.	0 to 12.....	Alluvium, derived from loess over limestone residuum.	Strong..
Dickson.....	Upland.....	Moderately well drained.	0 to 6.....	Loess over residuum from high-grade limestone or cherty limestone.	Strong.
Russellville.....	Upland.....	Well drained and moderately well drained.	2 to 20.....	Loess over residuum from high-grade limestone, from cherty limestone, or from a mixture of limestone, sandstone, and shale, in which limestone was predominant.	Moderate.
Tilsit.....	Upland.....	Moderately well drained.	0 to 12.....	Loess over sandstone and residuum from shale.	Strong.
Intergrading to Gray-Brown Podzolic— Zanesville.....	Upland.....	Well drained and moderately well drained.	2 to 20.....	Loess over residuum from sandstone and shale.	Moderate and strong.
Intergrading to Lithosol— Caneyville.....	Upland.....	Well drained and somewhat excessively drained.	6 to 30.....	Residuum from limestone, sandstone, and shale; limestone predominant.	Weak.
Litz.....	Upland.....	Well drained and somewhat excessively drained.	12 to 30.....	Partly residuum from sandstone, siltstone, and shale, and partly loess over residuum from sandstone, siltstone, and shale.	Weak.

See footnote at end of table.

TABLE 7.—Classification of soil series into higher categories, and significant characteristics of each series—Continued

Order, great soil group, and soil series	Topographic position	Drainage class	Slope range	Parent material	Degree of profile development <sup>1</sup>
Zonal Order—Continued Red-Yellow Podzolic group—Con. Intergrading to Reddish-Brown Lateritic— Pembroke.....	Upland.....	Well drained and somewhat excessively drained.	<i>Percent</i> 2 to 20.....	Partly residuum from high-grade limestone, and partly loess over residuum from high-grade limestone or calcareous sandstone.	Moderate.
Gray-Brown Podzolic group: Representative— Elk.....	Terrace.....	Well drained.....	0 to 6.....	Alluvium derived predominantly from limestone residuum but partly from sandstone and shale residuum and partly from alluvium and loess.	Moderate.
Intergrading to Alluvial— Ashton.....	Low terrace.....	Well drained.....	0 to 4.....	Alluvium derived partly from loess and partly from limestone residuum.	Weak.
Intergrading to Red-Yellow Podzolic— Gilpin.....	Upland.....	Well drained and somewhat excessively drained.	12 to 30.....	Partly residuum weathered from sandstone, siltstone, and shale, and partly loess over residuum weathered from sandstone, siltstone, and shale.	Moderate and weak.
Wellston.....	Upland.....	Well drained.....	2 to 20.....	Partly loess and partly residuum weathered from acid sandstone and shale.	Moderate.
Intergrading to Low-Humic Gley McGary.....	Terrace.....	Somewhat poorly drained.	0 to 2.....	Clayey, calcareous slack-water alluvium.	Strong.
Reddish-Brown Lateritic group: Fredonia.....	Upland.....	Well drained.....	6 to 20.....	Residuum weathered from high-grade limestone.	Strong.
Sol Brun Acide group: Representative— Dekalb.....	Upland.....	Well drained to excessively drained.	12 to 40.....	Residuum weathered from sandstone, siltstone, and shale.	Weak and moderate.
Intergrading to Lithosol— Muskingum.....	Upland.....	Somewhat excessively drained.	12 to 40.....	Residuum weathered from siltstone, shale, and sandstone.	Weak and moderate.
INTRAZONAL ORDER Planosol group: With fragipan— Johnsburg.....	Upland.....	Somewhat poorly drained.	0 to 2.....	Loess over residuum weathered from sandstone and shale.	Strong.

See footnote at end of table.

TABLE 7.—*Classification of soil series into higher categories, and significant characteristics of each series—Continued*

Order, great soil group, and soil series	Topographic position	Drainage class	Slope range	Parent material	Degree of profile development <sup>1</sup>
INTRAZONAL ORDER—Continued					
Planosol group: With fragipan					
Mullins.....	Upland.....	Poorly drained.....	<i>Percent</i> 0 to 2.....	Loess over residuum weathered from sandstone and shale.	Strong.
Taft.....	Terrace.....	Somewhat poorly drained.	0 to 2.....	Alluvium derived from loess and from limestone residuum.	Strong.
Low-Humic Gley group:					
Melvin.....	Bottom land.....	Poorly drained.....	0 to 2.....	Alluvium derived from loess and from residuum weathered from limestone, sandstone, and shale.	Little or none.
Waverly.....	Bottom land.....	Poorly drained.....	0 to 2.....	Alluvium derived from loess and from residuum weathered from sandstone and shale.	Little or none.
Grumusol group: Intergrading to Alluvial—					
Sharkey.....	Bottom land.....	Very poorly drained..	0 to 2.....	Clayey slack-water alluvium.	Little or none.
AZONAL ORDER					
Lithosol group: Intergrading to Sol Brun					
Acide—					
Ramsey.....	Upland.....	Excessively drained..	12 to 40....	Residuum weathered from sandstone, siltstone, and shale.	Weak.
Alluvial group: Representative—					
Collins.....	Bottom land.....	Moderately well drained.	0 to 3.....	Alluvium derived from loess and from residuum weathered from sandstone and shale.	Little or none.
Huntington.....	Bottom land.....	Well drained.....	0 to 3.....	Alluvium derived from limestone residuum and from loess.	Little or none.
Lindside.....	Bottom land.....	Moderately well drained.	0 to 3.....	Alluvium derived from loess and from limestone residuum.	Little or none.
Vicksburg.....	Bottom land.....	Well drained.....	0 to 3.....	Alluvium derived from loess and from residuum weathered from sandstone and shale.	Little or none.
Intergrading to Low-Humic Gley—					
Falaya.....	Bottom land.....	Somewhat poorly drained.	0 to 2.....	Alluvium derived from loess and from residuum weathered from sandstone and shale.	Little or none.
Newark.....	Bottom land.....	Somewhat poorly drained.	0 to 2.....	Alluvium derived from loess and from limestone residuum.	Little or none.

<sup>1</sup> As measured by the number of important genetic horizons and the degree of contrast between them.

nutrients. Areas that are forested have a thin, dark-colored A1 horizon over an A2 horizon that is somewhat leached and yellowish in color. The B horizon is yellowish red, red, or yellow and is more clayey than the A horizon. There has been movement of clay and colloids from the A horizon to the B horizon (4).

The representative Red-Yellow Podzolic soils in Caldwell County developed in a temperate, humid, continental climate and are less intensively weathered than is typical. The cation-exchange capacity and base saturation are somewhat higher, and there are more brown and yellow colors in the A and B horizons than in those of Red-Yellow Podzolic soils of the central concept in general.

In the Red-Yellow Podzolic soils, easily weatherable minerals are changed to secondary clays, oxides, and ions. As the bases are lost, insoluble oxides become segregated as amorphous material. Clay is apparently formed concurrently in place, the kind depending upon the source of minerals, differences in rate of solubility or weathering, and the ionic environment prevailing at the time. Matrix colors seem to depend upon the nature of the original minerals, the distribution of minerals in the original rock, and the time and environment sequence in which the soil formed. As large pores are filled and the B2 horizon thickens, mechanical filling and orientation of clay occurs. In situ alteration produces the bulk of the clay minerals and oxides, and a large percentage remains in place in the B2 horizon because of mechanical filling with altered material formed earlier in the A horizon and transported to the B horizon. As lower layers are sealed off so that the clays and oxides do not move further down, local rearrangement occurs in the B2 horizon, between grains and in small pores (4).

The soils of five of the series classified as Red-Yellow Podzolic soils in Caldwell County have fragipans in the lower part of the B horizon. The fragipans are of silt loam or silty clay loam texture, are very low in organic-matter content, and are high in bulk density compared with layers above. They are seemingly cemented (hard or very hard) when dry. When moist, they are moderately or weakly brittle, that is, the peds tend to rupture suddenly when pressure is applied rather than to undergo slow deformation. They are mottled and are slowly or very slowly permeable to water. Most commonly, the fragipans have abrupt or clear upper boundaries that are 15 to 40 inches below the surface. They range in thickness from a few inches to several feet and ordinarily have gradual or diffuse lower boundaries. They are nearly free of roots, except for those in the bleached soil material that is in cracks. Clay films are scarce to common.

The clay mineralogy of these soils is complex. Kaolinite and vermiculite are to be found in most profiles. Substantial quantities of illite and montmorillonite and lesser quantities of quartz, gibbsite, and goethite occur in many profiles.

Red-Yellow Podzolic soils and Gray-Brown Podzolic soils seem to have formed through similar processes, but they differ considerably in the degree of horizon differentiation. Red-Yellow Podzolic soils are the older, genetically. Their maturity is evident from the greater degree of alteration of the primary minerals, from the predominance of kaolinite clay, from the distribution of the clay, from the greater degree of profile development, and from the stronger acidity (4).

The Baxter, Brandon, Crider, and Hayter soils are Red-Yellow Podzolic soils that approach the central concept of the Red-Yellow Podzolic group but are less weathered. The Captina, Dickson, Russellville, Tilsit, and Zanesville soils are Red-Yellow Podzolic soils with fragipans. The Caneyville soils and the Litz soils are Red-Yellow Podzolic soils intergrading to Lithosols. The Pembroke soils are Red-Yellow Podzolic soils intergrading to Reddish-Brown Lateritic soils.

#### GRAY-BROWN PODZOLIC SOILS

Gray-Brown Podzolic soils that are in virgin forest have a thin, dark-colored A1 horizon, a grayish-brown, leached A2 horizon, and a dark-brown or dark yellowish-brown B horizon in which clay has accumulated. The Elk soils approach the central concept of the Gray-Brown Podzolic group. The Ashton soils are Gray-Brown Podzolic soils intergrading to Alluvial soils. The Gilpin and Wellston soils are Gray-Brown Podzolic soils intergrading to Red-Yellow Podzolic soils. McGary soils are Gray-Brown Podzolic soils intergrading to Low-Humic Gley soils.

#### REDDISH-BROWN LATERITIC SOILS

Reddish-Brown Lateritic soils have a dark reddish-brown A horizon and a dark-red, friable clay B horizon. These soils develop under forest vegetation in a warm, humid climate characterized by wet and dry seasons.

Reddish-Brown Lateritic soils occur geographically with Red-Yellow Podzolic soils, but they form from less acid parent material and consequently lack the highly leached A2 horizon that is characteristic of Red-Yellow Podzolic soils. They are commonly darker colored and more clayey than Red-Yellow Podzolic soils.

The Fredonia soils are the only Reddish-Brown Lateritic soils in Caldwell County. These soils have a dark reddish-brown A horizon and a thin, dark-red or dusky-red clay B horizon, but they lack a distinct leached A2 horizon. Limestone bedrock is generally between 20 and 36 inches below the surface.

#### SOLS BRUNS ACIDES

Sols Bruns Acides form under forest in a humid, temperate climate. They have thin A1 and A2 horizons and do not have a distinctive concentration of clay in the B horizon. They have a color B horizon that has weak blocky structure. The base saturation is lower than that of the Gray-Brown Podzolic soils.

The only Sols Bruns Acides in Caldwell County are the Dekalb soils and the Muskingum soils. The Dekalb soils approach the central concept of the group, but the Muskingum soils intergrade to Lithosols.

#### Intrazonal order

The intrazonal order consists of soils that have evident, genetically related horizons that reflect the dominant influence of a local factor of topography or parent material over the effects of climate and living organisms.

The Planosols and the Low-Humic Gley soils represent the intrazonal order in Caldwell County.

#### PLANOSOLS

Planosols have eluviated surface and subsurface horizons underlain abruptly by a B horizon that is either

strongly illuviated or moderately illuviated and compacted. The Planosols are represented in Caldwell County by the Johnsbury, Mullins, and Taft series.

The Johnsbury, Mullins, and Taft soils have a fragipan. They have an illuviated A horizon and a weakly developed textural and structural B horizon above the fragipan. The pan is very firm, brittle, and hard. It contains little clay.

#### LOW-HUMIC GLEY SOILS

Low-Humic Gley soils are poorly drained and have a thin, moderately dark colored A horizon and a prominently mottled subsoil. They form in slight depressions and in broad areas where water tends to pond. The Low-Humic Gley group is represented in Caldwell County by soils of the Melvin and Waverly series.

#### GRUMUSOLS

Grumusols are clay soils that exhibit properties of churning, which is brought about through shrinking, swelling, and cracking. Montmorillonite is the dominant clay mineral. Grumusols may have a prominent A<sub>1</sub> horizon, but they lack a B horizon. They have dull colors of low chroma and, as a rule, are not well drained. The Sharkey soils represent this great soil group in Caldwell County.

#### Azonal order

The azonal order consists of soils that lack distinct, genetically related horizons, commonly because of youth, resistant parent material, or steep topography. The azonal order is represented in Caldwell County by the Lithosols and Alluvial soils.

#### LITHOSOLS

Lithosols have no clearly expressed soil morphology and consist of a freshly and imperfectly weathered mass of rock fragments. They are largely confined to steep slopes. This great soil group is represented in Caldwell County by the Ramsey soils, which intergrade to Sols Bruns Acides.

#### ALLUVIAL SOILS

Alluvial soils lack distinct horizons because the sediments in which they are developing are so young. Given more time, most Alluvial soils would develop horizons and be similar to soils of the uplands and terraces that developed from similar parent material on the same type of relief and under similar conditions of climate and natural vegetation. It is not known whether such development will occur in soils now under cultivation.

The Collins, Huntington, Lindsie, and Vicksburg soils approach the central concept of Alluvial soils. The Falaya and Newark soils are Alluvial soils intergrading to Low-Humic Gley soils.

### Profile Descriptions

In this section, each of the soil series represented in Caldwell County is discussed and a profile of a typical soil of each series is described in detail.

#### Ashton Series

The Ashton series consists of well-drained Gray-Brown Podzolic soils intergrading to Alluvial soils. They occur on low stream terraces or second bottoms. They formed in alluvium washed mainly from limestone residuum or

from soils that had developed in loess over limestone residuum. A minor part of the alluvium was washed from mixed limestone, sandstone, and shale residuum. Ashton soils are associated with and closely related to Elk and Huntington soils. They have less distinct horizons than the Elk soils and more evident B horizons than the Huntington soils.

The following profile of Ashton silt loam, 0 to 4 percent slopes, is 600 feet west of a gravel road, 3 miles north of Ky. 91, at White Sulphur crossing.

- Ap—0 to 9 inches, dark-brown (10YR 3/3) silt loam; moderate, fine, granular structure; friable; slightly acid; abrupt, wavy boundary. 7 to 12 inches thick.
- B1—9 to 24 inches, brown (7.5YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; the dark-brown color of the Ap horizon extends into this horizon in places to a depth of 16 inches; medium acid; gradual, wavy boundary. 10 to 20 inches thick.
- B2t—24 to 39 inches, brown (7.5YR 4/4) heavy silt loam; moderate, medium, subangular blocky structure; few clay films; medium acid; gradual, wavy boundary. 10 to 20 inches thick.
- C—39 to 50 inches, dark yellowish-brown (10YR 4/4) silt loam; few, medium, distinct mottles of pale brown (10YR 6/3); weak, fine, subangular blocky structure; friable; mottles occur mostly as silt coatings; medium acid. 10 to 30 or more inches thick.

The deposit of alluvium generally is more than 3 feet thick. Some profiles resemble profiles of Elk soils, others resemble profiles of Huntington soils. Many profiles have no mottles, and others have mottles beginning at a depth of about 36 inches. Less than one-third of the acreage has a small amount of chert on the surface or throughout the profile.

#### Baxter Series

The Baxter series consists of well-drained, moderately sloping and moderately steep Red-Yellow Podzolic soils that developed in residuum weathered from cherty limestone. They occur in close association with the Crider series. The Baxter soils have irregular chert fragments over the surface and throughout the solum. Their parent material lacked the loess, or loesslike, component in which the upper horizons of the Crider soils developed, but some small areas that have a shallow mantle of loess are included with the Baxter soils. Irregular chert fragments are scattered over the surface and through the profile.

The following profile of Baxter cherty silt loam, 12 to 20 percent slopes, eroded, is 1 mile north of Princeton, near where the powerline crosses Ky. 293.

- Ap—0 to 5 inches, brown (10YR 4/3) or dark grayish-brown (10YR 4/2) cherty silt loam; moderate, fine and medium, granular structure; friable; medium acid or strongly acid; clear, smooth boundary. 5 to 8 inches thick.
- A3—5 to 12 inches, brown (7.5YR 5/4) to yellowish-brown (10YR 5/4) cherty silt loam; weak, medium, angular blocky structure; friable; medium acid or strongly acid; clear, smooth boundary. 6 to 10 inches thick.
- B1t—12 to 16 inches, strong-brown (7.5YR 5/6) cherty silty clay loam; moderate, medium, angular blocky structure; firm; medium acid or strongly acid; gradual, smooth boundary. 2 to 8 inches thick.
- B2t—16 to 53 inches, dark-red (2.5YR 3/6) cherty silty clay; strong, fine, angular blocky structure; common, medium, distinct mottles of reddish yellow (7.5YR 6/6); clay films prominent on face of peds; firm; medium acid or strongly acid; gradual, smooth boundary. 10 to 50 inches thick.

C—53 to 100 inches, mottled dark-red (10R 3/6), reddish-yellow (7.5YR 6/6), and very pale-brown (10YR 7/3) very cherty clay; strong, fine, angular blocky structure; chert content about 50 percent; friable to firm; medium acid or strongly acid. 3 to 10 feet thick.

Some profiles lack a B1 horizon. The depth to cherty limestone bedrock ranges from 3 to 30 feet. The amount of fragmentary chert ranges from 25 to 50 percent of the soil mass, but in some spots there is very little chert and in others it makes up more than 80 percent of the mass. In places the C horizon consists of massive red clay with common, distinct mottles of reddish-yellow and gray. This clay is very sticky and very plastic when wet and contains much chert.

#### Brandon Series

The Brandon series consists of well-drained Red-Yellow Podzolic soils that developed partly in a thin deposit of loess and partly in the underlying acid, gravelly material of the Coastal Plain. These soils occur in two relatively small areas where the Tertiary seas deposited gravel over limestone formations of the Mississippian system. The gravel deposit ranges from 1 foot to 30 feet in thickness. Brandon soils occur in close association with Russellville, Crider, and Baxter soils. They differ from Crider and Baxter soils in that they developed over Coastal Plain gravel instead of over cherty limestone. They lack the fragipan that is characteristic of Russellville soils.

The following profile of Brandon silt loam, 12 to 20 percent slopes, is along the east side of a gravel road, half a mile north of Ky. 278. The gravel road and Ky. 278 intersect 6 miles west of Princeton.

- O1—1 to ½ inch, hardwood leaves, mainly oak.  
 O2—½ inch to 0, partly decomposed hardwood leaves.  
 A1—0 to 1 inch, gray (10YR 5/1) to grayish-brown (10YR 5/2) silt loam; moderate, fine, granular structure; very friable; a little fine gravel; very strongly acid; abrupt, smooth boundary. 1 inch to 2 inches thick.  
 A2—1 inch to 3 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; very friable; a little fine gravel; very strongly acid; clear, wavy boundary. 1 inch to 8 inches thick.  
 A3—3 to 7 inches, light yellowish-brown (10YR 6/4) silt loam; weak, medium, granular structure; very friable; a little fine gravel; strongly acid; clear, wavy boundary. 2 to 5 inches thick.  
 B1—7 to 9 inches, dark-brown (7.5YR 4/4) to strong-brown (7.5YR 5/6) silt loam; weak, medium, subangular blocky structure; friable; a little fine gravel; strongly acid; clear, wavy boundary. 0 to 5 inches thick.  
 B2t—9 to 24 inches, yellowish-red (5YR 4/6) silty clay loam; moderate, medium, subangular blocky structure; thick clay films; friable; a little fine gravel; strongly acid; clear, wavy boundary. 8 to 20 inches thick.  
 IIB3t—24 to 34 inches, yellowish-red (5YR 4/6) silty clay loam; few, fine, distinct mottles of light brownish gray (10YR 6/2) and light gray (10YR 7/2); moderate, fine and medium, subangular blocky structure; patchy, thin clay films; friable or firm; the gravel gradually increases in amount and size in this horizon; very strongly acid; gradual, wavy boundary. 0 to 15 inches thick.  
 IIC—34 to 48 inches, yellowish-brown and gray gravel, mostly less than 1 inch in diameter; reddish sandy loam mottled with yellowish brown, dark brown, and gray fills the interstices; massive; firm, more or less cemented in places; strongly acid or very strongly acid. 1 foot to 30 feet thick.

Some profiles lack A3, B1, and IIB3t horizons. Other profiles have a B22 horizon that is strong brown (7.5YR 5/6) and may be mottled with grayish brown and gray.

In places, a faint, discontinuous fragipan less than 4 inches thick is part of the B3 horizon. The loess deposit ranges from 12 to 46 inches in depth, but is most commonly between 24 and 36 inches thick. In the very small areas where the loess is more than 42 inches thick, the profile is that of a Memphis soil.

#### Caneyville Series

The Caneyville series consists of well-drained and somewhat excessively drained Red-Yellow Podzolic soils intergrading to Lithosols. These soils developed in residuum derived, in varying proportions, from limestone, sandstone, and shale. They are sloping to steep and are commonly on the lower part of slopes. Caneyville soils occur in geographic association with Dekalb, Ramsey, and Muskingum stony soils, which are on the upper part of the slopes, and with Crider, Hayter, Wellston, and Zanesville soils. They are somewhat deeper than Dekalb, Ramsey, and Muskingum soils, have stronger horizonation, and have a finer textured and redder B horizon. They are more shallow than Crider, Hayter, Wellston, and Zanesville soils, have less evident horizonation, and have a thinner and finer textured B horizon.

Caneyville soils are widely distributed in the county. They are most extensive in the escarpment area between the Mississippian and Pennsylvanian geologic formations, but they may occur in any part of the county where the underlying rock is interbedded limestone, sandstone, and shale.

The following profile of Caneyville very rocky soils, 12 to 20 percent slopes, is along the east side of a gravel road, 150 yards north of Ky. 70. The gravel road intersects Ky. 70 a mile and a half east of where Ky. 70 crosses Ky. 139.

- A1—0 to 1 inch, very dark grayish-brown (10YR 3/2) loam; moderate, fine and medium, granular structure; very friable; limestone outcrops are common; neutral or slightly acid; abrupt, smooth boundary. 1 inch to 3 inches thick.  
 A2—1 inch to 6 inches, brown (10YR 5/3) or pale-brown (10YR 6/3) loam; weak, fine, granular structure; some coatings of very dark grayish-brown silt loam; very friable; very strongly acid; clear, smooth boundary. 4 to 7 inches thick.  
 B2t—6 to 18 inches, dark-brown (7.5YR 4/4) to yellowish-red (5YR 4/6) silty clay or silty clay loam; few, fine, faint mottles of brown (10YR 5/3); moderate, medium, angular blocky structure; few clay films; firm or very firm when moist, sticky and plastic when wet, hard when dry; few weathered fragments of brown sandstone; strongly acid or medium acid; clear, wavy boundary. 4 to 18 inches thick.  
 B3t—18 to 22 inches, yellowish-brown (10YR 5/4) to brownish-yellow (10YR 6/6) clay; few to common, medium, distinct mottles of gray (10YR 6/1); weak, medium, subangular blocky structure; few clay films; very firm when moist, sticky and plastic when wet, very hard when dry; strongly acid or medium acid; gradual, wavy boundary. 3 to 8 inches thick.  
 C—22 to 28 inches, light yellowish-brown (2.5Y 6/4) to olive-gray (5Y 5/2) clay or silty clay; common, medium, distinct mottles of strong brown and olive yellow; either massive or weak platy structure; very firm when moist, sticky and plastic when wet, very hard when dry; medium acid or slightly acid; irregular boundary. 4 to 12 inches thick.  
 R—28 inches +, limestone bedrock.

The thickness of the solum ranges from about 1 foot to slightly more than 2 feet. The depth to rock ranges

from 1 to 3 feet or more, but outcrops of limestone and sandstone are common especially on the steeper slopes. In places there is a very thin loess cap; in other places there is a thin "creep," or slope wash, of somewhat gravelly materials derived from the Dekalb, Ramsey, and Muskingum soils upslope. The texture of the A horizon is loam or silt loam or, rarely, fine sandy loam or silty clay loam; the texture of the B horizon may be heavy clay loam or sandy clay. In places there is a thin B1 horizon. The B2 horizon is strong brown, reddish brown, or red in some places.

#### Captina Series

The Captina series consists of moderately well drained Red-Yellow Podzolic soils with fragipans. These soils are on stream terraces. They developed in old alluvium washed from limestone residuum, and they lack the sand component that is normal in soils that formed, under similar conditions, in alluvium derived from sandstone and shale. Captina soils are associated with Elk and Taft soils, which formed in similar material. They are less well drained and are yellower in the subsoil than Elk soils, and they are better drained and less gray in the subsoil than Taft soils. Elk soils have no fragipan, and Taft soils have a more strongly developed fragipan than Captina soils.

The following profile of Captina silt loam, 2 to 6 percent slopes, is 4 miles northwest of Princeton, across the railroad track from Ky. 91.

- Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; very friable; slightly acid; abrupt, smooth boundary. 5 to 8 inches thick.
- B21t—7 to 16 inches, yellowish-brown (10YR 5/8) heavy silt loam; few, fine, faint mottles of pale brown (10YR 6/3); moderate, medium, subangular blocky structure; thin, almost continuous clay films; friable; strongly acid or very strongly acid; clear, wavy boundary. 7 to 10 inches thick.
- B22t—16 to 23 inches, yellowish-brown (10YR 5/4) heavy silt loam; common, fine, faint mottles of pale brown (10YR 6/3) and light gray (10YR 7/2); weak, fine and medium, subangular blocky structure; few patchy clay films; friable; strongly acid or very strongly acid; abrupt, smooth boundary. 6 to 9 inches thick.
- Bx1—23 to 26 inches, pale-brown (10YR 6/3) silt loam; common, medium, faint mottles of very pale brown (10YR 7/4) and light gray (10YR 7/2); medium, coarse, prismatic structure; slightly compact and brittle; few, small, dark-brown concretions; strongly acid or very strongly acid; clear, wavy boundary. 2 to 5 inches thick.
- Bx2—26 to 39 inches, mottled pale-brown (10YR 6/3), gray (5Y 6/1), and yellowish-brown (10YR 5/6) silty clay loam; medium, coarse, prismatic structure; very firm when moist, compact and brittle in places; few, small, dark-brown concretions; strongly acid or very strongly acid; gradual, diffuse boundary. 10 to 20 inches thick.
- Cg—39 to 48 inches, gray (10YR 6/1) silty clay loam; many, coarse, prominent mottles of yellowish brown (10YR 5/6); weak, fine, angular blocky structure or massive; strongly acid or very strongly acid. Several feet thick.

The thickness of the alluvial deposit ranges from about 3 to 15 feet, the thickness of the solum from about 30 to 40 inches, and the depth to the fragipan from about 18 to 28 inches. In places the fragipan is weakly expressed. Some profiles have 2 to 8 inches of strong-brown (7.5YR

5/6) soil material in the upper part of the B horizon. Partly weathered old alluvium consisting of sand, silt, clay, and gravel underlies some areas of these soils. The depth to unweathered bedrock ranges from 4 to 30 feet or more. The bedrock is generally limestone but is sandstone or shale in places.

#### Collins Series

The Collins series consists of moderately well drained Alluvial soils that developed in sediment washed from loess and from acid sandstone and shale residuum. These soils commonly occur either in natural levees along the larger streams or adjacent to Vicksburg soils on natural levees. Collins soils are less well drained than Vicksburg soils but are better drained than Falaya and Waverly soils, with which they are closely associated. They are more acid and somewhat less fertile than Lindsides soils, which are on bottom lands where a large part of the sediment was washed from limestone residuum.

The following profile of Collins silt loam is 250 yards southwest of the bridge over Donaldson Creek on Ky. 293.

- Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; very friable; strongly acid; abrupt, smooth boundary. 6 to 10 inches thick.
- C1—10 to 25 inches, dark grayish-brown (10YR 4/2) silt loam; few, medium, faint mottles of pale brown (10YR 6/3); moderate, fine, granular structure; friable; some dark-brown concretions; strongly acid; clear, smooth boundary. 12 to 15 inches thick.
- C2—25 to 38 inches, dark grayish-brown (10YR 4/2) to grayish-brown (2.5Y 5/2) silt loam; common, medium, distinct mottles of light brownish gray (10YR 6/2); moderate, fine, granular structure; friable; some dark-brown concretions; strongly acid; clear, smooth boundary. 12 to 15 inches thick.
- C3—38 to 48 inches +, dark grayish-brown (10YR 4/2) silt loam; common, medium, distinct mottles of light brownish gray (10YR 6/2); moderate, fine, granular structure; firm; strongly acid; 10 inches thick or more.

These soils are usually free of mottles above a depth of 20 inches but are heavily mottled below a depth of 20 inches. They may be gray below a depth of 30 inches. The texture below the A horizon ranges from sandy loam to silty clay loam. In places the structure throughout the profile is subangular blocky rather than granular. The color of the Ap horizon may be brown (10YR 4/3 to 5/3), and that of the upper part of the C horizon may be dark yellowish brown (10YR 4/4).

#### Crider Series

Crider soils are well-drained Red-Yellow Podzolic soils that developed partly from loess and partly from residuum derived entirely or predominantly from limestone. In the areas underlain by high-grade limestone (soil association 4), these soils occupy level to sloping uplands in close association with Pembroke and Fredonia soils. In the areas underlain by cherty limestone (soil associations 5, 6, and 7), they occupy gently sloping to strongly sloping uplands in close association with Russellville and Baxter soils. In the limestone-sandstone-shale areas (soil association 1), they occupy gently sloping to strongly sloping uplands and are closely associated with Zanesville, Caneyville, and Russellville soils. They differ from Pembroke, Fredonia, Baxter, and Caneyville soils in that

they developed partly from loess. They have browner B horizons than Pembroke, Fredonia, and Baxter soils. They are deeper than Caneyville soils. They differ from Russellville and Zanesville soils in lacking a definite fragipan and in having a redder B horizon.

The following profile of Crider silt loam, 2 to 6 percent slopes, is 1 mile east of Princeton, south of Ky. 91, on the Western Kentucky Agricultural Experiment Station.

- Ap—0 to 7 inches, dark-brown (10YR 3/3 to 4/3) silt loam; moderate, fine, granular structure; very friable; slightly acid; abrupt, smooth boundary. 6 to 8 inches thick.
- B21t—7 to 28 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, medium and fine, angular blocky structure; thin, almost continuous, dark reddish-brown (5YR 3/4) clay films; firm; strongly acid or very strongly acid; clear, wavy boundary. 18 to 30 inches thick.
- IIB22t—28 to 42 inches, red (2.5YR 4/6) to yellowish-red (5YR 4/6) silty clay loam; moderate, medium and fine, angular blocky structure; thin, continuous clay films; firm; some black concretionary stains; strongly acid or very strongly acid; clear, wavy boundary. 10 to 20 inches thick.
- IIB23t—42 to 60 inches, dark reddish-brown (5YR 3/3) and red (2.5YR 4/6) silty clay; few, medium, distinct mottles of pinkish gray (5YR 6/2); moderate, medium, angular blocky structure; thin, almost continuous clay films account for much of the dark reddish-brown color; firm; chert fragments between 1 and 4 inches long are common; strongly acid; clear, wavy boundary. 10 to 30 inches thick.
- IIC—60 to 74 inches, dark-red (2.5YR 3/6) silty clay; few, coarse, distinct mottles of weak red (2.5YR 4/2); weak, medium, blocky structure; almost massive; very firm; few chert fragments; medium acid or strongly acid; abrupt, irregular boundary. 8 to 36 inches thick.
- R—74 inches +, limestone.

The thickness of the layer of recognizable loess ranges from 18 to 42 inches. The profile described is in the high-grade limestone area (soil association 4), and the lower horizons in parts of this area contain less chert than the profile described. In the cherty limestone areas (soil associations 5, 6, and 7), the amount of chert varies greatly in short distances but is usually greater than that in the profile described. An 8- to 16-inch layer that is 30 to 90 percent chert occurs at the contact between the B21t and the IIB22t horizons in some places. In the limestone-sandstone-shale areas (soil association 1), the texture of the lower horizons is predominantly silty clay or silty clay loam but ranges to silt loam, sandy clay loam, sandy clay, or clay.

Crider soils are usually free of mottling in the contact zone between the loess and the underlying soil material, but in places this zone is mottled and includes a fragipan up to 5 inches thick. This thin fragipan seldom occurs in the noncherty, pure limestone areas. The color of the Ap horizon ranges from brown (10YR 4/3) to dark brown (7.5YR 3/2). In forested areas, there is generally a brown (10YR 5/3 or 7.5YR 4/4) A2 horizon beneath a thin A1 horizon. In many places there is a thin B1 horizon that is strong brown (7.5YR 5/6) or brown (7.5YR 4/4) in color. The color of the B21t horizon ranges to strong brown (7.5YR 5/6), yellowish red (5YR 4/6 to 5/6), reddish brown (5YR 4/4), and dark reddish brown (5YR 3/4).

#### Dekalb Series

The Dekalb series consists of well-drained and somewhat excessively drained Sols Bruns Acides that developed in

residuum weathered from sandstone interbedded in places with siltstone and shale. These soils are strongly sloping and steep. They occur in close geographic association with Ramsey, Muskingum, Litz, and Gilpin soils. They have a thicker solum than Ramsey soils. They differ from the Muskingum, Litz, and Gilpin soils in having a sandy rather than a silty subsoil.

The following profile of Dekalb stony loam is 1.3 miles south of Barnes Store, on the east side of Ky. 278.

- O—0 to 1 inch, partly decomposed leaves of deciduous trees.
- A1—0 to 2 inches, dark grayish-brown (10YR 4/2) to very dark gray (10YR 3/1) stony loam; weak, fine, granular structure; very friable; 20 percent small fragments of sandstone; strongly acid; abrupt, smooth boundary. 1 inch to 2 inches thick.
- A2—2 to 10 inches, light yellowish-brown (10YR 6/4) loam; moderate, fine, granular structure; very friable; about 25 percent fragments of sandstone and siltstone; strongly acid; clear, wavy boundary. 5 to 10 inches thick.
- B—10 to 24 inches, brownish-yellow (10YR 6/6) fine sandy loam; weak, fine, subangular blocky structure; friable; about 35 percent fragments of sandstone; strongly acid or very strongly acid; gradual, irregular boundary. 10 to 20 inches thick.
- C—24 to 36 inches, strong-brown (7.5YR 5/8) sandy loam; very friable; about 35 percent fragments of sandstone; gradual, irregular boundary. 8 to 16 inches thick.
- R—36 inches +, sandstone bedrock.

The texture of the A horizon ranges from silt loam to fine sandy loam. The texture of the B horizon is generally fine sandy loam but ranges to loam or sandy clay loam. The depth to bedrock ranges from 0 to 60 inches but is generally about 36 inches. Fragments of sandstone, siltstone, and shale make up 15 percent to 80 percent of the subsoil.

#### Dickson Series

Dickson soils are moderately well-drained Red-Yellow Podzolic soils with fragipans. They occupy smooth uplands. The upper part of the profile developed in loess, and the lower part in residuum weathered from limestone. Dickson soils are associated with the better drained Crider and Russellville soils and with the more poorly drained Mullins soils. The fragipan in Dickson soils is more evident and is closer to the surface than that in Russellville soils. The upper part of the B horizon in Dickson soils is yellower than that in Russellville soils.

Dickson soils occur mainly in the southwestern part of the county, but there are small areas throughout the limestone region.

The following profile of Dickson silt loam, 2 to 6 percent slopes, is near Ky. 139, a mile and a quarter south of Hopson.

- Ap—0 to 6 inches, brown (10YR 4/3) silt loam; moderate, fine, granular structure; friable; medium acid or slightly acid; abrupt, smooth boundary. 4 to 8 inches thick.
- B1—6 to 9 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; medium acid or strongly acid; clear, wavy boundary. 3 to 10 inches thick.
- B21—9 to 18 inches, yellowish-brown (10YR 5/6) silt loam to silty clay loam; moderate, medium, subangular blocky structure; friable; strongly acid; clear, wavy boundary. 6 to 10 inches thick.
- B22—18 to 23 inches, yellowish-brown (10YR 5/6) silt loam to silty clay loam; few, fine, distinct mottles of pale brown (10YR 6/3); moderate, medium, subangular blocky structure; friable; strongly acid; clear, wavy boundary. 4 to 7 inches thick.

Bx1—23 to 27 inches, yellowish-brown (10YR 5/4) silt loam; many, fine, distinct mottles of pale brown (10YR 6/3) and light brownish gray (10YR 6/2); moderate, medium, angular blocky structure; firm; compact; strongly acid or very strongly acid; clear, wavy boundary. 2 to 4 inches thick.

Bx2—27 to 43 inches, mottled yellowish-brown (10YR 5/4), light-gray (10YR 7/2), and pale-brown (10YR 6/3) silt loam to silty clay loam; much of the light gray is silty material in streaks between coarse, polygonal peds that break into moderate, medium, angular blocks; thick silt and clay films coat the faces of the polygons; very firm, compact, and brittle; very strongly acid or strongly acid; gradual, irregular boundary. 13 to 19 inches thick.

C—43 to 46 inches, mottled pale-brown (10YR 6/3), dark yellowish-brown (10YR 4/4), and light-gray (10YR 7/1) silty clay loam; weak, medium, angular blocky structure to massive; firm; compact; strongly acid or very strongly acid; clear, wavy boundary. 3 to 12 inches thick.

IIB2—46 to 72 inches +, red (2.5YR 4/6 to 10R 4/6) silty clay loam to silty clay; common, coarse, prominent mottles of pink (7.5YR 7/4); few, fine, prominent mottles of light gray (10YR 7/2); moderate to strong, medium, angular blocky structure; many clay films on ped surfaces; firm or very firm; few small chert fragments; strongly acid or very strongly acid. Several feet thick.

The depth to the IIB2 horizon, which formed in limestone residuum, ranges from 36 to 50 inches. This horizon is weakly developed in places. In places it contains chert. There are spots where the loess is as much as 60 inches deep. In the southern part of the county, east of Blue Spring Church, a shallow deposit of Tertiary gravel overlies the limestone residuum.

#### Elk Series

The Elk series consists of well-drained Gray-Brown Podzolic soils that developed in old alluvium derived mostly from limestone residuum and to a lesser extent from sandstone and shale residuum. These soils are on gently sloping stream terraces. They are the well-drained members of the Elk-Captina-Taft-Melvin drainage sequence. Elk soils are more brown throughout than either Captina or Taft soils, and they lack the fragipan that is characteristic of Captina and Taft soils. The horizons in Elk soils are more evident than those in the associated Ashton soils, which are on low terraces.

The following profile of Elk silt loam, 2 to 6 percent slopes, is 1 mile south of Crider, along Skinframe Creek.

Ap—0 to 7 inches, dark-brown (10YR 4/3 or 3/3) silt loam; moderate, fine, granular structure; very friable; medium acid; abrupt, smooth boundary. 5 to 8 inches thick.

B1—7 to 12 inches, strong-brown (7.5YR 5/6) to yellowish-brown (10YR 5/6) heavy silt loam; weak, medium, subangular blocky structure; friable; medium acid; gradual, smooth boundary. 5 to 9 inches thick.

B21t—12 to 28 inches, brown (7.5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; few clay films; firm; strongly acid; gradual, wavy boundary. 12 to 24 inches thick.

B22t—28 to 40 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; few, fine, distinct mottles of light brownish gray (10YR 6/2); weak, medium, subangular blocky structure; friable; strongly acid; gradual, wavy boundary. 8 to 16 inches thick.

C—40 to 48 inches +, reddish-brown (5YR 4/4) silty clay loam; many, medium, prominent mottles of light brownish gray (10YR 6/2) and pale brown (10YR 6/3); weak, medium, angular blocky structure; friable; medium acid. 8 to 40 inches thick.

The thickness of the alluvium ranges from about 3 to 15 feet. The reaction varies considerably. Some profiles are less acid than the one described. In some profiles, the B1 horizon is dark brown (7.5YR 4/4). Beds of gravel may occur at depths of more than 4 feet. In some areas there are a few pieces of chert on the surface and in the profile, and in some the lower part of the B horizon is reddish brown (5YR 4/4).

#### Falaya Series

The Falaya series consists of somewhat poorly drained Alluvial soils intergrading to Low-Humic Gley soils. They developed in alluvium washed from loess and from sandstone and shale residuum. Falaya soils are more poorly drained than Vicksburg and Collins soils but better drained than Waverly soils. They are in the same drainage sequence, and are closely associated geographically, with all these soils. They correspond in drainage to Newark soils, which developed in alluvium derived largely from limestone residuum, but they differ from Newark soils in being somewhat lighter colored, more acid, and slightly less productive.

Falaya soils occur along the larger creeks and branches and along the Tradewater River, in the eastern part of Caldwell County. Usually they are a short distance from the streams, and Vicksburg or Collins soils are on the natural levees. They are the most extensive soils on the bottom land of the Tradewater River.

The following profile of Falaya silt loam is 2 miles east of Shady Grove, on the Tradewater River bottom lands.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; few, fine, faint mottles of dark brown (10YR 3/3) and grayish-brown (10YR 5/2); weak, fine, granular structure; very friable; slightly acid; abrupt, wavy boundary. 6 to 10 inches thick.

C1g—8 to 24 inches, grayish-brown (2.5Y 5/2) to light olive-brown (2.5Y 5/4) silt loam; few, fine, distinct mottles of yellowish red (5YR 4/6) and dark brown (10YR 3/3); weak, fine granular structure; friable; small and medium concretions are common; strongly acid or very strongly acid; clear, wavy boundary. 15 to 25 inches thick.

C2g—24 to 35 inches, gray (5Y 5/1) silt loam; few, fine, faint mottles of dark brown (10YR 3/3); weak, fine, granular structure; friable; numerous, small and medium, dark-brown concretions; strongly acid or very strongly acid; gradual, diffuse boundary. 10 to 15 inches thick.

C3g—35 to 48 inches, gray (5Y 6/1) silt loam; common, medium, distinct mottles of yellowish brown (10YR 5/6); weak, medium, granular structure; friable; numerous, small and medium, brown concretions; strongly acid or very strongly acid. Several feet thick.

The Ap horizon may be free of mottles. Below a depth of 30 inches the texture ranges from sandy loam to silty clay but is most commonly silt loam. The horizons below a depth of 24 inches may be light gray in color, but in some profiles, colors similar to those of the C1g horizon extend downward for 42 inches or more. Small concretions occur in the Ap horizon and on the surface in some places. In a few areas the uppermost 10 to 30 inches of the profile is strongly mottled and the lower part is dark yellowish brown.

#### Fredonia Series

The Fredonia series consists of well-drained Reddish-Brown Lateritic soils that intergrade to Lithosols. These soils developed in limestone residuum. They occur in association with Pembroke, Crider, and Russellville soils.

Fredonia soils are shallower to bedrock than the Pembroke and Crider soils and are finer textured and firmer in consistency throughout. They are darker red in the upper part of the solum than Crider and Russellville soils, and they lack the strong mottling and the fragipan that are characteristic of Russellville soils.

The following profile of Fredonia silty clay loam, shallow, 6 to 12 percent slopes, eroded, is half a mile northeast of Rock Spring Church, south of a gravel road connecting Ky. 139 and Ky. 128.

- Ap—0 to 6 inches, dark reddish-brown (2.5YR 3/4) to dark-red (2.5YR 3/6) silty clay loam; weak, medium, angular blocky structure; friable; slightly acid to neutral; abrupt, smooth boundary. 3 to 7 inches thick.
- B21t—6 to 15 inches, dark-red (2.5YR 3/6) clay; strong, medium; angular blocky structure; very firm when moist, very hard when dry, sticky when wet; many clay films; slightly acid; clear, smooth boundary. 8 to 15 inches thick.
- B22t—15 to 20 inches, dark-red (10R 3/6) or dusky-red (10R 3/4) clay; strong, medium, angular blocky structure; very firm; many clay films; numerous, small, round, black concretions; slightly acid or neutral; clear, smooth boundary. 5 to 20 inches thick.
- B23t—20 to 28 inches, dusky-red (10R 3/4) clay; strong, fine, angular blocky structure; extremely firm; clay films noticeable; slightly acid or neutral. 5 to 15 inches thick.
- R—28 inches +, limestone.

In some areas the profile characteristics are intermediate between those of Pembroke and those of Fredonia soils, but the solum is shallower than that of Pembroke soils. In these areas the A horizon is brown (7.5YR 4/4), friable silty clay loam, the upper part of the B horizon is dark reddish-brown (5YR 3/4), firm silty clay loam, and the limestone bedrock is at a depth of about 30 inches.

#### Gilpin Series

The Gilpin series consists of well-drained to somewhat excessively drained Gray-Brown Podzolic soils intergrading to Red-Yellow Podzolic soils. These soils developed in thin loess and residuum weathered from acid shale, siltstone, and sandstone. They are strongly sloping or steep. Gilpin soils occur in close geographic association with Litz, Muskingum, Dekalb, and Ramsey soils. They differ from Litz soils in having a thicker B horizon. They differ from Muskingum, Dekalb, and Ramsey soils in having an accumulation of clay in the B horizon and in having a much smaller percentage of coarse fragments in the B horizon. They differ from Dekalb and Ramsey soils in being silty rather than sandy below the A horizon.

The following profile of Gilpin silt loam, 12 to 20 percent slopes, is a quarter of a mile east of Fairview Church, on a dirt road.

- O—1 inch to 0, partly decayed hardwood leaves.
- A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, granular structure; very friable; very strongly acid; clear, smooth boundary. 1 inch to 3 inches thick.
- A2—2 to 6 inches, yellowish-brown (10YR 5/4) silt loam; few, medium, faint mottles of very pale brown (10YR 7/3); weak, medium, platy structure that in some places breaks easily to moderate, fine and medium, granular structure; very friable; contains a few sandstone fragments; very strongly acid; clear, wavy boundary. 3 to 5 inches thick.
- B2t—6 to 20 inches, reddish-yellow (7.5YR 6/8) to strong-brown (7.5YR 5/6) silty clay loam; moderate, fine and medium, subangular blocky structure; friable to

firm; common clay films; a few sandstone fragments up to 2 inches long; very strongly acid; clear, wavy boundary. 9 to 15 inches thick.

- B3t—20 to 23 inches, strong-brown (7.5YR 5/6) to yellowish-red (5YR 5/6) sandy clay loam; medium, distinct mottles of very pale brown (10YR 7/3); weak, fine, subangular blocky structure; patchy clay films; sandstone fragments up to 4 inches long are common; strongly acid or very strongly acid; clear, wavy boundary. 0 to 5 inches thick.
- C—23 to 42 inches, red (10R 4/6) silty clay; many, medium, prominent mottles of very pale brown (10YR 7/3); some relict platy structure, but mostly massive; very firm; very strongly acid; gradual, diffuse boundary. 0 to 25 inches thick.
- R—42 inches +, pinkish-gray, soft shale.

The color of the A1 horizon is dark grayish brown (10YR 4/2) in places, and that of the A2 horizon ranges from brown (10YR 5/3) to yellowish brown (10YR 5/6). The B horizon is heavy silt loam or light silty clay loam and ranges from 9 to 18 inches in thickness. The profile described is underlain by shale, but sandstone or siltstone occur as commonly as shale. In profiles underlain by sandstone or siltstone, the color of the C horizon is yellowish brown or strong brown and the texture is silt loam, loam, fine sandy loam, or silty clay loam. The depth to bedrock ranges from 15 to 45 inches.

#### Hayter Series

The Hayter series consists of well-drained Red-Yellow Podzolic soils on foot slopes. These soils formed in old local alluvium washed from upland soils underlain by interbedded limestone, sandstone, and shale. Hayter soils occur in close geographic association with Caneyville, Dekalb, Ramsey, Muskingum, Crider, Zanesville, and Wells-ton soils. They differ from all these soils in occurring on foot slopes. They are deeper and have a better developed subsoil than Caneyville, Dekalb, Ramsey, and Muskingum soils. They lack the fragipan that is characteristic of Zanesville soils.

Hayter soils are widespread in the steeper parts of the county. Most of the areas were once cleared and used for cropland but are now in second-growth hardwood forest.

The following profile of Hayter silt loam, 6 to 12 percent slopes, is on the north side of Ky. 91, a quarter of a mile southeast of Pleasant Grove Church.

- Ap—0 to 6 inches, dark-brown (10YR 4/3 to 3/3) silt loam; moderate, fine, granular structure; very friable; slightly acid; clear, wavy boundary. 5 to 8 inches thick.
- B1—6 to 11 inches, brown (7.5YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; slightly acid; clear, wavy boundary. 4 to 8 inches thick.
- B21t—11 to 22 inches, dark-brown (7.5YR 4/4 to 4/2) silty clay loam; moderate, medium, subangular blocky structure; friable; few clay films; few very dark brown concretionary stains; strongly acid; clear, wavy boundary. 10 to 15 inches thick.
- B22t—22 to 36 inches, brown (7.5YR 4/4) heavy silt loam; common, medium, faint mottles of brown (10YR 5/3) and very dark grayish brown (10YR 3/2); moderate, medium, subangular blocky structure; friable; common clay films; few dark concretions; very strongly acid; gradual, wavy boundary. 8 to 15 inches thick.
- B3t—36 to 45 inches, yellowish-red (5YR 4/6) heavy silt loam; common, medium, distinct mottles of light brownish gray (10YR 6/2) and very dark grayish brown (10YR 3/2); weak, medium, subangular blocky structure; friable to firm; few clay films; common dark-brown concretions; very dark grayish-brown (10YR 3/2)

mottles caused by concretionary stains; very strongly acid; diffuse, wavy boundary. 8 to 15 inches thick.  
 C—45 to 62 inches, yellowish-red (5YR 4/6) silty clay loam; common, medium, distinct mottles of pinkish gray (7.5YR 6/2), very dark grayish brown (10YR 3/2), and light gray (10YR 7/2); weak, medium, subangular blocky structure; firm; light-gray (10YR 7/2) color occurs mainly as vertical streaks; very strongly acid. Several feet thick.

The deposit of local alluvium is commonly 3 to 12 feet thick, and the solum is 30 to 50 inches thick. Some profiles lack a B1 horizon, and some have dark yellowish-brown (10YR 4/4) B22 and B3 horizons. A few profiles have a weak fragipan 3 to 7 inches thick in the B3 horizon. A few areas, mostly less than 1 acre in size, have gravel on the surface.

#### Huntington Series

The Huntington series consists of well-drained Alluvial soils that formed in alluvium derived largely from limestone residuum and from loess. They are the well-drained members of the drainage sequence that includes the moderately well drained Lindsides soils, the somewhat poorly drained Newark soils, and the poorly drained Melvin soils. Huntington soils lack the faint B horizon that is characteristic of Ashton soils, with which they are closely associated. They are commonly darker brown, less acid, and more productive than Vicksburg soils, which formed in well-drained sediments derived chiefly from loess and from acid sandstone and shale residuum.

The largest areas of Huntington soils in Caldwell County are along Eddy Creek and its tributaries, but small areas occur near the channels of the larger streams throughout the parts of the county where the bedrock is limestone or interbedded limestone, sandstone, and shale.

The following profile of Huntington silt loam is along Hewlett Creek, 1½ miles south of Crider.

- Ap—0 to 7 inches, dark-brown (10YR 3/3) silt loam; moderate, fine, granular structure; very friable; neutral; clear, wavy boundary. 5 to 8 inches thick.  
 C1—7 to 18 inches, dark-brown (10YR 3/3 or 4/3) silt loam; weak, medium, subangular blocky structure and weak, fine, granular structure; very friable; neutral; clear, wavy boundary. 4 to 12 inches thick.  
 C2—18 to 36 inches, dark-brown (10YR 3/3) silt loam; moderate, fine, granular structure; friable; neutral; clear, smooth boundary. 15 to 30 inches thick.  
 C3—36 to 48 inches, dark grayish-brown (10YR 4/2) to brown (10YR 4/3) silt loam; common, fine, distinct mottles of light brownish gray (10YR 6/2); weak, medium, granular structure; friable; neutral; several feet thick in most places.

The color of the Ap horizon ranges from very dark grayish brown (10YR 3/2) to dark yellowish brown (10YR 3/4). The profile may be mottled below a depth of 30 inches or it may be unmottled to a depth of 5 feet. In most places the structure is granular throughout, but subangular blocky structure in the C horizon is not uncommon. A very small acreage has gravel on the surface and throughout the profile. The reaction is commonly slightly acid to mildly alkaline but is medium acid in places.

#### Johnsburg Series

The Johnsburg series consists of somewhat poorly drained Planosols. They developed in shallow loess overlying residuum weathered from sandstone and shale. They have a well-developed fragipan. Johnsburg soils

occur on nearly level upland areas in association with Tilsit and Mullins soils of the Muskingum-Wellston-Zanesville-Tilsit-Johnsburg-Mullins drainage sequence. In drainage, productivity, and many other features, they are intermediate between Tilsit and Mullins soils.

The following profile of Johnsburg silt loam is along a gravel road (Ky. 1119), 100 feet northwest of the intersection of Ky. 1119 and Ky. 293.

- Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; few, medium, faint mottles of light brownish gray (10YR 6/2); moderate, medium, granular structure; friable; strongly acid; abrupt, smooth boundary. 5 to 9 inches thick.  
 A3—6 to 9 inches, mottled grayish-brown (10YR 5/2), very pale brown (10YR 7/3), and yellow (10YR 7/8) silt loam; weak, fine, granular structure; friable; few, dark-brown, soft and hard, iron concretions; very strongly acid; clear, smooth boundary. 2 to 4 inches thick.  
 B2—9 to 18 inches, yellow (10YR 7/8) or olive-yellow (2.5Y 6/6) silt loam; many, coarse, prominent mottles of light gray (10YR 7/2); weak, fine, subangular blocky structure; friable; a few dark-brown, soft and hard iron concretions; very strongly acid; clear, smooth boundary. 8 to 15 inches thick.  
 Bx1—18 to 24 inches, gray (10YR 6/1) silt loam; many, coarse, prominent mottles of strong brown (7.5YR 5/8); moderate, medium and fine, angular blocky structure; firm, slightly compact, and brittle; large, irregular pieces of very dark brown concretionary material are common; very strongly acid; gradual, smooth boundary. 4 to 10 inches thick.  
 Bx2—24 to 36 inches, gray (10YR 6/1) silty clay loam; many, coarse, prominent mottles of strong brown (7.5YR 5/8); moderate, fine and medium, angular blocky structure; clay films on ped faces; very firm, compact, and brittle; concretionary material as in Bx1 horizon; very strongly acid; gradual, smooth boundary. 10 to 20 inches thick.  
 Cg—36 to 48 inches +, mottled strong-brown (7.5YR 5/8) and light-gray (10YR 7/2) silty clay loam; massive; friable or firm when moist, plastic when wet; the gray part is plastic silty clay, the brown part friable clay loam; very strongly acid. 20 to 60 inches thick.

The color of the Ap horizon is grayish brown (10YR 5/2) or brown (10YR 5/3) in places. The mottles in this horizon may be pale brown (10YR 6/3), and in abundance they range from none to common. Some profiles have only a thin A3 horizon, and some have none. The B2 horizon is brownish yellow (10YR 6/6) in places, and the gray mottles in this horizon range from common to many in abundance. The depth to the fragipan ranges from 17 to 24 inches. The fragipan has a platy structure in places.

#### Lindsides Series

The Lindsides series consists of moderately well drained Alluvial soils. They are forming in young sediments that were derived largely from limestone residuum but that include some material derived from loess and some derived from sandstone and shale residuum. These soils are the moderately well drained members of the catena that includes the well-drained Huntington soils, the somewhat poorly drained Newark soils, and the poorly drained Melvin soils. They resemble Collins soils, which are forming in moderately well drained sediments derived from loess and from acid sandstone and shale residuum, but they are somewhat darker brown, less acid, and more productive than Collins soils.

Lindside soils occur mainly near the channels of the larger branches and streams in the parts of the county where the bedrock is interbedded limestone, sandstone, and shale. Where the bedrock is limestone, Lindside soils occur between Huntington soils, which are nearest the stream, and Newark soils, which are commonly adjacent to the upland slopes.

The following profile of Lindside silt loam is along Donaldson Creek, 1 mile north of Farmersville.

- Ap—0 to 8 inches, brown (10YR 4/3) silt loam; moderate, fine, granular structure; very friable; slightly acid to neutral; abrupt, smooth boundary. 4 to 10 inches thick.
- C1—8 to 21 inches, brown (10YR 4/3) silt loam; few, medium, faint mottles of pale brown (10YR 6/3) and grayish brown (10YR 5/2); moderate, fine, granular structure; friable; slightly acid to neutral; clear, smooth boundary. 10 to 15 inches thick.
- C2—21 to 36 inches, mottled brown (10YR 4/3), dark yellowish-brown (10YR 4/4), pale-brown (10YR 6/3), and grayish-brown (10YR 5/2) silt loam; moderate, fine, granular structure; friable; a few small, black and dark-brown concretions; slightly acid or neutral; clear, smooth boundary. 10 to 20 inches thick.
- C3—36 to 48 inches +, light-gray (10YR 7/2) silt loam or loam; common, medium, prominent mottles of reddish yellow (7.5YR 6/8), grayish brown (10YR 5/2), and dark brown (10YR 3/3); moderate, fine, granular structure; friable; many small, round, dark-brown and black concretions; slightly acid or neutral. 10 to 15 inches thick.

Typically, Lindside soils are free of mottling to a depth of about 20 inches. They may be mottled with pale brown (10YR 6/3) and light brownish gray (10YR 6/2) below a depth of 20 inches, and they may be gray below a depth of 30 inches. The color of the Ap horizon ranges from brown (10YR 5/3) to very dark grayish brown (10YR 3/2). In some places the upper part of the C horizon is dark yellowish brown (10YR 4/4) or very dark grayish brown (10YR 3/2). In some profiles the C horizon has a weak, subangular blocky structure. Below a depth of 3 feet, the texture of the C horizon is dominantly silt loam but ranges from sandy loam to clay. There are indications that in the lower parts of the Donaldson Creek bottom lands the soils are underlain by gray slack-water clay at a depth of more than 6 feet. The reaction is commonly slightly acid to mildly alkaline throughout the profile, but in places it is medium acid.

#### Litz Series

The Litz series consists of excessively drained Red-Yellow Podzolic soils intergrading to Lithosols. These soils developed in residuum weathered from acid shale, siltstone, and sandstone. In many places a very thin mantle of loess overlies the residuum. Litz soils occur on strong to steep upland slopes in association with Gilpin, Muskingum, Dekalb, and Ramsey soils. They differ from Gilpin soils in having a thinner B horizon of clay accumulation. They differ from Muskingum, Dekalb, and Ramsey soils in having a B horizon where clay has accumulated and in having fewer stones and rocks in the B horizon. They differ from the Dekalb and Ramsey soils in being silty rather than sandy below the surface horizon.

The following profile of Litz silt loam is on the north side of West Kentucky Toll Road, 5 miles east of Princeton. The slope is 12 to 20 percent.

- O—1 inch to 0, partly decayed forest litter from hardwood trees.
- A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; very friable; strongly acid or very strongly acid; clear, smooth boundary. 1 inch to 3 inches thick.
- A2—3 to 8 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, granular structure; very friable; strongly acid or very strongly acid; gradual, wavy boundary. 3 to 7 inches thick.
- B1—8 to 12 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; friable to firm; very strongly acid; gradual, wavy boundary. 2 to 6 inches thick.
- B2—12 to 14 inches, strong-brown (7.5YR 5/6) to yellowish-red (5YR 5/6) light silty clay loam; common clay films; moderate, medium, subangular blocky structure; about 10 percent small fragments of sandstone and shale; very strongly acid; gradual, wavy boundary. 2 to 4 inches thick.
- R—14 inches +, shattered and irregularly bedded sandstone, siltstone, and shale.

The color of the A1 horizon is dark grayish brown (10YR 4/2) in places. The color of the A2 horizon ranges from brown (10YR 5/3) to yellowish brown (10YR 5/6). The B horizon consists of silt loam or light silty clay loam and is 2 to 9 inches thick. In places there is a C horizon, usually yellowish brown or strong brown, that ranges up to 15 inches in thickness. Generally the C horizon is silty and contains many coarse fragments of sandstone, siltstone, or shale. Ordinarily the bedrock is mostly sandstone or siltstone. Where shale is dominant, there may be a red, plastic, clayey C horizon. The depth to bedrock is ordinarily between 15 and 30 inches.

#### McGary Series

The McGary series consists of Gray-Brown Podzolic soils that intergrade toward Low-Humic Gley. These soils are on stream terraces. They developed in calcareous, clayey, slack-water deposits. They are the somewhat poorly drained members of a drainage sequence that includes better drained and more poorly drained soils that are not mapped in Caldwell County. McGary soils are associated with Sharkey and Falaya soils. McGary soils occupy higher positions than either of these associated soils. Their subsoil is less gray than that of Sharkey soils and more clayey than that of Falaya soils.

McGary soils occur only in the northeastern part of Caldwell County. The following profile of McGary silt loam is 3 miles northeast of Shady Grove, west of a dirt road, a quarter of a mile west of the Tradewater River. The slope is 0 to 2 percent.

- Ap—0 to 7 inches, brown (10YR 5/3) to pale-brown (10YR 6/3) silt loam; moderate, fine, granular structure; friable; medium acid or strongly acid; abrupt, wavy boundary. 5 to 8 inches thick.
- B1t—7 to 12 inches, mottled, gray (5YR 6/1, yellowish-brown (10YR 5/4), and light brownish-gray (10YR 6/2) light silty clay loam; weak, medium, angular blocky structure; patchy clay films; firm; medium acid or strongly acid; clear, wavy boundary. 4 to 7 inches thick.
- B21t—12 to 17 inches, yellowish-brown (10YR 5/4) silty clay; many, coarse, distinct, light brownish-gray (10YR 6/2) mottles; moderate, medium, angular blocky structure; continuous clay films; firm; much of the mottling consists of gray streaks and coatings on peds; medium acid or strongly acid; clear, wavy boundary. 5 to 10 inches thick.
- B22t—17 to 27 inches, yellowish-brown (10YR 5/4) silty clay; many, medium, distinct, light brownish-gray (10YR

6/2) mottles; moderate, medium, angular blocky structure; continuous clay films; firm, sticky, and plastic; medium acid; clear, wavy boundary. 8 to 12 inches thick.

C1g—27 to 38 inches, mottled strong-brown (7.5YR 5/6) and gray (5Y 6/1) clay; weak, fine, angular blocky structure; firm, sticky, and plastic; neutral to moderately alkaline; clear, wavy boundary. 8 to 15 inches thick.

C2g—38 to 50 inches, mottled gray (5Y 6/1) and yellowish-brown (10YR 5/4) clay; massive to weak, fine, angular blocky structure; firm, sticky, and plastic; mildly alkaline or moderately alkaline. Several feet thick.

The Ap horizon has a few yellowish-brown (10YR 5/6) and gray (10YR 5/1) mottles. Some profiles lack a B1 horizon. The texture of the B21 horizon is silty clay loam in some places, and the color is mottled light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6). The depth to neutral or alkaline layers ranges from 24 to 46 inches.

### Melvin Series

The Melvin series consists of poorly drained Low-Humic Gley soils that formed in alluvium derived largely from limestone residuum but also partly from loess and from sandstone and shale residuum. They are the poorly drained members of a drainage sequence that includes the well drained Huntington soils, the moderately well drained Lindsides soils, and the somewhat poorly drained Newark soils.

Melvin soils are in low areas on the larger bottom lands, in association with Newark soils. They are flooded more frequently than Newark soils and have a higher water table. They are generally not suitable for cultivation unless artificially drained.

The following profile of Melvin silt loam is on the bottom land of Donaldson Creek, 150 feet north of where the Texas Gas Line crosses Ky. 139.

Ap—0 to 6 inches, grayish-brown (10YR 5/2) silt loam; many, fine, faint mottles of gray (5Y 6/1) and pale brown (10YR 6/3); weak, fine, granular structure; friable; slightly acid to neutral; abrupt, smooth boundary. 5 to 7 inches thick.

C1g—6 to 21 inches, mottled light brownish-gray (10YR 6/2), gray (5Y 6/1), brown (10YR 5/3), and very dark gray (10YR 3/1) silt loam; the very dark gray color is caused by concretions and concretionary staining; weak, fine, granular structure; some indication of weak, medium, prismatic structure; friable; slightly acid or neutral; clear, wavy boundary. 12 to 18 inches thick.

C2g—21 to 27 inches, gray (5Y 6/1) heavy silt loam; common, medium, distinct mottles of pale brown (10YR 6/3) and yellowish brown (10YR 5/4); weak, fine, granular structure; friable; many, small, dark-brown concretions; slightly acid; clear, wavy boundary. 4 to 8 inches thick.

C3g—27 to 72 inches, gray (10YR 6/1) heavy silt loam; many, large, prominent mottles of light yellowish brown (10YR 6/4) and very dark gray (10YR 3/1); weak, fine, granular structure; friable; few, large, dark-brown concretions; slightly acid; several feet thick.

### Mullins Series

The Mullins series consists of poorly drained Planosols that developed in loess over sandstone and shale residuum. These soils occupy upland flats and areas around the head of drainageways. They are grayer and more poorly drained than Tilsit and Johnsborg soils, with which they are closely associated. The acreage is very small.

The following profile of Mullins silt loam is along a gravel road (Ky. 1119), 150 feet northwest of its intersection with Ky. 293.

Ap—0 to 6 inches, grayish-brown (10YR 5/2) or dark grayish-brown (10YR 4/2) silt loam; common, fine, faint mottles of gray (10YR 6/1); weak to moderate, fine, granular structure; friable; strongly acid; abrupt, smooth boundary. 4 to 8 inches thick.

A2—6 to 9 inches, light brownish-gray (10YR 6/2) silt loam; many, medium, distinct mottles of gray (10YR 6/1) and yellowish brown (10YR 5/6); weak, fine, granular structure; friable; few, small, dark-brown concretions; very strongly acid; abrupt, smooth boundary. 4 to 6 inches thick.

B2gt—9 to 18 inches, light brownish-gray (10YR 6/2) or light gray (10YR 7/1) silty clay loam; common, fine, prominent mottles of yellow (10YR 7/6); weak, fine, angular blocky structure; friable or firm; few small concretions; very strongly acid; abrupt, smooth boundary. 6 to 10 inches thick.

Bx1—18 to 24 inches, light-gray (10YR 7/1) silty clay loam; few, fine, prominent mottles of yellow (10YR 7/6); weak, fine, angular blocky structure; firm, compact; few small concretions; very strongly acid; gradual, smooth boundary. 4 to 8 inches thick.

Bx2—24 to 30 inches, light olive-gray (5Y 6/2) silty clay loam or silty clay; few, medium, prominent mottles of brownish yellow (10YR 6/6); weak, fine, angular blocky structure; very firm, compact and brittle; few small concretions; very strongly acid; gradual, wavy boundary. 4 to 10 inches thick.

C1g—30 to 42 inches, light olive-gray (5Y 6/2) clay; many, coarse, prominent mottles of strong brown (7.5YR 5/8); massive; plastic when wet, firm when moist; very strongly acid; gradual, wavy boundary. 10 to 20 inches thick.

C2g—42 to 48 inches, light olive-gray (5Y 6/2) silty clay loam; massive; friable or firm; many concretions; very strongly acid. 3 to 10 feet thick.

In places the Ap horizon is light brownish gray (10YR 6/2) with few to many mottles of dark grayish brown (10YR 4/2). Some profiles have only a thin A2 horizon, and some lack an A2 horizon. The depth to the fragipan ranges from 14 to 24 inches. In some profiles the C2g horizon is only slightly acid.

### Muskingum Series

The Muskingum series consists of somewhat excessively drained and well-drained Sols Bruns Acides intergrading to Lithosols. These soils developed in acid residuum weathered from siltstone, sandstone, and shale. They are strongly sloping to steep. They occur in close geographic association with Dekalb, Ramsey, Litz, and Gilpin soils. They differ from Dekalb and Ramsey soils in having a silty rather than a sandy B horizon. They differ from Litz and Gilpin soils in lacking a B horizon of clay accumulation.

The following profile of Muskingum stony silt loam is 1 mile south of Barnes Store, on Ky. 278.

O1—1 to ½ inch, partly decayed hardwood leaves.

O1—½ inch to 0, very dark brown (10YR 2/2) stony silt loam; moderate to fine, granular structure; very friable; neutral; clear, smooth boundary. 1 inch to 3 inches thick.

A1—0 to 4 inches, dark-brown (10YR 3/3) stony silt loam; moderate, fine, granular structure; very friable; strongly acid; clear, wavy boundary. 4 to 8 inches thick.

- A2—4 to 10 inches, yellowish-brown (10YR 5/4) stony silt loam; weak, fine, granular structure; very friable; strongly acid; clear, wavy boundary. 4 to 8 inches thick.
- B—10 to 22 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; small fragments of sandstone make up about 15 percent of this horizon; friable; strongly acid; clear, wavy boundary. 12 to 24 inches thick.
- C—22 to 42 inches, yellowish-brown (10YR 5/8) light silty clay loam; weak, relict, platy structure or massive; friable or firm; small fragments of sandstone and shale make up about 35 percent of this horizon; strongly acid; gradual, diffuse boundary. 15 to 25 inches thick.
- R—42 inches +, shattered interbedded sandstone, siltstone, and shale bedrock.

The color of the A1 horizon ranges from dark brown to very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). That of the A2 horizon ranges from brown (10YR 5/3) to yellowish brown (10YR 5/6). In a few places the B horizon has a silty clay loam texture, as a result of the weathering of minerals in place. There is little or no evidence of movement of clay from the A horizon to the B horizon. The depth to bedrock ranges from 0 to about 40 inches, but is most commonly about 27 inches.

#### Newark Series

The Newark series consists of somewhat poorly drained Alluvial soils intergrading to Low-Humic Gley soils. These soils are forming in alluvium derived mainly from limestone residuum and to a lesser extent from sandstone and shale residuum. They are more poorly drained than Huntington and Lindside soils and better drained than Melvin soils, with which they are associated. They are browner, less acid, and somewhat more productive than Falaya soils, which are forming in alluvium washed from sandstone and shale residuum.

The largest areas of Newark soils in Caldwell County are located along Donaldson Creek.

The following profile of Newark silt loam is west of Ky. 139, 1 mile north of Farmersville, on the Donaldson Creek bottom lands.

- Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; slightly acid; abrupt, smooth boundary. 0 to 8 inches thick.
- C1—6 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; few, fine, faint mottles of grayish brown (2.5Y 5/2); weak, fine, granular structure; very friable; slightly acid; clear, wavy boundary. 3 to 8 inches thick.
- C2g—10 to 18 inches, grayish-brown (10YR 5/2) silt loam; common, fine, distinct mottles of dark brown (10YR 4/3); weak, fine, granular structure; friable; slightly acid; gradual, wavy boundary. 6 to 10 inches thick.
- C3g—18 to 24 inches, mottled grayish-brown (2.5Y 5/2), dark grayish-brown (10YR 4/2), and strong-brown (7.5YR 5/6) silt loam; massive; friable; slightly acid; gradual, wavy boundary. 5 to 10 inches thick.
- C4g—24 to 36 inches, gray (10YR 5/1) silt loam mottled with dark grayish brown (10YR 4/2); massive; friable; few very dark-brown concretions; slightly acid; gradual, wavy boundary. 10 to 14 inches thick.
- C5g—36 to 48 inches, gray (10YR 6/1) silt loam mottled with yellowish brown; massive structure; friable; slightly acid.

Generally, Newark soils have little mottling in the plow layer but are strongly mottled below a depth of 7 inches. In places the degree of mottling is the same throughout the profile. In some places the color is dominantly gray below a depth of 24 inches. Ordinarily the texture is silt loam throughout, but in places the texture below a

depth of 3 feet ranges from fine sandy loam to clay. In many places the entire profile has a granular structure, but in some places the C horizon has a weak, medium or fine, subangular blocky structure.

#### Pembroke Series

The Pembroke series consists of well-drained Red-Yellow Podzolic soils intergrading to Reddish-Brown Lateritic soils. They developed in high-grade limestone residuum mixed with a small amount of loess. The loess has made the soil more friable. Unlike the loess in the Crider and Russellville soils, it generally is not recognizable as a separate layer. Pembroke soils are closely associated with, and are intermediate in color, texture, and consistence between, Crider and Fredonia soils. They are medium acid or strongly acid throughout.

The following profile of Pembroke silt loam, 2 to 6 percent slopes, is 1 mile northwest of Cobb, 300 yards south of Harmony Church.

- A1—0 to 1 inch, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; very friable; slightly acid; abrupt, smooth boundary. ½ inch to 2 inches thick.
- A2—1 inch to 8 inches, dark-brown (7.5YR 4/4) silt loam; weak to moderate, fine, granular structure; very friable; medium acid or slightly acid; clear, smooth boundary. 6 to 12 inches thick.
- B1t—8 to 11 inches, reddish-brown (5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet, slightly hard when dry; medium acid or strongly acid; clear, wavy boundary. 2 to 7 inches thick.
- B21t—11 to 22 inches, yellowish-red (5YR 4/6) to red (2.5YR 4/6) silty clay loam; moderate, medium, subangular blocky structure; thin, continuous clay films; friable when moist; slightly sticky and slightly plastic when wet, hard when dry; strongly acid; clear, wavy boundary. 8 to 14 inches thick.
- B22t—22 to 36 inches, red (2.5YR 4/6) or yellowish-red (5YR 4/6) silty clay loam; moderate to strong, medium, subangular blocky structure; thin, continuous clay films prominent on ped faces; friable or firm when moist, slightly sticky and slightly plastic when wet; black concretionary stains common on ped faces; a few black iron concretions; strongly acid; clear, wavy boundary. 12 to 18 inches thick.
- B23t—36 to 50 inches, dark-red (2.5YR 3/6) silty clay loam; moderate, medium, angular blocky structure; clay films and concretionary stains not so prominent as in B22t horizon; friable or firm; light-gray (10YR 7/2) silt coatings on some ped faces; strongly acid; clear, wavy boundary. 10 to 18 inches thick.
- B3t—50 to 60 inches, dark-red (2.5YR 3/6 or 10R 3/6) silty clay; common, fine, distinct mottles of light brown (7.5YR 6/4) or pale brown (10YR 6/3); moderate, medium, angular blocky structure; firm when moist, sticky and plastic when wet; medium acid; clear, wavy boundary. 10 to 22 inches thick.
- C—60 to 72 inches, dark-red (2.5YR 3/6) silty clay or clay mottled with brown or reddish gray; moderate, medium, angular blocky structure; firm or very firm when moist, sticky and plastic when wet; may contain some angular chert fragments; abrupt, wavy or irregular boundary.
- R—72 inches +, high-grade limestone rock.

The color of the A2 horizon ranges from dark brown to dark reddish brown (5YR 3/4). In cultivated areas the A1 and A2 horizons are likely to be mixed to form a dark-brown (10YR 4/3) or reddish-brown (5YR 3/4) Ap horizon. Some profiles lack a B1 horizon. The

darker colors described are generally the colors of iron-stained ped faces. If the peds are crushed, the color is generally lighter by one unit of chroma. Dark-colored concretions are common in the B2 horizon and below. The dark-red layers below a depth of 36 inches are mottled with gray in places. In some areas the lower part of the B horizon and the C horizon contain chert fragments, and in other areas they do not. Some areas are underlain by calcareous sandstone instead of limestone.

In these areas the C horizon is only 30 to 36 inches below the surface and consists of medium acid or strongly acid loam that contains small fragments of fine-grained sandstone. Small areas of Pembroke soils occur on high terraces. In these areas the B horizon is redder, finer textured, and firmer than in the profile described.

### Ramsey Series

The Ramsey series consists of excessively drained Lithosols intergrading to Sols Bruns Acides. They developed in residuum weathered from acid sandstone, siltstone, and shale. They are strongly sloping to steep. Ramsey soils occur in association with Dekalb, Muskingum, Litz, and Gilpin soils. They have a thinner solum than Dekalb soils. They have a sandier, thinner solum than Muskingum, Litz, and Gilpin soils.

The following profile of Ramsey stony silt loam is on the west side of Hunter Cemetery Road, 200 yards south of U.S. 62 and 3.6 miles west of Dawson Springs.

- O—1 inch to 0, partly decomposed forest litter from hardwood trees.
- A1—0 to 3 inches, dark grayish-brown (10YR 4/2) stony silt loam; weak, fine, granular structure; very friable; very strongly acid; abrupt, smooth boundary. 1 inch to 4 inches thick.
- A2—3 to 12 inches, yellowish-brown (10YR 5/4) stony silt loam; weak, fine, granular structure; very friable; about 10 percent fragments of sandstone and shale; very strongly acid; clear, wavy boundary. 6 to 12 inches.
- B—12 to 16 inches, yellowish-brown (10YR 5/6) stony sandy loam; weak, fine, subangular blocky structure; friable; about 30 percent fragments of sandstone and shale; very strongly acid; clear, wavy boundary. 2 to 8 inches thick.
- R—16 inches +, sandstone bedrock.

The A1 and A2 horizons range from silt loam to fine sandy loam in texture, and the B horizon from loam to sandy loam or sandy clay loam. The depth to bedrock ranges from 0 to 24 inches but is generally about 16 inches.

### Russellville Series

The Russellville series consists of well drained and moderately well drained Red-Yellow Podzolic soils with fragipans. These soils formed in loess over residuum derived mainly from limestone (fig. 17). They occupy gently sloping to strongly sloping uplands and are associated with Pembroke, Crider, and Dickson soils. They are intermediate in drainage between the well drained Pembroke and Crider soils and the moderately well drained Dickson soils. Russellville soils are not so red in the

B horizon as the Pembroke and Crider soils, and they have a weak but definite fragipan. The fragipan is thinner and less well developed than that in Dickson soils and is generally at a greater depth. Russellville soils occupy large areas in the western and southwestern parts of Caldwell County.



Figure 17.—Russellville silt loam. The uppermost 3 feet of this soil developed in loess. The lower part developed in residuum from cherty limestone. The light-colored layer in the loess is the fragipan. It is about 30 inches below the surface and is 10 to 20 inches thick.

The following profile of Russellville silt loam, 2 to 6 percent slopes, is half a mile south of Ky. 514, on a dirt road that intersects Ky. 514 at a sharp curve and extends south. The site is 2 miles southeast of Hopson.

- A1—0 to 2 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; medium acid or strongly acid; clear, smooth boundary. 1 inch to 3 inches thick.
- A2—2 to 9 inches, brown (10YR 4/3 or 7.5YR 4/4) silt loam; weak, fine, granular structure; friable; medium acid or strongly acid; clear, smooth boundary. 5 to 10 inches thick.
- B1—9 to 14 inches, brown (7.5YR 4/4) heavy silt loam; weak, medium, subangular blocky structure; friable when moist, slightly hard when dry; medium acid or strongly acid; clear, wavy boundary. 3 to 8 inches thick.
- B21t—14 to 24 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; few, thin clay films; friable; strongly acid; clear, wavy boundary. 6 to 15 inches thick.
- B22t—24 to 32 inches, yellowish-brown (10YR 5/6) silty clay loam; few, fine, faint mottles of pale brown (10YR 6/3); moderate, medium, subangular blocky structure; friable; few, small, dark-brown iron concretions; strongly acid or very strongly acid; clear, smooth boundary. 6 to 10 inches thick.
- Bx1—32 to 37 inches, pale-brown (10YR 6/3) silt loam; common, fine, faint mottles of yellowish brown (10YR 5/4 or 5/6) or strong brown (7.5YR 5/6); moderate, medium, angular blocky structure; firm, compact, and brittle; many, medium and large, black, rounded concretions and much concretionary staining; strongly acid or very strongly acid; clear, wavy boundary. 4 to 8 inches thick.
- Bx2—37 to 42 inches, brown (7.5YR 4/4 or 10YR 4/3) silty clay loam or heavy silt loam; common, medium, distinct mottles of grayish brown (10YR 5/2) or pale brown (10YR 6/3); vertical gray streaks of silty clay or clay; moderate, medium, angular blocky structure; firm, compact, and brittle; thin, patchy clay films; black concretions and concretionary staining; strongly acid or very strongly acid; gradual, wavy boundary. 5 to 16 inches thick.
- IIBt—42 to 80 inches, dark-red (10R 3/6) silty clay; few mottles of gray or brown and vertical streaks of gray silty clay extending from the Bx2 horizon; strong, medium, angular blocky structure; firm when moist; sticky and plastic when wet, extremely hard when dry; thin, patchy clay films; chert fragments in places; medium acid to neutral. 1 foot to 4 feet thick.
- R—80 inches +, limestone bedrock.

The loess is 24 to 42 inches thick. In cultivated areas there is a brown (10YR 4/3) Ap horizon instead of the distinct A1 and A2 horizons. The depth to mottling ranges from 27 to 38 inches and is ordinarily about 30 inches. The B21t horizon ranges from strong brown to dark brown (7.5YR 4/4) and to yellowish red (5YR 5/6) in color. The IIBt horizon varies mainly in amount of chert and clay and in degree of development. Where the underlying residuum included some material weathered from sandstone and shale, the IIBt horizon generally consists of tough, plastic, yellow or red clay mottled with gray. Small areas of Russellville soils are underlain by Coastal Plain material. In these areas the Bx2 horizon is generally underlain by gravel and red, interstitial sandy loam.

#### Sharkey Series

The Sharkey series consists of dark-colored, very poorly drained Grumusols intergrading to Alluvial soils. They formed in clayey slack-water sediments. These soils occur in association with McGary and Falaya soils. They are darker colored and finer textured than Falaya soils. They occupy slightly lower positions than McGary soils, and they have dark-gray or gray lower horizons, while the

lower horizons of McGary soils are yellowish brown mottled with gray.

Soils of the Sharkey series occur in the northeastern part of Caldwell County. The following profile of Sharkey silty clay loam, overwash, is 3 miles northeast of Shady Grove, a quarter of a mile west of a dirt road and half a mile west of the Tradewater River.

- Ap—0 to 5 inches, dark-gray (10YR 4/1) to dark grayish-brown (2.5Y 4/2) silty clay loam; weak, medium, subangular blocky structure; firm; medium acid or slightly acid; abrupt, smooth boundary. 4 to 6 inches thick.
- C1—5 to 9 inches, dark grayish-brown (2.5Y 4/2) silty clay loam; few, medium, distinct mottles of yellowish brown (10YR 5/6) and gray (N 5/0) to dark gray (N 4/0); strong, medium, prismatic structure that breaks to moderate, medium, angular blocky structure; few discontinuous clay films; firm; much evidence of earthworm activity; medium acid or slightly acid; clear, wavy boundary. 3 to 8 inches thick.
- C2g—9 to 25 inches, dark-gray (10YR 4/1) clay; many, medium, prominent mottles of yellowish brown (10YR 5/4) and grayish brown (10YR 5/2); strong, medium, prismatic structure; very firm when moist; slightly acid or neutral; clear, wavy boundary. 12 to 18 inches thick.
- C3g—25 to 48 inches, gray (5Y 5/1) clay; many, medium, prominent mottles of reddish brown (2.5YR 5/4) and light olive brown (2.5Y 5/4); weak, medium, angular blocky structure or massive; very firm; neutral or mildly alkaline. Several feet thick.

In places the Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). In some profiles the Ap horizon directly overlies the Cg horizon.

#### Taft Series

The Taft series consists of somewhat poorly drained Planosols on terraces. These soils developed in old alluvium washed chiefly from limestone residuum. They are more poorly drained than Captina soils and are grayer in color above the fragipan. The fragipan is more pronounced and is closer to the surface than that in Captina soils. Taft soils are neither so gray nor so poorly drained as the associated Melvin soils.

The following profile of Taft silt loam is near a gravel road 1½ miles southeast of Crider and ¾ mile southwest of Ky. 91.

- Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) to grayish-brown (10YR 5/2) silt loam; moderate, fine, granular structure; friable; small, dark-brown concretions are common; medium acid or strongly acid; abrupt, smooth boundary. 5 to 10 inches thick.
- A2—5 to 10 inches, dark yellowish-brown (10YR 4/4) to brown (10YR 5/3) silt loam; common, medium, distinct mottles of light brownish gray (10YR 6/2); moderate to weak, fine, granular structure; friable; a few small concretions; medium acid or strongly acid; clear, smooth boundary. 3 to 6 inches thick.
- B21—10 to 14 inches, light yellowish-brown (2.5Y 6/4) to yellowish-brown (10YR 5/4) heavy silt loam; common, medium, distinct mottles of pale brown (10YR 6/3) and light brownish gray (2.5YR 6/2); weak, fine and medium, angular blocky structure; friable; small concretions common; strongly acid or very strongly acid; clear, smooth boundary. 0 to 6 inches thick.
- B22—14 to 20 inches, yellowish-brown (10YR 5/4) heavy silt loam; many, medium, distinct mottles of light gray (2.5Y 7/2) and yellow (10YR 7/6); weak, fine and medium, subangular blocky structure; friable or firm; few medium concretions; strongly acid or very strongly acid; clear, smooth boundary. 4 to 8 inches thick.

**Bx**—20 to 44 inches, mottled light-gray (10YR 7/2), yellowish-brown (10YR 5/4), and yellow (10YR 7/8) silty clay loam to silt loam; moderate, fine and medium, angular blocky structure; compact in place, friable when disturbed; iron stains and small soft concretions; strongly acid or very strongly acid; gradual, smooth boundary. 15 to 30 inches thick.

**Cg**—44 to 48 inches +, light-gray (10YR 7/1) silty clay loam to silt loam; many, coarse, prominent mottles of yellowish brown (10YR 5/8); weak, fine, angular blocky structure; firm; few small concretions; strongly acid or very strongly acid.

The color of the Ap horizon ranges to very dark grayish brown (10YR 3/2) and brown (10YR 5/3). Some profiles lack a B21 horizon. In places the B22 horizon has no dominant color but is mottled yellowish brown (10YR 5/4) and light gray (2.5Y 7/2). The texture of the fragipan ranges from silt loam to light silty clay but is generally heavy silt loam or silty clay loam.

### Tilsit Series

The Tilsit series consists of moderately well drained Red-Yellow Podzolic soils with fragipans. These soils developed in a loess mantle over residuum weathered from noncalcareous, fine-grained sandstone and shale. They occupy fairly smooth upland areas. Tilsit soils are the moderately well drained members of the Wellston-Zanesville-Tilsit-Johnsburg-Mullins drainage sequence. They are associated with Zanesville and Johnsburg soils and are intermediate between them in drainage and in distinctness of the fragipan. They are less brown in the B horizon than Zanesville soils and have a more pronounced fragipan that is nearer the surface. Tilsit soils are browner in the B horizon than Johnsburg soils and have a less well developed fragipan that is at a greater depth.

The following profile of Tilsit silt loam, 2 to 6 percent slopes, is on the Western Kentucky Agricultural Experiment Station, 1 mile east of Princeton.

**Ap**—0 to 8 inches, dark grayish-brown (10YR 4/2) or brown (10YR 4/3) silt loam; moderate, fine, granular structure; friable; medium acid; abrupt, smooth boundary. 6 to 9 inches thick.

**B21t**—8 to 17 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate, fine and medium, subangular blocky structure; few clay films; friable; few hard concretions; strongly acid; clear, wavy boundary. 6 to 12 inches thick.

**B22t**—17 to 22 inches, yellowish-brown (10YR 5/6) heavy silt loam; many, medium, faint mottles of light brownish gray (10YR 6/2) or pale brown (10YR 6/3); moderate, medium, subangular blocky structure; friable; few clay films; black concretions are common; strongly or very strongly acid; clear, wavy boundary. 4 to 8 inches thick.

**Bx1**—22 to 26 inches, mottled, yellowish-brown (10YR 5/4) and light brownish-gray (10YR 6/2) silt loam; moderate, medium, angular blocky structure; firm, compact, and slightly brittle in place; small concretions are common; very strongly acid; clear, wavy boundary. 3 to 5 inches thick.

**Bx2**—26 to 38 inches, light brownish-gray (10YR 6/2) silty clay loam; many, medium, distinct mottles of yellowish brown (10YR 5/6) and light gray (10YR 7/2); moderate, medium, angular blocky structure; very firm, compact, and brittle; thin, patchy clay films; light-gray mottles are mostly silt coatings on faces of peds; common, dark-brown concretions; very strongly acid; diffuse, wavy boundary. 10 to 20 inches thick.

**C1g**—38 to 53 inches, yellowish-brown (10YR 5/6) silty clay loam; many, medium and coarse mottles of light brownish gray (10YR 6/2); weak, medium, angular

blocky structure; friable, compact; few clay films; some dark-brown concretionary stains; gradual, wavy boundary. 12 to 20 inches thick.

**C2b**—53 to 68 inches +, yellowish-brown (10YR 5/6) sandy clay loam; common, medium, distinct mottles of light brownish gray (10YR 6/2); weak, medium, angular blocky structure or massive; friable, compact; very strongly acid. 10 to 50 inches thick.

In places the B21 horizon is light olive brown (2.5Y 5/6), and in others the uppermost 6 inches of the B horizon is strong brown (7.5YR 5/6). The texture of the B horizon is silt loam or silty clay loam. In uneroded areas the soil may be mottled at a depth of 15 inches. The depth to the fragipan is commonly between 20 and 24 inches but in places is as little as 17 inches. The mantle of loess is 30 to 40 inches thick. In places it is difficult to tell whether the C horizon consists of loess or of residuum from fine-grained sandstone or siltstone. The depth to bedrock ranges from 5 to 10 feet and is most commonly about 8 feet.

### Vicksburg Series

The Vicksburg series consists of well-drained Alluvial soils that developed in sediments washed chiefly from loess and from acid sandstone and shale residuum. Vicksburg soils are better drained than Collins, Falaya, and Waverly soils, with which they are closely associated. They are lighter colored, more acid, and somewhat less fertile than Huntington soils.

Soils of this series occur near the larger creeks in Caldwell County. The following profile of Vicksburg silt loam is along Ky. 293, half a mile west of the bridge over the Tradewater River.

**Ap**—0 to 6 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, fine, granular structure; friable; strongly acid; abrupt, smooth boundary. 6 to 10 inches thick.

**C11**—6 to 18 inches, yellowish-brown (10YR 5/4) silt loam streaked with dark yellowish brown (10YR 4/4); moderate, fine, granular structure; friable; may have a few small concretions; strongly acid; clear, smooth boundary. 10 to 15 inches thick.

**C12**—18 to 34 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, fine, granular structure; friable; strongly acid; gradual, smooth boundary. 14 to 20 inches thick.

**C13**—34 to 38 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; numerous, small, dark-brown concretions and some fine bits of sandstone; strongly acid; clear, smooth boundary. 2 to 6 inches thick.

**Cg**—38 to 48 inches +, pale-brown (10YR 6/3) fine sandy loam to silt loam; many, medium, prominent mottles of dark brown (10YR 3/3) and yellowish red (5YR 4/8); weak, fine, granular structure; friable; strongly acid.

The color of the Ap horizon ranges from dark yellowish brown (10YR 4/4) to brown (10YR 5/3 to 4/3). The texture of the lower horizons ranges from fine sandy loam to silty clay loam but is generally silt loam. Very little or no mottling occurs above a depth of 30 inches, but prominent mottling may occur below this depth. The color may be dominantly gray below a depth of 3 feet.

### Waverly Series

The Waverly series consists of poorly drained Low-Humic Gley soils that formed in alluvium derived predominantly from loess and from acid sandstone and shale residuum. Waverly soils are grayer and more poorly drained than Vicksburg, Collins, and Falaya soils, with

which they are closely associated. They differ from Melvin soils in being derived from loess and sandstone and shale rather than from loess and limestone. They are more acid and less productive than Melvin soils.

The following profile of Waverly silt loam is 2 miles northwest of Quinn and a quarter of a mile west of Towy Bridge.

A1—0 to 1 inch, dark-brown (10YR 3/3) heavy silt loam; common, fine, distinct mottles of pale brown (10YR 6/3); moderate, fine, granular structure; friable; very strongly acid; clear, smooth boundary. 0 to 4 inches thick.

AC—1 inch to 8 inches, light brownish-gray (10YR 6/2) heavy silt loam or loam; many, coarse, distinct mottles of dark yellowish brown (10YR 4/4) and reddish yellow (7.5YR 6/8); moderate, fine, granular structure; friable; few small concretions; very strongly acid; clear, smooth boundary. 5 to 10 inches thick.

Cg—8 to 48 inches, light-gray (10YR 7/1) silt loam; common, medium, prominent mottles of reddish yellow (7.5YR 6/8); weak, fine and very fine, granular structure; friable; few small concretions; very strongly acid. More than 30 inches thick.

The thickness of the A1 horizon varies, depending on the amount of alluvium recently deposited. In small areas the A1 horizon is darker colored than in the profile described. The C horizon ranges from fine sandy loam to silty clay loam in texture. Locally, the C horizon is somewhat stratified.

#### Wellston Series

The Wellston series consists of well-drained Gray-Brown Podzolic soils intergrading to Red-Yellow Podzolic soils. They developed partly in a thin layer of loess and partly in residuum weathered from acid sandstone and shale. The loess mantle is neither so thick nor so easily recognized as that underlying the associated Zanesville soils. Wellston soils are shallower than Zanesville soils, and they lack the fragipan that is characteristic of Zanesville soils. Compared with Gilpin, Litz, and Muskingum soils, Wellston soils are deeper and better developed and have more evident horizonation.

Soils of the Wellston series occur mainly in the eastern and northern sections of Caldwell County. The following profile of Wellston silt loam, 2 to 6 percent slopes, is on the Jones-Keeney Game Refuge, 2 miles east of Beulah Hill Church.

A1—0 to 2 inches, dark-gray (10YR 4/1) silt loam; moderate, fine, granular structure; very friable; slightly acid; abrupt, smooth boundary. 1 inch to 3 inches thick.

A2—2 to 8 inches, pale-brown (10YR 6/3) silt loam; weak, fine, granular structure; friable; strongly acid; clear, smooth boundary. 5 to 8 inches thick.

B1—8 to 11 inches, brown (7.5YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; strongly acid; clear, smooth boundary. 2 to 8 inches thick.

B21t—11 to 16 inches, strong-brown (7.5YR 5/6) or yellowish-red (5YR 5/6) silty clay loam; few, fine, faint, yellowish-brown (10YR 5/4) silt coatings on some pedis; moderate, medium, subangular blocky structure; friable or firm, slightly plastic; patchy clay films; very strongly acid; gradual, wavy boundary. 4 to 12 inches thick.

B22t—16 to 26 inches, yellowish-red (5YR 5/6) or strong-brown (7.5YR 5/6) silty clay loam; few, fine, faint mottles of yellowish brown (10YR 5/4); moderate, medium, subangular blocky structure; friable or firm, slightly sticky, and slightly plastic; patchy clay films; very strongly acid; gradual, wavy boundary. 6 to 14 inches thick.

B3t—26 to 32 inches, yellowish-red (5YR 4/6) coarse sandy clay loam; few, fine, distinct, light brownish-gray silt coatings or mottles; moderate, fine, subangular blocky structure; friable; very strongly acid; clear, wavy boundary. 4 to 10 inches thick.

C—32 to 40 inches +, mottled strong-brown (7.5YR 5/6 or 5/4), yellowish-red (5YR 4/6), and pale-brown (10YR 6/3) highly weathered sandstone and acid shale, somewhat laminated into sandy and clayey bands, with an overall texture of fine sandy clay loam; structureless; friable; few small fragments of sandstone; very strongly acid.

The depth to bedrock ranges from 2 to 6 feet. The color of the A1 horizon is very dark gray (10YR 3/1) or dark grayish brown (10YR 3/2) in places, and that of the A2 horizon ranges from pale brown (10YR 6/3) or light yellowish brown (10YR 6/4) to dark grayish brown (10YR 4/2). The color of the B horizon varies, depending on the origin of the residuum and the thickness of the loess mantle. In some places the layer of loess appears to have been 2 feet thick or more. Where the layer was thin, the B horizon is likely to be yellowish red (5YR 4/6) or reddish brown (5YR 4/4). Where it was thicker, the B horizon may be yellowish brown (7.5YR 4/4) but is more commonly brown (7.5YR 4/4) or strong brown (7.5YR 5/6). A friable consistence is also attributable to loess. If the residuum was derived from sandstone rather than from shale, as was the case in most areas of Wellston soils in Caldwell County, the profile becomes sandier with depth.

#### Zanesville Series

The Zanesville series consists of well drained and moderately well drained Red-Yellow Podzolic soils with fragipans (fig. 18). These soils developed partly in loess and partly in residuum weathered from sandstone, shale, and siltstone. Zanesville soils are commonly associated with Wellston, Tilsit, Johnsbury, Mullins, Dekalb, Ramsey, and Muskingum soils. They are intermediate in drainage between the Wellston and Tilsit soils. They have a fragipan, which Wellston soils lack. They have a less distinct fragipan and a less yellow B horizon than Tilsit soils. The depth to the fragipan is commonly greater than in Tilsit soils. Zanesville soils are better drained than Johnsbury and Mullins soils. They are deeper than Dekalb, Ramsey, and Muskingum soils and have more evident horizonation. Zanesville soils resemble Russellville soils in the uppermost 30 to 36 inches of the profile. The lower part of the profile of Russellville soils developed in limestone residuum, and the lower part of the profile of Zanesville soils in residuum from sandstone, siltstone, or shale.

The following profile of Zanesville silt loam, 2 to 6 percent slopes, is a quarter of a mile north of Needmore, on Ky. 293.

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; moderate, fine, granular structure; very friable; slightly acid; abrupt, wavy boundary. 6 to 9 inches thick.

B21t—7 to 22 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; friable; few brown clay films; medium acid or strongly acid; clear, wavy boundary. 10 to 20 inches thick.

B22t—22 to 28 inches, strong-brown (7.5YR 5/6) to yellowish-brown (10YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; friable; few brown clay films; strongly acid or very strongly acid; clear, wavy boundary. 5 to 10 inches thick.

- Bx1—28 to 31 inches, yellowish-brown (10YR 5/8) silt loam; common, medium, distinct mottles of pale brown (10YR 6/3); moderate, medium and fine, angular blocky structure; friable or firm, slightly compact, and brittle; strongly acid or very strongly acid; clear, wavy boundary. 3 to 6 inches thick.
- Bx2—31 to 37 inches, light brownish-gray (10YR 6/2) heavy silt loam; many, medium and coarse, distinct mottles of yellowish brown (10YR 5/8), grayish brown (10YR 5/2), and light gray (10YR 7/1); moderate, medium, angular blocky structure; the light-gray mottles are mostly clay films; firm, brittle, and compact; strongly acid or very strongly acid; diffuse, wavy boundary. 5 to 15 inches thick.
- C—37 to 80 inches, strong-brown (7.5YR 5/6) heavy silt loam; many, medium and coarse, prominent mottles of light brownish gray (10YR 6/2); weak, medium and fine, angular blocky structure; friable, compact; sand content increases with depth; strongly acid. 10 to 70 inches thick.



**Figure 18.**—Zanesville silt loam. The fragipan is the light-colored layer that begins about 30 inches below the surface. It developed mostly in loess, but at places it extends into the underlying residuum. The fragipan is more resistant to erosion than the horizons above it.

In wooded areas, the A horizon ranges from very dark gray (10YR 3/1) to dark brown (10YR 3/3) in color but is generally very dark grayish brown (10YR 3/2). The A<sub>2</sub> horizon ranges from dark yellowish brown (10YR 4/4) to light yellowish brown (10YR 6/4) but is generally brown (10YR 5/3). The A<sub>3</sub> horizon, if there is one, is yellowish brown (10YR 5/4) to strong brown (7.5YR 5/6). The B horizon is yellowish red (5YR 5/6), brown (7.5YR 4/4), or yellowish brown (10YR 5/0) but is generally strong brown. The layer of loess is generally about 30 to 40 inches thick but in some places is 48 inches thick or slightly more. Where the residuum below the loess was derived from siltstone, it is difficult to see where the loess ends and the residuum begins.

## General Nature of the County

Caldwell County was formed from part of Livingston County in 1809. It was the 51st county formed in Kentucky and was named in honor of Gen. John Caldwell.

The county was first settled about 1782. According to the Federal census, the population was 13,199 in 1950 but had decreased to 13,078 by 1960. Shifts of rural popula-

tion to urban areas account for the slight decrease in population. This is a trend typical of the predominantly rural counties throughout Kentucky.

## Physiography, Relief, and Drainage

The rock formations that are exposed are all Mississippian and Pennsylvanian in age. The physiographic area of Mississippian age is popularly known in Kentucky as the Pennyryle and that of Pennsylvanian age is called the Western Coal Field. Some of the Mississippian formations are limestone, some are interbedded limestone, sandstone, and shale, and a few are sandstone and shale. The Pennsylvanian formations are sandstone and shale.

Soil associations 4, 5, 6, and 7 (see the general soil map) are underlain by limestone of the Meramec group of Mississippian formations. Soil associations 1 and 2 are underlain by mixed limestone, sandstone, and shale of the Chester group of Mississippian formations. Soil association 3 is underlain by mixed sandstone and shale of the Pottsville group of Pennsylvanian formations.

Loess, a windblown silt generally believed to have been deposited during or just after glacial times, overlies these formations in most parts of the county. The loess deposit is thinnest in the southeastern and east-central parts. This fact supports the theory that the loess was blown from areas adjacent to the Mississippi River and its tributaries by winds mostly from the northwest. Loess is not present on many of the steeper slopes. Moreover, in some gently sloping limestone areas this mantle of loess either is indistinct or has been removed by erosion.

The western and central parts of the county, an extensively faulted area, have been described in part by Weller (12) as follows:

“Nearly the entire of the area is extensively faulted. The most complicated faulting lies along a belt extending in a northwest direction from a little south of Claxton, near the eastern border of the quadrangle, to the western border, about two and one-half miles south of the northwestern corner. Apart from the faulting in this belt, where the direction of individual faults is in nearly every point of the compass, the major faults are for the most part in a general east-west direction. None of this faulting is reflected to any great extent in the topography of the area. In places drainage lines have been developed along fault lines, and after the structure is worked out, the faults are found locally to follow ravines and gullies in many places, but there are no outstanding topographic characteristics which would suggest to the observer of the topographic map [map] alone that the area is complexly faulted.”

Differential geologic erosion is responsible for the topography of much of the county. In many places the Pennsylvanian formations and the younger of the Mississippian formations have been completely removed by geologic erosion. In other places the younger of the Mississippian formations are exposed, as a result of geologic erosion of the Pennsylvanian formations.

The Pennsylvanian formations extend across the county from a point north of Creswell and Needmore, along the eastern edge of the county, southward to Claxton. The Mississippian formations occupy the southwestern and western parts of the county, where there are numerous sinkholes and the topography is typically irregular, or

karst. Generally an escarpment separates the two formations.

## Natural Resources <sup>6</sup>

Limestone is the most important mineral resource. Two quarries in the county supply limestone for agricultural, industrial, and roadbuilding uses. Some limestone is shipped to other states.

There are several fluorspar mines in the northwestern and north-central parts of the county, but little fluorspar is now being mined. Small quantities of coal, petroleum, and natural gas have been produced. The coal is mainly in the northeastern part of the county. The supply is believed to be limited. Several oil wells have been drilled in the county, but none have produced commercial quantities of oil or gas for more than a few days. Some wells produce enough gas to heat the homes of the landowners. Other potentially important minerals are clay and glass sand. Clay and shale suitable for the manufacture of ordinary brick have been reported. Recent investigations and tests indicate that the clay could be used in the manufacture of back-up brick and that the sand is suitable for the manufacture of some grades of glass. Quantitative data on these deposits are lacking.

The supply of surface water is from the Tradewater River and from impounded and natural lakes. The Tradewater River flows along the northeastern boundary of the county. Lake Beshear, which was constructed in 1961, has an area of 857 acres, mostly in Caldwell County. There are many natural ponds and small lakes in the limestone areas of the county and many impounded ponds and small lakes throughout the rest of the county.

Ground water is derived from rocks of the Mississippian and Pennsylvanian systems. In broad outcrop areas, four out of five of the wells drilled into the limestone of the Meramec group, which is in the southwestern part of the county and is part of the Mississippian system, yield enough water for domestic use. A number of these wells yield more than 100 gallons per minute, or enough for public and industrial supplies. From these formations issue many large springs, some of which discharge several hundred gallons per minute. Most wells drilled into the limestone and sandstone of the Chester group, which extends northwestward through the central part of the county and belongs to the Mississippian system also, yield enough water for domestic use. A few yield as much as 100 gallons per minute. Numerous springs, some of which discharge more than 100 gallons per minute, issue from these formations. Wells drilled into the conglomerate, sandstone, and siltstone of the Western Coal Field formations, which are in the northeastern part of the county and belong to the Pennsylvanian system, generally yield enough water for domestic use. Some yield as much as 100 to 500 gallons per minute. Numerous small springs issue from these rocks. Some water may be obtained from the coalbeds and also from the limestone in these formations. Little water is available from shale.<sup>7</sup>

<sup>6</sup> Based partly on INDUSTRIAL RESOURCES OF PRINCETON, KY. Prepared by the Princeton Chamber of Commerce and the Kentucky Department of Commerce, Frankfort, Ky. 1962.

<sup>7</sup> Summary of occurrence of ground water in Kentucky based on HYDROLOGIC INVESTIGATIONS ATLAS HA 10. Prepared by U.S. Geological Survey in cooperation with the Department of Economic Development of Kentucky. 1958.

## Industry

Seventeen manufacturing firms operate in the Princeton area. Seven of these firms produce lumber or some wood product other than furniture. Two are clothing factories. The others produce paper, concrete, food products, and drugs.

## Agriculture <sup>8</sup>

Much of the total income in Caldwell County has always come from the sale of farm products. In the early days, tobacco was the most important crop. Now, grain and hay crops account for a large percentage of the income. In 1959, more than two-thirds of farm income came from the sale of livestock and livestock products. Between 1940 and 1959, the number of beef cattle increased from 381 to 5,561, and the number of swine nearly doubled. The acreage in cultivated crops decreased between 1940 and 1959, but production more than doubled.

There have been many changes in the type of farms and in the type of farming practiced in the county since it was organized in 1809. For more than 100 years, the number of farms increased as the farms were subdivided among heirs. New land was brought into cultivation, and many homes were built throughout the county. Many of these old homesites have now been abandoned. Much of soil associations 2 and 3 and the rougher terrain in soil association 1 (see general soil map) have reverted to forest. Acreages that were farms 30 to 100 years ago are now completely reforested.

Since 1935, the number of farms has been decreasing, and the size of farms has been increasing. Better machinery makes it possible to farm larger acreages and to reclaim tracts that had been abandoned to bushes and trees.

According to the 1959 Census of Agriculture, there were 926 farms in Caldwell County. Of these, 401 were on hard-surfaced roads, 445 were on gravel roads, and 65 were on dirt roads. There were tractors on 591 farms, telephones on 571 farms, automobiles on 591 farms, and motortrucks on 476 farms.

The livestock population on farms in Caldwell County in 1959 was as follows:

	<i>Number</i>
Horses and mules-----	849
Cattle and calves-----	16,404
Hogs and pigs-----	19,626
Sheep and lambs-----	5,084

The acreage of principal crops in Caldwell County in 1959 was as follows:

	<i>Acrea</i>
Corn harvested for grain-----	20,755
Barley-----	771
Winter wheat harvested-----	1,122
Land from which hay was cut-----	14,469
Alfalfa-----	2,594
Clover-timothy-----	4,308
Lespedeza-----	6,704
Other tame hay-----	479
Tobacco-----	969

<sup>8</sup> See footnote 6.

**Climate**<sup>9</sup>

Caldwell County has a wide range in temperature, rain-fall, and humidity, but the range is within limits suitable for varied plant and animal life. The winters are moderately cold, and the summers are hot and humid. Precipitation is well distributed throughout the year.

The probability of very high and very low temperatures is shown in table 8. For example, as shown in this table, an average of 2 years in 10 will have at least 4 days during August when the temperature is 100° F. or higher. At the other extreme, 2 years in 10 will have at least 4 days during January when the temperature is 8° or lower.

The temperature is down to the freezing point or below on about 85 nights in an average winter, but it generally rises above 32° during the daytime. Thus, a daily freeze-thaw cycle is normal for cold weather. A reading of zero or below is recorded about once a year.

The average length of the growing season in Caldwell County, from the last freezing temperature in spring to the first in fall, is about 190 days. The probable risk of frost damage is shown in table 9. Dates are given for threshold temperatures of 32°, 28°, 24°, 20°, and 16°. Critical temperatures vary for individual crops. A freeze late in spring is more damaging than one early in fall. It is particularly harmful to strawberry crops and early vegetable crops, and it retards the development of tobacco plants. Hot spells are not infrequent in Caldwell County.

Caldwell County has an average annual precipitation of about 46 inches. Measurable precipitation is recorded on about 115 days during an average year, but in some years the amounts are either inadequate or excessive. The probability of getting either inadequate amounts or excessive amounts of precipitation is shown in table 8. For example, as shown in this table, in about 1 year in 10, June will have less than 0.85 inch, and in about 1 year in 10, March will have more than 7.32 inches.

TABLE 8.—*Temperature and precipitation*  
[Data from Princeton, Caldwell County, Kentucky]

Month	Temperature				Precipitation		
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have—	
			Maximum temperature equal to or higher than	Minimum temperature equal to or lower than		Less than—	More than—
	°F.	°F.	°F.	°F.	Inches	Inches	Inches
January	47.4	27.4	66	8	5.20	1.58	7.45
February	50.9	28.8	67	12	3.98	1.43	5.69
March	59.2	35.3	77	20	4.99	2.04	7.32
April	70.9	45.3	85	30	4.08	2.14	5.95
May	79.1	54.2	91	40	3.97	1.86	6.02
June	87.6	63.3	98	53	3.81	.85	5.24
July	90.6	66.9	99	57	3.45	1.34	5.04
August	90.1	65.6	100	56	3.33	1.14	4.43
September	83.9	57.8	96	44	2.89	.72	4.08
October	74.2	45.8	87	30	2.60	.85	4.14
November	59.2	34.6	76	19	3.72	1.42	5.21
December	49.0	28.6	66	12	3.90	2.06	5.75
Year	70.2	46.1			45.92		

TABLE 9.—*Probabilities of last freeze in spring and first freeze in fall, Caldwell County, Kentucky*

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	March 13	March 23	April 6	April 17	April 30
2 years in 10 later than	March 6	March 17	March 31	April 12	April 25
5 years in 10 later than	February 20	March 5	March 19	April 1	April 15
Fall:					
1 year in 10 earlier than	November 25	November 15	October 26	October 20	October 6
2 years in 10 earlier than	November 30	November 20	October 31	October 25	October 11
5 years in 10 earlier than	December 10	December 1	November 11	November 3	October 21

<sup>9</sup>This section was written by A. B. ELAM, JR., State climatologist, Kentucky Agricultural Experiment Station, Lexington, Kentucky.

During an ordinary year, the heaviest 1-hour rainfall is about 1¼ inches. There is a 30-percent chance that such a 1-hour rain will occur in July, but less than a 1-percent chance of its coming in December, January, or February. Once in 10 years, a 24-hour total of 4.9 inches can be expected. There is about a 2-percent chance that this much rain will fall in July, and a chance of 2 percent or less that this much will fall in any other month.

Thunderstorms occur on an average of 50 days per year. They are most frequent from March through November but may occur in any month. Thunderstorms bring most of the short, intense rains during summer. Less intense rainfall lasting for several days sometimes occurs late in spring and makes it necessary to delay tillage. These long, slow spring rains are those most apt to cause local floods, because they occur when the soils are frozen, snow covered, or saturated. Fortunately, long periods of mild sunny weather are typical in fall when harvesting needs to be completed.

Records of snowfall are not complete enough to furnish suitable tabular data. The yearly snowfall is ordinarily about 8½ inches, but the ground is seldom covered with snow for more than a few days. During a normal year there are no more than three snowfalls that result in an accumulation of more than 1 inch.

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## Glossary

- Acidity.** See Reaction.
- Alluvium.** Sand, mud, and other fine material that has been deposited on land by streams.
- Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
- Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
- Claypan.** A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.
- 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—
- 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, and tends to stretch somewhat and pull apart, rather than to pull free from other material.
- Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
- Soft.*—When dry, breaks into powder or individual grains under very slight pressure.
- Cemented.*—Hard and brittle; little affected by moistening.
- Diversion.** A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.
- Erosion.** The wearing away of the land surface by wind, running water, and other geological agents.
- Fragipan.** A loamy, brittle, subsurface horizon that is very low in organic matter and clay but is rich in silt or very fine sand. The layer is seemingly cemented when dry, has a hard or very hard consistence, and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.
- Horizon, soil.** A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes.
- Moisture-supplying capacity.** The relative capacity of the soil to take in and supply moisture in amounts favorable to most plants. It is related to the amount of runoff, the rate of infiltration, the available water capacity, the depth of the root zone, the depth of the soil, and the moisture-extraction pattern. Relative moisture-supplying capacity is expressed as *very high, high, moderately high, moderate, moderately low, low, or very low.*
- Mottling, soil.** Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common, and many*; size—*fine, medium, and coarse*; and contrast—*faint, distinct, and prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.
- Natural drainage.** The conditions that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural drainage are recognized.

*Excessively drained* soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

*Somewhat excessively drained* soils are also very permeable and are free from mottling throughout their profile.

*Well-drained* soils are nearly free from mottling and are commonly of intermediate texture.

*Moderately well drained* soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

*Imperfectly drained or somewhat poorly drained* soils are wet for significant periods; podzolic soils commonly are mottled below a depth of 6 to 16 inches in the lower A horizon and in the B and C horizons.

*Poorly drained* soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

*Very poorly drained* soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

**Permeability, soil.** The quality that enables water or air to move through the soil. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.*

**Profile, soil.** A vertical section of the soil through all its horizons and extending into the parent material.

**Reaction.** The degree of acidity or alkalinity of a soil, expressed in pH values or words as follows:

<i>pH</i>		<i>pH</i>	
Extremely acid___	Below 4.5	Mildly alkaline___	7.4 to 7.8
Very strongly acid_	4.5 to 5.0	Moderately alkali-	
Strongly acid_____	5.1 to 5.5	line _____	7.9 to 8.4
Medium acid_____	5.6 to 6.0	Strongly alkaline__	8.5 to 9.0
Slightly acid_____	6.1 to 6.5	Very strongly al-	
Neutral _____	6.6 to 7.3	kaline _____	9.1 and higher

**Residuum.** Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is frequently the material from which a soil forms.

**Sand.** As a soil separate, individual rock or mineral fragments 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz, but sand may be of any mineral composition. As a textural class, soil that is 85 percent or more sand and not more than 10 per cent clay.

**Silt.** As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a textural class, soil that is 80 percent or more silt and less than 12 per cent clay.

**Structure, soil.** The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

**Subsoil.** Technically, the B horizon; roughly, the part of the profile below plow depth.

**Surface soil.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

**Terrace (geologic).** An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted with flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.



GUIDE TO MAPPING UNITS

[See table 1, p. 11, for approximate acreage and proportionate extent of soils; table 2, p. 50, for estimated average acre yields; and table 4, p. 62, table 5, p. 70, and table 6, p. 78, for information on engineering properties of soils]

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group	
			Symbol	Page	Number	Page
AsB	Ashton silt loam, 0 to 4 percent slopes-----	10	I-3	41	1	53
BcD2	Baxter cherty silt loam, 12 to 20 percent slopes, eroded-----	12	IVe-3	45	5	56
BcE	Baxter cherty silt loam, 20 to 30 percent slopes-----	12	VIe-1	47	5	53
BdD	Brandon silt loam, 12 to 20 percent slopes-----	12	VIe-7	48	12	57
BdD3	Brandon silt loam, 12 to 20 percent slopes, severely eroded-----	13	VIIe-2	49	6	56
CeC	Caneyville silt loam, 6 to 12 percent slopes-----	13	IVe-6	46	8	57
CeD	Caneyville silt loam, 12 to 20 percent slopes-----	13	VIe-1	47	8	57
ClC3	Caneyville silty clay loam, 6 to 12 percent slopes, severely eroded-----	14	VIe-4	47	9	57
CmD	Caneyville very rocky soils, 12 to 20 percent slopes----	14	VIIs-1	47	8	57
CmD3	Caneyville very rocky soils, 12 to 20 percent slopes, severely eroded-----	14	VIIIs-2	49	9	57
CmE	Caneyville very rocky soils, 20 to 30 percent slopes----	14	VIIIs-2	49	8	57
CnA	Captina silt loam, 0 to 2 percent slopes-----	15	IIw-1	42	7	57
CnB	Captina silt loam, 2 to 6 percent slopes-----	15	IIe-6	41	7	57
CnB2	Captina silt loam, 2 to 6 percent slopes, eroded-----	15	IIe-6	41	7	57
CnC2	Captina silt loam, 6 to 12 percent slopes, eroded-----	16	IIIe-8	44	7	57
Co	Collins silt loam-----	16	I-2	41	1	53
CrA	Crider silt loam, 0 to 2 percent slopes-----	17	I-3	41	5	56
CrB	Crider silt loam, 2 to 6 percent slopes-----	17	IIe-1	41	5	56
CrB2	Crider silt loam, 2 to 6 percent slopes, eroded-----	17	IIe-1	41	5	56
CrC	Crider silt loam, 6 to 12 percent slopes-----	17	IIIe-1	43	5	56
CrC2	Crider silt loam, 6 to 12 percent slopes, eroded-----	17	IIIe-1	43	5	56
CrC3	Crider silt loam, 6 to 12 percent slopes, severely eroded-----	18	IVe-9	46	6	56
CrD	Crider silt loam, 12 to 20 percent slopes-----	18	IVe-1	45	5	56
CrD2	Crider silt loam, 12 to 20 percent slopes, eroded-----	18	IVe-1	45	5	56
CsC3	Crider silty clay loam, 6 to 12 percent slopes, severely eroded-----	18	IVe-9	46	6	56
CsD3	Crider silty clay loam, 12 to 20 percent slopes, severely eroded-----	19	VIe-2	47	6	56
DmD	Dekalb, Ramsey, and Muskingum stony soils, 12 to 20 percent slopes-----	19				
	Dekalb-----	--	VIIs-3	48	10, 11	57
	Ramsey-----	--	VIIs-3	48	10, 11	57
	Muskingum-----	--	VIIs-3	48	10, 11	57
DmF	Dekalb, Ramsey, and Muskingum stony soils, 20 to 40 percent slopes-----	19				
	Dekalb-----	--	VIIIs-1	49	10, 11	57
	Ramsey-----	--	VIIIs-1	49	10, 11	57
	Muskingum-----	--	VIIIs-1	49	10, 11	57
DnB	Dickson silt loam, 2 to 6 percent slopes-----	19	IIe-6	41	7	57
DnB2	Dickson silt loam, 2 to 6 percent slopes, eroded-----	20	IIe-6	41	7	57
EkA	Elk silt loam, 0 to 2 percent slopes-----	20	I-3	41	1	53
EkB	Elk silt loam, 2 to 6 percent slopes-----	20	IIe-1	41	1	53
Fa	Falaya silt loam-----	21	IIw-4	42	2	56
FdC2	Fredonia silty clay loam, shallow, 6 to 12 percent slopes, eroded-----	21	IVe-6	46	9	57
FdD2	Fredonia silty clay loam, shallow, 12 to 20 percent slopes, eroded-----	21	VIe-1	47	9	57
FrD2	Fredonia-Rock land complex, 6 to 20 percent slopes, eroded-----	22				
	Fredonia-----	--	VIIs-1	48	9	57
	Rock land-----	--	VIIs-1	48	15	57

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group	
			Symbol	Page	Number	Page
GmD	Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes-----	22				
	Gilpin-----	--	IVe-4	45	10, 11	57
	Litz-----	--	VIe-8	48	10, 11	57
	Muskingum-----	--	IVe-4	45	10, 11	57
GmD3	Gilpin, Litz, and Muskingum silt loams, 12 to 20 percent slopes, severely eroded-----	22				
	Gilpin-----	--	VIe-9	48	11	57
	Litz-----	--	VIIe-2	49	11	57
	Muskingum-----	--	VIe-9	48	11	57
GmE	Gilpin, Litz, and Muskingum silt loams, 20 to 30 percent slopes-----	22				
	Gilpin-----	--	VIe-7	48	10, 11	57
	Litz-----	--	VIe-8	48	10, 11	57
	Muskingum-----	--	VIe-8	48	10, 11	57
Gu	Gullied land-----	22	VIIe-4	49	15	57
HaC	Hayter silt loam, 6 to 12 percent slopes-----	23	IIIe-1	43	14	57
HaD	Hayter silt loam, 12 to 20 percent slopes-----	23	IVe-1	45	14	57
Hg	Huntington gravelly silt loam-----	24	IIIs-1	43	1	53
Hn	Huntington silt loam-----	24	I-1	40	1	53
Jb	Johnsburg silt loam-----	24	IIIw-1	44	4	56
Ld	Lindside silt loam-----	25	I-2	41	1	53
Ma	Made land-----	25	(none)		15	57
Mc	McGary silt loam-----	25	IIIw-1	44	3	56
Me	Melvin silt loam-----	26	IIIw-5	44	2	56
Mu	Mullins silt loam-----	26	IVw-1	47	4	56
Ne	Newark silt loam-----	27	IIw-4	42	2	56
PbB	Pembroke silt loam, 2 to 6 percent slopes-----	27	IIe-1	41	5	56
PbB2	Pembroke silt loam, 2 to 6 percent slopes, eroded-----	27	IIe-1	41	5	56
PbC	Pembroke silt loam, 6 to 12 percent slopes-----	28	IIIe-1	43	5	56
PbC2	Pembroke silt loam, 6 to 12 percent slopes, eroded-----	28	IIIe-1	43	5	56
PbD2	Pembroke silt loam, 12 to 20 percent slopes, eroded-----	28	IVe-1	45	5	56
PcC3	Pembroke silty clay loam, 6 to 12 percent slopes, severely eroded-----	28	IVe-9	46	6	56
PcD3	Pembroke silty clay loam, 12 to 20 percent slopes, severely eroded-----	28	VIe-2	47	6	56
Qd	Quarries and dumps-----	29	(none)		15	57
Ro	Rock land, limestone-----	29	VIIIs-5	49	15	57
Rs	Rock land, sandstone-----	29	VIIIs-5	49	15	57
RuB	Russellville silt loam, 2 to 6 percent slopes-----	29	IIe-10	42	7	57
RuB2	Russellville silt loam, 2 to 6 percent slopes, eroded-----	30	IIe-10	42	7	57
RuC	Russellville silt loam, 6 to 12 percent slopes-----	30	IIIe-2	43	7	57
RuC2	Russellville silt loam, 6 to 12 percent slopes, eroded-----	30	IIIe-2	43	7	57
RuC3	Russellville silt loam, 6 to 12 percent slopes, severely eroded-----	31	IVe-14	46	6	56
RuD2	Russellville silt loam, 12 to 20 percent slopes, eroded-----	31	IVe-3	45	7	57
RuD3	Russellville silt loam, 12 to 20 percent slopes, severely eroded-----	31	VIe-2	47	6	56
Sk	Sharkey silt loam, overwash-----	32	IIIw-7	45	2	56
So	Sharkey silty clay loam, overwash-----	32	IIIw-7	45	2	56
Ta	Taft silt loam-----	32	IIIw-1	44	4	56
TmA	Tilsit silt loam, 0 to 2 percent slopes-----	33	IIw-1	42	7	57
TmB	Tilsit silt loam, 2 to 6 percent slopes-----	33	IIe-6	41	7	57
TmB2	Tilsit silt loam, 2 to 6 percent slopes, eroded-----	33	IIe-6	41	7	57
TmC2	Tilsit silt loam, 6 to 12 percent slopes, eroded-----	33	IIIe-8	44	7	57
Vb	Vicksburg gravelly silt loam-----	34	IIIs-1	43	1	53
Vc	Vicksburg silt loam-----	34	I-1	40	1	53
Wa	Waverly silt loam-----	34	IIIw-5	44	2	56

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group	
			Symbol	Page	Number	Page
WeB	Wellston silt loam, 2 to 6 percent slopes-----	35	IIe-9	42	13	57
WeC	Wellston silt loam, 6 to 12 percent slopes-----	35	IIIe-7	43	13	57
WeC2	Wellston silt loam, 6 to 12 percent slopes, eroded-----	35	IIIe-7	43	13	57
WeD	Wellston silt loam, 12 to 20 percent slopes-----	35	IVe-4	45	13	57
WeD2	Wellston silt loam, 12 to 20 percent slopes, eroded-----	36	IVe-4	45	13	57
WnC3	Wellston silty clay loam, 6 to 12 percent slopes, severely eroded-----	36	IVe-9	46	6	56
WnD3	Wellston silty clay loam, 12 to 20 percent slopes, severely eroded-----	36	VIe-2	47	6	56
ZaB	Zanesville silt loam, 2 to 6 percent slopes-----	36	IIe-10	42	13	57
ZaB2	Zanesville silt loam, 2 to 6 percent slopes, eroded-----	37	IIe-10	42	13	57
ZaC	Zanesville silt loam, 6 to 12 percent slopes-----	37	IIIe-2	43	13	57
ZaC2	Zanesville silt loam, 6 to 12 percent slopes, eroded---	37	IIIe-2	43	13	57
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded-----	37	IVe-14	46	6	56
ZaD2	Zanesville silt loam, 12 to 20 percent slopes, eroded---	38	IVe-3	45	13	57
ZaD3	Zanesville silt loam, 12 to 20 percent slopes, severely eroded-----	38	VIe-2	47	6	56



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