

# SOIL SURVEY

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## **Elliott County Kentucky**

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

# HOW TO USE THE SOIL SURVEY REPORT

**T**HIS SOIL SURVEY of Elliott County will serve various groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; aid those who manage woodland; and add to the knowledge of soil scientists.

## Locating the soils

Use the index to map sheets at the back of this report to locate areas on the large map. The index is a small map of the county numbered to show where each sheet of the large map is located. When the correct sheet of the large map has been found, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they occur on the map. The symbol is inside the area if there is enough room; otherwise, it is outside the area and a pointer shows where the symbol belongs.

## Finding information

This report contains sections that will interest different groups of readers, as well as some sections that may be of interest to all.

*Farmers and those who work with farmers* can learn about the soils in the section "Descriptions of Soils" and then turn to the section "Use and Management of Soils." In this way, they first identify the soils on their farm and then learn how these soils can be managed and what yields can be expected. The "Guide to Mapping Units, Capability Units, and Woodland Suitability Groups" at the back of the report will simplify the use of the map and report. This guide lists each soil and land type mapped in the county, and the

page where each is described. It also lists, for each soil and land type, the capability unit and woodland suitability group, and the page where each of these is described.

*Foresters and others interested in woodland* can refer to the section "Woodland." In that section the soils in the county are grouped according to their suitability for trees, and factors affecting the management of woodland are explained.

*Farmers, wildlife managers, naturalists, and sportsmen* will want to refer to the section "Wildlife" for information about the kinds of wildlife in the county, and the suitability of the soils for wildlife habitats.

*Engineers* will want to refer to the section "Use of Soils for Engineering." Tables in that section show characteristics of the soils that affect engineering.

*Scientists and others who are interested* will find information about how the soils were formed and how they were classified in the section "Formation, Classification, and Morphology of Soils."

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

*Newcomers in Elliott County* will be especially interested in the section "General Soil Map," where broad patterns of soils are described, and in the section "General Nature of the County," which gives additional information about the county.

\* \* \* \*

Fieldwork for this survey was completed in 1960. Unless otherwise indicated, all statements in the report refer to conditions in the county at that time. The soil survey of Elliott County was made as part of the technical assistance furnished by the Soil Conservation Service to the Elliott County Soil Conservation District.

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# SOIL SURVEY OF ELLIOTT COUNTY, KENTUCKY

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

**E**LLIOTT COUNTY is in the northeastern part of Kentucky (fig. 1). It has an area of 153,600 acres,

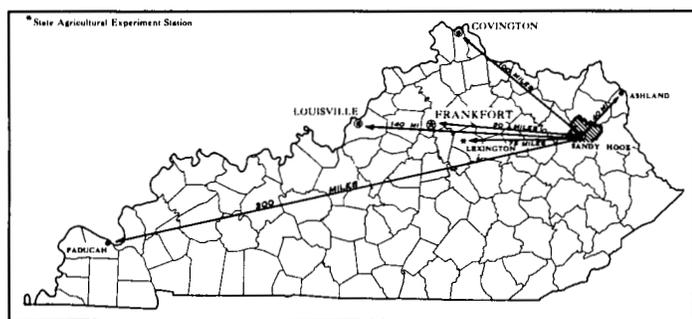


Figure 1.—Location of Elliott County in Kentucky.

or 240 square miles. The county is largely rural. Sandy Hook is the county seat. The population of the county was 6,330 in 1960.

The main cash crop is tobacco, which is grown in rather small allotted acreages. Woodland products are next in importance. About 70 percent of the county is woodland and consists of steep, mostly stony or rocky soils over sandstone or shale.

At the time of the survey, there was one manufacturer in the county. Many farmers work off the farms in industry outside the county.

## General Soil Map

Three general soil areas are delineated on a colored map in the back of this report. These areas, called soil associations, are named for the principal soil series in them. Soil associations are kinds of geographic areas. Each association consists of a combination of soils in a characteristic, repeating pattern. The proportion of each soil in the combination remains about the same throughout the association. The kinds, patterns, and proportions of soils in each association are characteristic of a given kind of landscape that can be easily identified as one travels over the county.

Soil associations are groupings of soils that lie side by side and form a pattern. The soils can be unlike one another, just as unlike trees stand side by side. In some associations the differences among soils are relatively small, but in others they are large. Because of the small

scale of the general soil map, the soils cannot be mapped in detail. Soils of the same kind can occur in more than one association. For example, soils of the Muskingum series occur in all three associations in this county. The location of different soils is shown in much more detail on the soil survey map.

The soil associations differ in their suitability for agriculture. For example, in one association the slopes are very steep, and the soils are used predominantly for timber; whereas, in another association, the slopes are not so steep and the soils can be used for pasture.

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

**Muskingum-Ramsey-Wellston association: Moderately deep or shallow soils on hillsides and moderately deep soils on ridges**

This dissected, rolling to very steep soil association covers much of the western part of the county, which is part of the Cumberland Plateau. The soils are underlain by acid sandstone, siltstone, and shale of Pennsylvanian geologic age. The ridgetops are gently sloping and narrow, and the side slopes range from moderately steep to very steep. This association (fig. 2) comprises about 26 percent of the county.

The moderately deep Muskingum soils are dominant. They occur on all the steep slopes and on some of the more narrow ridges. Generally they have a brown silty surface layer over a thin, yellowish-brown silty subsoil.

The Ramsey soils developed from the sandstone rock that caps many of the narrow ridges. The Ramsey soils also occur on the side slopes but are so intricately mixed with the Muskingum soils that separation in mapping is impractical. They are similar to the Muskingum soils but are sandier and more shallow to bedrock.

The Wellston soils are on the broader ridgetops. They have a dark-brown silt loam surface layer over a yellowish-brown silty clay loam subsoil. The Wellston soils are deeper and more productive than the Muskingum and Ramsey soils. Also, they are more strongly developed and have a more clayey subsoil.

The Montevallo soils occur to a minor extent on the steeper hillsides with the Muskingum and Ramsey soils. They are shallower than the Muskingum soils and contain a greater volume of coarse fragments.

The Rarden soils are not extensive and occur on ridgetops where the parent rock consists of soft, acid shale. These soils have a reddish, fine-textured subsoil. The

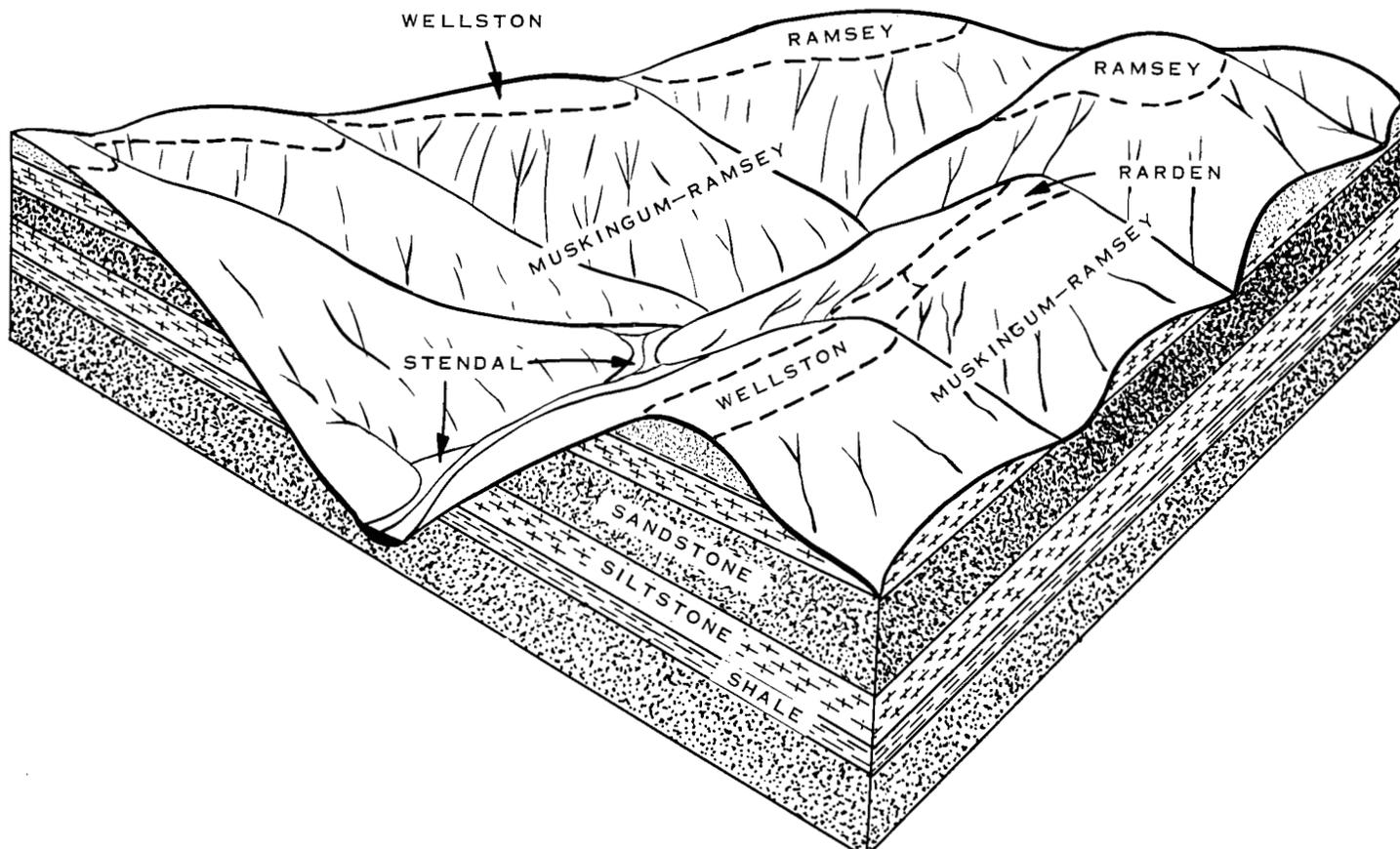


Figure 2.—Diagram of Muskingum-Ramsey-Wellston soil association, showing relationship of soil series to topography and parent material.

Stendal soils are dominant in the very narrow valleys. They are somewhat poorly drained soils on first bottoms and are gravelly in most places.

The soils in this association are only moderately fertile, but crops grown on them respond well to lime and fertilizer. The Wellston soils are preferred for farming because they are less sloping than the Muskingum or Ramsey soils and are deeper and more productive. The Rarden soils erode more readily than the Muskingum, Ramsey, or Wellston soils and are more difficult to till because of their fine-textured subsoil. The small acreage of Stendal soils, which are on first bottoms, must be drained for crops and must be cultivated with care because of the gravel.

Steep slope is the dominant limitation of soils in this association. Most areas of the Muskingum and Ramsey soils are too steep or too droughty for corn or other cultivated crops, but a large acreage is suitable for pasture. Fair pastures of Kentucky 31 fescue and other adapted grasses can be produced if lime and fertilizer are used. The soils could produce fairly good orchards or timber.

The farms are less than 100 acres, and most of them produce only for the farm household. Tobacco, the main cash crop, is grown in patches of less than 1 acre. A few farmers plant their small allotment of tobacco and their gardens and allow the rest of the land to lie idle or grow up in scrub trees. Most farmers have stopped plowing hills for corn. Many farmers have seeded their hills to

fescue pasture and are now grazing beef cattle and some dairy cattle. Many areas that have slopes of more than 35 percent are too steep to mow and are used for timber. The farms are operated mostly by owners.

**Rock land-Monongahela-Pope association: Rocky bluffs, soils on old high stream terraces, and sandy soils in narrow bottoms**

This soil association is made up of steep side slopes along the Little Sandy River Gorge, the plains above the gorge, and the narrow bottoms below it (fig. 3). The soils of the plains developed from old river alluvium laid down before the gorge was formed. Elevations range from about 600 feet above sea level at the bottom of the gorge to about 1,000 feet at the top. This association comprises about 14 percent of the county.

Rock land occurs on the steep sides of the gorge. There are vertical, bare sandstone outcrops, 50 to 100 feet thick, at the top of the gorge, and very steep, rocky soils below that are covered with stones and large boulders, which have fallen from the cliffs above.

The Monongahela soils are dominant on most of the gently sloping plains above the gorge. They are moderately well drained and have a fragipan at a depth of about 18 inches. The Allegheny soils, which are less extensive and are on the more rolling slopes, are well drained and do not have a fragipan. The Tyler soils occur in a still smaller acreage in depressed areas. They are somewhat poorly drained and have a fragipan.

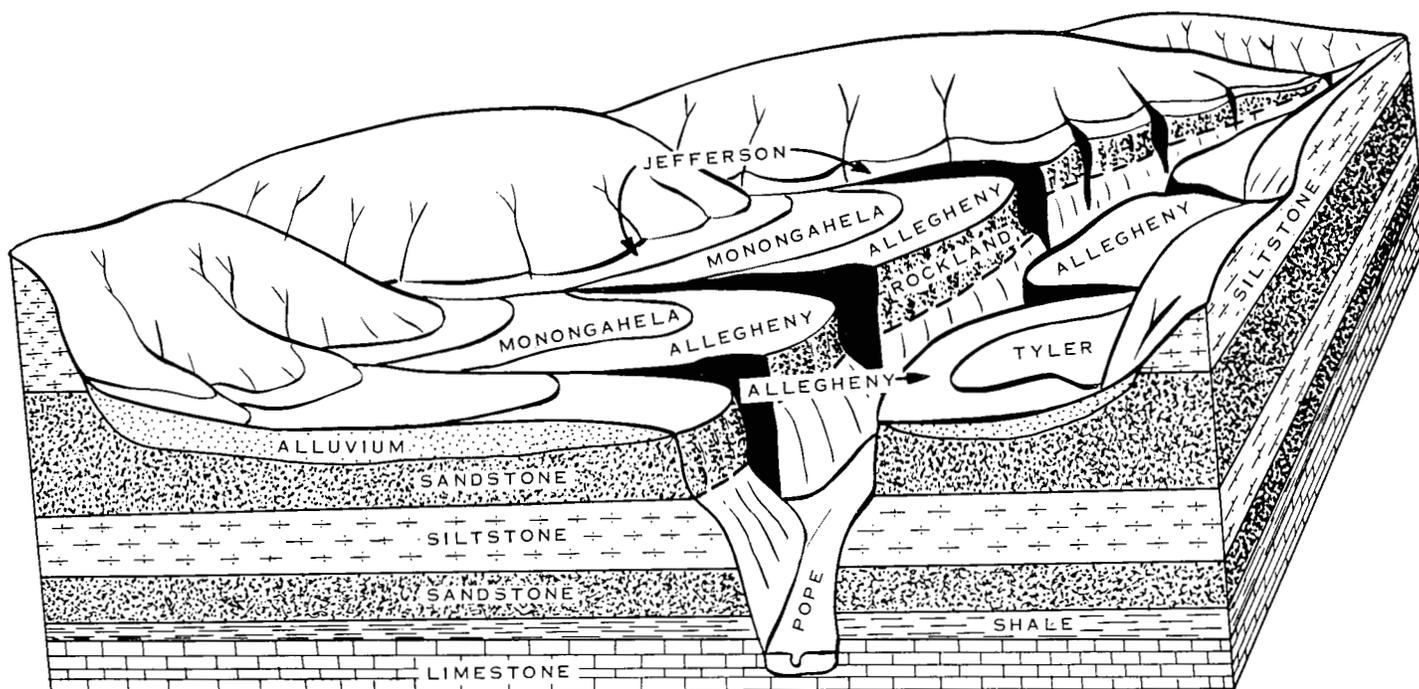


Figure 3.—Diagram of Rock land-Monongahela-Pope association, showing relationship of soil series to topography and parent material.

The Pope soils and the less extensive Bruno soils are on the narrow bottoms. The Pope soils are highly productive and well drained, but the Bruno soils are sandier and less productive. Small areas of deep, well-drained Jefferson soils occur on toe slopes just above the bottoms.

Rock land is too steep to be used for anything but timber. Some areas produce excellent tulip poplars, but the trees are difficult to harvest because the slopes are steep, and roads into the gorge are lacking. The Monongahela soils are suitable for corn, tobacco, and other row crops, and for hay. The Allegheny soils, however, are preferred for tobacco because they are better drained. These soils are only moderately fertile, but crops grown on them respond to lime and fertilizer. The Tyler soils are difficult to drain. Corn is suited to the Pope soils in the narrow bottoms and is grown on them where they can be reached by roads. Many of these areas, however, are difficult to get to with farm equipment and are left in trees.

Farms are larger in this soil association than in other parts of the county and are operated mostly by owners.

**Muskingum-Montevallo-Ramsey association: Shallow, steep soils on mountains and deeper soils on toe slopes and in bottoms**

This large, somewhat mountainous soil association lies mostly east of the Little Sandy River and the town of Sandy Hook. It is a part of the Cumberland Mountains and has very steep hills and narrow creek bottoms (fig. 4). The soils are underlain by acid sandstone, siltstone, and some shale of lower Pennsylvanian geologic age. Creek bottoms and toe slopes occupy about 8 percent of this association. The total area comprises about 60 percent of the county.

The Muskingum soils are the most extensive and, with the Montevallo and Ramsey soils, make up most of the

uplands. The Muskingum soils are moderately deep and have a stony silt loam to loam surface layer. The Montevallo soils are associated with the Muskingum geographically but are shallower and contain a much larger quantity of shale and siltstone fragments. The Ramsey soils are less extensive than the Muskingum and Montevallo soils and are shallower and sandier.

Jefferson soils are dominant on toe slopes and alluvial fans in the valleys. They are well drained and are deeper than the Muskingum, Montevallo, and Ramsey soils. A smaller acreage of Barbourville and Cotaco soils also occurs on the toe slopes, generally on lower slopes than the Jefferson soils and just above the first bottoms. The Barbourville soils are well drained, and the Cotaco soils are moderately well drained to somewhat poorly drained.

The somewhat poorly drained soils are dominant on the first bottoms. They occur with a small acreage of Pope soils, which are well drained, and Atkins soils, which are poorly drained. Soils on the bottoms differ primarily in drainage and texture. The better drained soils are generally nearest the stream channel, and the less well drained soils are nearest the hills. The soils in narrow draws are more gravelly than along larger streams. The Sequatchie and Whitwell soils occur on a few low stream terraces or second bottoms in the valleys. Sequatchie soils are well drained, and Whitwell soils are moderately well drained to somewhat poorly drained.

The Muskingum and Ramsey soils on the hillsides are mostly too steep for farming. They are used mainly for timber and are suitable for this use. Although there is some good timber in this association, many areas need re-seeding or other improvements. The Jefferson and Barbourville soils on the toe slopes, though not quite so fertile as those on first bottoms, are more suitable for tobacco be-

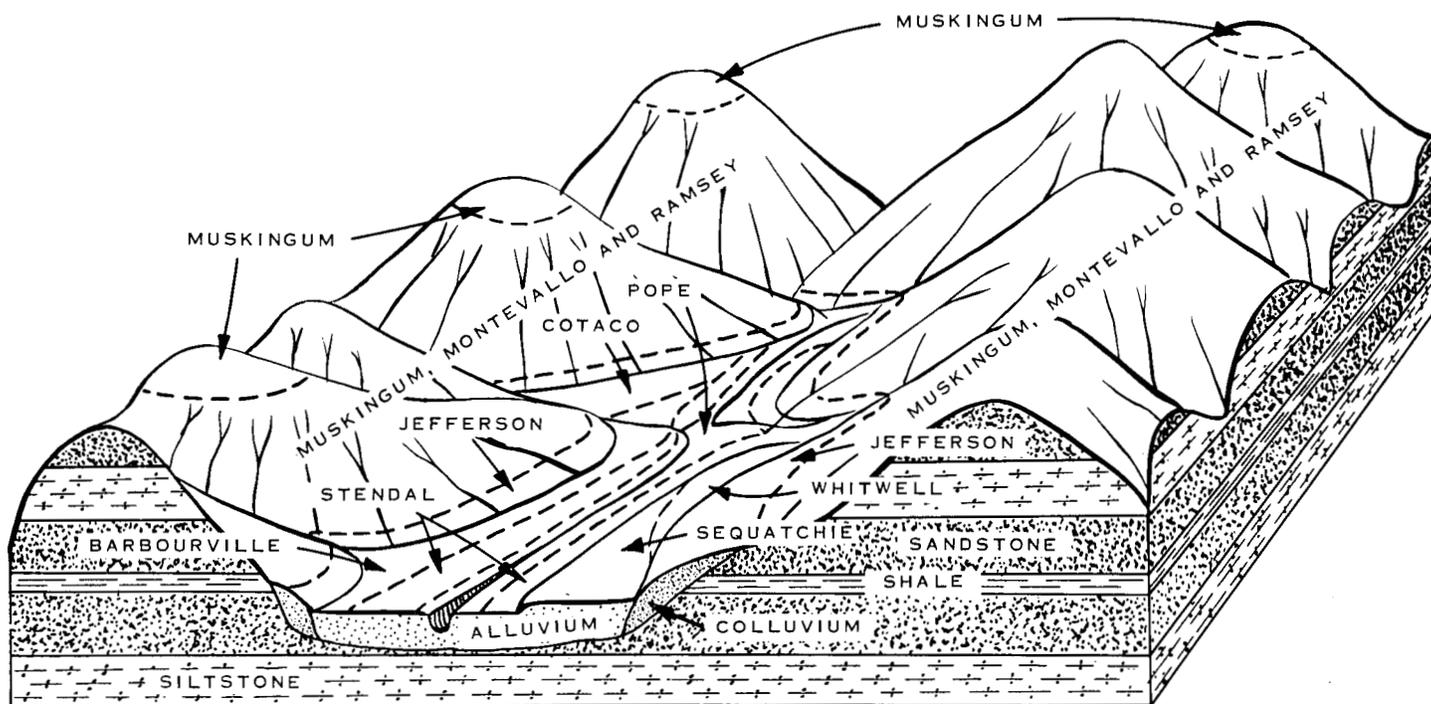


Figure 4.—Diagram of Muskingum-Montevallo-Ramsey association, showing relationship of soil series to topography and parent material.

cause they are less likely to be flooded. The Stendal, Pope, and Atkins soils of the first bottoms are suitable for row crops or pasture, but some areas need drainage. These soils are highly productive if fertilized and properly managed. Some are gravelly, but the gravel does not appreciably cut production or interfere with tillage. The Sequatchie and Whitwell soils on the low terraces are less likely to be flooded than the soils of the first bottoms.

Most of the farming is done on soils in the valleys. Gardens and small allotments of tobacco are grown mainly on the toe slopes and low terraces. Corn or pasture is grown on the first bottoms. The Muskingum soils on the hills are mostly in timber, though a few acres are in pasture.

Farms are small and mostly operated by owners. Many owners work part of the time on the farm and depend on mining or other work off the farm to supplement their income.

### ***How Soils Are Mapped and Classified***

Soil scientists made this survey to learn what kinds of soils are in Elliott 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 slope; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug or bored many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the

surface down to the rock material that has not been changed much by leaching or by roots of plants.

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

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where the soil of that series was first observed and mapped. Barbourville, for example, is a soil series named for the county seat of Knox County, Kentucky. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface layer 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. Monongahela fine sandy loam and Monongahela silt loam are two soil types in the Monongahela 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, Monongahela silt loam, 6 to 12 percent slopes, is one of two phases of Monongahela silt loam, a soil type that ranges from sloping 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 similar details that greatly 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, and so small in size, 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, the Muskingum-Ramsey complex.

Soils of two or more series may be mapped in one unit if they are so nearly alike in slope, stoniness, or some other dominant characteristic that mapping them separately would add little information to the soil survey. This kind of unit is an undifferentiated group of soils, such as the Muskingum, Montevallo, and Ramsey stony soils. An undifferentiated group of soils differs from a complex in that all the soil series named in the group may not occur in each mapped area.

In most mapping there are areas to be shown that are so rocky, so shallow, or so frequently worked by water that they cannot be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Gullied land or Rock land, 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 or 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 a way that is readily useful to different groups of readers, among them farmers, ranchers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil sur-

vey reports. Based on the yield and practice tables and other data, the soil scientists set up trial groups, and test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. 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.

## Descriptions of Soils

The soil mapping units in Elliott County are described in this section. Because all the soils of a series have many things in common, a short description of each series, including a brief profile description, is also given. In Elliott County 34 mapping units and 17 series have been correlated. The approximate acreage of each mapping unit and its percentage of the county area are given in table 1. The mapping units and the map symbol, capability unit, and woodland suitability group of each mapping unit are listed in the back of the report.

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

| Mapping unit   | Area         | Extent         |
|--|--------------|----------------|
|  | <i>Acres</i> | <i>Percent</i> |
| Allegheny loam, 2 to 6 percent slopes.....   | 203          | 0. 1           |
| Allegheny loam, 6 to 12 percent slopes.....  | 425          | . 3            |
| Allegheny loam, 6 to 12 percent slopes, eroded....   | 537          | . 4            |
| Atkins loam.....   | 290          | . 2            |
| Barbourville gravelly loam, 2 to 6 percent slopes..  | 694          | . 5            |
| Barbourville gravelly loam, 6 to 12 percent slopes..   | 515          | . 3            |
| Bruno loamy sand.....  | 266          | . 2            |
| Cotaco gravelly loam, 2 to 6 percent slopes.....   | 530          | . 4            |
| Gullied land.....  | 167          | . 1            |
| Jefferson gravelly loam, 6 to 12 percent slopes....  | 2, 050       | 1. 3           |
| Jefferson gravelly loam, 12 to 20 percent slopes....   | 2, 610       | 1. 7           |
| Jefferson gravelly loam, 20 to 30 percent slopes....   | 1, 639       | 1. 1           |
| Monongahela fine sandy loam, 2 to 6 percent slopes.....                                      | 309          | . 2            |
| Monongahela silt loam, 2 to 6 percent slopes.....  | 827          | . 5            |
| Monongahela silt loam, 6 to 12 percent slopes.....   | 216          | . 1            |
| Muskingum silt loam, 6 to 12 percent slopes.....   | 2, 039       | 1. 3           |
| Muskingum-Ramsey complex, 12 to 20 percent slopes.....                                       | 5, 803       | 3. 8           |
| Muskingum-Ramsey complex, 20 to 30 percent slopes.....                                       | 17, 744      | 11. 6          |
| Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes.....                  | 98, 135      | 63. 9          |
| Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes, severely eroded..... | 2, 426       | 1. 6           |
| Pope fine sandy loam, 0 to 3 percent slopes.....   | 1, 568       | 1. 0           |
| Pope fine sandy loam, 3 to 6 percent slopes.....   | 330          | . 2            |
| Pope gravelly fine sandy loam.....   | 479          | . 3            |
| Ramsey fine sandy loam, 6 to 12 percent slopes..   | 465          | . 3            |
| Rarden silt loam, 5 to 15 percent slopes.....  | 183          | . 1            |
| Rock land.....   | 6, 848       | 4. 5           |
| Sequatchie fine sandy loam, 0 to 4 percent slopes..  | 333          | . 2            |
| Stendal fine sandy loam.....   | 1, 433       | . 9            |
| Stendal gravelly fine sandy loam.....  | 2, 657       | 1. 7           |
| Stendal silt loam.....   | 491          | . 3            |
| Tyler silt loam.....   | 201          | . 1            |
| Wellston silt loam, 2 to 6 percent slopes.....   | 152          | . 1            |
| Wellston silt loam, 6 to 12 percent slopes.....  | 491          | . 3            |
| Whitwell loam.....   | 544          | . 4            |
| Total.....   | 153, 600     | 100. 0         |

Information about the formation, classification, and morphology of the soils, including a detailed profile description of each series, is given in the section "Formation, Classification, and Morphology of Soils." The use of soils for crops and pasture, woodland, wildlife, and engineering is discussed in the section "Use and Management of Soils." Most of the terms used in describing the soils are defined in the Glossary at the back of this report.

## Allegheny Series

The Allegheny series consists of well-drained soils on high terraces along streams. The uneroded areas have a dark yellowish-brown, loamy surface layer over a yellowish-brown to strong-brown, slightly finer textured subsoil. These soils developed in old stream alluvium that originated from sandstone, siltstone, and shale, and they are naturally acid. They are mostly gently sloping or sloping but are steeper in a few places.

Representative profile:

- 0 to 7 inches, dark yellowish-brown, very friable loam.
- 7 to 12 inches, yellowish-brown, friable silt loam.
- 12 to 26 inches, yellowish-brown, firm silty clay loam or clay loam.
- 26 to 36 inches, variegated brownish-yellow and yellowish-brown, firm sandy clay loam.
- 36 to 48 inches +, sandy loam with pockets of gravel.

The Allegheny soils occur with the moderately well drained Monongahela and somewhat poorly drained Tyler soils but are better drained and lack the fragipan layers that are in those soils. They occur below the Muskingum soils and are less steep, are deeper, and show more differences between soil horizons. The Allegheny soils are also below the Jefferson soils. They are less gravelly and less gray in the surface layer than the Jefferson soils, and they occur on terraces rather than on toe slopes.

The Allegheny soils are minor in extent. They occur mostly on the flats just above the sandstone cliffs of the Little Sandy River Gorge. They are productive soils that can be kept in good tilth. The gentle slopes are used for row crops, mostly tobacco, and the steeper slopes are used for pasture. A few odd-shaped areas that are hard to reach are left in trees.

**Allegheny loam, 2 to 6 percent slopes (AgB).**—This well-drained soil is on terraces. The surface layer is dark yellowish-brown, very friable loam. The subsoil is firm, yellowish-brown clay loam or silty clay loam. In areas where tobacco is grown continuously, the surface layer is darker because farmers have increased the organic matter by turning under green-manure crops and adding heavy applications of manure, lime, and fertilizer. The depth to rock ranges from 3 to well over 5 feet. In most areas the surface layer is loam, but in some it is silt loam or fine sandy loam.

The hazard of erosion is moderately low on this soil. The root zone is deep, and the moisture-supplying capacity is high. The soil is naturally strongly acid and has moderate natural fertility. Crops respond well to lime and a complete fertilizer. The soil is easy to till, has moderately rapid permeability, and contains a medium to low amount of organic matter.

Moderate to high yields of tobacco and corn are produced on this soil if it is well fertilized. Crops can be

planted on it earlier than on other soils, such as those on first bottoms. Good hay and pasture are produced from Kentucky 31 fescue and Korean lespedeza or ladino clover. To some extent, timothy and lespedeza are grown for hay, but little alfalfa and bluegrass. Some areas are in trees.

If well managed, this soil is well suited to cultivation, but it is subject to moderate erosion if cultivated and not protected. The soil is also suitable for hay, pasture, woods, or wildlife. (Capability unit IIe-1; woodland suitability group 1; wildlife suitability group 1)

**Allegheny loam, 6 to 12 percent slopes (AgC).**—This is a well-drained soil on stream terraces. The surface layer is dark yellowish-brown, very friable loam, and the subsoil is firm, yellowish-brown clay loam or silty clay loam. In areas where tobacco is grown, the surface layer is somewhat darker. The depth to rock ranges from 3 to 5 feet or more. Included in mapping are a few acres that have a fine sandy loam surface layer.

The hazard of erosion is moderate on this soil. The root zone is deep, and the moisture-supplying capacity is very high. The soil is naturally strongly acid and has moderate natural fertility. Crops respond well to lime and complete fertilizer. The soil is easy to till, has moderately rapid permeability, and contains a medium to low amount of organic matter. Excellent crops of tobacco and corn are grown on areas of this soil where fertility has been built up. Crops can be planted earlier than on most soils, but cover crops are sometimes difficult to establish in dry fall seasons. Early garden crops are well suited. Good pastures of Kentucky 31 fescue and ladino clover are produced, but little alfalfa is grown.

With good management, including proper erosion control, this soil is suitable for cultivation, but it is subject to severe erosion if cultivated and not protected. The soil is also suitable for hay, pasture, woods, or wildlife. (Capability unit IIIe-1; woodland suitability group 1; wildlife suitability group 1)

**Allegheny loam, 6 to 12 percent slopes, eroded (AgC2).**—This is a well-drained soil on stream terraces. The surface layer is generally mixed dark yellowish-brown and yellowish-brown, friable loam. The subsoil is yellowish-brown clay loam or silty clay loam. The depth to rock ranges from 2 to about 6 feet. In some areas a few shallow gullies have formed. Mapped with this soil are a few small areas as steep as 15 percent.

The erosion hazard on this soil is moderate. In places water from areas above this soil helped cause erosion. The root zone is deep, and the moisture-supplying capacity is high. The soil is naturally acid and moderately fertile. Crops respond well to lime and a complete fertilizer. The soil is easy to till, has moderately rapid permeability, and contains a small amount of organic matter.

Good crops of tobacco are grown on this soil, but the tilth has been damaged somewhat by erosion. Water on long slopes, or from slopes above, should be controlled. Vigorous, long-lived plants, such as Kentucky 31 fescue and sericea lespedeza, make good hay or pasture.

With good management, including proper erosion control, this soil can be used for cultivation, but it is subject to severe erosion if cultivated and not protected. The soil is well suited to hay, pasture, woods, or wildlife. (Capability unit IIIe-1; woodland suitability group 1; wildlife suitability group 1)

## Atkins Series

The Atkins series consists of poorly drained soils on first bottoms. These soils have a mottled light brownish-gray surface layer over a mottled gray layer. They are on low-lying flood plains in recent alluvium that washed from soils originating from acid sandstone, siltstone, and shale. The Atkins soils are naturally acid.

Representative profile:

0 to 10 inches, mottle light brownish-gray, very friable loam.  
10 to 48 inches +, highly mottled gray silt loam that, in some places, is gravelly in the lower part.

The Atkins soils are on first bottoms with the well-drained Pope and the somewhat poorly drained Stendal soils but are more poorly drained than those soils. All the soils on the first bottoms are subject to occasional flooding, but water remains on the Atkins soils longer than on the others.

The Atkins soils are minor in extent and occur in small depressions in stream flood plains throughout the county. Many areas have been tile drained and are producing good crops of corn. Kentucky 31 fescue is grown for hay or pasture on much of the acreage.

**Atkins loam (At).**—This poorly drained soil on first bottoms has a plow layer of highly mottled light brownish-gray, very friable loam. The subsoil is mottled gray and, in most places, is silt loam. Depth to rock generally is well over 5 feet.

In places the surface layer is highly mottled dark grayish brown instead of light brownish gray. The texture of the surface layer ranges from silt loam to fine sandy loam, and that of the subsoil, from silt loam to sandy clay loam or silty clay loam.

This soil is wet, but in most places this can be partly corrected by tile drainage. Because runoff is slow, water often stands on the surface after heavy rains. Scalding and occasional flooding may damage crops.

If the soil is drained, crops respond well to lime and a complete fertilizer because the soil is acid and has moderately low natural fertility. The soil is easy to till except when it is too wet. It is moderately permeable and contains a medium to small amount of organic matter. The high water table sometimes damages plants.

Yields of corn are good if this soil is properly drained and fertilized, but they are only fair without drainage. Many undrained pastures grow up in swamp grasses or other weeds. Some areas are in trees and bushes.

This soil is suited to cultivation but wetness severely limits the choice of plants. Even if the soil is drained, it is likely to be waterlogged or flooded. It is well suited to meadow, pasture, woods, or wildlife. (Capability unit IIIw-5; woodland suitability group 2; wildlife suitability group 3)

## Barbourville Series

The Barbourville series consists of well-drained, gently sloping or sloping soils on low toe slopes or alluvial fans. These soils have a dark-brown surface layer over a dark yellowish-brown subsoil. They developed in local alluvium or colluvium washed from soils that originated from acid sandstone, siltstone, and shale and are naturally acid.

Representative profile:

0 to 8 inches, dark-brown, friable gravelly loam.

8 to 16 inches, dark-brown, friable gravelly loam.

16 to 26 inches, faintly mottled dark yellowish-brown, friable gravelly sandy clay loam.

26 to 48 inches +, yellowish-brown, faintly mottled very gravelly sandy clay loam or loam.

The Barbourville soils are below Muskingum soils and occur with well-drained Jefferson and somewhat poorly drained to moderately well drained Cotaco soils. Barbourville soils are more productive than Muskingum soils and are deeper and darker. They are darker, are on more nearly flat slopes closer to the first bottoms, and have less difference between soil horizons than the Jefferson soils. They are better drained than Cotaco soils and are in higher positions that are less apt to be flooded.

The Barbourville soils are minor in extent, though they are in many small areas just above the stream flood plains throughout the county. They are highly desirable for growing burley tobacco and vegetables. These soils are used mostly for row crops, but a few areas are used for pasture.

**Barbourville gravelly loam, 2 to 6 percent slopes (BcB).**—This well-drained soil is on low toe slopes and alluvial fans. It has a dark-brown plow layer over a dark-brown to yellowish-brown loam to sandy clay loam subsoil. The depth to rock is well over 5 feet.

The hazard of erosion is moderately low. The root zone is deep, and the moisture-supplying capacity is high. This soil is naturally acid and has moderately high natural fertility. Crops respond well to lime and fertilizer. The soil is somewhat difficult to till because of gravel. It has moderately rapid permeability and contains a medium amount of organic matter. Farmers prefer this soil for tobacco and vegetables because it is less apt to be flooded than soils on first bottoms. In some places crops are damaged by runoff from hills above.

Where fertility has been built up, very good crops of tobacco and corn are produced. A few fairly good yields of red clover hay are obtained, but alfalfa is seldom grown. Many good gardens are grown on this soil.

If well managed, this soil is well suited to cultivation, but it is subject to moderate erosion if cultivated and not protected. This soil is also suitable for hay, pasture, woods, or wildlife. (Capability unit IIe-3; woodland suitability group 1; wildlife suitability group 1)

**Barbourville gravelly loam, 6 to 12 percent slopes (BcC).**—This well-drained soil is on low toe slopes and alluvial fans. It has a dark-brown plow layer over a dark-brown to yellowish-brown loam to sandy clay loam subsoil. The depth to rock is well over 5 feet.

The hazard of erosion is moderate on this soil. The root zone is deep, and the moisture-supplying capacity is very high. The soil is naturally acid and moderately high in natural fertility. Crops respond well to lime and fertilizer. The soil is somewhat difficult to till because of gravel. It has moderately rapid permeability and contains a medium amount of organic matter. Most areas of this soil are above the flood zone. For this reason farmers prefer it to first bottom soils for tobacco and vegetables. In some places crops are damaged by runoff from the hills above.

Where fertility is built up, many excellent crops of tobacco and some good crops of corn are produced. Kentucky 31 fescue and ladino clover make good pasture. Little bluegrass is grown on this soil.

If well managed, this soil is suitable for cultivation, but it is subject to severe erosion if cultivated and not protected. The soil is well suited to hay, pasture, woods, or wildlife. (Capability unit IIIe-5; woodland suitability group 1; wildlife suitability group 1)

## Bruno Series

The Bruno series consists of excessively drained soils on first bottoms near stream channels. These soils have low productivity. The plow layer is dark-brown loamy sand underlain by rapidly permeable, lighter colored loamy sand several feet thick. These soils have formed in very sandy alluvium and are naturally acid.

### Representative profile:

- 0 to 8 inches, dark-brown, very friable loamy fine sand.
- 8 to 26 inches, dark yellowish-brown, loose loamy sand.
- 26 to 50 inches, stratified layers of loamy sand, sand, and gravel.

The Bruno soils are associated with the well-drained Pope, the somewhat poorly drained Stendal, and the poorly drained Atkins soils, but Bruno soils are more sandy and more droughty because they are near stream channels where floods deposit coarser material.

The Bruno soils are minor in extent; they occur mostly in narrow bands along the major streams. Most areas are used for pasture, some are used for corn, and others are left in trees.

**Bruno loamy sand (Br).**—This sandy, somewhat excessively drained, naturally acid soil is on first bottoms. It has a very friable loamy sand plow layer that is dark-brown or yellowish-brown, depending upon the amount of organic matter. The plow layer is underlain by loose loamy sand. The depth to rock is well over 5 feet.

This soil is not susceptible to erosion, but it is susceptible to occasional flooding and is somewhat droughty. The soil has a deep root zone and a moderately low moisture-supplying capacity. Natural fertility is low, but crops respond to lime and fertilizer except in very dry seasons. The soil is easy to till, is rapidly permeable, and contains a low to very low amount of organic matter.

Some fair crops of corn are produced on this soil, but areas where the overflow hazard is greatest are mostly in Kentucky 31 fescue pasture or in trees.

This soil can be used continuously for crops, but yields may be low. It can also be used for hay, pasture, woods, or wildlife. (Capability unit IIIs-1; woodland suitability group 1; wildlife suitability group 2)

## Cotaco Series

The Cotaco series consists of moderately well drained to somewhat poorly drained soils on low toe slopes and alluvial fans. These soils have a dark grayish-brown gravelly loam plow layer over a mottled yellowish-brown to light yellowish-brown subsoil. They consist of local alluvium or colluvium washed from soils that originated from acid sandstone and shale. They are naturally acid and are gently sloping and sloping.

### Representative profile:

- 0 to 8 inches, dark grayish-brown, friable gravelly loam.
- 8 to 17 inches, mottled dark grayish-brown, friable gravelly loam.
- 17 to 23 inches, mottled yellowish-brown, friable gravelly fine sandy clay loam.

- 23 to 29 inches, highly mottled light yellowish-brown, friable gravelly fine sandy clay loam.
- 29 to 36 inches, mottled pale-yellow, friable gravelly fine sandy clay loam.
- 36 to 44 inches +, mottled light brownish-gray gravelly alluvium.

The Cotaco soils occur on toe slopes and alluvial fans with the well-drained Barbourville soils but are less well drained. They are below the well-drained Jefferson soils and less well drained and have less horizon development than Jefferson soils. Cotaco soils have drainage similar to that of Stendal soils on first bottoms and Whitwell soils on low terraces, but Cotaco soils consist of local material washed from the soils above, whereas Whitwell and Stendal soils consist of general stream deposits.

The Cotaco soils are minor in extent, but they occur just above the stream flood plains in small areas throughout the county. They are moderately productive, and many areas are used for corn, tobacco, or vegetables.

**Cotaco gravelly loam, 2 to 6 percent slopes (CoB).**—This somewhat poorly drained to moderately well drained soil is on low toe slopes and alluvial fans. It has a dark grayish-brown plow layer over a mottled yellowish-brown subsoil that becomes more mottled, grayer, and finer textured with depth. The depth to rock is more than 5 feet.

The hazard of erosion is moderately low on this soil except in the steeper areas. The soil ranges from slightly wet to wet, but much of the wetness can be eliminated by tile drainage or diversion channels. This soil has a deep root zone and a very high moisture-supplying capacity. It is naturally acid and has moderately low natural fertility. Crops respond well to lime and a complete fertilizer if the soil is adequately drained. Tillage is somewhat difficult because of the gravel. Permeability is moderately rapid, and the amount of organic matter is medium to low. Farmers prefer this soil for tobacco and vegetables because it is less likely to be flooded than many soils on bottom lands. In many places crops are damaged by wetness and runoff from hills above.

A few good crops of corn are produced on this soil, but tobacco is seldom grown. Undrained fields are mostly in swamp grass, weeds, or trees.

The choice of plants is limited by wetness, even after drainage. Also, the soil is susceptible to moderate erosion in some places if it is cultivated and not protected. This soil can be used for meadow, pasture, woods, or wildlife. (Capability unit IIw-3; woodland suitability group 1; wildlife suitability group 1)

## Gullied Land

**Gullied land (Gu)** is an intricate pattern of moderately deep and deep gullies. The characteristics of the original soils have been destroyed, except in small areas between the gullies.

Included with this unit in mapping are areas where sheet erosion has removed most or all of the soil (solum), and substratum material is exposed. Most Gullied land is extremely acid, but this mapping unit includes a small acreage of soil material that developed from limestone. Also included are strip-mine areas.

Gullied land is not suitable for row crops, meadow, or intensive grazing. It can be used for limited grazing, woods, or wildlife. (Capability unit VIIe-4; woodland suitability group 8; wildlife suitability group 3)

## Jefferson Series

The Jefferson series consists of well-drained, gently sloping to moderately steep soils on toe slopes and alluvial fans. In uneroded areas these soils have a dark grayish-brown surface layer over a yellowish-brown, somewhat finer textured subsoil. They consist of local alluvium or colluvium washed from soils that originated from acid sandstone, siltstone, and shale and are naturally acid.

Representative profile:

- 0 to 9 inches, dark grayish-brown, very friable gravelly loam.
- 9 to 18 inches, yellowish-brown, friable gravelly clay loam.
- 18 to 35 inches, yellowish-brown, firm gravelly clay loam or silty clay loam.
- 35 to 48 inches +, local alluvium of yellowish-brown gravelly clay loam or fine sandy clay loam.

The Jefferson soils occur with the Barbourville and Cotaco soils and below the Muskingum soils. They are deeper and more productive than the Muskingum soils. They are lighter colored, and more leached, and have more horizon development than the Barbourville and Cotaco soils. The Jefferson soils are similar to the Barbourville soils in drainage but are generally on steeper slopes and at higher elevations. They are better drained than the Cotaco soils. In drainage, Jefferson soils are similar to the Allegheny soils on stream terraces, but Jefferson soils consist of local alluvial material washed from hillsides, whereas the Allegheny soils consist of materials deposited by streams. Also, the Jefferson soils have angular gravel in their profile, and the Allegheny soils have more rounded gravel.

The Jefferson soils are moderately extensive and occur in many small areas throughout the county. They are very desirable for tobacco because they are less likely to be flooded than soils on first bottoms and are nearly as productive. Many of the larger areas are used for row crops, and the small, irregularly shaped areas are used mostly for pasture. The more steeply sloping areas in the rougher section of the county are in trees.

**Jefferson gravelly loam, 6 to 12 percent slopes (JfC).**—This well-drained soil developed in local alluvium on toe slopes and fans. It has a dark grayish-brown, very friable gravelly loam surface layer over a yellowish-brown, firm gravelly clay loam or silty clay loam subsoil. In a few places the subsoil is strong brown or yellowish red. The depth to rock is well over 5 feet. Included with this soil in mapping are a few eroded spots and a few areas that have a silt loam surface layer.

The hazard of erosion is moderate on this soil. The root zone is deep, and the moisture-supplying capacity is very high. The soil is naturally acid and is moderate in natural fertility. Crops grown on it respond well to lime and fertilizer. The soil has moderately rapid permeability and contains a medium to small amount of organic matter. Because this soil occurs on areas that are not subject to flooding, many farmers prefer it to first-bottom soils for tobacco and gardens. In places, however, crops are damaged by runoff from hillsides above. The soil is somewhat difficult to till because of the gravel.

Excellent yields of tobacco and corn are produced on this soil if it is heavily fertilized. Also, good pastures of Kentucky 31 fescue are grown. Red clover, timothy, and

redtop are grown occasionally for hay, and yields are fair to good.

If well managed, this soil is suitable for cultivation, but it is subject to severe erosion if cultivated and not protected. The soil is well suited to hay, pasture, woods, or wildlife. (Capability unit IIIe-5; woodland suitability group 1; wildlife suitability group 1)

**Jefferson gravelly loam, 12 to 20 percent slopes (JfD).**—This well-drained soil developed in local alluvium on toe slopes. In uneroded areas it has a dark grayish-brown, very friable gravelly surface layer over a yellowish-brown, firm gravelly clay loam or silty clay loam subsoil. Small patches of yellowish-brown soil are at the surface in places. The depth to rock is well over 5 feet.

The hazard of erosion is high on this soil. The root zone is deep, and the moisture-supplying capacity is very high. This soil is naturally acid and has moderate natural fertility. Crops respond well to lime and fertilizer. The soil has moderately rapid permeability and contains a medium to small amount of organic matter. It is somewhat difficult to till because of the gravel. Farm machinery can be used on these slopes, but turning the furrow uphill is difficult with a moldboard plow. Farmers often use this soil for tobacco, however, because the soils on first bottoms are likely to be flooded and better soils are lacking on the hills above.

This soil produces good yields of tobacco, but it often erodes. Many areas are in wild grass, but some areas are in good stands of Kentucky 31 fescue. Very little bluegrass or alfalfa is grown. Many areas of this soil are in trees.

This soil is subject to very severe erosion if cultivated and not protected. Therefore, it should not be cropped if more level land is available. It is well suited to hay, pasture, woods, or wildlife. (Capability unit IVe-4; woodland suitability group 1; wildlife suitability group 2)

**Jefferson gravelly loam, 20 to 30 percent slopes (JfE).**—This well-drained soil developed in local alluvium and is on rather steep toe slopes. It has a dark grayish-brown, very friable gravelly surface layer over a yellowish-brown, firm gravelly clay loam or silty clay loam subsoil. The depth to rock is generally more than 5 feet. Included with this soil in mapping are moderately eroded areas in which some of the original surface soil and subsoil are mixed.

Because of the slopes, the hazard of erosion is high on this soil. The root zone is deep and the moisture-supplying capacity is high. The soil is naturally acid and has moderate natural fertility. Crops grown on it respond well to lime and fertilizer. The soil has moderately rapid permeability and contains a medium amount of organic matter. It is somewhat difficult to till because of the gravel. The slopes are too steep for easy operation of farm machinery, but with care a wheel-type tractor can be used for mowing. Farmers sometimes use this soil for tobacco when less steep soils are lacking.

The soil produces good yields if heavily fertilized, but some erosion generally occurs. Some areas have good stands of Kentucky 31 fescue, and many have good stands of poplar or oak trees. This soil is suited to pasture, woods, or wildlife. (Capability unit VIe-8; woodland suitability group 1; wildlife suitability group 2)

## Monongahela Series

The Monongahela series consists of moderately well drained, nearly level to sloping soils on stream terraces. These soils have a fragipan. In uneroded areas, they have a leached, dark grayish-brown surface layer over a light olive-brown to light yellowish-brown, slightly finer textured subsoil. The fragipan is at a depth of about 18 inches. These soils developed in old stream alluvium that originated from acid sandstone, siltstone, and shale, and they are naturally acid.

Representative profile:

- 0 to 7 inches, dark grayish-brown, friable silt loam.
- 7 to 11 inches, brownish-yellow, friable silty clay loam.
- 11 to 18 inches, faintly mottled brownish-yellow to light yellowish-brown, firm silty clay loam.
- 18 to 36 inches, mottled brownish-yellow to yellowish-brown, brittle and compact silty clay loam fragipan.
- 36 inches +, massive (structureless) light-gray silty clay loam that is stream alluvium.

The Monongahela soils are on high stream terraces with the well-drained Allegheny and somewhat poorly drained Tyler soils. They are more poorly drained than the Allegheny soils and are better drained than the Tyler soils. They also differ from the Allegheny soils in having a fragipan.

The Monongahela soils are minor in extent. They are mostly on the flats just above the sandstone cliffs of the Little Sandy River Gorge. They are moderately productive soils, though excessive moisture is a problem early in spring. Some areas of these soils are used for tobacco and corn, and other areas are used for pasture or woods.

**Monongahela fine sandy loam, 2 to 6 percent slopes (MfB).**—This moderately well drained soil on stream terraces has a fragipan. The surface layer of dark grayish-brown fine sandy loam is underlain by friable, brownish-yellow or light yellowish-brown clay loam or sandy clay loam. The fragipan is at a depth of 18 inches, and the depth to rock is well over 5 feet.

This soil is slightly wet, especially in the more nearly level places, and the hazard of erosion is moderately low. The root zone over the fragipan is shallow, and the moisture-supplying capacity is moderately low. The soil is naturally acid and has moderately low natural fertility. Crops grown on it respond to lime and fertilizer. Above the fragipan, the soil is moderately permeable to water, but water moves slowly through the fragipan. The soil is very easy to till except early in spring when it is wet. It contains a small amount of organic matter.

Some areas of this soil produce fair to good yields of corn and tobacco, but most areas are in Kentucky 31 fescue, wild grass, brush, or trees.

Under good management, this soil is suitable for cultivation, but it is subject to moderate erosion if cultivated and not protected. The soil is also suited to hay, pasture, timber, or wildlife. (Capability unit IIe-7; woodland suitability group 4; wildlife suitability group 2)

**Monongahela silt loam, 2 to 6 percent slopes (MgB).**—This moderately well drained soil is on stream terraces and has a fragipan. The surface layer is dark grayish-brown, friable silt loam. This layer is underlain by brownish-yellow to yellowish-brown, friable, light silty clay loam. The fragipan is at a depth of about 18 inches. The depth to rock is generally well over 5 feet.

This soil is slightly wet, especially in more nearly level

areas, and the hazard of erosion is moderately low. The root zone is shallow over the fragipan, and the moisture-supplying capacity is moderately low. The soil is naturally acid and has moderate natural fertility. Crops respond well to lime and fertilizer. Above the fragipan the soil is moderately permeable, but water and air move very slowly through the fragipan. The soil contains a small amount of organic matter and is easy to till except when wet early in spring.

In some areas good yields of corn and tobacco are produced if the soil is heavily fertilized. Many fields are used for hay. Alfalfa has been grown, but it generally lasts only a short time.

With good management this soil is suitable for cultivation, but it is subject to moderate erosion if cultivated and not protected. The soil is also suited to hay, pasture, timber, or wildlife. (Capability unit IIe-7; woodland suitability group 4; wildlife suitability group 2)

**Monongahela silt loam, 6 to 12 percent slopes (MgC).**—This moderately well drained soil is on stream terraces and has a fragipan. The surface layer is dominantly grayish-brown, friable silt loam and is underlain by brownish-yellow or light yellowish-brown, friable, light silty clay loam, over a fragipan at a depth of about 18 inches. The depth to rock generally is more than 5 feet. As a result of erosion, in some places the surface layer consists of light yellowish-brown subsoil material and the fragipan is at a depth of only about 14 inches.

The hazard of erosion is moderate, and the soil is slightly wet early in spring. It has a shallow root zone over the fragipan and a moderately low moisture-supplying capacity. The soil is naturally acid and has moderately low natural fertility. It is easy to till. Crops respond well to lime and fertilizer. Above the fragipan, the soil is moderately permeable, though water and air move very slowly through the fragipan. The soil contains a small amount of organic matter. Water, seeping from the more nearly level slopes above to the impermeable fragipan in this soil, causes most of the wetness. In places water comes to the surface in small, wet-weather springs or seeps.

If proper crop rotations are used and erosion is controlled, this soil is suitable for cultivation, but it is subject to severe erosion if cultivated and not protected. It is also suited to hay, pasture, woods, or wildlife. (Capability unit IIIe-9; woodland suitability group 4; wildlife suitability group 2)

## Montevallo Series

The Montevallo series consists of shallow, stony and gravelly, excessively drained soils that are mostly on steep and very steep hillsides. In uneroded areas these soils have a stony, dark-brown and yellowish-brown surface layer over a very gravelly or shaly silty subsoil. Montevallo soils developed in residuum from acid, shattered siltstone, sandstone, and shale and are naturally acid.

Representative profile:

- 0 to 1 inch, dark grayish-brown, very friable stony silt loam.
- 1 to 4 inches, yellowish-brown, very friable stony silt loam.
- 4 to 15 inches, light yellowish-brown, gravelly or shaly silt loam over interbedded shattered siltstone, shale, and sandstone.

The Montevallo soils have more coarse material in their subsoil than the Muskingum soils. This material is more than 2 millimeters in diameter. The Montevallo soils contain less sand and more silt than the Ramsey soils.

Most areas of these soils are in scrub timber, but a few areas are used for pasture. Plants respond to fertilizer but are affected by lack of moisture.

The Montevallo soils are fairly extensive in Elliott County, but they occur mostly on steep, stony hillsides in close association with the Muskingum and Ramsey soils. They have been mapped only in undifferentiated units with the associated soils. These units are described in alphabetical order in this section.

## Muskingum Series

The soils of the Muskingum series are moderately deep and somewhat excessively drained. They range from gently sloping on narrow ridges to very steeply sloping on hillsides. In uneroded areas they have a brown silt loam surface layer over a slightly finer textured, yellowish-brown subsoil. These soils developed in residuum from acid sandstone, siltstone, and shale and are naturally acid. Stony, nonstony, and rocky Muskingum soils occur in Elliott County.

Representative profile:

- 0 to 2 inches, brown, very friable silt loam.
- 2 to 7 inches, yellowish-brown, very friable silt loam.
- 7 to 24 inches, yellowish-brown, friable silt loam, over shattered siltstone and shale.

These soils occur on valley walls below Wellston and Rarden soils. They are shallower, are more droughty, and have less horizon development than Wellston soils. They are deeper than Montevallo soils and contain less shale and siltstone fragments. They have a deeper, less sandy subsoil than the Ramsey soils and a more yellow, coarser textured subsoil than the Rarden soils. The Muskingum soils are shallower and less productive than the soils below them on toe slopes, terraces, and first bottoms.

The Muskingum soils are the most extensive in the county. In the western part, where the slopes are less steep, the soils are used for tobacco, gardens, and pasture. In the rougher sections of the county and on steeper slopes, these soils are used for trees. Crops and adapted grasses respond well to fertilizer except during periods of drought. The soils are well suited to trees for the production of timber.

In Elliott County, many areas of the Muskingum soils are mapped in a complex with the Ramsey soils or in undifferentiated units with the Montevallo and Ramsey soils.

**Muskingum silt loam, 6 to 12 percent slopes (MkC).**—This is a moderately deep, somewhat excessively drained soil on uplands, mostly on narrow ridges. The soil developed in residuum from mixed acid sandstone, siltstone, and shale. In cultivated areas the surface layer is a mixture of dark-brown and yellowish-brown friable silt loam, and the subsoil is thin, yellowish-brown, friable gravelly silt loam. The depth to rock generally is about 30 inches.

The soil has a moderately deep root zone over shattered rock. The moisture-supplying capacity is moderately low. The soil is naturally acid and has moderately low natural fertility. Crops grown on this soil respond to lime and fertilizer. The soil has moderately rapid permeability,

contains a small amount of organic matter, and is easy to till.

Much of this soil is in rather small areas that are occupied by roads or by fences along farm boundaries. Tobacco and corn are not often grown on these small areas. Many of them are in weeds, bushes, or trees. Occasionally areas of this soil are used for hay, and they produce fair yields of Korean lespedeza, redbud, and timothy. Fair to good pasture of Kentucky 31 fescue is grown, depending upon the season and the amount of fertilizer used.

With proper rotations and erosion control practices, this soil is suitable for cultivation, but it is subject to severe erosion if not protected. It is also suited to hay, pasture, woods, or wildlife. (Capability unit IIIe-7; woodland suitability group 3; wildlife suitability group 2)

## Muskingum-Ramsey Complex

Muskingum and Ramsey soils occupy strongly sloping to moderately steep uplands, mostly in the central and northern parts of the western half of the county. In areas where Muskingum and Ramsey soils are mapped as a complex, they occur in similar positions and generally are intermixed in such an intricate pattern that separation is not practical. The Muskingum soils make up from 50 to 70 percent of the areas mapped as a complex. They are deeper than the Ramsey soils and have a silty subsoil. The Ramsey soils have a loam or fine sandy clay loam subsoil.

Most areas of these complexes are used for pasture and woods; a less extensive acreage is idle. The soils produce profitable pasture of adapted grasses and legumes if adequate fertilizer and lime are applied. They are well suited to the production of timber.

Representative profiles of the Muskingum and Ramsey soils are given in their respective series descriptions. The following are descriptions of two mapping units that are Muskingum-Ramsey complexes.

**Muskingum-Ramsey complex, 12 to 20 percent slopes (MrD).**—This mapping unit consists of excessively drained, shallow soils on hillsides. These soils developed in residuum from interbedded acid sandstone, siltstone, and shale.

The surface layer of the Muskingum soils, where cultivated, is a mixture of dark-brown and yellowish-brown friable silt loam. The subsoil is a thin layer of yellowish-brown, friable silt loam. The depth to bedrock ranges from 20 to 36 inches. Ramsey soils have a fine sandy loam surface layer over a thin loam or light sandy clay loam subsoil. The depth to rock is generally about 18 inches, but it ranges from 14 to 22 inches.

The soils have a root zone that ranges from shallow to deep. Their moisture-supplying capacity is moderately high on cool, north slopes and moderately low on warm, south slopes. The soils are naturally acid, and their natural fertility is moderately low. Crops respond well to lime and fertilizer. Farm machinery can be used, but turning the soil uphill with a moldboard plow is difficult. Water infiltration is rapid, and permeability is moderately rapid. The content of organic matter is low.

If more nearly level soils are lacking, some areas of the soils in this complex are used for tobacco year after year and produce fair yields. Light rains are beneficial during the summer because most of the rain soaks into these soils. Occasionally these soils are used for corn. Many areas, however, are in Korean lespedeza and timothy pasture,

are idle, or are in trees. Some good pasture of Kentucky 31 fescue and ladino clover is produced. These soils should not be used for cultivated crops if more suitable land is available. They are susceptible to very severe erosion if cultivated and not protected. These soils are suitable for meadow, pasture, woods, or wildlife. (Capability unit IVE-4; woodland suitability group 3; wildlife suitability group 2)

**Muskingum-Ramsey complex, 20 to 30 percent slopes (MrE).**—These somewhat excessively drained soils are on moderately steep hillsides. They developed in residuum from acid sandstone, siltstone, or shale.

The surface layer of the Muskingum soils, where cultivated, is a mixture of dark-brown and yellowish-brown, friable silt loam. The subsoil is a thin layer of yellowish-brown, friable silt loam. Depth to bedrock ranges from 18 to 24 inches. Ramsey soils have a fine sandy loam surface layer over a loam or light sandy clay subsoil. They occur on hillsides in narrow bands overlying parent rock that is dominantly sandstone. Their depth to rock ranges from 14 to about 20 inches.

The soils of this complex are susceptible to severe erosion. They have a shallow to moderately deep root zone over shattered rock. Their moisture-supplying capacity is moderately high on cool, north slopes and moderately low on warm, south slopes. The soils are naturally acid, and their natural fertility is moderately low. Crops respond to lime and fertilizer. The slopes of these soils are too steep for easy operation of farm machinery, but a wheel-type tractor can be used with care. The content of organic matter tends to be medium on cool, north slopes and very low on warm, south slopes.

These soils are occasionally used for crops, but the erosion hazard is too high and slopes are too steep for safe or economical cultivation. Many areas are in broomsedge and other wild grasses, or in bushes or trees. Other areas, however, are producing good pasture of Kentucky 31 fescue and Korean lespedeza, and a few acres have been seeded to sericea lespedeza.

Though the erosion hazard is too high for cultivation, these soils can be safely used for pasture, woods, or wildlife. (Capability unit VIe-8; woodland suitability groups 6, 7, and 8; wildlife suitability group 2)

### **Muskingum, Montevallo, and Ramsey Stony Soils**

The Muskingum, Montevallo, and Ramsey stony soils in this undifferentiated group are on steep, upland slopes, mainly in the eastern half of the county. The soils in the three series occur on similar landscape but differ in texture or percentage of rock fragments in their subsoil. In this undifferentiated group the Muskingum soils apparently have the largest acreage, followed in order by the Montevallo and Ramsey, but proportions vary greatly among delineated areas. Soils of all three series do not necessarily occur in each mapped area, but the soils are so nearly alike in steepness and stoniness that separate mapping is not justified.

This undifferentiated group occupies more than 60 percent of the land area of the county. A small acreage is used for pasture or is lying idle, but most of the acreage is in trees. The soils are best suited to growing trees or to

developing wildlife habitats, but pastures of Kentucky 31 fescue can be established in areas that are already cleared and are not severely eroded. These pastures will provide limited grazing. Representative profiles of the Muskingum, Montevallo, and Ramsey soils are given in their respective series descriptions. The following are descriptions of two mapping units of these undifferentiated soils.

**Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes (MvF).**—These somewhat excessively drained, very stony soils are on steep hillsides. They developed in residuum from interbedded bands of acid sandstone, siltstone, and shale.

The Muskingum soils, in wooded areas, have a dark-brown silt loam surface layer, only about 2 inches thick, over yellowish-brown silt loam that is slightly fine textured in the lower part. The Montevallo soils are very gravelly or shaly, especially in the subsoil. The Ramsey soils have a fine sandy loam surface layer over a loam or light sandy clay loam subsoil.

Because of their variable parent material, these soils have a surface layer that ranges from silt loam to fine sandy loam. The depth to rock ranges from 12 to 30 inches, but there are outcrops in a few areas. The texture and stoniness vary within areas that are too small to be separated accurately on a map.

The hazard of erosion is very high on these soils, and their root zone varies in depth. Their moisture-supplying capacity varies considerably from upper to lower slopes and from cool north slopes to warm south slopes. The content of organic matter is medium on north slopes and very low on warm upper slopes and south slopes. The soils are too steep to be farmed with wheel-type tractors, and weeds must be controlled mostly with hand tools or chemicals. A few areas are cleared for pasture, but most areas are in timber.

Clearing these soils for pasture generally is not economical. They are best used for woods or wildlife, but in cleared areas, pastures of Kentucky 31 fescue provide limited grazing. Fertilizing and reseeding are difficult because of the steep slopes. (Capability unit VIIIs-1; woodland suitability groups 6, 7, and 8; wildlife suitability group 3)

**Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes, severely eroded (MvF3).**—The soils of this undifferentiated group are somewhat excessively drained and severely eroded. They are on steep hillsides and have developed in residuum from interbedded bands of acid sandstone, siltstone, and shale. This unit occurs in areas that were once used for crops or pasture.

Except for a thin layer of organic staining, the surface layer of these soils is much like the subsoil. The soils are dominantly yellowish-brown silt loam but range from silt loam to fine sandy loam or loam. They may be shaly or channery, depending upon the extent of erosion and the proportions of sandstone, siltstone, and shale from which they originated. These soils are generally very stony, but the texture and stoniness vary within areas that are too small to be separated accurately on a map. The depth to rock ranges from 6 to 22 inches, depending on the severity of erosion and the amount of material received from hillside creep.

The Muskingum soil, dominant in this mapping unit, is silty. It is deeper and contains fewer shale and silt-

stone fragments than the Montevallo soil. The Ramsey soil is mostly shallow to bedrock and is sandier than either of the other two soils.

The hazard of erosion is very high on soils of this unit. The root zone varies in depth but is no more than moderately deep. The moisture-supplying capacity varies considerably from north to south slopes and from the upper to lower parts of slopes. The slopes are too steep and irregular for use of farm machinery. The content of organic matter is generally very low. Many areas, once cleared for crops or pasture, have been allowed to return to trees. Quite a few areas are idle. The soils are best suited to woods or wildlife. (Capability unit VII-3; woodland suitability group 8; wildlife suitability group 3)

### Pope Series

The soils of the Pope series are well drained and are on first bottoms. These soils have a dark grayish-brown surface layer, darkened mainly by organic matter, and a brown subsoil that is very similar to the surface layer in texture and structure. The Pope soils consist of recent stream alluvium washed from soils that originated from acid sandstone, siltstone, and shale. They are naturally acid.

#### Representative profile:

0 to 8 inches, dark grayish-brown, very friable fine sandy loam.  
8 to 50 inches +, stratified layers of brown, very friable fine sandy loam, silt loam, sandy loam, and gravel.

The Pope soils are on first bottoms with the somewhat poorly drained Stendal and the poorly drained Atkins soils. They are brighter colored, less mottled, and better drained than Stendal and Atkins soils. In drainage, they are similar to the Sequatchie soils on low terraces and to the Barbourville soils on low toe slopes above them. The Pope soils do not have distinct horizons; the Sequatchie and Barbourville soils have weakly developed horizons.

The Pope soils are minor in extent, though they occur in many small areas along the stream flood plains throughout the county. If fertilized, they are highly productive, and many areas are used for corn. Some areas are used for pasture. These soils produce good tobacco crops; but because of occasional flooding during the growing season, they are not generally used for tobacco.

**Pope fine sandy loam, 0 to 3 percent slopes (PfA).**—This is a well-drained soil on first bottoms. It has a dark grayish-brown, very friable fine sandy loam plow layer over a brown fine sandy loam subsoil. The subsoil is very similar to the surface soil, except for organic staining. The surface layer varies in degree of darkness according to the amount of organic matter present. The depth to rock generally is well over 5 feet.

The soil is not wet, but crops are subject to occasional flooding. Erosion is not a hazard. The soil has a deep root zone and a high moisture-supplying capacity. It is naturally acid and has moderate natural fertility. Crops respond well to lime and fertilizer. The soil is very easy to till, has moderately rapid permeability, and contains a small amount of organic matter.

Some farmers get high yields of corn on this soil if they fertilize it heavily, but yields are low without fertilizer. Some areas are planted to Korean lespedeza or red clover

and timothy for hay, and others are in good stands of Kentucky 31 fescue and ladino clover. As the soil is subject to flooding, very little of it is used for tobacco.

This soil is suitable for intensive cropping, as well as for meadow, pasture, woods, or wildlife. (Capability unit I-1; woodland suitability group 1; wildlife suitability group 1)

**Pope fine sandy loam, 3 to 6 percent slopes (PfB).**—This well-drained soil is mostly on the narrow, first bottoms in the deep gorge along the Little Sandy River. The plow layer is dark grayish-brown, very friable fine sandy loam. It is underlain by a brown fine sandy loam subsoil. The depth to rock is more than 5 feet. Slopes in a few areas exceed 6 percent. Most areas of this soil are naturally acid, but near the Carter County line, a small area has been influenced by limestone and is nearly neutral in reaction.

The soil has a deep root zone and a high moisture-supplying capacity. It has moderate natural fertility, and crops respond well to lime and fertilizer. The soil is very easy to till, is rapidly permeable, and contains little organic matter. Crops are sometimes washed out by the swift river current. New material is deposited in some places and scoured away in others as the stream cuts new channels.

Because of the difficulty in getting equipment down into the gorge, many areas of this soil are left in trees or brush. Where roads provide access to these areas, they are used continuously for corn, and yields range from excellent to fair, depending upon the amount of fertilizer used.

This soil is suitable for intensive cropping, but some conservation practices are necessary in places. It is also suited to hay, pasture, woods, or wildlife. (Capability unit IIe-8; woodland suitability group 1; wildlife suitability group 1)

**Pope gravelly fine sandy loam (Pg).**—This somewhat excessively drained soil is on narrow first bottoms, mainly along the smaller streams. The horizons in this soil are more heterogeneous and less stratified than those in Pope soils along the larger streams. The surface layer is generally dark grayish-brown gravelly fine sandy loam or silt loam, and the subsoil is brown gravelly silt loam, loam, or fine sandy loam. The depth to rock ranges from 4 to a little more than 6 feet. Gravel occurs throughout the profile in various amounts.

This soil is not wet, but crops are subject to occasional flooding. Erosion is not a hazard. The soil has a deep root zone and a moderately low moisture-supplying capacity. It is naturally acid and has moderately high natural fertility. Crops respond well to lime and fertilizer. The soil is rapidly permeable and contains a small amount of organic matter. It is somewhat difficult to till because of the gravel.

Corn and tobacco are grown in small patches, and fair to good crops are produced, though they are occasionally damaged by floods. Some areas are idle or in trees. A few areas are in fescue pasture.

This soil is suitable for continuous row cropping. Cover crops, seeded early, help to reduce the droughtiness. The soil is also suited to hay, pasture, woods, or wildlife. (Capability unit IIs-1; woodland suitability group 1; wildlife suitability group 2)

## Ramsey Series

The Ramsey series consists of shallow, sandy, and somewhat excessively drained soils in uplands. These soils are sloping to steep. In uneroded areas they have a dark grayish-brown to grayish-brown fine sandy loam surface layer over a shallow, sandy subsoil. These soils developed in residuum from acid sandstone and are naturally acid.

### Representative profile:

- 0 to 2 inches, very dark grayish-brown, very friable fine sandy loam.
- 2 to 6 inches, grayish-brown, very friable fine sandy loam.
- 6 to 11 inches, brown, friable, light sandy clay loam.
- 11 to 22 inches, yellowish-brown sandy loam over soft, acid sandstone.

In the western part of the county, the Ramsey soils are on the higher ridgetops with the Rarden and Wellston soils. Toward the east, the sandstone rock from which these soils developed is on the hillsides below the ridgetops. On these steep hillsides the Ramsey soils are intermixed with the Muskingum and Montevallo soils. The Ramsey soils are sandier than any of these soils, however, and have less profile development than the Rarden and Wellston soils.

The Ramsey soils are rather extensive but occur in small areas throughout the county. Most areas are in trees, but some are cleared and in pasture. A few acres are used for crops. These soils have low natural fertility, but crops respond to fertilizer except during dry periods. The soils are very easy to till. They warm up early in the spring and therefore are suitable for early garden crops. They produce fair timber.

In Elliott County, many areas of the Ramsey soils are mapped in a complex with the Muskingum soils or in undifferentiated units with the Montevallo and Muskingum soils.

**Ramsey fine sandy loam, 6 to 12 percent slopes (RcC).**—This is a shallow, somewhat excessively drained soil of the uplands. It developed from massive sandstone rock that caps the hills west of Sandy Hook. The surface layer is dark yellowish-brown, friable fine sandy loam, and the subsoil is thin, yellowish-brown sandy clay loam. The depth to rock generally is about 18 inches.

The soil has a shallow root zone over soft sandstone rock. The moisture-supplying capacity is moderately low, the natural fertility is low, and the soil is naturally acid. Crops on this soil respond to lime and fertilizer except in dry seasons. The soil has moderately rapid permeability and contains a small amount of organic matter.

Much of this soil is in wild grass, weeds, brush, or trees, but a few areas produce fair yields of tobacco.

This soil should not be cultivated if more suitable land is available. It is subject to very severe erosion if cultivated and not protected. This soil is suited to hay, pasture, woods, or wildlife. (Capability unit IVE-7; woodland suitability group 3; wildlife suitability group 2)

## Rarden Series

The Rarden series consists of well drained to moderately well drained, gently sloping to strongly sloping soils on uplands. In uneroded areas these soils have a dark-brown, medium-textured surface layer over a reddish, fine-textured subsoil. They developed in residuum from soft, acid clay shale and are naturally acid.

### Representative profile:

- 0 to 5 inches, brown, friable silt loam; weak, granular structure.
- 5 to 8 inches, strong-brown, firm silty clay loam; moderate, angular blocky structure.
- 8 to 21 inches, yellowish-red, sticky and plastic silty clay; strong, angular blocky structure.
- 21 to 30 inches, variegated strong-brown, light-gray, and red, tough and plastic silty clay or clay.
- 30 to 38 inches, highly weathered soft gray shale.

The Rarden soils are mostly on ridgetops along with Ramsey soils. They have a much redder and finer textured subsoil than Ramsey soils and a more distinct horizon development. The Rarden soils also occur on ridgetops with the Wellston soils but have a redder and finer textured subsoil.

The Rarden soils are inextensive and occur mostly in the western part of the county. They have low natural fertility and erode readily. Much of the area is in woods, and the rest is in pasture.

**Rarden silt loam, 5 to 15 percent slopes (RdC).**—This soil is moderately deep, is well drained to moderately well drained, and has a fine-textured subsoil. It has a brown, friable silt loam surface layer over a yellowish-red, sticky and plastic silty clay subsoil. The surface layer is brown silt loam in cultivated areas and dark grayish-brown in wooded areas. The depth to the clay shale ranges from 24 to 48 inches. Included in this mapping unit is a small acreage that is eroded and has a silty clay loam surface layer of brighter color.

The hazard of erosion is moderately high. This soil has a root zone that is moderately deep over shale and a moderately low moisture-supplying capacity, and it is somewhat droughty. The soil is naturally acid and has moderately low natural fertility. Crops respond to heavy applications of lime and fertilizer. The content of organic matter is medium to low. Water enters the soil slowly because of the slowly permeable subsoil; therefore, runoff is somewhat rapid. The soil is easy to till where it is not eroded.

Much of this soil is idle or in trees. A few areas that were once cleared and cropped have been seeded to Kentucky 31 fescue for pasture.

This soil produces fair yields of corn and tobacco, but erosion adversely affects the tilth. The soil can be used for hay, pasture, woods, or wildlife. (Capability unit IVE-7; woodland suitability group 5; wildlife suitability group 2)

## Rock Land

**Rock land (Rk)** is a miscellaneous land type made up mostly of rock outcrops and steep slopes. Rock outcrops occupy 25 to 90 percent of the area. Loose stones and boulders predominate in some areas. All but a few areas of Rock land are on the steep sides of the Little Sandy River Gorge.

Bluffs of bare sandstone rock stand 50 to 75 feet high. Below these bluffs are very steep areas partly covered with stones and large boulders that fell from the bluffs. In the lower part of the gorge there is a thin outcropping of high-grade limestone.

Rock land is too steep and too rocky to be used for anything but timber, and nearly all of it is in timber, including some fine stands of yellow-poplar in the small coves. This land is inaccessible except where gravel

roads have been cut across the gorge at intervals of 5 to 10 miles. Trees are skidded off the steep hills by winches and loaded on trucks in the narrow valley below. (Capability unit VIIs-5; woodland suitability group 8; wildlife suitability group 3)

### Sequatchie Series

The Sequatchie series consists of well-drained, weakly developed, mostly level soils on low terraces. These soils have a dark-brown to dark grayish-brown surface layer over a brown to strong-brown, slightly finer textured subsoil. They developed in general stream alluvium washed from soils derived from acid sandstone, siltstone, and shale. They are naturally acid.

Representative profile:

- 0 to 8 inches, dark-brown to dark grayish-brown, very friable fine sandy loam.
- 8 to 26 inches, brown, friable fine sandy loam.
- 26 to 38 inches, strong-brown, friable sandy clay loam.
- 38 to 48 inches +, dark-brown to yellowish-brown, stratified beds of sand, silt, and some clay.

The Sequatchie soils are on low stream terraces with the moderately well drained to somewhat poorly drained Whitwell soils. They are better drained than the Whitwell soils, however. The Sequatchie soils are on second bottoms slightly above the well-drained Pope soils, the somewhat poorly drained Stendal soils, and the poorly drained Atkins soils, all of which are on first bottoms.

The Sequatchie soils are not extensive, although they occur in many rather small areas along streams. These soils are very productive if fertilized, and they are highly desirable for tobacco, corn, and other crops because they are not flooded so often as soils on first bottoms. The Sequatchie soils are used mostly for row crops. A few areas are used for pasture.

**Sequatchie fine sandy loam, 0 to 4 percent slopes (SfA).**—This well-drained soil is on low stream terraces. It has a dark-brown to dark grayish-brown surface layer over a brown to strong-brown, slightly finer textured subsoil. In a few places the plow layer is very dark grayish brown and the subsoil is yellowish brown or dark yellowish brown. The depth to rock is well over 5 feet.

Erosion is not a hazard, and the soil is not wet. This soil has a deep root zone and a high moisture-supplying capacity. It is naturally acid and has moderately low natural fertility. Crops respond well to lime and fertilizer. The permeability is moderately rapid, and the content of organic matter is medium to low. The plow layer is very easy to till.

This soil is preferred for tobacco over soils on first bottoms because it is not flooded so often. Excellent yields of tobacco and corn are produced if the soil is heavily fertilized. Yields are much lower, however, without fertilizer. Korean lespedeza and timothy, Korean lespedeza alone, red clover and timothy, or ladino clover and Kentucky 31 fescue are grown for hay. Little, if any, alfalfa is grown.

This soil is suitable for intensive cropping if it is well managed. It is also suitable for hay, pasture, woods, or wildlife. (Capability unit I-1; woodland suitability group 1; wildlife suitability group 1)

### Stendal Series

The soils of the Stendal series are on first bottoms and are somewhat poorly drained. They have a brown or dark grayish-brown surface layer over a mottled subsoil. The subsoil is dominantly gray below 24 inches. These soils formed in recent alluvium washed from soils that originated from acid sandstone, siltstone, and shale. They are therefore naturally acid.

Representative profile:

- 0 to 5 inches, brown, friable silt loam.
- 5 to 18 inches, dark grayish-brown, friable silt loam; fine, distinct, gray mottles.
- 18 to 24 inches, brown, friable silt loam mottled with grayish brown.
- 24 to 48 inches +, light brownish-gray silt loam highly mottled with brown.

The Stendal soils are on first bottoms with the well-drained Pope and somewhat poorly drained Atkins soils. They are more poorly drained than the Pope soils, however, and are better drained than the Atkins soils. They have slightly poorer drainage than the moderately well drained to somewhat poorly drained Whitwell soils on low terraces and the Cotaco soils on low toe slopes. The Stendal soils have little or no horizon development, but the Whitwell and Cotaco soils have weakly developed horizons.

The Stendal soils are moderately extensive. They occur in rather small depressions scattered throughout the stream flood plains. They are productive soils if drained and fertilized, but they are subject to occasional flooding. Many areas have been tile drained and are now used for corn. The rest of the areas are used mostly for pasture; some are used as woodland.

**Stendal fine sandy loam (Sd).**—This is a somewhat poorly drained soil on first bottoms. It has a brown fine sandy loam surface layer over a mottled brown and gray fine sandy loam or sandy clay loam subsoil that becomes dominantly gray below about 2 feet. The depth to rock is generally more than 5 feet.

Erosion is not a hazard, but the soil is moderately wet. The wetness can be reduced by tile drainage, but crops are subject to occasional flooding. The soil has a deep root zone and a high moisture-supplying capacity. It is naturally acid and has moderately low natural fertility. Crops respond well to lime and fertilizer if the soil is drained. This soil has moderately rapid permeability, contains a small amount of organic matter, and is very easy to till when dry. Plants are damaged in places by a high water table.

Some areas of this soil have been drained and are producing fair to good yields of corn or hay. Only a small acreage of tobacco is grown. Ladino clover and Kentucky 31 fescue are used for hay and pasture, but undrained areas produce low yields. Many areas of this soil are in moisture-tolerant grasses or in bushes or trees.

This soil is suitable for intensive cropping if it is drained, but wetness limits the choice of plants even after drainage. The soil can be used for meadow, pasture, woods, or wildlife. (Capability unit IIw-4; woodland suitability group 2; wildlife suitability group 2)

**Stendal gravelly fine sandy loam (Sg).**—This is a somewhat poorly drained soil on first bottoms, mostly in narrow valleys along the smaller streams. The surface layer is brown gravelly fine sandy loam. The subsoil is fine sandy loam or gravelly sandy clay loam. It is mottled

brown and gray, but it becomes dominantly gray at a depth of about 24 inches. The depth to rock is generally more than 5 feet. Included in this mapping unit are a few areas in which the surface layer is gravelly silt loam.

Erosion is not a hazard, but the soil is moderately wet. Although the wetness can be reduced by tile drainage, crops are subject to occasional flooding. The soil has a deep root zone and a moderately high moisture-supplying capacity. It is naturally acid and moderately low in natural fertility. Crops respond well to lime and fertilizer if the soil is drained. The soil has moderately rapid permeability and contains a small amount of organic matter. The surface layer is somewhat difficult to till because of the gravel. Plants are damaged in places by a high water table.

Because this soil is in narrow valleys, it is generally left in trees or pasture, or it is used for the same purpose as the hillsides above. Corn is grown in a few small patches where drainage has been improved. Yields are low, however, if the soil is not fertilized or drained. Swampgrass, wiregrass, and other wild, moisture-tolerant plants grow on patches of this soil.

This soil is suitable for intensive cropping if it is properly drained, but the wetness somewhat limits the choice of plants, even after drainage. The soil can also be used for meadow, pasture, woods, or wildlife. (Capability unit IIw-4; woodland suitability group 2; wildlife suitability group 2)

**Stendal silt loam (St).**—This somewhat poorly drained soil is on first bottoms, mostly along major streams. It has a brown silt loam surface layer over a mottled gray and brown silt loam subsoil that becomes grayer with depth. The depth to rock is generally more than 5 feet.

There is no erosion hazard, but the soil is moderately wet. Although the wetness can be reduced by tile drainage, crops are still subject to occasional flooding. The soil has a deep root zone and a very high moisture-supplying capacity. It is naturally acid and has moderate natural fertility. Crops respond well to lime and fertilizer after drainage. The soil is easy to till, is moderately permeable, and contains a medium to small amount of organic matter. Plants are damaged in places by a high water table.

Many areas of this soil have been tile drained, and good to very good yields of corn are produced if lime and fertilizer are applied. A small amount of tobacco is grown on less wet areas. Some fields are used for hay or pasture, and others are left in trees or bushes. Kentucky 31 fescue and ladino clover or Korean lespedeza make good hay and pasture, but undrained areas produce low yields. Some areas are in wild, moisture-tolerant plants or in trees.

This soil is suitable for intensive cropping if it is properly drained, but the wetness somewhat limits the choice of plants, even after drainage. The soil can also be used for meadow, pasture, woods, or wildlife. (Capability unit IIw-4; woodland suitability group 2; wildlife suitability group 2)

## Tyler Series

The soils of the Tyler series are somewhat poorly drained. They are in depressions or nearly level areas on stream terraces. They have a dark grayish-brown surface layer over a mottled light yellowish-brown subsoil,

underlain by a fragipan at a depth of 16 to 24 inches. These soils developed in old stream alluvium that originated from sandstone, siltstone, and acid shale. They are naturally acid.

### Representative profile:

- 0 to 7 inches, dark grayish-brown, friable silt loam; commonly faintly mottled.
- 7 to 15 inches, mottled light yellowish-brown, friable silt loam.
- 15 to 20 inches, highly mottled gray and light yellowish-brown, friable silt loam; compact and brittle in places.
- 20 to 36 inches, highly mottled light-gray silt loam fragipan that is brittle and compact.

The Tyler soils are on high terraces with the well drained Allegheny and the moderately well drained Monongahela soils but are less well drained than those soils.

These inextensive soils are mostly on the flats above the sandstone cliffs of the Little Sandy River Gorge. Because of their somewhat poor drainage, they are only moderately productive. Drainage is difficult because of the fragipan. These soils are sometimes used for row crops, but are more often used for pasture. A few areas are in woods.

**Tyler silt loam (Ty).**—This is a somewhat poorly drained soil on stream terraces. It has a dark grayish-brown surface layer over a mottled light yellowish-brown subsoil. It is underlain by a fragipan at a depth of 16 to 20 inches. The depth to rock is generally more than 5 feet. Included in this mapping unit are a few areas of more poorly drained soil that is grayer than normal and has a fragipan at a shallower depth.

This soil is moderately wet, and tile drainage is not generally feasible because of the compact fragipan. Runoff is slow, and water stands in depressions after heavy rains. The root zone is moderately deep to shallow; therefore, the moisture-supplying capacity is only moderately high. The soil is naturally acid and has moderately low natural fertility. Crops respond to lime and fertilizer if the soil is drained. Permeability is moderate above the fragipan but slow in it. The soil has a low content of organic matter but is easy to till when the moisture is right.

Though a few areas remain in trees, most areas are used for hay or pasture consisting of Kentucky 31 fescue and ladino clover. A few areas are used for corn, and some are used for tobacco, but yields are generally low.

Erosion is not a hazard on this soil, but wetness severely limits the choice of plants. (Capability unit IIIw-1; woodland suitability group 2; wildlife suitability group 2)

## Wellston Series

The Wellston series consists of well-drained, gently sloping soils of the uplands. The uneroded areas have a brown surface layer over a slightly finer textured, yellowish-brown to strong-brown subsoil. These soils developed in residuum from acid siltstone and interbedded sandstone and shale, and they are naturally acid.

### Representative profile:

- 0 to 10 inches, brown friable silt loam.
- 10 to 19 inches, strong-brown, firm silty clay loam.
- 19 to 24 inches, yellowish-brown silty clay loam faintly mottled or variegated in places.
- 24 to 32 inches, variegated strong-brown and light yellowish-brown silty clay loam in which very highly weathered pieces of shale and sandstone are scattered.

The Wellston soils are on gently sloping hilltops with the Rarden soils but above the steeper Muskingum soils. They have a coarser textured and less red subsoil than the Rarden soils, and they are deeper and have more distinct horizons than the Muskingum soils.

The Wellston soils are inextensive and occur in widely scattered, small areas on the broader ridges. They are very productive if fertilized. Because level land is scarce, these soils are very important to farmers for growing row crops. Much of the acreage is used for tobacco and gardens.

**Wellston silt loam, 2 to 6 percent slopes (WnB).**—This is a moderately deep, well-drained soil of the uplands. It has a brown surface layer over a slightly finer textured, strong-brown subsoil, but in wooded areas, the top 2 inches of surface soil is very dark grayish brown. The depth to rock ranges from 28 to 36 inches.

The hazard of erosion is moderately low on this soil. It has a moderately deep root zone over shattered rock, and the moisture-supplying capacity is high. The soil is naturally acid and has moderate natural fertility. Crops respond well to lime and fertilizer. Permeability is moderate, and the content of organic matter is medium to low. The plow layer is easy to till.

This soil is well suited to tobacco and to gardens. If heavily fertilized, it produces excellent yields except in very dry seasons. The soil occurs in small areas, many of which are divided by county roads and fences along farm boundaries. These smaller areas are often used for pasture or woods.

This soil is suitable for somewhat intensive cultivation but is subject to moderate erosion if runoff is not controlled. (Capability unit IIe-1; woodland suitability group 3; wildlife suitability group 1)

**Wellston silt loam, 6 to 12 percent slopes (WnC).**—This is a moderately deep, well-drained soil of the uplands. It has a brown surface layer, over a slightly finer textured, strong-brown subsoil. In eroded places the plow layer is lighter in color because it has been mixed with the subsoil. The depth to rock ranges from about 20 to 30 inches.

The hazard of erosion is moderate. The soil has a high moisture-supplying capacity and a moderately deep root zone that overlies shattered rock. It is naturally acid and has moderate natural fertility. Crops respond well to lime and fertilizer. The soil is moderately permeable, contains a medium to low amount of organic matter, and is easy to till.

Because better soils are scarce, this soil is used permanently for tobacco and gardens. Yields are good if the soil is properly managed and fertilized. Some areas support good stands of Kentucky 31 fescue, and some are in trees.

This soil is suitable for limited cultivation, but it is subject to severe erosion if cultivated and not protected. It is also suited to hay, pasture, woods, or wildlife. (Capability unit IIIe-7; woodland suitability group 3; wildlife suitability group 1)

## Whitwell Series

The Whitwell series consists of somewhat poorly drained to moderately well drained, low-lying soils on stream terraces. These soils are nearly level and have

weakly developed horizons. They have a dark grayish-brown surface layer over a mottled dark yellowish-brown to yellowish-brown subsoil that is more mottled and gray with depth. The subsoil is only slightly finer textured than the surface layer. These soils consist of general stream alluvium washed from soils derived from acid sandstone, siltstone, and shale. They are naturally acid.

Representative profile:

- 0 to 7 inches, dark grayish-brown, very friable loam.
- 7 to 18 inches, dark yellowish-brown, mottled, friable loam.
- 18 to 30 inches, yellowish-brown, highly mottled, friable sandy clay loam.
- 30 to 50 inches, light brownish-gray, mottled sandy clay loam or loam.

The Whitwell soils are on low stream terraces with the Sequatchie soils but are less well drained. They are on second bottoms slightly above the well-drained Pope, the somewhat poorly drained Stendal, and the poorly drained Atkins soils, all of which are on first bottoms. The Whitwell soils are intermediate in drainage between the moderately well drained Monongahela soils and the somewhat poorly drained Tyler soils on the higher terraces. They have less horizon development than those soils and do not have a fragipan.

The Whitwell soils are inextensive, though they occur in many small, widely scattered areas along the main streams. They are quite productive if drained and treated with lime and fertilizer. Most areas are used for corn, but some are in pasture.

**Whitwell loam (Wh).**—This is a somewhat poorly drained to moderately well drained soil on low stream terraces. It has a dark grayish-brown surface layer over a mottled dark yellowish-brown or yellowish-brown subsoil. The subsoil has gray mottles that increase with depth; it is dominantly gray below a depth of about 24 inches. The depth to rock is generally more than 5 feet.

This soil is slightly to moderately wet, and water sometimes stands on the surface for short periods after heavy rains. The wetness can be corrected to a great extent by drainage. The soil has a deep root zone and a very high moisture-supplying capacity. It is naturally acid and has moderate natural fertility. Crops respond well to lime and fertilizer if the soil is drained. This soil is moderately permeable, contains a medium to low amount of organic matter, and is easy to till when the moisture is right. It is not flooded so frequently as soils on first bottoms.

Drained areas of this soil are used for gardens, tobacco, and hay or pasture. Yields are often low because of wetness and improper management. A few areas support good stands of Kentucky 31 fescue and ladino clover, but some areas are in wild, moisture-tolerant plants, bushes, or trees.

This soil is suitable for intensive cultivation, but wetness somewhat limits the choice of plants, even after drainage. The soil can be used for hay, pasture, woods, or wildlife. (Capability unit IIw-4; woodland suitability group 1; wildlife suitability group 1)

## Use and Management of Soils

This section discusses the use and management of soils for crops and pasture, woodland, wildlife, and engineering.

## Crops and Pasture

This subsection is a guide to the management of soils in Elliott County for crops and pasture. It does not suggest specific management for individual soils or give detailed information about management. The information in this section is based on experimental work and field trials on soil fertility, crop varieties, predictions of soil losses, drainage, rainfall characteristics affecting erosion in different areas of the country, and other factors affecting crops and pasture. This experimental work was done by the Kentucky Agricultural Experiment Station and by the Soil Conservation Service and the Agricultural Research Service of the U.S. Department of Agriculture. More detailed information can be obtained from the local staff of the Soil Conservation Service, the Agricultural Extension Service, or the Agricultural Experiment Station.

### Principles of soil management

Soils differ in such properties as slope, texture, depth to rock, fertility, and wetness and therefore are suited to different crops and require different management. Each farm has its own soil pattern and its own management problems. Some general principles of farm management, however, apply to all farms. Other principles apply only to specific soils and crops. This subsection of the report presents general principles of soil management that may be applied to the agriculture of Elliott County. Specific problems in managing certain groups of soils are described in the subsection "Use and management of soils by capability units."

*Fertility.*—Most soils in Elliott County are naturally acid, low in organic matter, and medium to low in basic plant nutrients. Crops generally respond well to additions of lime and fertilizer.

This report gives only general information about fertilizer and lime. Any detailed suggestion on use of lime and fertilizer should be based on laboratory analysis of a soil sample and should take into account a number of other factors including the crops to be grown, the past cropping history, and the level of yield desired.

The soil map can be used as a guide for taking soil samples. A sample for laboratory testing should consist of a single soil type, and each sample should represent no more than 10 acres. The county agricultural extension agent or a member of the Soil Conservation Service staff can give information about soil sampling for fertilizer tests.

*Maintenance of organic matter.*—Organic matter helps maintain good tilth in the surface layer and is also an important source of nitrogen for crops. The soils of Elliott County have never contained much organic matter, and attempting to build up large amounts of organic matter in them is not economical. Maintaining a constant supply, however, is important.

Organic matter can be maintained by adding farm manure, by leaving plant residue on the soil, and by increasing the topgrowth and root system of plants. Thus, applying lime and fertilizer increases crop yields and also helps to maintain a supply of organic matter.

*Tillage.*—The two major purposes of tillage are to prepare a seedbed and to control weeds. Planting, cultivating, and harvesting operations usually tend to destroy the structure of the soil. Therefore, overcultivating the soils

should be avoided. Adding organic matter and growing sod cover crops and green-manure crops help to restore the structure of the soil.

Some of the clayey soils puddle during the heavy rains. Puddling seals the surface and reduces water infiltration, thereby increasing runoff and erosion. Water infiltration can be increased and runoff and erosion decreased by the use of tillage implements that stir the surface layer and leave crop residue on top. This practice helps protect the surface from beating rain and thus retards puddling. In addition, the mulch provided by crop residue helps control the loss of water through evaporation.

Soils that are high in content of clay become cloddy unless they are cultivated within a narrow range of moisture content.

A compacted layer often forms just below plow depth in some soils that are plowed frequently to the same depth. This is often called a plowpan or plowsole. This compacted layer can be avoided if more sod crops are grown or if the depth of plowing is changed slightly from time to time.

*Control of soil and water.*—All of the sloping soils in Elliott County are subject to erosion if they are cultivated. Sheet erosion removes surface soil, which generally contains a larger proportion of organic matter and plant nutrients than the subsoil. Gullies form in areas that receive a concentrated flow of water if erosion is not controlled. Some severely gullied areas in the county are no longer suitable for crops.

On soils subject to erosion, excessive losses of soil and water generally occur when a cultivated crop is growing. For this reason a cropping sequence should be used that, in combination with other needed practices, will reduce the loss of soil and water to a minimum. Other practices that control erosion are (1) tilling on the contour, (2) constructing field and diversion terraces, (3) stripcropping, (4) establishing grassed waterways, (5) keeping tillage to a minimum, (6) leaving crop residue on the surface, (7) growing cover crops, and (8) applying fertilizer.

Effective combinations of erosion control practices vary for different kinds of soils. Also, several combinations may be equally effective on the same soil. In determining what practices or combinations of practices will be effective on a specific soil, farmers should consider the following factors: (1) The relative total effectiveness of each of the practices used to control erosion; (2) the degree of the erosion hazard; (3) the eroding characteristics of rainstorms and their distribution during the year; (4) the length and steepness of slopes; and (5) the average annual loss of soil that can be tolerated.

All of the factors except the first are dependent upon the kinds of soil or the climate and therefore do not vary appreciably for any one kind of soil. But the practices that control erosion can be applied singly or in combination according to the degree of the erosion hazard and the desires of the farmer. For example, suppose that soil loss could be kept within permissible limits by a crop sequence of row crop-meadow-meadow, plus applications of fertilizer that would bring high yields, without any other practices. If a farmer, however, wanted to use a shorter crop sequence, such as row crop-meadow, he would also have to use one or more of the other practices, such as contour tillage, terraces, or minimum tillage.

Representatives of the Soil Conservation Service can assist farmers in selecting the proper combination of practices that will control erosion on their farms.

*Drainage.*—Yields of most crops, especially cultivated crops, can be increased on wet land by the removal of excess water. Excess moisture prevents seedbed preparation at the correct time and hence delays planting; also, it may cause an unhealthy environment for roots of most common crops, or it may drown out the crops.

The most common method of removing excess water is by open ditches. A more expensive and, in some areas, more satisfactory method is by tile drains.

Soils that have a fragipan are difficult to drain. Even if they are drained, the pan may still prevent high yields of deeper rooted crops, such as corn. Wet soils that are deep and permeable, such as the Atkins and Whitwell, generally are very productive after drainage if they are well fertilized and limed. A drainage system of ditches or tile cannot be installed, however, unless an outlet is available. Local representatives of the Soil Conservation Service can assist farmers in planning a drainage system.

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

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry. Subclass *c* is not applicable to soils in Elliott County.

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 limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, which are 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-5. They are part of a statewide capability system, and therefore the capability units for each county may not be numbered consecutively.

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 and reclamation that would change the slope, depth, or other characteristics of the soil.

Capability classes, subclasses, and units in this county are described in the list that follows.

**Class I.** Soils that have few limitations that restrict their use. (No subclasses)

Capability unit I-1.—Nearly level, well-drained soils on first bottoms and low terraces.

**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.

Capability unit IIe-1.—Gently sloping, well-drained soils on uplands and along stream terraces.

Capability unit IIe-3.—Gently sloping, well-drained, gravelly soil.

Capability unit IIe-7.—Gently sloping, moderately deep, moderately well drained soils that have a fragipan.

Capability unit IIe-8.—Gently sloping, well-drained soil on first bottoms.

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

Capability unit IIw-3.—Gently sloping, moderately well drained to somewhat poorly drained soil.

Capability unit IIw-4.—Nearly level, somewhat poorly drained to moderately well drained soils.

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

Capability unit IIs-1.—Nearly level gravelly, somewhat excessively drained soil 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.

Capability unit IIIe-1.—Deep, sloping, well-drained soils.

Capability unit IIIe-5.—Deep, sloping, well-drained, gravelly soils.

Capability unit IIIe-7.—Moderately deep, sloping, well-drained to somewhat excessively drained soils.

Capability unit IIIe-9.—Sloping, moderately well drained soil that has a fragipan.

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

Capability unit IIIw-1.—Somewhat poorly drained soil that has a fragipan.

Capability unit IIIw-5.—Poorly drained soil on first bottoms.

Subclass IIIs. Soils that have severe limitations of moisture capacity or tilth.

Capability unit IIIs-1.—Excessively drained sandy soil on bottom lands.

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.

Capability unit IVe-4.—Strongly sloping, well-drained and somewhat excessively drained soils.

Capability unit IVe-7.—Sloping soils that are somewhat droughty.

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

Class VI. Soils that have such severe limitations that they are generally unsuitable for cultivation and are limited in use largely to pasture, woodland, or wildlife food and cover.

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

Capability unit VIe-8.—Moderately steep, well-drained to somewhat excessively drained soils.

Class VII. Soils that have such severe limitations that they are unsuitable for cultivation without major reclamation, and their use is restricted largely to woodland, pasture, or wildlife.

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

Capability unit VIIe-4.—Gullied land.

Subclass VIIs. Soils very severely limited by moisture capacity, rockiness, shallowness, or other soil features.

Capability unit VIIs-1.—Very stony, steep soils.

Capability unit VIIs-3.—Severely eroded soils that are very shallow, very stony, and steep.

Capability unit VIIs-5.—Rock land.

Class VIII. Soils and landforms that have limitations that, without major reclamation, 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 Elliott County.)

### **Use and management of soils by capability units**

The soils of Elliott County have been placed in 22 capability units. The soils in each unit are listed, suitable crops are given, and management is suggested.

The cropping systems and practices suggested are only examples. For each capability unit, there are often many combinations of practices that can be followed. Among the factors that affect farming practices are (1) the length, degree, and type of slope, (2) the size and type of farm, (3) the number, acreage, and kinds of soils in other capability units on the farm, (4) the size and location of soil areas, (5) the likes and dislikes of the farmer, (6) the equipment, labor, and markets available, (7) the value of crops, and (8) the costs of production. A more exact

farming system can be planned after on-site inspection. Representatives of the Soil Conservation Service can give assistance.

#### **CAPABILITY UNIT I-1**

This capability unit consists of nearly level, well-drained soils on first bottoms and low terraces. The soils are—

Pope fine sandy loam, 0 to 3 percent slopes.

Sequatchie fine sandy loam, 0 to 4 percent slopes.

These soils have a high yield potential, and only slight limitations restrict their use. They are not subject to erosion. They have a deep root zone and a very high moisture-supplying capacity. They have moderately high natural fertility and are acid. Crops on these soils respond well to lime and fertilizer. The soils are easy to till, have moderately rapid permeability, and contain a medium amount of organic matter. The two soils are very similar, except that the Sequatchie is on low terraces and is less apt to be flooded than the Pope, which is on first bottoms.

Under good management, these soils produce excellent yields of corn. They also produce excellent yields of tobacco, but there is some risk of flooding and diseases, especially on the Pope soil. Excellent late summer garden or truck crops can be grown on these soils. They are suited to all the grasses and legumes normally grown in the county. Flooding early in spring, however, may prevent the growth of winter grain. Grasses well suited to these soils are Kentucky bluegrass, smooth bromegrass, Kentucky 31 fescue, orchardgrass, reedtop, reed canarygrass, and timothy. Alfalfa is also well suited. Lime and fertilizer should be applied as indicated by soil tests and according to plant needs.

These soils can be used continuously for corn and other crops, and they are well suited to meadow, pasture, or woodland, or as wildlife habitats. Proper arrangement of rows on these soils helps to prevent concentration of surface water. Streams on the first bottoms require channel improvements in some places. If corn is grown continuously, organic matter can be maintained and the soil structure improved by growing a summer green-manure crop occasionally.

#### **CAPABILITY UNIT IIe-1**

Capability unit IIe-1 consists of gently sloping, well-drained soils on terraces along streams and on upland ridgetops. The soils are—

Allegheny loam, 2 to 6 percent slopes.

Wellston silt loam, 2 to 6 percent slopes.

These soils have a high potential yield, but they are subject to erosion if cultivated and not protected. They have a deep to moderately deep root zone, a very high to high moisture-supplying capacity, and moderate natural fertility that is easy to build up. These soils are easy to till, have moderately rapid permeability, and contain a medium to small amount of organic matter. They are naturally acid.

These soils produce excellent crops of tobacco and corn under good management. They are well suited to Kentucky 31 fescue and ladino clover, but their fertility must be built up for alfalfa or bluegrass.

The Allegheny soil dries out early in spring and is therefore especially suited to lettuce, peas, sweet corn, and other cool-season vegetables. Both soils in this unit are well suited to garden or truck crops.

Cultivation of these soils is limited chiefly by risk of erosion. The hazard varies with the length of the slopes. On short slopes, row crops can be grown continuously if contour tillage and grassed waterways are used and a cover crop is grown. On slopes of moderate length, erosion can be controlled by the following rotation practiced in combination with contour tillage: 1 year of a row crop, 1 year of a small grain, and 2 years of grasses and legumes. On moderately long slopes, a 4-year rotation can be used along with stripcropping and grassed waterways. Slopes of any length can be used continuously for row crops without damage from erosion if they are protected by terraces, grassed waterways, contour tillage, and cover crops.

The soils in this unit can also be used safely for meadow, pasture, woods, or wildlife.

#### CAPABILITY UNIT IIe-3

Barbourville gravelly loam, 2 to 6 percent slopes, is the only soil in this capability unit. It is a gently sloping, well-drained, gravelly soil on foot slopes and alluvial fans.

This soil has a high yield potential but is subject to erosion if cultivated and not protected. The soil is also somewhat difficult to till because of gravel. It has a deep root zone and high moisture-supplying capacity. The soil is naturally acid and is moderate in natural fertility. Crops respond well to lime and fertilizer. The soil has moderately rapid permeability and contains a medium to small amount of organic matter.

Under good management that includes building up fertility, this soil produces excellent crops of tobacco and corn. Farmers choose this soil for tobacco and gardens because it is less likely to be flooded than soils on first bottoms, and it produces nearly as well. It is well suited to such plants as Kentucky 31 fescue and ladino clover, but fertility must be built up to produce lasting stands of alfalfa or bluegrass. The soil is well suited to garden or truck crops. Potatoes and other midsummer and fall vegetables grow well.

Cultivation of this soil is limited chiefly by the risk of erosion. Because most slopes are short, the soil generally can be used continuously for row crops if a winter cover crop, contour tillage, and grassed waterways are used. On longer slopes a rotation should be used, or the slopes should be terraced. Diversion channels are commonly needed above this soil to control runoff from the hillsides above. The gravel interferes with cultivation, especially when plants are young. The soil is somewhat difficult to till with large equipment, and hand cultivation is often required near young plants.

This soil is also well suited to meadow, pasture, woods, or wildlife.

#### CAPABILITY UNIT IIe-7

This capability unit consists of gently sloping, moderately deep, moderately well drained soils on stream terraces. The soils are—

- Monongahela fine sandy loam, 2 to 6 percent slopes.
- Monongahela silt loam, 2 to 6 percent slopes.

These soils are subject to moderate erosion if they are cultivated and not protected. They are slightly wet and have a moderately deep root zone over a fragipan. Their moisture-supplying capacity is moderately low. Their

fertility is also moderately low but can be easily built up. Above the fragipan these soils are moderately permeable, but water and air move slowly through the fragipan. The content of organic matter is low. These soils are naturally acid and have a moderately low yield potential. Crops respond well to applications of lime and fertilizer. The soils are easy to till, except early in spring when they are likely to be wet.

If they are drained and otherwise well managed, these soils produce good yields of corn and tobacco. They are better suited, however, to Kentucky 31 fescue, ladino clover, Korean lespedeza, and other plants that are tolerant to excessive moisture and slight droughtiness. Alfalfa and other deep-rooted plants do not live long on these soils. Garden crops are usually late because of wetness in spring, and are affected to some extent by drought later in the growing season.

The hazard of erosion somewhat limits the use of these soils; it varies, however, with the length of slope. On short slopes row crops can be grown continuously if erosion is controlled by contour tillage, grassed waterways, and cover crops. On slopes of moderate length, a rotation can be used that consists of 1 year of a row crop, 1 year of a small grain, and 2 years of grasses and legumes, if erosion is controlled by contour tillage and grassed waterways. Moderately long slopes can be farmed in a 4-year rotation along with stripcropping and grassed waterways. Slopes of any length can be farmed continuously if erosion is controlled by terraces, grassed waterways, contour tillage, and cover crops.

Drainage can be improved on these soils by terraces. If tile drainage is attempted, careful on-site inspection of the compact layer, or fragipan, should first be made. The fragipan generally is at a depth of about 18 inches, but the depth varies. Also, the fragipan is more compact, more brittle, and thicker in some places than in others. In a few places, drainage can be improved by interceptor tile drains on slopes above these soils. Proper arrangement of rows and careful plowing help prevent concentration of surface water.

These soils are well suited to meadow, pasture, woods, or wildlife.

#### CAPABILITY UNIT IIe-8

Pope fine sandy loam, 3 to 6 percent slopes, is the only soil in this capability unit. It is a gently sloping, well-drained soil on first bottoms.

This soil has a high yield potential but is subject to damage from scouring and deposition. It has a deep root zone, a high moisture-supplying capacity, and moderately high natural fertility that is easy to build up. It is naturally acid but can be neutralized by lime. The soil is easy to till, has moderately rapid permeability, and contains a medium amount of organic matter.

This soil produces excellent yields of corn and tobacco but is subject to scouring by rapidly flowing streams. It is suited to all the grasses and legumes normally grown in the county, except winter grain, which may be damaged by flooding early in spring.

Row crops can be grown continuously on areas that are protected from scouring. Stream-channel improvements are often necessary to prevent the banks from breaking during the flood stage. Reed canarygrass and Kentucky 31 fescue withstand scouring.

Many areas of this soil are in the Little Sandy River Gorge where there are few State and county roads. Farm roads down the cliffs to this soil are very expensive to build and maintain, and they often last only one season before they are washed out. Consequently, the use of this soil is somewhat limited.

#### CAPABILITY UNIT IIw-3

Cotaco gravelly loam, 2 to 6 percent slopes, is the only soil in this capability unit. It is a gently sloping, moderately well drained to somewhat poorly drained soil on toe slopes and alluvial fans.

The soil is slightly wet to wet, but this can be partly corrected by tile drains or diversion channels. Wetness somewhat limits the choice of plants, however, even after drainage. The hazard of erosion is moderately low. This soil has a deep root zone and a very high moisture-supplying capacity. It is naturally acid and is moderately low in natural fertility. If the soil is drained, crops respond well to lime and complete fertilizer. This soil has moderately rapid permeability and contains a medium to small amount of organic matter. In many areas gravel interferes with tillage to a moderate extent, and hand cultivation may be necessary near young plants.

This soil produces good yields of corn and tobacco under good management that includes proper drainage and fertilizing. There is a slight risk of scalding or disease in tobacco crops. A few areas are subject to flooding. Undrained areas of this soil are best suited to Kentucky 31 fescue, reed canarygrass, ladino or alsike clover, and other plants tolerant to wetness. Garden crops are late because the soil is wet in spring. Fall vegetables are better suited to this soil than early vegetables.

Tile or diversion drains placed on areas above this soil are effective in intercepting water from adjoining hillsides. Wetness in alluvial fans is often caused by water that is blocked in the channel that drains the narrow valley behind this soil. The perched water table thus formed seeps out in the soil. In many cases, removing the water in the valley eliminates the wetness.

Most slopes are short. Therefore, erosion generally can be controlled by contour tillage and grassed waterways, even if the soil is used continuously for cultivated crops.

This soil can be used safely for meadow, pasture, woods, or wildlife.

#### CAPABILITY UNIT IIw-4

This capability unit consists of nearly level, somewhat poorly drained to moderately well drained soils on first bottoms and low stream terraces. The soils are—

- Stendal fine sandy loam.
- Stendal gravelly fine sandy loam.
- Stendal silt loam.
- Whitwell loam.

These soils have a moderately high yield potential. They are moderately wet, but this can be partly corrected by drainage. Wetness somewhat limits the choice of plants, however, even after drainage. These soils have a deep root zone, a very high moisture-supplying capacity, and moderate natural fertility. They are naturally acid but can be neutralized by lime. The soils are moderately permeable and contain a small amount of organic matter. They are all easy to till, except Stendal gravelly fine sandy loam, which contains some gravel.

These soils produce good yields of corn if they are drained, fertilized, and otherwise well managed. As they are subject to flooding, they are not suited to tobacco. Undrained areas are best suited to Kentucky 31 fescue, reed canarygrass, ladino or alsike clover, and other moisture-tolerant plants. If the soils are drained and well managed, they produce stands of alfalfa that last for short periods.

Diversion channels are often needed between the bottoms and the hillsides to control surface water. Where suitable outlets are available, these soils can be drained by tile, but the tile lines must be maintained. Proper arrangement of rows and careful plowing help prevent concentration of surface water in places. If corn is grown continuously, organic matter and soil structure can be improved by occasionally growing a summer green-manure crop of soybeans or sudangrass.

These soils require drainage for sustained high yields of row crops. Without drainage, they can be used for meadow, pasture, woods, or wildlife.

#### CAPABILITY UNIT IIe-1

Pope gravelly fine sandy loam is the only soil in this capability unit. It is a nearly level, gravelly, somewhat excessively drained soil on first bottoms.

This soil has a moderately high potential yield, but it is somewhat difficult to till because of the gravel. It has a deep root zone and a moderately low moisture-supplying capacity. It is naturally acid and moderately low in natural fertility. Crops grown on this soil respond very well to lime and fertilizer. The permeability is moderately rapid and the content of organic matter is medium to low.

This soil produces good yields of corn and tobacco under good management, but tobacco diseases and flooding are hazards. The soil is well suited to Kentucky 31 fescue, ladino clover, and other plants for pasture or hay. If the soil is limed, fertilized, and otherwise well managed, it produces alfalfa for short periods.

This soil can be used for row crops, hay, pasture, woods, or wildlife. Continuous row cropping does not adversely affect it. In places rather swift floodwaters damage crops and the soil. If the soil is cropped, diversion channels may be needed to control runoff from the hillsides above.

#### CAPABILITY UNIT IIIe-1

This capability unit consists of deep, sloping, well-drained soils on stream terraces. The soils are—

- Allegheny loam, 6 to 12 percent slopes.
- Allegheny loam, 6 to 12 percent slopes, eroded.

These soils have a moderately high yield potential, but they are subject to severe erosion if cultivated and not protected. They have a deep root zone, a high moisture-supplying capacity, and moderate natural fertility that is easy to build up. They are naturally acid but can be neutralized by applications of lime. They are easy to till, have moderately rapid permeability, and contain a medium to small amount of organic matter.

These soils produce very good yields of tobacco and corn under good management that includes adequate improvement of fertility. They are especially suitable for tobacco beds because they have good aeration and drainage in early spring, and an excellent seedbed is easily prepared. These soils are suited to Kentucky 31 fescue, ladino clover, sericea

lespedeza, and similar plants, but their fertility must be built up before they will produce alfalfa.

Special practices are required to control erosion. The hazard varies with the length of slope. On short slopes, erosion can be controlled by contour tillage, grassed waterways, and good fertility management in combination with a rotation consisting of 1 year of a row crop and 2 years of grasses and legumes. On longer slopes erosion can be controlled by terraces or contour stripcropping and a rotation lasting at least 3 years.

These soils can be safely used for meadow, pasture, woods, or wildlife.

#### CAPABILITY UNIT IIIe-5

This capability unit consists of deep, sloping, gravelly, well-drained soils on foot slopes and alluvial fans. The soils are—

Barbourville gravelly loam, 6 to 12 percent slopes.

Jefferson gravelly loam, 6 to 12 percent slopes.

These soils have a high yield potential, but they are subject to severe erosion if cultivated and not protected. They have a deep root zone and a high moisture-supplying capacity. Their moderate natural fertility can be improved with fertilizer, and their natural acidity can be corrected by applying lime. They are somewhat difficult to till because of gravel. The soils have moderately rapid permeability and contain a medium amount of organic matter.

These soils produce excellent yields of tobacco and corn under good management that increases fertility. Farmers choose these soils over bottom-land soils for tobacco and gardens because they are less likely to be flooded, and they produce nearly as well. They are suited to such plants as Kentucky 31 fescue and ladino clover, but their fertility must be built up if they are to produce alfalfa or bluegrass. They are well suited to tobacco and garden crops.

Special practices are required to control erosion. The hazard varies with the length of slope. On most short slopes, erosion can be controlled by contour tillage, grassed waterways, good fertility management, and a rotation such as 1 year of a row crop and 2 years of grasses and legumes. In addition to these practices, terracing is needed on long slopes. If these soils are used for crops, it is necessary to cut diversion channels above them to control runoff from adjoining hillsides. The gravel in these soils tends to damage young plants when the soils are cultivated; thus, cultivation should be held to a minimum.

The soils can be safely used for meadow, pasture, woods, or wildlife.

#### CAPABILITY UNIT IIIe-7

This capability unit consists of sloping, moderately deep, well-drained to somewhat excessively drained soils. The soils are—

Muskingum silt loam, 6 to 12 percent slopes.

Wellston silt loam, 6 to 12 percent slopes.

These soils have a moderately high yield potential, but they are subject to severe erosion if cultivated and not protected. They have a moderately deep to shallow root zone over shattered rock and a moderate to moderately high moisture-supplying capacity. Their moderate natural fertility is fairly easy to build up. The soils are easy to till. They have moderate to moderately rapid permeability and contain a medium to small amount of organic matter.

They are naturally acid, but this can be easily corrected by applying lime.

These soils produce good yields of tobacco and corn under management that improves fertility. They are suited to Kentucky 31 fescue, ladino clover, sericea lespedeza, and similar plants, but their fertility must be built up for alfalfa. The moisture-supplying capacity is less than optimum on these soils. Crops should be planted early in spring to obtain as much growth as possible during the moist part of the growing season. Increasing the organic matter improves the moisture-supplying capacity. Peas, lettuce, onions, and other early garden vegetables do better on these soils than late-maturing vegetables.

Special practices are required to control erosion. The hazard of erosion varies with the length of slopes. On short slopes, erosion can be controlled by contour tillage, grassed waterways, good fertility management, and a rotation such as 1 year of a row crop and 2 years of grasses and legumes. On longer slopes, erosion can be controlled by terracing or stripcropping, as well as by using a rotation that includes grasses and legumes.

These soils can be safely used for meadow, pasture, woods, or wildlife.

#### CAPABILITY UNIT IIIe-9

Monongahela silt loam, 6 to 12 percent slopes, is the only soil in this capability unit. It is a sloping, moderately deep, moderately well drained soil on terraces, and it has a fragipan. This soil is subject to severe erosion if cultivated and not protected. It is slightly wet and has a shallow to moderately deep root zone over the fragipan and a moderately low moisture-supplying capacity. The natural fertility is moderately low but can be easily built up. The soil is naturally acid and has a moderate yield potential. Permeability is moderate above the fragipan but is slow in it. The content of organic matter is low. The soil is easy to till.

This soil produces good yields of corn and tobacco if it is well managed. It is well suited to Kentucky 31 fescue, ladino clover, Korean lespedeza, and other forage plants that are tolerant to moisture and drought. Alfalfa can be grown if fertility is built up, but stands are short lived because of a seasonal perched water table that is held up by the fragipan. The moisture-supplying capacity of this soil is less than optimum because of the limited root zone. The soil is wet early in spring and slightly droughty late in fall. Therefore, short-season crops are more suitable than long-season crops. The moisture-supplying capacity can be improved by increasing the organic matter in the soil.

Special practices are required to control erosion. The hazard of erosion varies with the length of slopes. On short slopes erosion can be controlled by contour tillage, grassed waterways, and a rotation that includes 1 year of a row crop and 2 years of grasses and legumes. On longer slopes, erosion can be controlled by terracing or stripcropping, as well as by using a rotation that includes grasses and legumes. These soils can be safely used for meadow, pasture, woods, or wildlife.

#### CAPABILITY UNIT IIIw-1

Tyler silt loam is the only soil in this capability unit. It is a somewhat poorly drained soil with a fragipan.

This soil is moderately wet, and tile drainage generally is not feasible because the compact fragipan is at a shallow depth. Runoff is slow, and water stands in depressed areas after heavy rains. Wetness severely limits or reduces the choice of plants. The root zone is moderately deep to shallow, and therefore the moisture-supplying capacity is only moderately high. The soil is naturally acid and has a moderately low to low natural fertility that is fairly easy to build up. The yield potential is moderately low. This soil is easy to till. Permeability is moderate above the fragipan but slow in it. The content of organic matter is low.

This soil produces fair yields of corn and tobacco if surface drainage is installed and the soil is otherwise well managed. It is better suited, however, to Kentucky 31 fescue, Korean lespedeza, reed canarygrass, and other moisture-tolerant plants.

Erosion is not a hazard on this soil. If it is cultivated, however, the soil can be improved by surface drainage and a rotation consisting of 2 years of row crops, each followed by a cover crop in winter, and 2 years of grasses and legumes. Corn can be grown continuously in some areas, but this soil will produce only fair yields if tillage, supply of organic matter, and fertility are not improved.

Careful, on-site examination of the depth to the slowly permeable fragipan layer should be made before tile drainage is attempted. The fragipan in this soil is usually at a depth of about 20 inches, but depth to it ranges from 15 to 24 inches. Surface water can be removed from the soil by shallow ditches and waterways. Also, in places, tile lines are needed on the slopes above these soils to intercept seepage and improve internal drainage. Proper arrangement of rows and careful plowing will help prevent concentration of surface water.

This soil can also be used for meadow, pasture, woods, or wildlife.

#### CAPABILITY UNIT III<sub>w</sub>-5

Atkins loam is the only soil in this capability unit. This poorly drained soil is on first bottoms.

The soil is very wet, but drainage can be improved somewhat by use of tiles where outlets are available. Wetness severely limits the choice of plants, as the soil is somewhat waterlogged even after it is drained. It has a deep root zone and a very high moisture-supplying capacity. The natural fertility is moderately low but can be easily built up with fertilizer, and the natural acidity can be corrected with lime. The soil has a moderate to moderately high yield potential. It is easy to till, is moderately permeable, and contains a medium to small amount of organic matter.

If properly drained and otherwise well managed, this soil produces good yields of corn, but yields are only fair to poor without drainage. Because of scalding, flooding, and disease, tobacco does not grow well on this soil. The soil is better suited to Kentucky 31 fescue, Korean lespedeza, alsike clover, reed canarygrass, reedtop, and other moisture-tolerant plants.

Erosion is not a hazard on this soil. If the soil is drained and fertilized, and crop residue is retained, row crops can be grown continuously. If corn is grown continuously, organic matter and soil tillage can be improved by growing an occasional summer green-manure crop of soybeans or sudangrass.

Between the bottoms and hillsides, diversion channels are often needed to intercept runoff. Surface water can be removed by diversions, shallow ditches, or grassed waterways.

Without drainage, the soil can be used for hay, pasture, or woodland, or for wildlife habitats.

#### CAPABILITY UNIT III<sub>s</sub>-1

Bruno loamy sand is the only soil in this capability unit. It is an excessively drained sandy soil on bottom lands.

Erosion is not a hazard on this soil, but the yield potential is moderately low. The soil has a deep root zone but is moderately droughty because of a low moisture-supplying capacity. It is extremely acid and has low natural fertility that is somewhat difficult to improve. The soil is rapidly permeable, contains a small amount of organic matter, and is easy to till.

This soil produces fair yields of corn and tobacco if it is managed well and if rains are well distributed during the growing season. It is better suited, however, to Kentucky 31 fescue, sericea lespedeza, and other drought-resistant plants.

Plant nutrients leach readily from this soil. Therefore, fertilizer should be applied annually, or more often, in quantities required by each crop. The organic matter in this soil should be increased as much as possible, so as to increase the moisture-supplying capacity.

This soil can be used continuously for row crops, but green-manure crops should be grown. It can be used best for hay, pasture, woods, or wildlife.

#### CAPABILITY UNIT IV<sub>e</sub>-4

This capability unit consists of strongly sloping, well-drained and somewhat excessively drained loamy and silty soils on toe slopes and uplands. The soils are—

Jefferson gravelly loam, 12 to 20 percent slopes.

Muskingum-Ramsey complex, 12 to 20 percent slopes.

These soils have a moderately high yield potential, but the hazard of erosion is severe if the soils are cultivated and not protected. The Jefferson soil has a deep root zone, and the soils of the Muskingum-Ramsey complex have a shallow to moderately deep root zone over shattered rock. All of these soils are naturally acid and have moderate natural fertility that is easy to build up. The soils, in places, are somewhat difficult to till because of gravel and steepness. Their permeability is moderately rapid, and the content of organic matter is medium to low.

These soils produce good yields of corn and tobacco under good management. Much tobacco is grown because less steep soils are scarce. The soils are well suited to Kentucky 31 fescue, ladino clover, sericea lespedeza, and other forage plants. The fertility must be built up, however, for alfalfa.

Because of the hazard of erosion on these soils, their use for row crops is limited, and careful management is required. These soils are well suited to hay or pasture, but they can be used for row crops occasionally if more suitable soils are not available. The slopes are too steep for terracing, but stripcropping helps to control erosion if good plant growth is maintained.

These soils can be used for meadow, pasture, woods, or wildlife.

**CAPABILITY UNIT IVe-7**

This capability unit consists of sloping soils on uplands. These soils have a sandy or fine-textured subsoil. The soils are—

Ramsey fine sandy loam, 6 to 12 percent slopes.  
Rarden silt loam, 5 to 15 percent slopes.

These soils have a moderately low yield potential. They are subject to severe erosion if they are cultivated and not protected. They are somewhat droughty because of their shallow root zone. They have a moderately low moisture-supplying capacity and moderately low fertility, but crops grown on them respond to fertilizer. These soils are naturally acid and generally have a low content of organic matter. They are easy to till. The Rarden soil has a slowly permeable subsoil.

The soils in this unit produce fair yields of corn and tobacco under good management, but they are better suited to drought-resistant plants such as Kentucky 31 fescue and Korean or sericea lespedeza. Because of the erosion hazard, the use of these soils for row crops is somewhat limited. Peas, lettuce, radishes, onions, and other early vegetables do well on the Ramsey soil, but late-maturing crops are affected by drought. The Rarden soil is not well suited to vegetables. This soil is rather cold and slightly wet early in spring. Consequently, extra tillage is required because the soil puddles or crusts with each rain.

Soils of this capability unit are suited to hay or pasture but can be used for row crops if better soils are not available. They can also be used for woods or wildlife.

Because of the fine-textured, slowly permeable subsoil, the Rarden soil is not suitable for terracing. Plant nutrients leach readily from the Ramsey soil; therefore, fertilizer should be applied in quantities that can be used immediately by each crop.

**CAPABILITY UNIT VIe-8**

Capability unit VIe-8 consists of moderately steep, well-drained to somewhat excessively drained, loamy soils on toe slopes and uplands. The soils are—

Jefferson gravelly loam, 20 to 30 percent slopes.  
Muskingum-Ramsey complex, 20 to 30 percent slopes.

These soils have a moderate yield potential, but the hazard of erosion is too high for successful production of row crops. The Jefferson soil is deep, but the soils of the Muskingum-Ramsey complex are shallow to moderately deep. The soils of this unit have slopes that are too steep for easy operation of farm machinery, but they can be mowed with a wheel-type tractor. These soils are naturally acid and moderate in natural fertility. Crops grown on them respond well to lime and fertilizer. The permeability is moderately rapid, and the content of organic matter is medium to low.

These soils produce good pasture under proper management. The Jefferson soil is somewhat more productive than the Muskingum-Ramsey soils. These soils are best suited to such plants as Kentucky 31 fescue and sericea or Korean lespedeza. Bluegrass and alfalfa are difficult to maintain for long periods.

In a few gullied or eroded places, mulching, temporary diversion of water, heavy application of seed and fertilizer, and other special practices may be necessary.

These soils can be used for pasture, woods, or wildlife.

**CAPABILITY UNIT VIIe-4**

Gullied land is the only mapping unit in this capability unit. It is a land type too gullied or eroded to be identified by a soil name. This land type has a low moisture-supplying capacity and is extremely acid. The gullies make the operation of machinery extremely difficult.

Gullied land is best suited to Kentucky 31 fescue, sericea lespedeza, and other drought-resistant plants. If this land type is used for pasture, it should be smoothed so that machinery can operate on it. It should then be improved by special treatment, such as mulching, diversion of water, heavy applications of lime and fertilizer, and heavy seeding rates. It should be temporarily fenced or covered with brush to keep stock off until a sod is established. In some places check-dams are needed in the gullies.

The best use for Gullied land is for woodland or wildlife.

**CAPABILITY UNIT VIIs-1**

Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes, is the only mapping unit in this capability unit. These soils are too steep and shallow to use for cultivated crops. They are subject to very severe erosion if protective cover is not maintained. Farm machinery is difficult to operate on these steep, very stony soils.

Kentucky 31 fescue, sericea lespedeza, and Korean lespedeza grow fairly well, but the control of weeds and brush is difficult and must be done by hand or with chemicals. Fertilizer and lime must also be applied by hand and carried on sleds rather than on trucks or wagons.

These soils can be used for limited grazing, but yields of forage are low. Grazing must be carefully regulated to maintain a protective cover. The soils are best suited to woods and wildlife.

**CAPABILITY UNIT VIIs-3**

Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes, severely eroded, is the only mapping unit in this capability unit. The soils in this mapping unit are very shallow and are too steep and stony for cultivated crops. They are very droughty.

These soils can support only poor stands of forage, and they are subject to further erosion if used for anything but woodland or wildlife.

**CAPABILITY UNIT VIIs-5**

Rock land is the only mapping unit in this capability unit, and it is suited only to woods or to wildlife.

***Estimated yields***

The estimated average yields per acre of the principal crops that the soils of Elliott County may be expected to produce under a good level of management are shown in table 2. This level of management includes:

1. The use of adapted varieties.
2. Proper seeding rates, proper dates of planting, and efficient harvesting methods.
3. Control of weeds, insects, and plant diseases.
4. Application of fertilizer in amounts equal to or greater than the current recommendations of the Kentucky Agricultural Experiment Station (6),<sup>1</sup> or equal to or more than the need shown by properly interpreted soil tests.

<sup>1</sup> Italic numbers in parentheses refer to Literature Cited, p. 52.

5. Adequate applications of lime.
6. Drainage of naturally wet soils that are feasible to drain.
7. Crop rotations that control erosion and maintain soil structure and organic matter.
8. Use of contour tillage, terracing, stripcropping, grassed waterways, and other conservation measures where needed.
9. Use of cover crops and crop residue to increase the supply of organic matter and to control erosion.
10. Use of all practices that improve and maintain pasture.

Many of the practices that improve yields and protect soils from damage have already been discussed in the subsections "Principles of soil management" and "Use and management of soils by capability units."

If yields are not shown in table 2, the crop is considered to be unsuited to the soil. For example, yields of corn are not shown for soils in capability class VI. Pasture

yields are estimated for the number of days during a grazing season that an acre will provide grazing for an animal unit without injury to the pasture. An animal unit is one cow, one horse or steer, five hogs, or seven sheep. The yields in table 2 are not the maximum that can be expected, but they are the yields most farmers will find practical to obtain.

The level of management a farmer chooses depends on many things in addition to the soils. Before making his choice, he considers probable prices, distance to market, the type of farm enterprise he wishes to have, and other factors. His choice of crops also affects management. Thus, management varies, depending on the crops and the soils.

The estimates of yields were taken from tables made for statewide use. The statewide estimates were based on long-term average yields and on the best information available from soil conservationists and agronomists who know the soils in Kentucky.

TABLE 2.—Estimated average acre yields of principal crops under good management

[Estimated yields are based on long-term average yields, assuming soils are not irrigated and receive average rainfall. Absence of figure indicates crop is not suited to the soil or is not commonly grown on it]

| Soil   | Corn  | Wheat | Soybeans | Tobacco | Alfalfa and grass | Red clover and grass (1st year) | Red clover and grass (2d year) | Lespedeza | Pasture                      |
|--|-------|-------|----------|---------|-------------------|---------------------------------|--------------------------------|-----------|------------------------------|
|  | Bu.   | Bu.   | Bu.      | Lbs.    | Tons              | Tons                            | Tons                           | Tons      | Grazing days per animal unit |
| Allegheny loam, 2 to 6 percent slopes.....   | 90    | 35    | 30       | 2,200   | 3.7               | 1.1                             | 3.0                            | 2.0       | 180                          |
| Allegheny loam, 6 to 12 percent slopes.....  | 90    | 35    | 30       | 2,050   | 3.6               | 1.1                             | 3.0                            | 2.0       | 175                          |
| Allegheny loam, 6 to 12 percent slopes, eroded.....  | 80    | 30    | 30       | 1,850   | 3.3               | 1.1                             | 3.0                            | 1.9       | 165                          |
| Atkins loam.....   | 65    | 20    | 25       | 1,550   | .....             | .7                              | 1.8                            | 1.7       | 175                          |
| Barbourville gravelly loam, 2 to 6 percent slopes.....                                       | 85    | 35    | 30       | 1,950   | 3.4               | 1.1                             | 3.0                            | 1.9       | 160                          |
| Barbourville gravelly loam, 6 to 12 percent slopes.....                                      | 80    | 30    | 30       | 1,800   | 3.2               | 1.1                             | 2.9                            | 1.8       | 150                          |
| Bruno loamy sand.....  | 40    | 15    | .....    | 1,300   | 1.9               | .6                              | 1.7                            | 1.0       | 120                          |
| Cotaco gravelly loam, 2 to 6 percent slopes.....   | 85    | 30    | 30       | 1,600   | 2.5               | 1.0                             | 2.6                            | 1.7       | 175                          |
| Gullied land.....  | ..... | ..... | .....    | .....   | .....             | .....                           | .....                          | .....     | .....                        |
| Jefferson gravelly loam, 6 to 12 percent slopes.....   | 75    | 30    | 25       | 1,600   | 3.3               | 1.1                             | 2.9                            | 1.8       | 165                          |
| Jefferson gravelly loam, 12 to 20 percent slopes.....  | 70    | 30    | 25       | 1,350   | 3.2               | 1.0                             | 2.7                            | 1.7       | 160                          |
| Jefferson gravelly loam, 20 to 30 percent slopes.....  | ..... | ..... | .....    | .....   | 3.1               | 1.0                             | 2.6                            | 1.6       | 150                          |
| Monongahela fine sandy loam, 2 to 6 percent slopes.....                                      | 60    | 25    | 25       | 1,550   | 1.9               | .8                              | 2.2                            | 1.4       | 150                          |
| Monongahela silt loam, 2 to 6 percent slopes.....  | 75    | 25    | 25       | 1,700   | 2.0               | .9                              | 2.3                            | 1.7       | 165                          |
| Monongahela silt loam, 6 to 12 percent slopes.....   | 70    | 25    | 25       | 1,550   | 1.8               | .8                              | 2.1                            | 1.6       | 150                          |
| Muskingum silt loam, 6 to 12 percent slopes.....   | 60    | 25    | 20       | 1,400   | 2.7               | 1.0                             | 2.7                            | 1.5       | 140                          |
| Muskingum-Ramsey complex, 12 to 20 percent slopes.....                                       | 55    | 20    | 20       | 1,150   | 2.7               | .9                              | 2.5                            | 1.5       | 140                          |
| Muskingum-Ramsey complex, 20 to 30 percent slopes.....                                       | ..... | ..... | .....    | .....   | 2.5               | .9                              | 2.4                            | 1.4       | 130                          |
| Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes.....                  | ..... | ..... | .....    | .....   | .....             | .....                           | .....                          | .....     | .....                        |
| Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes, severely eroded..... | ..... | ..... | .....    | .....   | .....             | .....                           | .....                          | .....     | .....                        |
| Pope fine sandy loam, 0 to 3 percent slopes.....   | 85    | 35    | 30       | 1,750   | 3.3               | 1.1                             | 3.0                            | 1.7       | 160                          |
| Pope fine sandy loam, 3 to 6 percent slopes.....   | 80    | 30    | 30       | 1,550   | 3.2               | 1.1                             | 3.0                            | 1.7       | 155                          |
| Pope gravelly fine sandy loam.....   | 80    | 30    | 30       | 1,550   | 3.2               | 1.1                             | 3.0                            | 1.7       | 155                          |
| Ramsey fine sandy loam, 6 to 12 percent slopes.....  | 55    | 20    | 20       | 1,150   | 2.3               | .8                              | 2.1                            | 1.1       | 125                          |
| Rarden silt loam, 5 to 15 percent slopes.....  | 50    | 20    | 20       | 1,350   | 1.9               | .8                              | 2.1                            | 1.5       | 140                          |
| Rock land.....   | ..... | ..... | .....    | .....   | .....             | .....                           | .....                          | .....     | .....                        |
| Sequatchie fine sandy loam, 0 to 4 percent slopes.....                                       | 80    | 35    | 30       | 1,750   | 3.3               | 1.1                             | 2.9                            | 1.9       | 165                          |
| Stendal fine sandy loam.....   | 75    | 25    | 30       | 1,450   | 2.6               | .8                              | 2.0                            | 1.6       | 170                          |
| Stendal gravelly fine sandy loam.....  | 65    | 20    | 25       | 1,600   | 2.9               | 1.0                             | 2.7                            | 1.5       | 165                          |
| Stendal silt loam.....   | 85    | 30    | 35       | 1,750   | 2.8               | .9                              | 2.3                            | 2.0       | 180                          |
| Tyler silt loam.....   | 50    | 15    | 20       | 1,500   | .....             | .....                           | .....                          | 1.5       | 155                          |
| 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                          |
| Whitwell loam.....   | 75    | 30    | 30       | 1,700   | 2.8               | .9                              | 2.3                            | 1.9       | 180                          |

## Woodland <sup>2</sup>

At the time of settlement, Elliott County was nearly all in woodland. Yellow-poplar, black walnut, white oak, and other desirable hardwoods were dominant in the timber stands on the north and east slopes. Black oak, scarlet oak, and hickory were dominant on the south and west slopes. Chestnut oak, scarlet oak, and occasional groups of shortleaf pine and pitch pine grew on most of the upper slopes and narrow ridges.

Probably more than half of the area on mountain slopes has been cleared and farmed, but much of it has since been abandoned and has reverted to woodland.

By 1920 nearly all the virgin timber had been cut. Repeated high grading in logging operations, frequent burning, and woodland grazing for many decades have resulted in the low-quality tree cover that is in nearly all woodland areas. Progress, however, is being made in the protection of woodland from fire and livestock.

About 70 percent of the area of the county is in trees, mostly hardwoods. Some stands of shortleaf pine and Virginia pine are growing on old cropland or idle land. Most farm woodland is in small tracts of 60 to 75 acres. One area of commercial woodland, about 3,600 acres, is on Little Fork Creek. Trees suited for commercial use are yellow-poplar, shortleaf pine, red oak, black oak, white oak, hard maple, white ash, linden, sycamore, chestnut oak, scarlet oak, and hickory.

About 16 sawmills in the county are operated by farmers on a seasonal basis. One commercial mill employs about 12 men and operates the year round.

<sup>2</sup> E. A. OREN, woodland conservationist, and E. V. HUFFMAN, assistant State soil scientist, collaborated in writing this section.

A few landowners are making some progress in woodland management. Markets are fair for good quality logs, which are in short supply, but markets are poor for the huge inventory of low-quality timber.

The site quality of many mountain slopes has been lowered by erosion of cultivated areas, repeated burning, and livestock grazing. However, a large area of potentially productive woodland remains.

There is no record of recent epidemic disease and insect attacks. Yet insect borers cause large losses annually, especially of oak. Heart rot, resulting from fire scars, causes another large annual loss.

### Woodland suitability grouping of soils

In Elliott County there are many different kinds of soils. Information about their effect on woodland use and management has been obtained from field studies and research. The soils that are about similar in the kinds of trees they produce, in the management they require, and in potential productivity are placed in one of the eight woodland suitability groups. These groups are briefly described in table 3, and factors affecting their management are noted. The woodland suitability groups are also discussed in the text, and the soils in each are listed.

The interpretations that are made for each soil in table 3 include (1) potential soil productivity, (2) preferred species to favor in existing woodlands, (3) preferred species for planting, and (4) critical management factors. These interpretations were made according to the following guidelines:

TABLE 3.—Woodland suitability groups and factors affecting management

| Woodland suitability group   | Potential soil productivity (site index) <sup>1</sup>   | Preferred species for—  |   | Critical management factors  |
|--|---|---|---|--|
|  |   | Existing woodlands  | Open land planting  |  |
| Group 1: Dominantly well-drained soils on bottoms, stream terraces, and foot slopes; soil profile textures are mostly loam, fine sandy loam, and loamy fine sand; the Barbourville, Jefferson, and Cotaco soils are gravelly; topography ranges from level to sloping. | Yellow-poplar, 104±6; upland oaks, 80±4; shortleaf pine, 80±2; Virginia pine, 83; white pine, 95. | Yellow-poplar, black walnut, white oak, northern red oak, basswood, cucumbertree, sugar maple, hemlock. | White pine, shortleaf pine, loblolly pine, black locust, yellow-poplar, black walnut. | Plant competition; gully erosion hazard on slopes over 6 percent; equipment limitations on slopes over 12 percent. |
| Group 2: Deep, poorly drained to somewhat poorly drained silt loam, fine sandy loam, and loam soils on bottoms subject to flooding, and somewhat poorly drained soils along stream terraces, shallow to fragipan; slopes range from level to nearly level.             | Pin oak, 90-100; sweetgum, 90-100; cottonwood, 100-110.   | Cottonwood, pin oak, sweetgum, sycamore.  | Cottonwood, sweetgum, pin oak.  | Plant competition; equipment limitations.  |
| Group 3: Moderately deep, gently sloping to sloping soils that developed from sandstone and shale; the surface layer is mostly silt loam and fine sandy loam; the subsoil varies from silty clay loam to loam, fine sandy loam, and silt loam.                         | Upland oaks, 65±5; shortleaf pine, 76±5; Virginia pine, 71±4.                                     | Shortleaf pine, black oak, white oak, Virginia pine.  | Shortleaf pine, loblolly pine, white pine.  | Plant competition; gully erosion hazard; equipment limitations on slopes over 12 percent.                          |

See footnotes at end of table.

TABLE 3.—Woodland suitability groups and factors affecting management—Continued

| Woodland suitability group   | Potential soil productivity (site index) <sup>1</sup>                                      | Preferred species for—   |   | Critical management factors                                      |
|--|--|--|---|--|
|  |  | Existing woodlands   | Open land planting  |  |
| Group 4: Moderately well drained, gently sloping to sloping soils on stream terraces; the surface layer varies from silt loam to fine sandy loam; the subsoil varies from silty clay loam to sandy clay loam; an impervious fragipan occurs at about 18 to 24 inches.  | Upland oaks, 72; shortleaf pine, 81; Virginia pine, 84; yellow-poplar, 91.                 | Yellow-poplar, shortleaf pine, white oak, black oak, Virginia pine.        | White pine, shortleaf pine, loblolly pine.  | Plant competition.   |
| Group 5: Gently sloping to strongly sloping soil of shale origin; the surface layer is silt loam and the subsoil is tough, very plastic clay.  | Upland oaks, 50-60; shortleaf pine, 55-60; Virginia pine, 55-65.                           | Shortleaf pine, Virginia pine, black oak, scarlet oak, white oak, hickory. | Shortleaf pine, loblolly pine.  | Gully erosion hazard.  |
| Group 6: Somewhat excessively drained soils that developed from sandstone and shale; occur on lower two-thirds of moderately steep to steep slopes that have a warm aspect; <sup>2</sup> mostly medium in texture and, on steep areas, very stony.   | Upland oaks, 63 ± 5; shortleaf pine, 60-65; Virginia pine, 60 ± 4; pitch pine, 55-60.      | Shortleaf pine, Virginia pine, black oak, scarlet oak, pitch pine.         | Shortleaf pine, loblolly pine, white pine.  | Gully erosion hazard; equipment limitations.                     |
| Group 7: Somewhat excessively drained soils that developed from sandstone and shale; occur on the lower four-fifths of moderately steep to steep slopes that have a cool aspect <sup>2</sup> ; mostly medium in texture and, in steep areas, very stony.   | Yellow-poplar, 96 ± 7; upland oaks, 76 ± 5; shortleaf pine, 77 ± 6; Virginia pine, 76 ± 3. | Yellow-poplar, black walnut, basswood, white oak, northern red oak.        | White pine, shortleaf pine, loblolly pine, black locust, black walnut, yellow-poplar. | Plant competition; gully erosion hazard; equipment limitations.  |
| Group 8: Somewhat excessively drained, moderately steep to steep soils that developed from sandstone and shale; occur on the upper third of warm slopes, on the upper fifth of cool slopes, and on the very narrow ridges; the steep areas are very stony; erosion ranges from none to moderate; also in this group are Gullied land, Rock land, and severely eroded Muskingum stony soils in all aspects and slope positions. | Upland oaks, 58 ± 4; shortleaf pine, 50 ± 4; Virginia pine, 52 ± 4.                        | Shortleaf pine, Virginia pine, chestnut oak, scarlet oak, pitch pine.      | Shortleaf pine, loblolly pine.  | Gully erosion hazard; equipment limitations; seedling mortality. |

<sup>1</sup> Site index at 30 years of age for cottonwood and at 50 years for all other species.

<sup>2</sup> Cool slopes are north and east aspects; azimuth bearing from the slope face is from 340° to 125°; warm slopes are south and west aspects; azimuth from 125° to 340°.

Potential productivity of the soils for wood crops was estimated on the basis of studies of nearly 250 sites in soil association areas similar to those in Elliott County. Each site was selected to represent a specific kind of wood crop growing on a recognized kind of soil. As nearly as possible, studies were confined to well-stocked, naturally occurring, even-aged, and unmanaged forest stands that were undamaged by fire, livestock grazing, insects, or disease. The study of each site included a determination of site index, which is considered to be a good indicator of potential soil productivity. Site index is the average height of the dominant trees, excepting cottonwood in a stand at 50 years of age. The site index for cottonwood is based on 30 years of age. Height and age measurements were converted to site indexes by applying information obtained from published research. The site indexes for the important species are given for each woodland suitability group in table 3. These site indexes are related to the figures on average yearly growth in tables

4 and 5, which are based on information published by the U.S. Forest Service and other sources.

Site indexes for the lowland soils for cottonwood, sweetgum, and red oak are based on data in Agriculture Handbook No. 181, "Management and Inventory of Southern Hardwoods" (8). Estimates of potential productivity under good management can be made on the basis of this data. Soils that have a site index of 100 or more for cottonwood have a potential productivity that will average 770 board feet per acre annually. This estimate is based on several intermediate harvests and a final harvest when the trees are 45 years old and average about 34 inches in diameter at breast height. Soils that have a site index of 90 or more for pin oak have a potential productivity that will average 520 board feet per acre annually. This estimate is based on several intermediate harvests and a final harvest when the trees are 80 years old and average about 38 inches in diameter at breast height. Soils that have a site index of 90 or more for sweetgum have a potential

TABLE 4.—Approximate average annual growth per acre of well-stocked, unthinned stands on uplands<sup>1</sup>

| Woodland suitability group | Yellow-poplar <sup>2</sup> |                    | Virginia pine <sup>3</sup> |                    | Shortleaf pine <sup>4</sup> |                    |
|----------------------------|----------------------------|--------------------|----------------------------|--------------------|-----------------------------|--------------------|
|                            | Board feet <sup>5</sup>    | Cords <sup>6</sup> | Board feet <sup>5</sup>    | Cords <sup>6</sup> | Board feet <sup>5</sup>     | Cords <sup>6</sup> |
| 1-----                     | 770                        | 1.9                | (?)                        | (?)                | (?)                         | (?)                |
| 2-----                     | <sup>8</sup> 700           | <sup>8</sup> 1.8   | (?)                        | (?)                | <sup>8</sup> 570            | <sup>8</sup> 1.5   |
| 3-----                     | (?)                        | (?)                | 460                        | 1.2                | 580                         | 1.5                |
| 4-----                     | 550                        | 1.5                | 530                        | 1.3                | 655                         | 1.5                |
| 5-----                     | (?)                        | (?)                | 370                        | 1.0                | 325                         | 1.0                |
| 6-----                     | (?)                        | (?)                | 370                        | 1.0                | 400                         | 1.2                |
| 7-----                     | 640                        | 1.7                | 490                        | 1.2                | 600                         | 1.5                |
| 8-----                     | (?)                        | (?)                | 290                        | .7                 | 220                         | .9                 |

<sup>1</sup> To age 60 for board-foot yields and to age 35 for cord yields.  
<sup>2</sup> Data interpreted from U.S. Department of Agriculture Technical Bulletin 356 (4).  
<sup>3</sup> Data interpreted from North Carolina Agricultural Experiment Station Technical Bulletin 100 (10).  
<sup>4</sup> Data interpreted from U.S. Department of Agriculture Miscellaneous Publication 50 (12).  
<sup>5</sup> International log rule.  
<sup>6</sup> Rough cords.  
<sup>7</sup> These trees do not occur, or are not significant, on these soils.  
<sup>8</sup> These trees occur occasionally where slight slopes afford surface drainage.

TABLE 5.—Approximate average yearly growth per acre of well-managed upland oak stands<sup>1</sup>

| Woodland suitability group | Board feet <sup>2</sup> (International 1/4-inch rule) | Cords (rough <sup>3</sup> ) |
|----------------------------|---|-----------------------------|
| 1-----                     | 560   | 1.2                         |
| 2-----                     | 490   | 1.0                         |
| 3-----                     | 350   | .9                          |
| 4-----                     | 445   | 1.0                         |
| 5-----                     | 235   | .7                          |
| 6-----                     | 300   | .8                          |
| 7-----                     | 500   | 1.0                         |
| 8-----                     | 260   | .7                          |

<sup>1</sup> Data interpreted from U.S. Department of Agriculture Technical Bulletin 560 (9).  
<sup>2</sup> Board-foot yields are obtained from stands ranging from 65 to 80 years of age.  
<sup>3</sup> Cord yields are obtained from stands ranging from 30 to 60 years of age.

productivity that will average 360 board feet per acre per year. This estimate is based on several intermediate harvests and a final harvest when the trees are 96 years old and average about 34 inches in diameter at breast height.

Data on woodland sites were not available for determining the site index of all species on all soils. If a suitable site was not available, the site indexes of similar soils were used.

Preferred species to favor in existing woodlands are listed in order of priority in table 3. Factors that indicate the priority of these species are site index, tree quality, and density in natural stands. These are the species that generally should be favored in weeding, improvement cutting, and other operations.

Preferred species for planting are also listed in table 3. Experience indicates that cottonwood is the best species

to plant on the open fields in lowlands and that pines are the best species to plant on open fields in the uplands.

Critical management factors are limitations or hazards that are likely to cause management problems. These factors include plant competition, equipment limitations, gully erosion, and seedling mortality. They are listed in table 3, if applicable, and are discussed in more detail in the description of each woodland suitability group.

WOODLAND SUITABILITY GROUP 1

This group consists of dominantly well-drained soils on bottom lands, stream terraces, and foot slopes. The soils are—

- (AgB) Allegheny loam, 2 to 6 percent slopes.
- (AgC) Allegheny loam, 6 to 12 percent slopes.
- (AgC2) Allegheny loam, 6 to 12 percent slopes, eroded.
- (BaB) Barbourville gravelly loam, 2 to 6 percent slopes.
- (BaC) Barbourville gravelly loam, 6 to 12 percent slopes.
- (Br) Bruno loamy sand.
- (CoB) Cotaco gravelly loam, 2 to 6 percent slopes.
- (JfC) Jefferson gravelly loam, 6 to 12 percent slopes.
- (JfD) Jefferson gravelly loam, 12 to 20 percent slopes.
- (JfE) Jefferson gravelly loam, 20 to 30 percent slopes.
- (PfA) Pope fine sandy loam, 0 to 3 percent slopes.
- (PfB) Pope fine sandy loam, 3 to 6 percent slopes.
- (Pg) Pope gravelly fine sandy loam.
- (SfA) Sequatchie fine sandy loam, 0 to 4 percent slopes.
- (Wh) Whitwell loam.

The potential soil productivity of this group is high, and intensive management is justified. Plant competition is severe because available moisture is abundant during the growing season. Shade-tolerant trees of low quality establish themselves in the understory of saw-log stands. Following logging, these shade-tolerant trees usually prevent the reestablishment of desirable trees unless the stands are weeded intensively. Because of severe competition, interplanting or conversion planting generally is not feasible. Trees planted in open fields usually require one or more cultivations.

The hazard of gully erosion is severe on slopes of more than 6 percent, mainly because of the texture of the soils. As the slope increases, the hazard increases. If water concentrates on these soils, it readily forms gullies. Therefore, special attention must be given to the proper location, construction, and maintenance of roads and skid trails.

Equipment limitations are severe on slopes of more than 12 percent. Steepness of slope and rough terrain limit the use of farm-type equipment. Track-type equipment and power winches are required for efficient woodland harvesting.

WOODLAND SUITABILITY GROUP 2

This group consists of deep, poorly drained to somewhat poorly drained soils on bottom lands and somewhat poorly drained soils along stream terraces. The soils are—

- (At) Atkins loam.
- (Sd) Stendal fine sandy loam.
- (Sg) Stendal gravelly fine sandy loam.
- (St) Stendal silt loam.
- (Ty) Tyler silt loam.

The potential productivity of this group of soils is high, and intensive management is justified. The level soils in this group are mainly suited to the production of cottonwood, pin oak, sweetgum, and other trees commonly called bottom-land hardwoods. These trees also grow on the nearly level soils but are frequently associated with yellow-poplar, upland oaks, shortleaf pine, and other

species common to the uplands. Site indexes range from 95 to 105 for yellow-poplar and average about 75 for upland oaks and shortleaf pine.

Plant competition is severe because available moisture is abundant during the growing season. Shade-tolerant trees of low quality establish themselves in the understory of saw-log stands. Following logging, these shade-tolerant trees usually prevent the reestablishment of desirable trees unless the stands are weeded intensively. Because of severe competition, interplanting or conversion planting generally is not feasible. Trees planted in open fields usually require one or more cultivations.

Equipment limitations are severe because of seasonal wetness. These soils are wet for periods that total about 3 months annually.

#### WOODLAND SUITABILITY GROUP 3

This group consists of moderately deep, gently sloping to sloping soils that developed from sandstone and shale. The soils are—

- (MkC) Muskingum silt loam, 6 to 12 percent slopes.
- (MrD) Muskingum-Ramsey complex, 12 to 20 percent slopes.
- (RaC) Ramsey fine sandy loam, 6 to 12 percent slopes.
- (WnB) Wellston silt loam, 2 to 6 percent slopes.
- (WnC) Wellston silt loam, 6 to 12 percent slopes.

The potential soil productivity of this group is moderately high, and intensive management is justified.

Plant competition is severe because moisture is favorable during the growing season. Shade-tolerant trees of low quality usually establish themselves in the understory of saw-log stands. When the overstory is removed by logging, these shade-tolerant trees usually prevent the reestablishment of desirable trees. One or more weedings are usually required to assure the growth of a desirable wood crop. Because of the intensive weeding requirements, interplanting or conversion planting usually is not feasible. Newly planted trees generally have severe competition on open areas that have been abandoned as cropland or pasture for 2 or more years.

The hazard of gully erosion is severe because of the steep slopes and the texture of the soils. If water concentrates on these soils, it forms gullies readily. Therefore, special attention should be given to the proper location, construction, and maintenance of roads and skid trails.

Equipment limitations are severe on slopes of more than 12 percent. Steep slopes, rough terrain, and occasional rocks limit the use of farm-type equipment. Track-type equipment and power winches are required for efficient woodland harvesting.

#### WOODLAND SUITABILITY GROUP 4

This group consists of moderately well drained, gently sloping to sloping soils along stream terraces. The soils are—

- (MfB) Monongahela fine sandy loam, 2 to 6 percent slopes.
- (MgB) Monongahela silt loam, 2 to 6 percent slopes.
- (MgC) Monongahela silt loam, 6 to 12 percent slopes.

The potential soil productivity of this group is high, and intensive management is justified. Plant competition is moderately severe because moisture is favorable during most of the growing season. Shade-tolerant trees of low quality usually establish themselves in the understory of saw-log stands. When the overstory is removed by logging, these trees usually prevent the reestablishment of

desirable trees. One or more weedings generally are required to assure the growth of a desirable wood crop. Because of intensive weeding requirements, interplanting or conversion planting generally is not feasible. Newly planted trees usually have severe competition on open areas that have been abandoned as cropland or pasture for 2 or more years.

#### WOODLAND SUITABILITY GROUP 5

Rarden silt loam, 5 to 15 percent slopes (RdC), is the only soil in this group. It is a gently sloping to strongly sloping soil of shale origin.

The potential soil productivity is fair, and only moderately intensive management is justified. The hazard of gully erosion is severe, mainly because of the length of slopes. The hazard increases with steepness of slope. If water concentrates on this soil, it readily forms gullies. Therefore, special attention should be given to the proper location, construction, and maintenance of roads and skid trails.

#### WOODLAND SUITABILITY GROUP 6

This group consists of somewhat excessively drained soils that developed from sandstone and shale. They occur on the lower two-thirds of moderately steep to steep slopes. The soils are—

- (MrE) Muskingum-Ramsey complex, 20 to 30 percent slopes (warm aspect).
- (MvF) Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes (warm aspect).

The potential soil productivity of this group is fair, and management investments should be moderate.

The hazard of gully erosion is severe because of the steepness and length of slopes and the texture of the soils. If water concentrates on these soils, it readily forms gullies. Therefore, special attention should be given to the proper location, construction, and maintenance of roads and skid trails.

Equipment limitations are severe on these soils. Steep slopes, rough terrain, and rocks limit the use of farm-type equipment. Track-type equipment and power winches are required for efficient woodland harvesting.

#### WOODLAND SUITABILITY GROUP 7

This group consists of somewhat excessively drained soils that developed from sandstone and shale. They occur in the lower four-fifths of moderately steep to steep slopes. The soils are—

- (MrE) Muskingum-Ramsey complex, 20 to 30 percent slopes (cool aspect).
- (MvF) Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes (cool aspect).

The potential soil productivity of this group is high, and intensive management is justified. Plant competition is severe because moisture is favorable during the growing season. Shade-tolerant trees of low quality usually establish themselves in the understory of saw-log stands. When the overstory is removed by logging, these shade-tolerant trees usually prevent the reestablishment of desirable trees. One or more weedings are generally required to assure the growth of a desirable wood crop. Because of intensive weeding requirements, interplanting or conversion planting generally is not feasible. Newly planted trees generally have severe competition on open land that has been abandoned as cropland or pasture for 2 or more years.

The hazard of gully erosion is severe because of the steepness and length of slopes and the texture of the soils. If water concentrates on these soils, it forms gullies readily. Therefore, special attention should be given to the proper location, construction, and maintenance of roads and skid trails.

Equipment limitations are severe. Steep slopes, rough terrain, and rocks limit the use of farm-type equipment. Track-type equipment and power winches are required for efficient woodland harvesting.

#### WOODLAND SUITABILITY GROUP 8

This unit consists of somewhat excessively drained soils that developed from sandstone and shale. The Muskingum, Montevallo, and Ramsey stony soils in this group are limited to narrow ridges, the upper third of warm slopes, and the upper fifth of cool slopes. The soils are—

|        |   |
|--------|---|
| (Gu)   | Gullied land.   |
| (MrE)  | Muskingum-Ramsey complex, 20 to 30 percent slopes.                                      |
| (MvF)  | Muskingum, Montevallo and Ramsey stony soils, 30 to 50 percent slopes.                  |
| (MvF3) | Muskingum, Montevallo and Ramsey stony soils, 30 to 50 percent slopes, severely eroded. |
| (Rk)   | Rock land.  |

The potential productivity of this group of soils is fairly low, and management investments should be somewhat limited.

The hazard of gully erosion is severe, mainly because of the steepness of slopes and the texture of the soils. If water concentrates on these soils, it readily forms gullies. Therefore, special attention should be given to the proper location, construction, and maintenance of roads and skid trails.

Equipment limitations are severe. Steep slopes, rough terrain, and rocks limit the use of farm-type equipment. Track-type equipment and power winches are required for efficient woodland harvesting.

Seedling mortality is severe because droughts of 2 to 3 weeks occur during the early part of some growing seasons and cause moderate to severe losses of newly planted trees. Volunteer seedlings generally grow too slowly to provide adequate cover on open land.

### Wildlife<sup>3</sup>

In this subsection the principal kinds of wildlife in Elliott County and their habitat requirements are discussed. The wildlife suitability groups in which the soils have been placed are also discussed, and the soils in each group are listed.

#### Wildlife and their habitat requirements

The principal kinds of wildlife in Elliott County are cottontail rabbits, gray squirrels, fox squirrels, bobwhite quail, mourning doves, ruffed grouse, white-tailed deer, raccoons, opossums, skunks, minks, muskrats, and red and gray foxes. There are also many kinds of songbirds and nongame mammals. The streams of the county contain the kinds of game, pan, and rough fish commonly found in the State.

*Cottontail rabbits* are abundant, but the population fluctuates from year to year. It is generally highest on

the Muskingum-Ramsey-Wellston soil association, is medium on the Muskingum-Montevallo-Ramsey association in the southwestern part of the county, and is low on this same association in the eastern half of the county.

Rabbits are most numerous in agricultural areas. They are vegetarians and eat such a wide variety of plants that food is seldom a problem. But cover is, and the proverbial brier patch is a good example of the best protective cover a rabbit can have. Farms that have fields of crops and pasture produce the most rabbits if the fields are separated by wide, brushy fence rows. Rabbits use abandoned groundhog burrows when the weather is bitter cold.

*Gray squirrels* are also abundant. Their population is highest in the eastern half of the county on the Muskingum-Montevallo-Ramsey soil association. It is less in the northwestern part of the county on the northernmost part of the Muskingum-Ramsey-Wellston association, and is lowest on the southern half of this association and on that part of the Muskingum-Montevallo-Ramsey association in the extreme southwestern part of the county.

Gray squirrels prefer large expanses of hardwood forest for their home. Forests with a high percentage of mature or decaying hardwood trees furnish most of the hollows for dens. Squirrels are mast-eaters, and their population fluctuates according to the annual production of nuts and acorns from trees that furnish the bulk of their food. Important trees that produce food for gray squirrels are shagbark hickory, white oak, black oak, walnut, hackberry, sassafras, dogwood, and blackgum. Squirrels also eat mulberries and Osage oranges.

*Fox squirrels* are common in about the same pattern throughout the county as gray squirrels. In contrast to gray squirrels, however, fox squirrels prefer small farm woodlots with parklike openings. They need the same kind of trees for dens and food as gray squirrels, but fox squirrels seem to be more closely associated with bottom lands and streams.

*Bobwhite quail* are common in this county. Their population is highest on the Muskingum-Ramsey-Wellston soil association, is medium on the Muskingum-Montevallo-Ramsey association in the eastern third of the county, and is lowest on this same association in the southwestern third of the county.

Quail thrive best in agricultural areas where each farm has pasture, cropland, and woodlots. Quail are attracted by small fields (not more than 10 acres) that are separated by wide, brushy fence rows. These birds require grass and other herbaceous cover for nesting; seed-bearing plants, including cultivated crops, for food; and brush and trees for protection from weather and natural enemies. They require open water for drinking only during extreme drought. Ordinarily they get sufficient moisture from insects, berries, and fleshy fruits.

*Mourning doves* are also common. Their population generally is highest on the Muskingum-Ramsey-Wellston soil association in the northwestern half of the county. It is medium on the Muskingum-Montevallo-Ramsey association in the southwestern half of the county, especially in the northernmost part of the association, and is lowest on the southwestern half of this soil association.

Mourning doves are migratory, but a few probably remain in the county throughout the winter. They are seedeaters and therefore are especially attracted to grain crops. Partly because they eat no insects, they require

<sup>3</sup> This subsection was written by WILLIAM H. CASEY, biologist, Soil Conservation Service.

open water, such as farm ponds, for drinking. Most doves nest in trees with rather open foliage, such as that of pine or elm. A few nest on the ground. Pine plantations, or evergreens planted as ornamentals in parks and cemeteries, are preferred nesting sites.

*Ruffed grouse* are abundant. They are more numerous now than they have been for many years. Their population is high on the Muskingum-Ramsey-Wellston and the Rock land-Monongahela-Pope soil associations in the northwestern half of the county. The population is medium on the western half of the Muskingum-Montevallo-Ramsey association and is low on the rest of the association.

Ruffed grouse are birds of the forest, but within the forest they are attracted to natural or man-made openings where they find many of their preferred food plants. Among these are blackberry, wild cherry, flowering dogwood, and domesticated apple trees. Grouse also eat insects and acorns when they are available. During winter, when other foods are scarce, they feed almost exclusively on buds of woody plants. Drumming logs are required for good grouse habitat because on these logs the males perform their courtship display. They seem to prefer an old log, disintegrating from decay, and more than 20 inches in diameter.

*White-tailed deer* are abundant. They have been restocked and are protected by the Kentucky Department of Fish and Wildlife Resources. Though abundant, they are not found throughout the county, but are in definite localities. The greatest population is in a small area on the Muskingum-Ramsey-Wellston soil association near Ruin and Bigstone on State Highway No. 556. Their population is medium on the other side of the county on the Muskingum-Montevallo-Ramsey association near the junction of Wallow Hole Creek and Little Fork of Little Sandy River. A low population is concentrated on this same association along the Little Sandy River southwest of the town of Sandy Hook.

Deer are generally considered forest animals, although they thrive in agricultural areas that have a rather high percentage of woodland, interspersed with cropland and pasture. They browse more than they graze, but their eating habits change with the seasons. Generally, in the spring they eat tender grass and clover; during summer they eat the leaves of herbs, shrubs, and trees; in the fall they eat acorns; and in winter they browse on tender twigs of shrubs and trees. Deer also like corn and apples. They need open water for drinking, especially during dry periods.

*Raccoons* are also abundant. They are most numerous on the southern part of the Muskingum-Ramsey-Wellston and Rock land-Monongahela-Pope soil associations south of Rocky Creek and on that part of the adjoining Muskingum-Montevallo-Ramsey association north of the Little Sandy River. A medium population occurs on the remaining parts of the Muskingum-Ramsey-Wellston and Rock land-Monongahela-Pope associations, and a low population on the rest of the Muskingum-Montevallo-Ramsey association.

Raccoons are likely to be found in almost any woodland where there are large, hollow trees, which they prefer for dens. They are especially attracted to wooded areas along streams and other bodies of water. Their principal plant foods are persimmons, pecans, acorns, grapes, poke-

berries, and corn. Their animal foods include crayfish, insects, frogs, and small mammals.

*Opossums* and *skunks* are common in the county. They are in greatest number in the northwestern fourth of the county on the Muskingum-Ramsey-Wellston and Rock land-Monongahela-Pope soil associations. Their population is lowest on the southern half of these associations and on the adjoining part of the Muskingum-Montevallo-Ramsey association along the Little Sandy River. A medium population occurs in the rest of the Muskingum-Montevallo-Ramsey association.

Although opossums are commonly found around farmland, they are primarily woodland animals. They make their dens in abandoned groundhog burrows, under brushpiles or old buildings, or in hollow trees. Their diet consists of fruits (especially persimmon), insects, mice, garbage, and carrion. They require water near their habitat. Skunks are beneficial animals and are most numerous in agricultural areas that have a well-balanced combination of woodland, brushland, and grassland. Skunks seldom stray farther than a couple of miles from water. Their den is generally a hole in the ground, but an old building may be used as temporary shelter. Their food consists of insects, mice, eggs, and various fruits and berries.

*Mink* are common and *muskrat* are abundant. These furbearers occur in greatest number on the parts of the Rock land-Monongahela-Pope and the Muskingum-Montevallo-Ramsey soil associations that are along the Little Sandy River. Their population is medium on the rest of the Rock land-Monongahela-Pope and the Muskingum-Ramsey-Wellston associations, and is low on the Muskingum-Montevallo-Ramsey association in the eastern third of the county.

Mink, like raccoons, prefer wooded streams and lake shores. Their home is most often a brushpile or a burrow in a streambank. They spend most of their life near water, where they feed on muskrats, aquatic insects, crayfish, frogs, and small fish. Occasionally, they stray a considerable distance from water, probably when food is scarce within their normal range.

Muskrats require an aquatic habitat. They ordinarily live in bank burrows, which they make along streams and in farm ponds. In marshes, they build houses of aquatic vegetation. Their main food is the stems and roots of cattails, rushes, and other aquatic plants, but sometimes they eat frogs, turtles, and fish. At certain times of the year when there is a need to adjust to a changed environment, there is a "shuffling" of the muskrat population. This is why muskrats constantly reappear in farm ponds from which they have been removed.

*Red foxes* are common and are in greatest number on the Muskingum-Ramsey-Wellston and Rock land-Monongahela-Pope soil associations in the northwestern third of the county. Their population is medium on the Muskingum-Montevallo-Ramsey association in the eastern half of the county. It is lowest in the southwestern third of the county.

Red foxes are most numerous in rolling or hilly country that is a combination of cropland, meadow, and fairly open woodland. Their den is usually an abandoned groundhog borrow. Rabbits and mice make up nearly half of their diet, and birds, insects, and fruit, such as persimmons and grapes, make up the rest.

*Gray foxes* are abundant, and they are most numerous where red foxes are fewest—in the southwestern third of the county on the Muskingum-Ramsey-Wellston soil association to the north and the Muskingum-Montevallo-Ramsey association to the south. The Muskingum-Montevallo-Ramsey association in the eastern third of the county supports a medium population, and a low population is in the northwestern third of the county on the Muskingum-Ramsey-Wellston and Rock land-Monongahela-Pope associations.

Gray foxes are more retiring than red foxes and seem to prefer river bottoms, bluffs or cliffs, and fairly open brushland. They use a ground den less than do red foxes. Instead, they may use a hollow log or a hole in a cliff. They can climb trees. Their food is about the same as that of red foxes, but they probably eat more vegetable matter.

*Songbirds* are common throughout the county. Some species are more numerous in certain parts of the county than in others because of differences in land use and, consequently, in vegetation. The exact number of species in the county is not known, but 228 species visit at one time or another.

The habitat requirements of songbirds are many and varied. Some nest on the ground, some in shrubs, some in tall trees, and some in dead, hollow trees. Their food is also varied. Some eat mostly seeds, insects, and fruits, whereas others eat mostly meat. The landscape that has the greatest variety and amount of vegetation will have the greatest variety and number of birds.

The greatest number of *fish* are in the Little Sandy River, the Little Fork of Little Sandy River, and Laurel Creek. All these streams have many tributaries that contain some fish. Game, pan, and rough fish are all common in these streams in about equal numbers. Most farm ponds have been stocked with game and pan fish by the Kentucky Department of Fish and Wildlife Resources.

Large populations of game, pan, and rough fish normally are not found together in the same body of water, because different kinds of fish require, or can tolerate, markedly different physical and chemical properties in water. Generally, rough fish can tolerate less oxygen in water than game and pan fish. Also, rough fish feed largely by taste and smell and, therefore, do not require water as clear as that required by the sight-feeding game and pan fish. Consequently, silt-laden, chemically-polluted waters are usually devoid of the more desirable game and pan fish.

### **Wildlife suitability groups**

The capacity of a soil to support wildlife depends on the ability of the soil to produce a wide variety and a large amount of vegetation. The soils of Elliott County have been placed in three wildlife suitability groups on this basis.

#### **WILDLIFE SUITABILITY GROUP 1**

The major soils in this group have a high to very high moisture-supplying capacity and a moderately high to high natural fertility. They are the most productive soils of the county and are capable of producing a wide variety and large amount of vegetation. The soils are—

- Allegheny loam, 2 to 6 percent slopes.
- Allegheny loam, 6 to 12 percent slopes.

- Allegheny loam, 6 to 12 percent slopes, eroded.
- Barbourville gravelly loam, 2 to 6 percent slopes.
- Barbourville gravelly loam, 6 to 12 percent slopes.
- Cotaco gravelly loam, 2 to 6 percent slopes.
- Jefferson gravelly loam, 6 to 12 percent slopes.
- Pope fine sandy loam, 0 to 3 percent slopes.
- Pope fine sandy loam, 3 to 6 percent slopes.
- Sequatchie fine sandy loam, 0 to 4 percent slopes.
- Wellston silt loam, 2 to 6 percent slopes.
- Wellston silt loam, 6 to 12 percent slopes.
- Whitwell loam.

These soils can support large populations of most wildlife in the county, but they are used mostly for cultivated crops and are probably supporting more rabbits, quail, and songbirds than any other kinds of wildlife.

Habitats for bobwhite quail can be improved by planting hedgerows around the larger fields. Other wildlife can be benefited best by protecting hedgerows, woodland, and idle land from uncontrolled burning and grazing.

#### **WILDLIFE SUITABILITY GROUP 2**

The soils in this group have a moderately low to high moisture-supplying capacity and a moderate to moderately low natural fertility. They can produce about the same variety of vegetation as the soils in group 1. They produce less, however, because their fertility is lower. The soils are—

- Bruno loamy sand.
- Jefferson gravelly loam, 12 to 20 percent slopes.
- Jefferson gravelly loam, 20 to 30 percent slopes.
- Monongahela fine sandy loam, 2 to 6 percent slopes.
- Monongahela silt loam, 2 to 6 percent slopes.
- Monongahela silt loam, 6 to 12 percent slopes.
- Muskingum silt loam, 6 to 12 percent slopes.
- Muskingum-Ramsey complex, 12 to 20 percent slopes.
- Muskingum-Ramsey complex, 20 to 30 percent slopes.
- Pope gravelly fine sandy loam.
- Ramsey fine sandy loam, 6 to 12 percent slopes.
- Rarden silt loam, 5 to 15 percent slopes.
- Stendal fine sandy loam.
- Stendal gravelly fine sandy loam.
- Stendal silt loam.
- Tyler silt loam.

This group probably supports more ruffed grouse, deer, opossums, skunks, raccoons, red foxes, and songbirds than either of the other two groups. Its production, however, is limited by the moderate to moderately low natural fertility.

Aside from protection from fire and grazing, there are probably few feasible practices that can be used to improve existing habitats for wildlife.

#### **WILDLIFE SUITABILITY GROUP 3**

The soils of this group are severely limited in the variety and amount of vegetation they can produce. Some are droughty and are suited to only a few kinds of vegetation. Others are highly fertile but are suited to only a few kinds of vegetation because they are wet. And others have adequate moisture-supplying capacity but have low fertility. The soils are—

- Atkins loam.
- Gullied land.
- Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes.
- Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes, severely eroded.
- Rock land.

Because only a small acreage is cultivated or used for pasture, only a few quail, rabbits, and mourning doves

live on these soils. The production of other kinds of wildlife probably ranges from low to moderate. Thus, the potential production of wildlife on these soils is considerably less than on soils of the other two groups.

The habitat for deer and ruffed grouse on these soils could be improved by making openings in the more extensively forested areas and seeding them to palatable grasses and legumes. Keeping livestock out of the woods would also help deer and grouse as well as gray squirrels. But probably the best way to improve conditions for wildlife on these soils is to apply conservation practices that build up soil fertility.

### Use of Soils for Engineering

In engineering, soil is used as structural material and as foundation material upon which structures are built. Some soil properties are of special interest to engineers because they affect roads, airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, sewage disposal systems, and

other structures. The soil properties that most affect these structures are permeability to water, shear strength, compaction characteristics, drainage, shrink-swell characteristics, grain size, plasticity, and degree of acidity or alkalinity (pH values). Topography, depth to water table, and depth of bedrock also affect engineering structures.

*This report does not eliminate the need for on-site sampling and testing of soils for specific engineering works and uses. The interpretations in the report should be used primarily in planning more detailed field investigations to determine the in-place condition of soils at the proposed sites for engineering works.*

Information in this report can be used to:

1. Make studies of soil to aid in selecting and developing industrial, business, residential, and recreational jobs.
2. Make preliminary estimates of the engineering properties of soils in order to plan agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.

TABLE 6.—*Brief descriptions of soils and*

| Soil name  | Description of soil and site  | Depth to rock | Depth to seasonally high water table |
|--|---|---------------|--------------------------------------|
|  |   | Feet<br>3-5+  | Feet<br>10+                          |
| Allegheny loam, 2 to 6 percent slopes.<br>Allegheny loam, 6 to 12 percent slopes.<br>Allegheny loam, 6 to 12 percent slopes, eroded.                       | About 1 foot of friable loam or silt loam, over 2 feet of firm silty clay loam or sandy clay loam, over 1 to 10 feet of stratified layers of sand, silt, clay, and gravel alluvium. Well-drained soils on old, high terraces.   | 3-5+          | 10+                                  |
| Atkins loam.   | Very friable loam, 3 to more than 10 feet thick, ranging in spots from silt loam to sandy loam. Poorly drained soil on first bottoms subject to flooding.   | 10+           | 0-1                                  |
| Barbourville gravelly loam, 2 to 6 percent slopes.<br>Barbourville gravelly loam, 6 to 12 percent slopes.  | About ½ foot of very friable gravelly loam, over 2 feet of friable gravelly loam, over 2 to more than 5 feet of local alluvium. Well-drained soils on low toe slopes that are seldom flooded.   | 8-10+         | 5-10                                 |
| Bruno loamy sand.  | Loose loamy sand, 3 to more than 10 feet thick. Excessively drained soil on first bottoms subject to flooding.  | 5+            | 0-10                                 |
| Cotaco gravelly loam, 2 to 6 percent slopes.   | About 1½ feet of very friable gravelly loam, over 1½ feet of friable gravelly sandy clay loam, over 2 to 5 feet of local alluvium. Moderately well drained to somewhat poorly drained soil on toe slopes that are seldom flooded. Shallow to water table or seeps.  | 5+            | 1-4                                  |
| Jefferson gravelly loam, 6 to 12 percent slopes.<br>Jefferson gravelly loam, 12 to 20 percent slopes.<br>Jefferson gravelly loam, 20 to 30 percent slopes. | About 9 inches of very friable loam, over 2 feet of firm gravelly clay loam, over 2 to more than 5 feet of local alluvium. Well-drained soils on toe slopes.  | 5+            | 4-10                                 |
| Monongahela fine sandy loam, 2 to 6 percent slopes.  | About ½ foot of very friable loam, silt loam, or fine sandy loam, over 1 foot of friable silty clay loam or fine sandy clay loam, over a slowly permeable, compact silty clay loam fragipan 2 to 4 feet thick, over 1 to more than 5 feet of stratified alluvium. Moderately well drained soil on terraces; seasonal perched water table. | 5-10          | 1-2                                  |
| Monongahela silt loam, 2 to 6 percent slopes.<br>Monongahela silt loam, 6 to 12 percent slopes.  | Same as for Monongahela fine sandy loam, 2 to 6 percent slopes.   | 5-10          | 1-2                                  |

3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables, and in planning detailed investigations at the selected locations.
4. Locate 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 overall planning, design, and maintenance of other engineering structures.
6. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps, reports, and aerial photographs in preparing maps and reports that can be used readily by engineers.
8. Develop preliminary estimates for construction in a specific area.

Some terms used by soil scientists may not be familiar to engineers, or may have different meanings in engineer-

ing and in other fields. The Glossary at the back of this report defines such terms. Other parts of the report, especially the sections "Descriptions of Soils" and "Formation, Classification, and Morphology of Soils," give information that will help engineers determine the properties of soils in a specific area.

**Physical and chemical properties of soils**

Table 6 contains brief descriptions of the soils and their estimated physical and chemical properties that affect engineering works. The columns of the table are explained as follows:

*Description of soil and site* is a brief description of the soil mapping unit to a depth of 36 to 60 inches and a description of the site on which it occurs.

*Depth from surface* shows the thickness of each layer and its depth from the surface.

*Depth to rock* generally is the depth to noncompressible material, which may be shale or sandstone bedrock.

In table 6 the classification of the soils is given according to the systems used by the U.S. Department of Agri-

*their estimated physical and chemical properties*

| Depth from surface    | Classification                   |          |            | Percent passing sieve— |        |         | Permeability | Available water capacity | Reaction      | Shrink-swell potential |
|-----------------------|----------------------------------|----------|------------|------------------------|--------|---------|--------------|--------------------------|---------------|------------------------|
|                       | USDA                             | Unified  | AASHO      | No. 4                  | No. 10 | No. 200 |              |                          |               |                        |
| <i>Inches</i><br>0-12 | Loam or silt loam                | ML-----  | A-4-----   | 95-100                 | 90-100 | 60-80   | 2.5-7.5      | 0.18-0.22                | pH<br>6.6-7.3 | Low.                   |
| 12-26                 | Silty clay loam                  | CL-----  | A-6-----   | 95-100                 | 95-100 | 85-95   | 0.8-2.5      | 0.19                     | 5.1-6.0       | Moderate.              |
| 26-36                 | Sandy clay loam                  | CL-----  | A-4 or A-6 | 95-100                 | 90-100 | 60-80   | 2.5-5.0      | 0.17                     | 5.1-5.5       | Moderate.              |
| 36-48+                | Fine sandy loam                  | SM-----  | A-4-----   | 95-100                 | 90-100 | 40-50   | 5.0-10.0     | 0.13                     | 5.1-5.5       | Low.                   |
| 0-10                  | Loam-----                        | ML-----  | A-4-----   | 95-100                 | 90-100 | 50-70   | 5.0-10.0     | 0.18                     | 5.1-5.5       | Low.                   |
| 10-48+                | Silt loam-----                   | ML-----  | A-4-----   | 95-100                 | 90-100 | 60-95   | 2.5- 5.0     | 0.22                     | <5.0          | Low to moderate.       |
| 0-8                   | Gravelly loam                    | GM or ML | A-2, A-4   | 60-85                  | 55-75  | 30-65   | 5.0-10.0     | 0.13                     | 5.5-6.0       | Low.                   |
| 8-48+                 | Gravelly loam to sandy clay loam | ML-----  | A-4 or A-6 | 70-85                  | 70-85  | 60-80   | 2.5- 5.0     | 0.13                     | 4.5-5.5       | Moderate to low.       |
| 0-48+                 | Loamy sand                       | SM-----  | A-2-----   | 90-100                 | 85-100 | 25-40   | 10.0         | 0.10                     | 4.5-6.0       | Low.                   |
| 0-17                  | Gravelly loam                    | GM or ML | A-2, A-4   | 60-85                  | 60-85  | 30-65   | 5.0-10.0     | 0.13                     | 5.1-6.0       | Low.                   |
| 17-48+                | Gravelly sandy clay loam         | GC or CL | A-2 or A-6 | 60-85                  | 55-85  | 45-70   | 2.5-5.0      | 0.14                     | 4.5-5.5       | Moderate to low.       |
| 0-9                   | Gravelly loam                    | GM or ML | A-2 or A-4 | 65-85                  | 65-85  | 35-55   | 5.0-10.0     | 0.14                     | 5.6-6.0       | Low.                   |
| 9-48+                 | Gravelly clay loam               | CL-----  | A-6-----   | 70-85                  | 70-85  | 50-60   | 2.5-5.0      | 0.14                     | 4.5-5.0       | Moderate.              |
| 0-7                   | Fine sandy loam                  | SM-----  | A-4-----   | 95-100                 | 90-100 | 40-50   | 5.0-10.0     | 0.13                     | 5.6-6.0       | Low.                   |
| 7-18                  | Clay loam                        | CL-----  | A-6-----   | 95-100                 | 95-100 | 70-85   | 2.5-5.0      | 0.18                     | 5.1-5.5       | Moderate.              |
| 18-48+                | Clay loam                        | CL-----  | A-6-----   | 95-100                 | 95-100 | 70-85   | <0.5         | <0.10                    | 4.5-5.0       | Moderate.              |
| 0-7                   | Silt loam                        | ML-----  | A-4-----   | 95-100                 | 95-100 | 75-95   | 2.5-5.0      | 0.22                     | 5.1-6.0       | Low.                   |
| 7-18                  | Silty clay loam                  | CL-----  | A-6-----   | 95-100                 | 95-100 | 85-95   | 0.8-2.5      | 0.19                     | 5.1-5.5       | Moderate.              |
| 18-48+                | Silty clay loam                  | CL-----  | A-6-----   | 95-100                 | 95-100 | 85-95   | <0.5         | <0.10                    | 4.5-5.0       | Moderate.              |

TABLE 6.—*Brief descriptions of soils and their estim*

| Soil name  | Description of soil and site  | Depth to rock      | Depth to seasonally high water table |
|--|---|--------------------|--------------------------------------|
| Montevallo silt loam.  | About 1 foot of friable shaly silt loam over silty shale. Well-drained to excessively drained upland slopes.  | Feet<br>½-1½       | Feet<br>10+                          |
| Muskingum silt loam, 6 to 12 percent slopes.<br>Muskingum silt loam, 12 to 20 percent slopes.<br>Muskingum silt loam, 20 to 30 percent slopes.             | Very friable silt loam, ½ foot thick, over 1½ feet of fine silt loam containing 20 to 30 percent, by volume, gravel-sized shale and siltstone fragments and overlying interbedded siltstone, brittle shale, and sandstone. Somewhat excessively drained.      | 1½-3               | 1-2                                  |
| Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes.<br>Muskingum, Montevallo, and Ramsey stony soils, 30 to 50 percent slopes, eroded. | See Muskingum silt loam, Montevallo silt loam, and Ramsey fine sandy loam for data.   | -----              | -----                                |
| Muskingum-Ramsey complex, 12 to 20 percent slopes.<br>Muskingum-Ramsey complex, 20 to 30 percent slopes.   | See Muskingum silt loam and Ramsey fine sandy loam for data.  | -----              | -----                                |
| Pope fine sandy loam, 0 to 3 percent slopes.<br>Pope fine sandy loam, 3 to 6 percent slopes.   | Fine sandy loam, 3 to more than 10 feet thick, ranging to silt loam and loam in places. Well-drained soils on first bottoms subject to flooding.  | 4-6+               | 3-5                                  |
| Pope gravelly fine sandy loam.   | Same as Pope fine sandy loam but gravelly.  | -----              | -----                                |
| Ramsey fine sandy loam, 6 to 12 percent slopes.  | About ½ foot of very friable fine sandy loam, over 1 foot of friable sandy clay loam or sandy loam, underlain by soft sandstone. Somewhat excessively drained soil on hillsides.  | 1-2                | 1-2                                  |
| Rarden silt loam, 5 to 15 percent slopes.  | About ½ foot of friable silt loam, over ¼ foot of firm silty clay loam, over 2 feet of very firm, sticky and plastic, slowly permeable, silty clay, underlain by soft clay shale. Well drained to moderately well drained soil on uplands.                    | 1 <sup>1</sup> 2-4 | 4-10                                 |
| Sequatchie fine sandy loam, 0 to 4 percent slopes.   | About 2 feet of very friable fine sandy loam, over 1 foot of friable sandy clay loam, over 2 to more than 5 feet of stratified alluvium. Well-drained soil on low terraces that are seldom flooded.   | 8+                 | 4-10                                 |
| Stendal fine sandy loam.   | Fine sandy loam 3 to more than 10 feet thick. Somewhat poorly drained soil on first bottoms subject to flooding.  | 5+                 | 0-1                                  |
| Stendal gravelly fine sandy loam.  | Same as Stendal fine sandy loam, except gravelly.   | 5+                 | 0-1                                  |
| Stendal silt loam.   | Silt loam 3 to more than 10 feet thick. Somewhat poorly drained soil on first bottoms subject to flooding.  | -----              | -----                                |
| Tyler silt loam.   | About 2 feet of friable silt loam over a slowly permeable, compact silt loam fragipan 1 to 4 feet thick, over stratified beds of alluvium. Moderately well drained soil on terraces; seasonally high water table.   | 4-12+              | 0-1                                  |
| Wellston silt loam, 2 to 6 percent slopes.<br>Wellston silt loam, 6 to 12 percent slopes.  | About 1 foot of friable silt loam over 2 feet of firm silty clay loam, underlain by siltstone, sandstone, and/or shale. Well-drained soils on uplands.  | 2½-5               | 10+                                  |
| Whitwell loam.   | About 1½ feet of very friable loam, over 2 feet of friable sandy clay loam, over 2 to 5 feet of stratified alluvium. Moderately well drained to somewhat poorly drained soil on low terraces that are seldom flooded. Shallow to seasonally high water table. | 6-12+              | 1-2                                  |

<sup>1</sup> To clay shale.

ated physical and chemical properties—Continued

| Depth from surface           | Classification   |  |  | Percent passing sieve—               |                                      |                                  | Permeability                              | Available water capacity               | Reaction                                 | Shrink-swell potential                      |
|------------------------------|--|--|--|--------------------------------------|--------------------------------------|----------------------------------|---|--|--|---|
|                              | USDA   | Unified  | AASHO  | No. 4                                | No. 10                               | No. 200                          |   |  |  |   |
| <i>Inches</i><br>0-12<br>12+ | Shaly silt loam...<br>Silty shale.....                                 | GM or ML..                                     | A-2 or A-4..   | 65-95                                | 60-90                                | 55-85                            | <i>Inches per hour</i><br>5.0-10.0        | <i>Inches per inch of soil</i><br>0.16 | <i>pH</i><br>4.5-5.0                     | Low.  |
| 0-7<br>7-24                  | Silt loam.....<br>Gravelly silt loam.                                  | ML.....<br>ML.....                             | A-4.....<br>A-4.....                                 | 95-100<br>80-95                      | 95-100<br>70-85                      | 75-95<br>55-75                   | 2.5-5.0<br>2.5-5.0                        | 0.22<br>0.20                           | 5.5-6.0<br>4.5-5.0                       | Low.<br>Low.                                |
| 0-48                         | Fine sandy loam..  | SM.....  | A-4.....   | 95-100                               | 90-100                               | 40-50                            | 5.0-10.0                                  | 0.13                                   | 6.0-<4.5                                 | Low.  |
| 0-48                         | Gravelly fine sandy loam.  | GM or SM..                                     | A-2, A-4...  | 60-85                                | 55-85                                | 30-50                            | 5.0-10.0                                  | 0.10                                   | 6.0-<4.5                                 | Low.  |
| 0-6<br>6-18                  | Fine sandy loam..<br>Sandy clay loam..                                 | SM or ML..<br>SM or SC..                       | A-4.....<br>A-4.....                                 | 95-100<br>95-100                     | 90-100<br>85-100                     | 40-60<br>50-70                   | 5.0-10.0<br>5.0-10.0                      | 0.13<br>0.15                           | 5.6-6.0<br>5.1-5.5                       | Low.<br>Low.                                |
| 0-5<br>5-8<br>8-38+          | Silt loam.....<br>Silty clay loam...<br>Silty clay or clay.            | ML or CL..<br>CL.....<br>CL or CH..            | A-4 or A-6..<br>A-6 or A-7..<br>A-7.....             | 95-100<br>95-100<br>100              | 95-100<br>95-100<br>98-100           | 75-95<br>85-95<br>90-100         | 2.5- 5.0<br>0.8- 2.5<br>0.05-0.2          | 0.22<br>0.19<br>0.15                   | 4.5-5.5<br>4.5-5.0<br>4.5-5.0            | Moderate.<br>Moderate.<br>Moderate to high. |
| 0-26<br>26-38<br>38-48+      | Fine sandy loam..<br>Sandy clay loam..<br>Fine sandy loam..            | SM or ML..<br>SC or CL..<br>SM or ML..         | A-4.....<br>A-4 or A-6..<br>A-4.....                 | 95-100<br>95-100<br>95-100           | 90-100<br>90-100<br>90-100           | 40-60<br>45-75<br>40-60          | 5.0-10.0<br>2.5- 5.0<br>5.0-10.0          | 0.13<br>0.17<br>0.13                   | 5.1-6.0<br>4.5-5.0<br>4.5-5.0            | Low.<br>Low to moderate.<br>Low.            |
| 0-48+                        | Fine sandy loam..  | SM or ML..                                     | A-4.....   | 95-100                               | 90-100                               | 40-60                            | 5.0-10.0                                  | 0.13                                   | 6.0-<4.5                                 | Low.  |
| 0-48+                        | Gravelly fine sandy loam.  | SM.....  | A-2, A-4...  | 70-85                                | 65-85                                | 30-50                            | 5.0-10.0                                  | 0.10                                   | 6.0-<4.5                                 | Low.  |
| 0-48+                        | Silt loam.....   | ML.....  | A-4.....   | 95-100                               | 95-100                               | 75-95                            | 2.5-5.0                                   | 0.22                                   | 6.0-<4.5                                 | Low.  |
| 0-24<br>24-48+               | Silt loam.....<br>Silt loam.....                                       | ML.....<br>ML.....                             | A-4.....<br>A-4.....                                 | 95-100<br>95-100                     | 95-100<br>95-100                     | 75-95<br>75-95                   | 2.5-5.0<br>0.5                            | 0.22<br>0.22                           | 4.5-6.0<br>4.5-5.0                       | Low.<br>Low.                                |
| 0-10<br>10-32                | Silt loam.....<br>Silty clay loam...<br>Loam.....<br>Sandy clay loam.. | ML or CL..<br>CL.....<br>ML.....<br>ML or CL.. | A-4 or A-6..<br>A-6 or A-7..<br>A-4.....<br>A-6..... | 95-100<br>95-100<br>95-100<br>95-100 | 95-100<br>95-100<br>90-100<br>90-100 | 75-95<br>85-95<br>50-70<br>60-80 | 2.5-5.0<br>0.8-2.5<br>5.0-10.0<br>2.5-5.0 | 0.22<br>0.19<br>0.18<br>0.17           | 5.1-6.0<br>4.5-5.0<br>4.5-5.0<br>4.5-5.0 | Low.<br>Moderate.<br>Low.<br>Moderate.      |

culture (USDA), The American Association of State Highway Officials (AASHO), and the Corps of Engineers, U.S. Army (Unified). These systems are explained as follows.

The USDA system of naming soil texture is primarily for agricultural use. However, it is also useful to engineers. It is based on the relative proportions of the various sized individual soil grains in a mass of soil. Specifically, classes of soil texture are based on different proportions of sand (2.0 millimeters to 0.05 millimeter in size), 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*. The sand, loamy sand, and sandy loam classes may be further divided into coarse, fine, or very fine. Gravelly soils are those that contain gravel as large as 3 inches in diameter, and stony soils are those that contain stones more than 10 inches in diameter. Shaly soils have flat fragments of shale less than 6 inches long. Flaggy soils contain thin fragments of sandstone, limestone, slate, or shale 6 to 15 inches long.

The Unified soil classification system is based on the textural and plastic qualities of soils and their performance as construction materials (3, 7, 14). The properties that form the basis of this soil classification are (1) percentage of gravel, sand, and fines (fractions passing the number 200 sieve), (2) shape of the grain-size distribution curve, and (3) plasticity characteristics. The soils are divided into three classes—coarse-grained, fine-grained, and highly organic.

The coarse-grained soils contain 50 percent or less material that is smaller than the number 200 sieve (0.074 millimeter). These soils are subdivided into gravel (G) and sand (S). The gravel soils are those having the greater percentage of the coarse fraction (larger than the number 200 sieve) retained on the number 4 sieve (4.76 millimeters), and the sands are those having the greater percentage passing the number 4 sieve. The soils in each of these two groups are further classified on the basis of the amount of fines, the plasticity characteristics, and the shape of the grain-size distribution curve. The symbols of the gravelly soils are GW (well graded), GP (poorly graded), GM (silty), and GC (clayey), and those of the sandy soils are SW (well graded), SP (poorly graded), SM (silty), and SC (clayey).

More than 50 percent of the material that is in the fine-grained soils is smaller than the number 200 sieve. These soils are subdivided into silts (M) and clays (C), depending on their liquid limit and plasticity index. Each of these groups are further classified on the basis of whether the soils have a relatively low (L) or high (H) liquid limit. The symbols of the silt soils are ML and MH, and those of the clay soils are CL and CH.

The AASHO system (2, 7) is based on the field performance of soils used in highways. Soils of about the same general load-carrying capacity and service are placed in seven basic groups from A-1 through A-7. The A-1 soils are the best for road subgrades, whereas A-7 soils are the poorest.

The textural soil fractions that are used in classification are gravel, coarse sand, fine sand, and combined silt and clay. The soil classifications are divided into two major

groups, namely, granular materials, 35 percent or less of which passes the number 200 sieve, and silt-clay materials, more than 35 percent of which passes the number 200 sieve. If the plasticity index of a soil has a value of 10 or less, the soil is silty, and if the plasticity index is more than 10, the soil is clayey.

The granular soils are classified as A-1, A-2, and A-3. The A-1 group is made up of soils that are well-graded mixtures, from coarse to fine, with a nonplastic or slightly plastic soil binder. Soils in the A-2 group may be poorly graded and contain inferior binder material. Soils in the A-3 group are composed of sands that are deficient in soil binder and coarse material.

The silt-clay soils are classified as A-4, A-5, A-6, and A-7. The soils in the A-4 group are composed predominantly of silt and have only moderate to small amounts of coarse material and only small amounts of sticky, colloidal clay. When dry, they provide a firm riding surface with little rebound after loading. When they absorb water rapidly, these soils expand, lose stability, and are subject to frost-heave. The A-5 soils are similar to the A-4 soils but include very poorly graded soils that have elastic properties and very low stability. The A-6 soils consist mostly of clay and moderate to small amounts of coarse material. They have good bearing capacity when compacted to maximum dry density, but they lose this bearing capacity when they absorb moisture. The A-7 soils consist mostly of clay but are elastic because of the content of silt particles of one size, organic matter, mica flakes, or lime carbonate. At some moisture contents, the A-7 soils deform quickly under a load and rebound when the load is removed.

*Permeability* relates only to the movement of water downward through undisturbed material and is expressed in inches per hour. Rates are based on estimates made by soil scientists who know the properties of the soils.

*Available water capacity* is that part of the water in the soil that is available and can be taken up by plants at rates significant to their growth. The estimates of available water capacity are based on experiments made on soils in Tennessee and parts of Kentucky.

*Reaction* is the acidity of a soil expressed in terms of pH values. The complete pH scale is divided into 14 units numbered from 1 to 14. Soils that have a pH value of 7 are neutral, those below 7 are acid, and those above are alkaline. The values are based on quick tests made at the time the soils were identified.

*Shrink-swell potential* ratings are based on uniform comparison of soils throughout Kentucky and are expressed as low, moderate, or high. In general, CH or A-7 soils have a high shrink-swell potential. Silts that are slightly plastic and sands that contain small amounts of nonplastic to slightly plastic fines have a low shrink-swell potential. Medium plastic clays and elastic silts have a moderate shrink-swell potential.

*Depth to seasonally high water table* is the estimated depth to the water level during a prolonged period of rainfall.

### **Interpretations of soils for engineering uses**

Properties or features of soils that affect their use for highway construction and farm conservation are given in table 7. Additional information can be found in the sections "Descriptions of Soils" and "Formation, Classification, and Morphology of Soils."

In table 7 the suitability of soil material for topsoil, sand, gravel, and road fill is given only for the soil and does not include the underlying rock strata. Topsoil is used on slopes, on road shoulders, and in ditches for the growth of vegetation. Normally, only the surface layer is removed for topsoil, but the subsoil may also be suitable. The suitability of the soil material for roadfill depends largely on the texture of the material and its natural water content. Highly plastic soil materials with high natural water content are rated *poor*. Highly erodible soils (silts and fine sands) are difficult to compact, require moderately gentle slopes, and fast-growing vegetative cover. Therefore, these soils are rated *fair*.

Topography, as well as the kind of soil, influences the location of highways, but the interpretations in table 7 are based only on the soils. Where rock influences the location of the grade line, the engineer must determine the difficulty of excavating the rock, the probability of slides occurring in the rock strata, and the probability of water seeping along or through the bedrock. On wet soils and soils that are flooded, the roadway is best constructed on a continuous embankment that is several feet above the high water table or above the flood line. Interceptor ditches or underdrains may be needed where there is subsurface seepage. Seepage in back slopes or cuts may cause overlying material to slump or slide.

Features that affect the construction of farm ponds, drainage systems, irrigation systems, terraces, diversions, and waterways are estimated in table 7. Many of the soils are subject to seepage, and some have a high water table. Wet soils that have a fragipan are not generally suitable for tile drainage. If suitable outlets are available, however, other wet soils can be drained by tile.

## **Formation, Classification, and Morphology of Soils**

In this section the factors that affected the development of the soils are discussed. The soils are classified in higher categories, which are briefly defined, and the morphology of the soils in each category is discussed.

### **Factors of Soil Formation**

Soils are natural bodies that occupy parts of the earth's surface and support plants. Soil formation results from the action of climate and living matter on parent material, as influenced by relief and time. Thus, climate, living matter, parent material, relief, and time affect the formation of every soil. Though climate and living matter vary little throughout the county, there are many local differences in soils because of the influences of relief, parent material, or time.

*Climate*, directly or indirectly, causes variations in plant and animal life and major differences among soils; and to a certain extent, climate determines the character of many important rock formations. Climate affects the weathering of rocks, the removal and deposition of materials by water, and the percolation of water through the soil.

The soils in Elliott County were formed under a humid, temperate to warm climate. Under this climate the soils are moist and subject to leaching most of the year, except

for short, dry periods during the summer. The average annual precipitation is slightly more than 46 inches a year, and the distribution by seasons is fairly uniform. The highest average precipitation is in the early spring and summer months. On the average, March and July are the wettest months, and October is the driest. The average annual temperature is about 56° Fahrenheit. July averages 76°, and January 35°.

Elliott County is near the boundary of the climatic zones where Gray-Brown and Red-Yellow Podzolic soils are developed. Here, the normal soils that show the influence of climate have a leached, acid surface horizon over an illuviated, finer textured subsoil that is strong brown, yellowish brown, yellow, or yellowish red.

*Living matter* directly affects soil development. Bacteria, fungi, and other micro-organisms aid in weathering rock and in decomposing organic matter. The large plants alter the soil microclimate, furnish organic matter, and transfer elements from the subsoil to the surface soil.

The soils in Elliott County were formed under hardwood trees. About 65 percent of the county is still in trees, mostly second-growth mixed oaks, hickory, tulip poplar, blackgum, and beech; on warm south slopes, the stands include Virginia pine. The bottoms are mostly cleared but were originally in sycamore, willow, red maple, sweetgum, and beech. Good stands of tulip poplar are in coves below steep slopes. Hardwood trees, more than grasses, allow calcium and other bases to leach from the soil.

Living matter adds organic matter (humus) and imparts a dark color to the surface layer. Although climate and parent material have some influence, organic matter has much to do with the structure of soil. In Elliott County some of the influence of living matter is shown by a (1) thin, dark grayish-brown A1 horizon with moderate, fine, granular structure, (2) a thin, leached, lighter colored A2 horizon with weak, granular and weak subangular blocky structure, and (3) a brighter colored subsoil with a more blocky structure. The soils are also naturally strongly acid throughout the profile, though the acidity is probably due more to the nature of the parent material than to the leaching of bases by water containing carbon dioxide that was released in the decay of organic matter.

Man has also changed the environment in which the soils were formed. Many areas have been cleared of trees and planted to grass or row crops. The main change that man has made in the soil, other than erosion, is in the surface layer where, in many places, there is now a plow layer instead of a thin organic A0 horizon and organic-mineral A1 horizon over a leached A2 horizon. Many wet soils have been artificially drained; also, many soils have been further changed by application of lime, fertilizer, and manure.

*Parent material* is the weathered or decomposed mass of rocks and minerals from which a soil develops. The weathering process is brought about by the natural physical and chemical forces of climate and living matter.

The parent material of soils are in three groups: (1) Residual material, which develops in place by the natural weathering and decomposing of rocks and minerals; (2) colluvial material, which is transported by water and gravity from hillsides and deposited at the base of slopes; and (3) alluvial material, which is deposited by streams.

TABLE 7.—*Interpretations of*  
[Absence of information indicates no adverse

| Soil series and map symbols   | Suitability as source of—              |                   |                          |  | Soil features—<br>affecting                                   |
|---|--|-------------------|--------------------------|--|---|
|   | Topsoil                                | Sand              | Gravel                   | Road fill                                | Location of<br>highways                                       |
| Allegheny (AgB, AgC,<br>AgC2).  | Surface layer good...                  | Poor.....         | Not suitable....         | Fair; erodes readily..                   | Seepage in a few<br>places.                                   |
| Atkins (At).....  | Surface layer good...                  | Not suitable....  | Not suitable....         | Fair.....                                | Frequent flooding....   |
| Barbourville (BaB, BaC).....  | Surface layer fair....                 | Poor.....         | Poor.....                | Fair to good.....                        | Seepage from hill-<br>sides in a few<br>places.               |
| Bruno (Br).....   | Surface layer fair....                 | Good.....         | Not suitable....         | Good; erodes readily<br>on steep slopes. | Frequent flooding....   |
| Cotaco (CoB).....   | Surface layer fair....                 | Poor.....         | Poor to fair....         | Good.....                                | Seasonally wet, very<br>short periods of<br>flooding.         |
| Jefferson (JfC, JfD, JfE).....  | Surface layer fair....                 | Poor to fair....  | Fair.....                | Fair to good.....                        | Bedrock at 5 to<br>about 15 feet.                             |
| Monongahela (MfB, MgB,<br>MgC).   | Surface layer good...                  | Not suitable....  | Not suitable....         | Poor.....                                | Seepage in road cuts<br>above fragipan<br>during wet season.  |
| Montevallo (mapped in un-<br>differentiated group with<br>Muskingum and Ramsey<br>stony soils). | Surface layer fair....                 | Not suitable....  | Not suitable....         | Good to fair.....                        | Shallow to silty<br>shale; steep<br>slopes.                   |
| Muskingum (MkC).....  | Surface layer good<br>where not stony. | Poor.....         | Not suitable....         | Fair to good.....                        | Bedrock at 1½ to 3<br>feet; steep slopes.                     |
| Pope (PfA, PfB, Pg).....  | Surface and subsoil<br>layers good.    | Poor to good....  | Fair.....                | Good.....                                | Occasional flooding.  |
| Ramsey (RaC).....   | Surface layer good...                  | Poor; shallow.... | Not suitable....         | Good.....                                | Bedrock at 1 to 2<br>feet; steep slopes.                      |
| Rarden (RdC).....   | Surface layer fair....                 | Not suitable....  | Not suitable....         | Poor.....                                | Plastic clay at 8<br>inches; bedrock<br>shale at 2 to 4 feet. |
| Sequatchie (SfA).....   | Surface layer good...                  | Poor.....         | Not suitable....         | Fair; erodible.....                      | Very infrequent<br>flooding in places.                        |
| Stendal (Sd, Sg, St).....   | Surface layer good...                  | Fair to poor....  | Fair to not<br>suitable. | Good to fair.....                        | Moderately wet;<br>frequent flooding.                         |

*engineering properties of soils*  
 features or that the practice is not necessary]

| Soil features affecting—  |   |  |  |  |   |
|---|---|--|--|--|---|
| Farm ponds  |   | Agricultural drainage  | Irrigation   | Terraces and diversions                                | Waterways   |
| Reservoir area  | Embankment  |  |  |  |   |
| Underlying material variable; may need blanket lining.                      | Low strength-----   | High water table; frequent flooding; tile outlet inadequate in places. | Moderate slope; permeable.                                   | Moderate slope----                                     | Wet.  |
| Some seepage; core trench required in embankment.                           | Low strength; not suitable for core.                                |  | Gently sloping; rapid infiltration.                          |  |   |
| Some seepage; core trench required in embankment.                           | Gravelly-----   |  | Very rapid water infiltration; excessive percolation.        |  |   |
| Excessive seepage; core trench required in embankment.                      | Subject to severe erosion on side slopes; subject to piping.        | Seasonally wet; very short periods of flooding.                        | Rapid infiltration; generally adequate moisture.             |  | Erodes readily; subject to sloughing and caving on side slopes during floods. |
| Some seepage; core trench required in embankment.                           | Gravelly-----   |  | Moderate slope----   | Moderate slope----                                     | Gravelly.   |
| Some seepage; deep core trench required in embankment.                      | Gravelly-----   |  | Seasonal perched water table; low response to tile drainage. | Moderate slope; somewhat droughty because of fragipan. | Fragipan at 20 inches.  |
| Underlying material is variable; core trench may be required in embankment. | Generally favorable..   | Steep; shallow to bedrock.   |  | Steep; shallow to shale.                               | Steep; shallow to shale.  |
| Slight seepage in places....  | Shaly; core material scarce.  | Steep; shallow to bedrock.   |  | Steep; shallow to rock.                                | Steep; shallow to rock.   |
| Slight seepage in places....  | Some gravelly and stony material; core material scarce.             |  | Nearly level; permeable.                                     |  |   |
| Excessive seepage; core trench required in embankment.                      | Not suitable for core material.                                     |  | Steep; shallow to bedrock.                                   | Steep; shallow to bedrock.                             | Steep; shallow to bedrock.  |
| Very little seepage; blanket lining may be required.                        | Low strength; seepage; core material scarce.                        |  | Plastic clay at very shallow depth.                          | Irregular slopes; very shallow to plastic clay.        | Plastic clay; grass difficult to establish.                                   |
|   | Slowly permeable; subsoil suitable for core material; very plastic. |  | Very gently sloping; permeable.                              |  |   |
| Excessive seepage; core trench required in embankment.                      | Sandy; not suitable for core material.                              |  |  |  |   |
| Some seepage; core trench required in embankment.                           | Sandy or gravelly; not suitable for core material.                  |  |  |  |   |

TABLE 7.—*Interpretations of engi*

| Soil series and map symbols | Suitability as source of— |                  |                  |                   |   |
|-----------------------------|---------------------------|------------------|------------------|-------------------|---|
|                             | Topsoil                   | Sand             | Gravel           | Road fill         | Location of highway                                 |
| Tyler (Ty)-----             | Surface layer good...     | Not suitable.... | Not suitable.... | Fair.....         | Seasonally high water table; fragipan at 20 inches. |
| Wellston (WnB, WnC)-----    | Surface layer good...     | Not suitable.... | Not suitable.... | Fair.....         | Bedrock at 2½ to 5 feet.                            |
| Whitwell (Wh)-----          | Surface layer good...     | Not suitable.... | Not suitable.... | Poor to fair..... | Seasonally high water table.                        |

The rocks in Elliott County are sedimentary, mostly of lower Pennsylvanian geologic age. They are comparatively soft rocks consisting of formations of acid sandstone, acid siltstone, and thin beds of soft, acid shale. A thin formation of argillaceous limestone of upper Mississippian geologic age occurs in the lowest formation in the county. Only a few of the soils, however, were affected by the limestone. All other soils in the county are strongly acid to extremely acid. Mainly because of variation in texture of the parent rocks, the soils vary in texture from sandy loam to silty clay in their profiles. All but the Rarden and Ramsey soils were formed in material that weathered from a mixture (or interbedding) of sandstone, siltstone, and shale. These rocks differed primarily in texture. The fine-textured Rarden soils developed from soft shale, and the sandy Ramsey soils developed from sandstone. Rarden soils have a strong structure, and Ramsey soils have a weak structure.

*Relief* influences soil formation primarily through its effects upon drainage and erosion and secondarily through variations in plant cover and in exposure to sun, wind, and air drainage. Relief varies greatly but is classified as excessive, normal, and subnormal in Elliott County. Slopes are steep, ridges and valleys are narrow, and the county is now in the later youth or early maturity stage of the geologic erosion cycle.

Steep, convex slopes are classified as excessive relief. In areas of excessive relief, the soils have less profile development than those formed in areas of normal relief because runoff is more rapid, erosion is greater than normal, and less water percolates through the soil. These soils are shallow and have weakly developed profiles. The Muskingum, Montevallo, and Ramsey soils, which make up about 82 percent of the county, are examples of such soils.

In areas of excessive relief, some differences in soils are caused by differences in slope aspect, or exposure, such as north and south slopes or upper and lower slopes. The

amount of organic matter varies in soils on slopes of different exposure, but not enough to show on the soils map.

Gently sloping to moderately steep slopes are classified as normal relief. Only 8 percent of the county has normal relief. Soils that formed in areas of normal relief show more clearly the full influence of climate and living matter. These soils have A, B, and C horizons. Examples are Allegheny and Jefferson soils.

The relief of flat or gently sloping land with slow to very slow runoff is classified as subnormal. Soils in areas of subnormal relief had excessive water in their profiles during development. Consequently their subsoil is gray from lack of oxidation. This process, called gleization, is apparent in the Atkins soils, which are light colored and poorly drained. In time, soils on subnormal relief develop a fragipan, which is a loamy, brittle subsurface horizon that is hard and apparently cemented when dry, but ruptures suddenly under pressure when moist. The somewhat poorly drained Tyler soils have a fragipan.

The amount of water entering the soil is not directly proportional to the slope of the land. Slopes are not uniform, and even a slight undulation of the surface causes water to drain away from high places and collect in lower places. The amount of water entering the soil also varies with the permeability of the different soils and parent materials.

*Time* is necessary for the development of soils from parent materials. In warm, moist climates, less time is required for soil to develop than in cool, dry climates. Soils on steep slopes are young because erosion has kept pace with soil formation. Soils on flood plains are young because new materials continue to accumulate. Alluvial soils, such as the Pope and Bruno, are young soils with weak horizon development. Soils that are moderately or strongly developed, such as those on river terraces or uplands, are considered mature soils. The Montevallo are

## neering properties of soils—Continued

| Soil features affecting—Continued   |  |   |  |  |                          |
|---|--|---|--|--|--------------------------|
| Farm ponds  |  | Agricultural drainage                               | Irrigation                                 | Terraces and diversions  | Waterways                |
| Reservoir area  | Embankment   |   |  |  |                          |
| Underlying material is variable; core trench may be required in embankment. | Slowly permeable; not suitable for core material.      | Fragipan at 20 inches; seasonally high water table. | Some midsummer droughtiness.               | Fragipan; drainage terraces required; care needed to prevent ponding in channel. | Shallow to fragipan.     |
| -----   | Silty clay loam subsoil is suitable for core material. |   |  |  |                          |
| Some seepage; core trench required in embankment.                           | Permeable; not suitable for core material.             | -----   | Moderate slope; permeable.                 | Moderate slope; bedrock at 2½ to 5 feet.   | Moderately deep to rock. |
| -----   | -----  | -----   | Nearly level; generally adequate moisture. | -----  | -----                    |

young soils that have a weak horizon development as a result of excessive relief rather than lack of time. The age of a soil is reflected by the degree to which the genetic horizons have developed rather than the years required for formation. Eighty-seven percent of the soils in the county are young.

#### Key to the soil-forming factors

As discussed in the foregoing subsection, differences in soils are due to five soil-forming factors. Two of these factors—climate and living matter—varied little in Elliott County during soil development. The effects of the other three factors—parent material, relief, and time—are shown in table 8. In this table the soil series are placed in a natural classification to bring out as many genetic relations as possible. The different parent materials and positions are listed in the left-hand column, and differences in relief and drainage are shown in the succeeding columns. Soils in areas of excessive relief and soils that formed in parent materials of the bottom lands are young; all others are mature.

#### Classification and Morphology of Soils

Soils can be classified in many ways. The soils in this survey have been named, correlated, and fitted into a natural system of soil classification so that (1) they may be compared on a national or international basis, and (2) soils that are alike will have the same name in any State or county.

The natural soil classification system used in the United States consists of six categories (11). Beginning at the top these are order, suborder, great soil group, family, series, and type. The suborder and family categories have never been fully developed and thus will not be discussed in this report. The many soils in the county are

first grouped into lower categories of soil types and series, then into great soil groups, and in turn, into orders. The orders and great soil groups in the county and the soils in each are discussed in this section.

Table 9 lists the soil series by orders and great soil groups and gives some distinguishing characteristics important in classification.

#### Zonal order

Zonal soils occupy 59 percent of the county. They are moderately to strongly developed, and have well-differentiated, genetically related horizons that reflect the dominant influence of climate and living matter (13). These soils are formed on slopes that have good drainage, and from parent material that is not extreme texturally or chemically. In Elliott County, the great soil groups in the zonal order are Gray-Brown Podzolic, Red-Yellow Podzolic, and Sols Bruns Acides.

#### GRAY-BROWN PODZOLIC SOILS

Gray-Brown Podzolic soils occupy 2.6 percent of the county. In undisturbed areas these zonal soils have a thin, organic A0 layer, a thin, dark, organic-mineral A1 layer, a grayish-brown leached A2 layer, and a brown B horizon richer in clay than the horizons above. These soils developed under deciduous forest in a temperate, moist climate (13).

The Allegheny soils are Gray-Brown Podzolic soils that intergrade toward Red-Yellow Podzolic soils. These soils are well drained. They developed on normal relief in old alluvium washed from soils that formed in residuum from sandstone and shale. Their Ap horizon is dark-colored loam, and their B horizon is yellowish-brown, medium to strongly acid silty clay loam. Illuviation in the B horizon is indicated by a finer texture and the presence of clay films. These soils are moderately to highly leached of bases.

TABLE 8.—Key to soil-forming factors<sup>1</sup>

| Parent material and position  | Relief and drainage   |                                 |                                |                             |                      |
|---|---|---------------------------------|--------------------------------|-----------------------------|----------------------|
|   | Excessive relief  | Normal relief                   |                                | Subnormal relief            |                      |
|   | Excessively drained   | Well drained                    | Moderately well drained        | Somewhat poorly drained     | Poorly drained       |
| Parent materials of the uplands:<br>Moderately coarse textured to moderately fine textured material from sandstone, shale, and siltstone in varying proportions.  | Muskingum <sup>2</sup> -----<br>Montevallo <sup>2</sup> ----- | { Wellston <sup>3</sup> -----   |                                |                             |                      |
| Fine-textured, acid material from variegated clay shale.  |   | Rarden <sup>3</sup> -----       |                                |                             |                      |
| Medium-textured to moderately fine textured material from acid, sandy rocks.  | Ramsey <sup>2</sup> -----                                     |                                 |                                |                             |                      |
| Parent materials of the stream terraces and colluvial slopes:<br>Old local alluvium, chiefly of mixed acid shale and sandstone; medium textured on colluvial slopes; contains considerable sand and gravel.   |   | Jefferson <sup>4</sup> -----    |                                |                             |                      |
| Same as above, but in low colluvial positions.  |   | Barbourville <sup>3</sup> ----- | Cotaco <sup>3</sup> -----      | Cotaco <sup>5</sup> -----   |                      |
| Medium-textured material on stream terraces; in places contains considerable sand and rounded gravel.   |   | Allegheny <sup>3</sup> -----    | Monongahela <sup>3</sup> ----- | Tyler <sup>6</sup> -----    |                      |
| Same as above, but on low terraces.   |   | Sequatchie <sup>6</sup> -----   | Whitwell <sup>5</sup> -----    | Whitwell <sup>6</sup> ----- |                      |
| Parent materials of the bottom lands:<br>Recent alluvium, chiefly of moderately coarse textured to moderately fine textured material on stream flood plains; from mixed acid shale, siltstone, and sandstone. | Bruno <sup>6</sup> -----                                      | Pope <sup>6</sup> -----         |                                | Stendal <sup>6</sup> -----  | Atkins. <sup>7</sup> |

<sup>1</sup> Information extracted from "A Key to Kentucky Soils" by JOSEPH H. WINSOR and H. H. BAILEY; Univ. of Ky. Agr. Expt. Sta. Misc. Pub. 204 (15).

<sup>2</sup> Sloping to steep mountainous.

<sup>3</sup> Sloping or gently sloping.

<sup>4</sup> Sloping to moderately steep.

<sup>5</sup> Gently sloping.

<sup>6</sup> Level to gently sloping.

<sup>7</sup> Level or depressed.

Moist profile of Allegheny loam in field along Highway 504, about 200 yards north of junction with Highway 7:

Ap—0 to 7 inches, dark yellowish-brown (10YR 4/4) loam; weak, fine, crumb structure; very friable; neutral; clear, smooth boundary; 4 to 8 inches thick.

B1—7 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; medium acid; few, very fine, soft, dark concretions; clear, smooth boundary; 2 to 6 inches thick.

B21—12 to 19 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; noticeable clay films; firm; medium acid; gradual, smooth boundary; 5 to 9 inches thick.

B22—19 to 26 inches, yellowish-brown (10YR 5/8) silty clay loam; moderate, fine, blocky structure and moderate, medium, subangular blocky structure; clay films as in layer above; firm; strongly acid; gradual, smooth boundary; 6 to 9 inches thick.

B3—26 to 36 inches, variegated brownish-yellow (10YR 6/6) and yellowish-brown (10YR 5/8) sandy clay loam; clay films are fewer than in horizon above; moderate, medium, subangular blocky structure; firm; strongly acid; gradual, wavy boundary, 6 to 12 inches thick.

C—36 to 48 inches +, variegated brownish-yellow (10YR 6/6) and yellowish-brown (10YR 5/8) fine sandy loam; weak, fine and medium, subangular blocky structure; friable; strongly acid; 1 to more than 3 feet thick.

The Barbourville, Cotaco, Sequatchie, and Whitwell are Gray-Brown Podzolic soils that intergrade toward Alluvial soils. They have a dark-brown or dark grayish-brown surface layer (Ap) with granular structure, over a yellowish-brown to strong-brown subsoil with weak to moderate, subangular blocky structure.

Barbourville and Cotaco soils developed on low toe slopes, and Sequatchie and Whitwell soils, on low terraces. Having formed from fairly recent deposits, these soils have not had time to develop strong horizons. Their leached horizons are difficult to see. Their brown color is partly due to organic matter that has not been removed by leaching. The A and B horizons of these soils are darker than those of soils developed from similar material on higher terraces or uplands and lighter colored than those of soils

TABLE 9.—*Characteristics and genetic relationships of soil series and classification by higher categories*

| Order, great soil group, and soil series  | Profile description   | Position       | Drainage class                                      | Slope range            | Parent material  | Degree of profile development |
|---|---|----------------|---|------------------------|--|-------------------------------|
| <i>Zonal order:</i><br>Gray-Brown Podzolic soils:<br>Intergrade toward Red-Yellow Podzolic soils—<br>Allegheny----- | Dark yellowish-brown loam Ap layer; thick, yellowish-brown silty clay loam B horizon; strongly acid, variegated fine sandy loam C horizon at about 36 inches.   | High terraces. | Well drained----                                    | <i>Percent</i><br>2-12 | Old stream alluvium of sandstone, shale, and siltstone origin. | Moderate.                     |
| Intergrade toward Alluvial soils—<br>Barbourville-----  | Dark-brown gravelly loam Ap layer; thin, strongly acid, dark-brown to dark yellowish-brown gravelly silty clay loam B horizon; very strongly acid, yellowish-brown gravelly silty clay loam C horizon at about 26 inches. | Toe slopes--   | Well drained----                                    | 2-12                   | Colluvium of sandstone, siltstone, and shale origin.           | Weak.                         |
| Cotaco-----   | Dark grayish-brown gravelly loam Ap layer; thick, strongly acid, mottled, yellowish-brown sandy clay loam B horizon; very strongly acid, light brownish-gray fine sandy loam at about 36 inches.                          | Toe slopes--   | Moderately well drained to somewhat poorly drained. | 2-6                    | Colluvium of sandstone, siltstone, and shale origin.           | Weak.                         |
| Sequatchie-----   | Dark-brown fine sandy loam Ap layer; thick, strongly acid, brown to strong-brown sandy clay loam B horizon; strongly acid, dark-brown to yellowish-brown C horizon at about 38 inches.                                    | Terraces----   | Well drained----                                    | 0-5                    | Alluvium of sandstone, siltstone, and shale origin.            | Weak.                         |
| Whitwell-----   | Dark grayish-brown loam Ap layer, very strongly acid; mottled, yellowish-brown sandy clay loam B horizon; thick, very strongly acid, mottled, light brownish-gray C horizon at about 30 inches.                           | Terraces----   | Somewhat poorly drained to moderately well drained. | 0-4                    | Alluvium of sandstone, siltstone, and shale origin.            | Weak.                         |
| Red-Yellow Podzolic soils:<br>Representative—<br>Jefferson-----   | Dark grayish-brown gravelly loam Ap layer; thick, very strongly acid, yellowish-brown gravelly clay loam B horizon; very strongly acid, gravelly clay loam C horizon at about 35 inches.                                  | Toe slopes--   | Well drained----                                    | 6-30                   | Colluvium of sandstone, siltstone, and shale origin.           | Moderate.                     |
| Rarden-----   | Brown silt loam Ap layer; thick, very strongly acid, yellowish-red silty clay B horizon; thick, very strongly acid, variegated light-gray silty clay or clay C horizon at about 30 inches.                                | Uplands----    | Well drained to moderately well drained.            | 5-15                   | Acid clay residuum from soft shale.                            | Moderate.                     |
| Wellston-----   | Brown silt loam Ap layer; thick, very strongly acid, yellowish-brown silty clay loam B horizon; very strongly acid, variegated silty clay loam C horizon at about 24 inches.  | Uplands----    | Well drained----                                    | 2-12                   | Residuum from acid siltstone and shale.                        | Moderate.                     |

See footnote at end of table.

TABLE 9.—*Characteristics and genetic relationships of soil series classification by higher categories—Continued*

| Order, great soil group, and soil series  | Profile description   | Position     | Drainage class                | Slope range         | Parent material  | Degree of profile development |
|---|---|--------------|-------------------------------|---------------------|--|-------------------------------|
| With fragipan—<br>Monongahela-----  | Dark grayish-brown silt loam Ap layer; thin, strongly acid, brownish yellow to light yellowish-brown silty clay loam B horizon; fragipan at about 18 inches.  | Terraces---- | Moderately well drained.      | Percent<br>2-12     | Old stream alluvium of sandstone, siltstone, and shale origin. | Strong.                       |
| Sols Bruns Acides:<br>Intergrade toward<br>Lithosols—<br>Muskingum-----             | Thin A1 layer and yellowish-brown silt loam A2 layer; yellowish-brown silt loam B horizon of higher chroma; shattered rock at about 24 inches.  | Uplands----  | Excessively drained.          | 6-40+               | Residuum from sandstone, siltstone, and shale.                 | Weak.                         |
| <i>Intrazonal order:</i><br>Low-Humic Gley soils:<br>Representative—<br>Atkins----- | Mottled light brownish-gray loam Ap layer; very strongly acid gleyed C horizon that ranges from silt loam to fine sandy loam.   | Bottoms----  | Poorly drained--              | 0-1                 | Alluvium of sandstone, siltstone, and shale origin.            | Very weak.                    |
| Planosols:<br>With fragipan—<br>Tyler-----  | Mottled dark grayish-brown silt loam Ap layer; thin, mottled, light yellowish-brown and light-gray silt loam; fragipan at about 20 inches.  | Terraces---- | Somewhat poorly drained.      | 0-4                 | Alluvium of sandstone, siltstone, and shale origin.            | Strong to moderate.           |
| <i>Azonal order:</i><br>Alluvial soils:<br>Representative—<br>Bruno-----            | Dark-brown loamy sand Ap layer, underlain by extremely acid, dark yellowish-brown loamy sand C horizon.   | Bottoms----  | Excessively drained.          | 0-4                 | Alluvium of sandstone origin.                                  | Very weak.                    |
| Pope-----   | Dark grayish-brown fine sandy loam Ap horizon, underlain by extremely acid, brown fine sandy loam C horizon.  | Bottoms----  | Well drained----              | 0-4                 | Alluvium of sandstone, siltstone, and shale origin.            | Very weak.                    |
| Intergrade toward<br>Low-Humic Gley<br>soils—<br>Stendal-----                       | Brown silt loam Ap layer, underlain by strongly acid C horizon that is brown mottled with brownish gray; brownish gray predominates below 24 inches.  | Bottoms----  | Somewhat poorly drained.      | 0-4                 | Alluvium of sandstone, siltstone, and shale origin.            | Very weak.                    |
| Lithosols:<br>Intergrade toward<br>Sols Bruns Acides—<br>Ramsey-----                | Very dark grayish-brown fine sandy loam A1 layer and grayish-brown fine sandy loam A2 layer; brown, light sandy clay loam BC layer; weathered soft sandstone.   | Uplands----  | Somewhat excessively drained. | 6-40+               | Residuum from soft sandstone.                                  | Very weak to weak.            |
| Montevallo-----   | Dark grayish-brown stony silt loam A1 layer and yellowish-brown A2 layer; very shaly or channery, light yellowish-brown BC silt loam layer containing more than 50 percent coarse fragments more than 2 millimeters in size; shattered interbedded siltstone, shale, and sandstone. | Uplands----  | Excessively drained.          | <sup>1</sup> 30-40+ | Residuum from siltstone, sandstone, and shale.                 | Very weak to weak.            |

<sup>1</sup> Few small areas with slopes less than 30 percent.

in first bottoms. The Barbourville and Sequatchie soils are well drained. Cotaco and Whitwell soils are somewhat poorly drained to moderately well drained.

The Barbourville, Cotaco, Sequatchie, and Whitwell are classified as Gray-Brown Podzolic soils, though they are naturally acid throughout. They are not so highly leached or oxidized as the Red-Yellow Podzolic soils.

Moist profile of Barbourville gravelly loam in field along Highway 32, two-tenths of a mile west of the junction of Highway 756:

- Ap—0 to 8 inches, dark-brown (10YR 3/3) gravelly loam; moderate, fine and medium, granular structure; very friable; gravel is subangular sandstone; medium acid; gradual, smooth boundary; 0 to 9 inches thick.
- B1—8 to 16 inches, dark-brown (10YR 4/3) gravelly loam; weak, fine and medium, subangular blocky structure; friable; common, dark, subangular, fragments of sandstone and shale; strongly acid; clear, smooth boundary; 6 to 12 inches thick.
- B2—16 to 26 inches, dark yellowish-brown (10YR 4/4) gravelly sandy clay loam; few, fine, faint yellowish-brown (10YR 5/6) mottles or variegations; weak, medium, subangular blocky structure; friable; very strongly acid; clear, smooth boundary; 8 to 12 inches thick.
- C—26 to 48 inches +, yellowish-brown (10YR 5/4) very gravelly sandy clay loam or loam; common, fine, faint yellowish-brown (10YR 5/8) and grayish-brown (2.5Y 5/2) mottles; weak, medium, subangular blocky structure; friable; very strongly acid; 1 to 3 or more feet thick.

Moist profile of Cotaco gravelly loam in cultivated field at junction of Highways 706 and 32 at Isonville:

- Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly loam; weak, fine, granular structure; very friable; medium acid; gradual, smooth boundary; 6 to 12 inches thick.
- B1—8 to 17 inches, dark grayish-brown (10YR 4/2) gravelly loam; common, fine, faint, light brownish-gray (2.5Y 6/2) mottles; weak, fine, subangular blocky structure; friable; strongly acid; gradual, smooth boundary; 4 to 10 inches thick.
- B21—17 to 23 inches, yellowish-brown (10YR 5/4) gravelly fine sandy clay loam; fine to medium, faint, light brownish-gray (2.5Y 6/2) mottles and few, fine, faint, dark-brown (10YR 3/3) mottles; weak, fine to medium, subangular blocky structure; friable; strongly acid; gradual, smooth boundary; 3 to 8 inches thick.
- B22—23 to 29 inches, light yellowish-brown (2.5Y 6/4) gravelly fine sandy clay loam; many fine to medium, faint, light brownish-gray (2.5Y 6/2) mottles; common, fine, faint, light-gray (2.5Y 7/2) mottles; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; friable; strongly acid; gradual, smooth boundary; 5 to 10 inches thick.
- B3—29 to 36 inches, pale-yellow (2.5Y 7/4) gravelly fine sandy clay loam; many, medium, faint, light-brownish gray (2.5Y 6/2) mottles; common, fine and medium, faint light-gray (2.5Y 7/2) mottles; few, fine, faint, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; friable; common, soft, small, dark concretions; very strongly acid; gradual, smooth boundary; 4 to 10 inches thick.
- Cg—36 to 44 inches +, light brownish-gray (2.5Y 6/2) gravelly fine sandy clay loam; many, medium, distinct pale-yellow (2.5Y 7/4), light brownish-gray (10YR 6/2), and olive-gray (5Y 5/2) mottles; massive (structureless); friable; common, small, soft, dark concretions; very strongly acid; 1 to more than 3 feet thick.

Moist profile of Sequatchie fine sandy loam in cultivated field near schoolhouse at Isonville on Highway 32:

- Ap—0 to 8 inches, dark-brown (10YR 4/3) to dark grayish-brown (10YR 4/2) fine sandy loam; weak, medium, granular structure; very friable; medium acid; clear, smooth boundary; 6 to 9 inches thick.

B1—8 to 26 inches, brown (7.5YR 4/4) fine sandy loam; weak, fine and medium, subangular blocky structure; friable; strongly acid; gradual, smooth boundary; 10 to 20 inches thick.

B2—26 to 38 inches, strong-brown (7.5YR 5/6) sandy clay loam; weak to moderate, medium, subangular blocky structure; friable; very strongly acid; gradual, smooth boundary; 5 to 16 inches thick.

C—38 to 48 inches +, dark-brown (10YR 4/3) to yellowish-brown (10YR 5/4), stratified beds of sand, silt, and some clay; few, fine, faint, grayish-brown (10YR 5/2) mottles; very strongly acid; 2 or more feet thick.

Moist profile of Whitwell loam in a cultivated field at junction of Highways 706 and 32 at Isonville:

- Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam; weak, fine, granular structure; very friable; very strongly acid; clear, smooth boundary; 6 to 10 inches thick.
- B1—7 to 18 inches, dark yellowish-brown (10YR 4/4) fine loam; few, fine, faint, light yellowish-brown (2.5Y 6/4) mottles and few, fine, faint, strong-brown (7.5YR 5/6) mottles in the lower part; weak, fine to medium, subangular blocky structure; friable; very strongly acid; gradual, smooth boundary; 9 to 12 inches thick.
- B2—18 to 30 inches, yellowish-brown (10YR 5/4), fine sandy clay loam; common, medium, faint mottles of light yellowish brown and strong brown; weak to moderate, fine, subangular blocky structure; friable; very strongly acid; gradual, smooth boundary; 10 to 14 inches thick.
- Cg—30 to 50 inches +, light brownish-gray (10YR 6/2) to grayish-brown (10YR 5/2) fine sandy clay loam or loam; common, fine to medium, light yellowish-brown and strong-brown mottles; friable; very strongly acid; 1 to several feet thick.

#### RED-YELLOW PODZOLIC SOILS

Red-Yellow Podzolic soils occupy 5.4 percent of the county. These zonal soils are well developed and are acid. In undisturbed areas they have a thin, organic A0 horizon, an organic-mineral A1 horizon, a light-colored, bleached A2 horizon, and a red, yellowish-red, or yellow, illuviated B horizon. The parent materials are all more or less siliceous and the leaching of bases is rather complete. The chemical composition of the mineral colloids in the sola does not vary greatly (13). The Jefferson, Rarden, and Wellston are representative of the Red-Yellow Podzolic great soil group.

The Jefferson soils developed on toe slopes from local alluvium, chiefly of acid sandstone and siltstone origin. In undisturbed areas they have a thin, organic mineral A1 horizon, a light-colored or bleached A2 horizon, and a yellowish-brown, more clayey B horizon with moderate, subangular blocky structure. The parent materials are yellowish brown and have light yellowish-brown and pale-brown mottles. The B and C horizons are very strongly acid.

Moist profile of Jefferson gravelly loam in a cultivated field at the junction of Highways 7 and 709, about 4 miles southwest of Sandy Hook:

- Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary; 5 to 12 inches thick.
- B1—9 to 18 inches, yellowish-brown (10YR 5/4) gravelly clay loam; weak to moderate, fine, subangular blocky structure; friable to firm; very strongly acid; clear, smooth boundary; 4 to 12 inches thick.
- B2—18 to 26 inches, yellowish-brown (10YR 5/6) gravelly clay loam or silty clay loam; moderate, medium, subangular blocky structure; firm; very strongly acid; clear, smooth boundary; 7 to 20 inches thick.

- B3—26 to 35 inches, yellowish-brown (10YR 5/8) gravelly sandy clay loam or silty clay loam; weak to moderate, medium, subangular blocky structure; friable to firm; very strongly acid; gradual, wavy boundary; 6 to 16 inches thick.
- C—35 to 48 inches +, yellowish-brown (10YR 5/8) gravelly clay loam or fine sandy clay loam; common, fine to medium, faint, light yellowish-brown and pale-brown mottles; weak, medium, angular blocky structure; firm; few, small, black concretions; very strongly acid; 10 to 20 inches thick.

The Rarden soils formed in residuum from acid shale material. They have a fine-textured, plastic B horizon that ranges from strong brown to red. The C horizon is variegated light gray and brown and has streaks of red in places. The B and C horizons are very strongly acid to extremely acid.

Moist profile of Rarden silt loam in a pasture along Highway 504, 1 mile east of Gimlet:

- Ap—0 to 5 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure and weak, fine, subangular blocky structure; friable; slightly acid; abrupt, clear boundary; 3 to 6 inches thick.
- B1—5 to 8 inches, strong-brown (7.5YR 5/6) silty clay loam; few, fine, faint dark-brown (10YR 4/3) streaks from above; moderate, fine and medium, angular blocky structure; firm when moist, slightly sticky and slightly plastic when wet; very strongly acid; clear, smooth boundary; 2 to 4 inches thick.
- B2—8 to 21 inches, yellowish-red (5YR 5/8) silty clay with small patches of brownish yellow (10YR 6/8); strong, medium, angular blocky structure; very firm when moist, sticky and plastic when wet; thick, continuous clay skins on pedis; very strongly acid; clear, wavy boundary; 8 to 15 inches thick.
- B3—21 to 30 inches, variegated strong-brown (7.5YR 5/6), light-gray (2.5Y 7/2) and red (2.5YR 5/6) silty clay or clay; strong, medium and coarse, angular blocky structure; very firm when moist, sticky and plastic when wet; few tree roots; some clay skins on pedis; very strongly acid; gradual, wavy boundary; 6 to 12 inches thick.
- C—30 to 38 inches, variegated light-gray (2.5Y 7/2) and strong-brown (7.5YR 5/6) silty clay or clay; massive (structureless) to weak, medium, platy structure; very firm when moist, sticky and plastic when wet; many small pieces of weathered, soft shale; very strongly acid; gradual boundary; 6 to 12 inches thick.
- Dr—38 inches +, soft, acid clay shale.

The Wellston soils developed in residuum from acid siltstone and interbedded sandstone and shale. They are not so deep as the Jefferson soils, but they are somewhat similar to them in color and texture.

Moist profile of Wellston silt loam in the corner of a field near a strip mine in the northwestern part of the county:

- Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, very fine, crumb structure and weak, fine, subangular blocky structure; friable; medium acid; few, small pieces of hard, brown shale; clear, smooth boundary; 5 to 9 inches thick.
- B1—7 to 10 inches, brown (7.5YR 5/4) fine silt loam with streaks of dark brown (10YR 4/3) from above; weak to moderate, fine, subangular blocky structure; friable; very strongly acid; clear, smooth boundary; 2 to 4 inches thick.
- B21—10 to 19 inches, strong-brown (7.5YR 5/8) silty clay loam; moderate, fine and medium, subangular blocky structure; firm when moist, slightly sticky and slightly plastic when wet; very strongly acid; clear, wavy boundary; 6 to 10 inches thick.

- B22—19 to 24 inches, yellowish-brown (10YR 5/4) silty clay loam with common, fine, faint, brownish-yellow (10YR 6/6) variegations; moderate, medium, subangular blocky structure; firm when moist, slightly sticky and slightly plastic when wet; very strongly acid; gradual, wavy boundary; 3 to 10 inches thick.
- C—24 to 32 inches, variegated yellowish-brown (10YR 5/6–5/8), strong-brown (7.5YR 5/6) and light yellowish-brown (10YR 6/4) silty clay loam with thin pieces of sandstone and highly weathered shale; massive (structureless) to weak, coarse, platy structure; very strongly acid; gradual, wavy boundary; 6 to 10 inches thick.
- D—32 inches +, interbedded siltstone and shale.

The Monongahela are Red-Yellow Podzolic soils that have a fragipan. They are moderately well drained. Areas that have not been limed are very strongly acid to extremely acid throughout. These soils are highly leached, and the leached A<sub>2</sub> horizon can easily be seen in undisturbed areas. The fragipan is brittle and compact and occurs at a depth of about 18 inches.

A moist profile of Monongahela silt loam in a cultivated field along Highway 504:

- Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, very fine crumb structure and weak, fine subangular blocky structure; friable; neutral; clear, smooth boundary; 6 to 7 inches thick.
- B1—7 to 11 inches, brownish-yellow (10YR 6/6) silty clay loam that contains streaks of dark grayish-brown (2.5Y 4/2) silt loam from above; weak, fine and medium, subangular blocky structure; friable; slightly acid; clear, smooth boundary; 3 to 5 inches thick.
- B2—11 to 18 inches, brownish-yellow to light yellowish-brown (10YR 6/6–6/4) silty clay loam; few, fine, faint, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; strongly acid; clear, smooth boundary; 6 to 8 inches thick.
- B3m1—18 to 24 inches, brownish-yellow to yellowish-brown (10YR 6/6–5/6) silty clay loam; common, medium, distinct strong-brown (7.5YR 5/6) mottles and few, fine, faint, pale-yellow (2.5Y 7/4) mottles; moderate, medium, subangular blocky structure; brittle and compact in places, firm when disturbed; very strongly acid; clear, smooth boundary; 5 to 7 inches thick.
- B3m2—24 to 36 inches, light yellowish-brown (2.5Y 6/4) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/8) and pale-yellow (2.5Y 7/4) mottles; weak, medium to coarse, blocky structure to massive (structureless); brittle and compact in place, friable when disturbed; very strongly acid; gradual, wavy boundary; 10 to 15 inches thick.
- Cg—36 to 48 inches +, light-gray (2.5Y 7/2) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; massive (structureless); compact and brittle in place, firm when disturbed; very strongly acid; 1 to 3 feet thick, or more.

#### SOLS BRUNS ACIDES

Sols Bruns Acides occupy 31 percent of the county. These zonal soils are somewhat excessively drained and have a weakly developed B horizon that is of higher chroma or redder hue than their A horizon.

The Muskingum soils are Sols Bruns Acides intergrading toward Lithosols. They have an A horizon with a chroma of 4 or less, underlain by a B horizon with a chroma of 6 or more. The B horizon is only slightly higher in clay content than the A horizon. There is slight evidence of bridging of sand grains by translocated clay. The B horizon is nonskeletal; that is, it is not dominantly coarse fragments.

Moist profile of Muskingum silt loam in pasture along Highway 32, near Stark:

- A1—0 to 2 inches, brown (10YR 4/3) silt loam; weak, very fine, granular structure; very friable; some small, angular gravel; medium acid; clear, abrupt boundary; 1 to 3 inches thick.
- A2—2 to 7 inches, yellowish-brown (10YR 5/4) silt loam; weak, very fine and medium, granular structure; very friable; few angular sandstone fragments; medium acid; clear, smooth boundary; 3 to 6 inches thick.
- B—7 to 24 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak, fine and medium, subangular blocky structure; slight evidence of bridging by translocated clays; friable; small, subangular fragments of sandstone and hard shale that increase with depth; very strongly acid; gradual, wavy boundary; 10 to 14 inches thick.
- Dr—24 inches +, interbedded sandstone, siltstone, and medium-hard shale that are partly decomposed and usually shattered.

### Intrazonal order

Soils in the intrazonal order occupy 0.3 percent of the county area. These soils have genetically related horizons that reflect the dominating influence of some local factor of relief or parent material over the normal influences of climate and living matter (13). In Elliott County the great soil groups in this order are Low-Humic Gley soils and Planosols.

#### LOW-HUMIC GLEY SOILS

Low-Humic Gley soils occupy 0.2 percent of the county area. These intrazonal soils are poorly drained. They have a thin light-colored surface horizon (Ap), over a gleyed mineral horizon. These soils were formed in areas with poor drainage or in swamps.

The Atkins are representative Low-Humic Gley soils. They consist of alluvium, have a mottled, light brownish-gray Ap layer over a C horizon, and they lack the fragipan characteristic of the Planosols.

Moist profile of Atkins loam in cultivated field at junction of Highways 409 and 486 at Stephens:

- Ap—0 to 10 inches, light brownish-gray (10YR 6/2) loam; common, fine to medium, distinct, dark grayish-brown (10YR 4/2) mottles and few, fine, distinct, dark-brown (10YR 4/3) mottles; weak, fine, granular structure; very friable; strongly acid; gradual, smooth boundary; 7 to 11 inches thick.
- Cg1—10 to 22 inches, gray (10YR 5/1) silt loam or loam; many, medium, faint, grayish-brown (2.5Y 5/2) mottles and few, very fine, distinct, dark-brown (10YR 4/3) mottles; very weak, fine to medium, granular structure; friable; very strongly acid; gradual, wavy boundary; 6 to 16 inches thick.
- Cg2—22 to 48 inches +, gray (10YR 6/1) silt loam; many, medium, distinct, yellowish-red (5YR 5/6) mottles and few, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive (structureless); some rounded, small sandstone gravel; friable; extremely acid; 2 to more than 5 feet thick.

#### PLANOSOLS

Planosols comprise 0.1 percent of the county. These intrazonal soils are somewhat poorly drained or poorly drained. They have a thin A horizon and a pale, mottled subsoil, underlain by a silty, very firm, compact, brittle fragipan. They developed in flat or depressed areas under poor drainage or somewhat poor drainage.

The Tyler soils are representative Planosols. They are somewhat poorly drained and have a brittle and compact silt loam fragipan.

Moist profile of Tyler silt loam in plowed field on B. L. White's farm:

- Ap—0 to 7 inches, dark grayish-brown (2.5Y 4/2) silt loam; common, fine, faint, dark-brown (10YR 4/3) mottles; weak, fine and medium, crumb structure; friable; neutral; clear, smooth boundary; 5 to 8 inches thick.
- B1—7 to 15 inches, light yellowish-brown (2.5Y 6/4) silt loam; common, fine, faint, light olive-brown (2.5Y 5/6) mottles; weak, fine and medium, subangular blocky structure; friable; neutral; clear, smooth boundary; 8 to 12 inches thick.
- B2g—15 to 20 inches, silt loam; common, medium, distinct light-gray (2.5Y 7/2), light yellowish-brown (2.5Y 6/4), and yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky structure; friable; slightly compact in place; very strongly acid; clear, smooth boundary; 4 to 7 inches thick.
- B3mg—20 to 36 inches, light-gray (2.5Y 7/2) silt loam; many, fine, faint, pale-yellow (2.5Y 7/4) mottles and many, medium, distinct, yellowish-brown (10YR 5/6), and dark yellowish-brown (10YR 4/4) mottles; weak, medium, subangular blocky structure to massive (structureless); brittle and compact; very strongly acid; gradual, wavy boundary; 10 to 16 inches thick.
- Cg—36 inches +, silt loam; common, medium, distinct, light-gray (N 7), pale-yellow (2.5Y 7/4), and yellowish-brown (10YR 5/6) mottles; massive (structureless); brittle and compact in place, friable when disturbed; very strongly acid; 1 to more than 3 feet thick.

### Azonal order

Azonal soils occupy 36.1 percent of the county. These soils have little or no horizon development because of (1) steep topography, (2) parent material that is very low in weatherable mineral, or (3) a youthful stage of development, or all three. In Elliott County the great soil groups in this order are Alluvial soils and Lithosols.

#### ALLUVIAL SOILS

Alluvial soils occupy 4.6 percent of the county area. These azonal soils consist of transported and relatively recently deposited material that has been modified little or not at all by soil-forming processes.

The Bruno and Pope are representative Alluvial soils. They have a dark-brown or dark grayish-brown Ap layer over a C layer that varies little from the surface layer except in color, which is the result of organic staining. The Bruno soils are sandier than the Pope soils. They occur near the edge of stream channels, an indication that they were very recently deposited. Horizons have not developed in these soils. In contrast to Regosols, these soils lack horizon development because of their youth rather than because of the character of the parent material.

Profile of Bruno loamy sand in a moist field in a cultivated area along Highway 32, 1 mile east of junction with Highway 486:

- Ap—0 to 8 inches, dark-brown (10YR 4/3) loamy sand; very weak, fine, granular structure; very friable to loose; medium acid; clear, smooth boundary; 7 to 9 inches thick.
- C11—8 to 26 inches, dark yellowish-brown (10YR 4/4) loamy sand; single grain; loose; strongly acid; gradual, wavy boundary; 12 to 24 inches thick.
- C12—26 to 50 inches +, stratified layers of loamy fine sand, loamy coarse sand, and sand; pockets of rounded gravel; extremely acid; 1 to several feet thick.

Profile of Pope fine sandy loam in a cultivated field at junction of Highways 706 and 32:

- Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary; 6 to 10 inches thick.

- C11—8 to 30 inches, brown (10YR 4/3) fine sandy loam with very weak granular structure; very friable; medium acid; gradual, smooth boundary; 8 to 16 inches thick.
- C12—30 to 50 inches +, brown (10YR 4/3-5/3), stratified, silty and sandy layers with an admixture of rounded sandstone and siltstone fragments; extremely acid; 1 to more than 3 feet thick.

The Stendal are Alluvial soils that intergrade toward Low-Humic Gley soils. They have a brown Ap layer over a mottled subsoil that becomes gray with depth. They are somewhat poorly drained. Soils on poorly drained first bottoms are in the Low-Humic Gley group.

Moist profile of Stendal silt loam in a field along Briar Fork Creek off Highway 752 about 1 mile north of Highway 32:

- Ap—0 to 5 inches, brown (10YR 5/3) silt loam; weak to medium, fine, granular structure; friable; medium acid; clear, smooth boundary; 4 to 7 inches thick.
- C11—5 to 18 inches, dark grayish-brown (10YR 4/2) silt loam; common, fine, distinct, grayish-brown (10YR 5/2) and brown (10YR 5/3) mottles; weak, fine, granular structure; friable; strongly acid; clear, smooth boundary; 10 to 14 inches thick.
- C12—18 to 24 inches, brown (10YR 5/3-4/3) silt loam; common, medium, distinct, brownish-gray (2.5Y 5/2) mottles and few, very fine, faint, yellowish-red (5YR 5/8) mottles; massive (structureless) but porous; very strongly acid; clear, smooth boundary; 5 to 10 inches thick.
- Cg—24 to 48 inches +, light brownish-gray (2.5Y 6/2) to grayish-brown (2.5Y 5/2) silt loam; common, medium, distinct, light olive-brown (2.5Y 5/4) mottles and few, fine, distinct, reddish-brown (5YR 4/3) mottles; massive (structureless) but porous; very strongly acid; 2 to 4 or more feet thick.

#### LITHOLSOLS

Lithosols occupy 31.5 percent of the county. These azonal soils have an incomplete solum, or no clearly expressed soil morphology. They consist of a partly weathered mass of hard rock or rock fragments. They are confined to steep land or narrow ridges.

The Ramsey and Montevallo soils are Lithosols that intergrade toward Soils Bruns Acides. The Ramsey soils have horizons similar to those of the Muskingum soils. The Ramsey soils, however, are sandier and their B horizon is more poorly expressed.

Moist profile of Ramsey fine sandy loam in a wooded area along Highway 32 near Rowan County line:

- A0—1 inch to 0, thin layer of decomposed leaves and twigs.
- A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; weak, fine, granular structure; very friable; medium acid; clear, smooth boundary; 1 to 3 inches thick.
- A2—2 to 6 inches, grayish-brown (10YR 5/2) fine sandy loam; weak, fine, granular structure; very friable; few small pieces of sandstone gravel; strongly acid; clear, smooth boundary; 3 to 5 inches thick.
- BC—6 to 11 inches, brown (10YR 5/3), light sandy clay loam; weak, medium, subangular blocky structure; friable; few small pieces of sandstone gravel; strongly acid; gradual, smooth boundary; 4 to 7 inches thick.
- C—11 to 18 inches, yellowish-brown (10YR 5/4) sandy loam; structureless or very weak, medium, subangular blocky structure; some sandstone fragments increasing in amount with depth; extremely acid, gradual, wavy boundary; 3 to 6 inches thick.
- Dr—18 inches +, yellowish-brown (10 YR 5/4), soft, weathered sandstone that crumbles into loamy sand.

The Montevallo soils contain more coarse fragments than the Muskingum soils and are less sandy than the Ramsey soils. The BC horizon is skeletal and contains

more than 50 percent coarse fragments larger than 2 millimeters. This horizon is silty (silt loam), shows little if any evidence of clay accumulation, and ranges in thickness from 2 to 13 inches.

Moist profile of Montevallo stony silt loam in a wooded area:

- A00—1 to ½ inch, loose litter from mixed oak and pines.
- A0—½ inch to 0 partly decayed roots, leaves, and twigs.
- A1—0 to 1 inch, dark grayish-brown (10YR 4/2) stony silt loam; weak, fine, granular structure; very friable; common, small, angular pieces of gravel; very strongly acid; clear, smooth boundary; 1 to 2 inches thick.
- A2—1 to 4 inches, yellowish-brown (10YR 5/4) stony silt loam; weak, fine, granular structure; very friable; many, small, angular pieces of gravel; extremely acid; clear, smooth boundary; 2 to 5 inches thick.
- BC—4 to 15 inches, light yellowish-brown (10YR 6/4) very gravelly silt loam; weak, fine, and medium, subangular blocky structure; friable; gravel consists mostly of small (1 to 2 inches across), hard, angular fragments of siltstone and sandstone; coarse fragments more than 2 millimeters in diameter make up about 70 percent of this horizon, but the percentage increases with depth; very friable; extremely acid; gradual, wavy boundary; 8 to 12 inches thick.
- Dr—15 inches +, interbedded sandstone, siltstone, and rather hard shale, partly decomposed and shattered.

## General Nature of the County

In this section some information is given about the history, the physiography, geology, and drainage, the climate, and the agriculture of Elliott County. Other subjects of general interest are briefly discussed.

## History

Elliott County, named after Judge John Elliott, became a county in 1869. It was formed from parts of Morgan, Lawrence, and Carter Counties.

Martinsburg was the original name of the county seat, which was laid out on April 5, 1869, by Judge J. K. Hunter. Sometime after 1900, however, the name of the county seat was changed to Sandy Hook.

## Physiography, Geology, and Drainage

Elliott County is in the Eastern Mountains and Coal Fields physiographic region of Kentucky (1). The mountains are a part of the Cumberland Plateau in the Appalachian Mountains. They are lower and less rough than the mountains in much of the region southeast of the county.

Most of the soils are underlain by sedimentary rocks of older formations of the Pennsylvanian geologic age, but outcrops of Mississippian rock occur at the lowest elevations (5). The rocks of the Pennsylvanian age are acid and comparatively soft. They range from shale to coarse sandstone. The rocks of Mississippian age are the only limestone rocks in the county. The county has some gas, oil, and coal.

Topographically the county is in the youth or early maturity stage of geologic erosion. Elevations range from about 600 to a little more than 1,360 feet above sea level. The region is generally characterized by rather steep hills with fairly even summit levels and deep narrow valleys. In the northwestern part, the hills are less steep

and the ridge tops are broader. Along the Little Sandy River and some tributaries, there is a deep gorge that is bordered in many places by relatively smooth uplands of old, high river terraces.

Nearly all of the county is drained by the north-flowing Little Sandy River and its tributaries. A small area in the southwest is drained by the Licking River. The hills are excessively drained, but many soils in the stream valleys require artificial drainage, and farmers have already drained many areas.

**Climate<sup>4</sup>**

Elliott County has a wide range of temperature, rainfall, wind, and humidity, but the climate is within limits suitable for varied plant and animal life. The average annual temperature is about 56° F. Occasional heat spells in summer and cold spells in winter are the greatest extremes in temperature, and there is considerable variability in all seasons. The maximum temperature reaches 90° or higher about 30 days in the average year. About once each year in June, July, August, or September, the temperature reaches 100°. Temperature and precipitation data from U.S. Weather Bureau records are given in table 10.

During an average winter, freezing occurs about 97 nights, but the temperature rises above 32° during all but about 15 winter days. Thus, a daily freeze-thaw cycle is normal for cold weather. Temperatures below zero occur, on the average, once per winter.

The average growing season in Elliott County, from the last light freeze in the spring to the first light freeze in the fall, is 168 days. About 5 years in 10 have a growing season ranging from 157 to 179 days, and 8 years in 10 have a growing season ranging from 147 to 189 days.

Table 11 will enable farmers to determine the probable risk of frost damage to various crops. Temperatures that are critical for individual crops must, of course, be known. Table 11 shows the percentage probabilities of severe (24° F.), moderate (28° F.), and light (32° F.) freezes after specified dates in spring and before specified dates in fall.

Elliott County has an annual average rainfall of 46.36 inches, which is enough for agricultural production. Monthly averages of precipitation are given in table 10. During an ordinary year, the heaviest 1-hour rainfall to be expected is 1.10 inches. The chance of this much occurring in July is 30 percent, and in December through February, less than 1 percent. Once in 10 years, 4.05 inches of rain can be expected in 24 hours. The chance of this occurring in July is about 2 percent, and in any other month, 1 percent or less. Thunderstorms occur an average of 46 days a year. They are most frequent from March through November but may occur in any month. Most of the short, intense rains fall during thunderstorms, which are most likely to occur during summer. Less intense rainfall, lasting for several days, sometimes occurs late in spring and delays early farm tillage. Such a rainfall at this time of year is likely to cause local flooding, since it occurs when soils are frozen, snow covered, or saturated. Long periods of mild, sunny weather are typical in the

TABLE 10.—*Temperature and precipitation*

[Data from U.S. Weather Bureau records]

| Month          | Temperature           |                       | Average monthly total |
|----------------|-----------------------|-----------------------|-----------------------|
|                | Average daily maximum | Average daily minimum |                       |
|                | °F.                   | °F.                   | Inches                |
| January.....   | 46.6                  | 24.2                  | 4.48                  |
| February.....  | 48.7                  | 24.8                  | 3.16                  |
| March.....     | 58.7                  | 32.1                  | 4.50                  |
| April.....     | 68.7                  | 40.7                  | 3.92                  |
| May.....       | 77.8                  | 49.5                  | 4.14                  |
| June.....      | 85.0                  | 58.6                  | 4.51                  |
| July.....      | 88.1                  | 62.2                  | 4.72                  |
| August.....    | 87.0                  | 60.6                  | 4.38                  |
| September..... | 82.1                  | 53.8                  | 2.98                  |
| October.....   | 71.8                  | 41.9                  | 2.82                  |
| November.....  | 57.9                  | 32.1                  | 3.08                  |
| December.....  | 47.5                  | 25.6                  | 3.67                  |

TABLE 11.—*Probabilities of last freezing temperatures in spring and first in fall*

| Probability                     | Dates for given probability and temperature |                 |                 |
|---------------------------------|---|-----------------|-----------------|
|                                 | 24° F. or lower                             | 28° F. or lower | 32° F. or lower |
| Spring:                         |   |                 |                 |
| 1 year in 10 later than.....    | Apr. 23                                     | Apr. 30         | May 10          |
| 2 years in 10 later than.....   | Apr. 17                                     | Apr. 24         | May 4           |
| 5 years in 10 later than.....   | Apr. 5                                      | Apr. 13         | Apr. 25         |
| Fall:                           |   |                 |                 |
| 1 year in 10 earlier than.....  | Oct. 14                                     | Oct. 7          | Sept. 26        |
| 2 years in 10 earlier than..... | Oct. 20                                     | Oct. 11         | Oct. 1          |
| 5 years in 10 earlier than..... | Oct. 31                                     | Oct. 21         | Oct. 11         |

fall when harvest operations must be completed. Measurable amounts of precipitation occur an average of 133 days each year.

Although the average yearly snowfall is 14.7 inches, the ground is seldom covered with snow for more than a few days. During the normal year, not more than six snowfalls are more than 1 inch deep.

Relative humidity depends on the temperature as well as the moisture content of the air and is therefore extremely variable. An average for the early morning hours is 83 percent and for early afternoon, 59 percent. Relative humidity in early morning may range from 55 percent to 100 percent. In the afternoon it is seldom more than 75 percent, but it may fall to 30 percent or, infrequently, lower.

Winds, prevailingly from the south, average 10.6 miles per hour. Calm periods seldom last for as long as 24 hours. Peak gusts, ranging from 50 to 65 miles per hour, generally occur at the beginning of heavy thunderstorms.

During the average year, there are 90 clear days, 165 cloudy days, and 110 days with partly cloudy skies.

Data in this section are based partly on records from weather stations at Ashland and Farmers, Kentucky,

<sup>4</sup>This section was prepared by O. K. ANDERSON, State climatologist, U.S. Weather Bureau, Louisville, Ky.

which are close enough to Elliott County to have similar climate.

## Agriculture

In Elliott County there are about 1,145 farms, and they average 102 acres per farm. An inventory of soil and water conservation needs shows that 9,693 acres, or 7 percent of the county, is used for cropland; 29,653 acres, or 19 percent, is used for pasture; 106,299 acres, or 69 percent is in forest; and 7,955 acres, or 5 percent, is used for other purposes.

Burley tobacco is the main cash crop produced in the county. Cash income comes mainly from tobacco on 48 percent of the farms, from livestock on 3 percent, and from miscellaneous products on 49 percent. Most farmers grow feed crops for livestock and garden crops for home use. A small amount of corn and a small amount of livestock, dairy, and poultry products are sold. Forestry products are also a source of farm income.

Farms in the county vary in size, but most are small. They are operated mostly by owners and are mainly tobacco and miscellaneous types of farms. The 1959 Census of Agriculture shows the general distribution of farms by size as follows: Less than 50 acres, 24 percent; 50 to 139 acres, 49 percent; 140 to 259 acres, 22 percent; and 260 acres or more, 5 percent.

Of the total farm operators, 78 percent are full owners, 15 percent are part owners, and the remaining 7 percent are tenants.

## Programs for Better Farming

In the early agricultural history of the county, little was done to maintain soil fertility or control soil erosion. As the original fertility of the soil was depleted and erosion became a problem, the need for better use and treatment of soil became apparent.

Various agricultural agencies aided in a movement for better farming methods. The agricultural extension program was begun in 1926. It included teaching and demonstrating soil improvements and better soil management practices.

The vocational agricultural department was established in the Sandy Hook High School in 1934. The curriculum included courses in soil, soil judging, water management, practical experience in crop production, and soil and water conservation.

The Agricultural Conservation Program of the Federal Government has helped to pay for many soil-building and soil-conserving practices. The Farmers' Home Administration has also helped in making loans and providing guidance to farmers.

In May 1949, the Elliott County Soil Conservation District was organized. The district includes the entire county. Through the district, the Soil Conservation Service furnishes technical assistance to farmers in planning and applying soil and water conservation practices. The soil survey is part of the technical assistance furnished to districts by the Soil Conservation Service.

The Rural Development program was started in October 1956. Nine rural communities were organized under this program. Six of the communities arranged for monthly meetings to promote cooperation among churches, schools,

and agricultural organizations. Agricultural agencies meet regularly to discuss agricultural problems of the county.

## Industry

Until 1959 there was no industry of any size in the county. At that time, a manufacturing company was set up to make kitchen cabinets and other household furnishings. About 40 people were employed in this work in 1960.

Many part-time farmers in the county work off their farms in industry about 40 miles away in the Tri-State Area of Ohio, West Virginia, and Kentucky.

## Community, Farm, and Home Facilities

Schools and churches are conveniently located. The county has one high school, two consolidated schools, and 32 one- and two-room grade schools. There are about 30 churches of various denominations. Rural mail delivery serves all parts of the county, and electricity is available to every farm and home. Telephone service is provided along all main roads in the county.

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## Glossary

**Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

**Acidity.** See Reaction, soil.

**Association, soil.** A group of soils geographically associated in a characteristic repeating pattern. The soils may or may not be derived from the same kind of parent material or have similar characteristics.

**Available water capacity.** The capacity of a soil to hold water in a form available to plants. The difference between the amount of water in a soil at field capacity and the amount in the same soil at the permanent wilting point. Commonly expressed as inches of water per inch of depth of soil.

**Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

**Clay.** See Texture, soil.

**Color, soil.** In this report soil colors are described in words and are designated by symbols according to the Munsell color chart, which provides an accurate, uniform system of naming and comparing colors. By this numerical system, colors are classified according to *hue*, *value*, and *chroma*. *Hue* is the dominant spectral color, such as red, blue, or yellow. *Value* is the degree of lightness of color. *Chroma* is the saturation, strength, or intensity of color.

**Colluvium.** Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

**Concretions.** Hard grains, pellets, or nodules of soil that contain chemical compounds, such as calcium carbonate or compounds of iron, that cement the soil grains together. Concretions are of mixed composition and of various sizes, shapes, and colors. Some concretions are composed of material unlike that of the surrounding soil.

**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 gentle to 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; tends to stretch somewhat and pull apart, rather than 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.

**Contour farming.** Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terraces.

**Contour stripcropping.** Growing crops in strips that follow the contour or are parallel to terraces or diversions. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

**Cover crop.** A close-growing crop grown primarily to improve and to protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.

**Crop residue.** Plant material left in fields after harvest. Crop residue is used to control erosion, conserve moisture, and improve the soil by working the residue into the soil or leaving it on the surface.

**Diversion channel.** A channel with a supporting ridge on the lower side. The channel is constructed across the slope to intercept runoff and minimize erosion or to prevent overflow of lower areas.

**Drainage, internal.** The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by the height of the water table, either permanent or perched. Relative terms for expressing internal drainage are *none*, *very slow*, *slow*, *medium*, *rapid*, and *very rapid*.

**Drainage, natural.** Refers to 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 or somewhat poorly drained* soils are wet for significant periods but not all the time and, among podzolic soils, they commonly have mottling below 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.

**Drainage, surface.** Runoff, or surface flow of water from an area.

**Erosion hazard.** An evaluation of the susceptibility of a soil to loss of surface soil by erosion, and the probable damage to the soil by more erosion. In Elliott County the classes of erosion hazard are *none to slight*, *moderately low*, *moderate*, *moderately high*, *high*, and *very high*.

**Erosion, soil.** The removal of soil material by wind, running water, and other geological agents. Technically, *erosion* is the wearing away of soils by geological processes, and *accelerated erosion* is the loss of soil material through the activities of man. In this report, however, the term, *erosion* refers to *accelerated erosion*, and the term, *geologic erosion* refers to *natural geologic erosion*. The following classes of erosion are used in this report:

*Little or no erosion (not in soil name).* The surface layer, or top 7 inches, shows properties of the A horizon. The present surface layer consists of 75 percent of the original A horizon material. These conditions prevail in 75 percent or more of the delineated area.

*Eroded.* The surface layer, or top 7 inches, shows properties resulting from an intermixing of the A horizon and underlying horizons. The mixture contains 25 to 75 percent of the original A horizon material. Seventy-five percent of the delineated area contains at least 25 percent of A horizon material in the surface layer. There may be a few shallow gullies.

*Severely eroded.* The surface layer, or top 7 inches, shows properties of layers beneath the A horizon. The present surface layer contains more than 75 percent of material from horizons that were under the original A horizon. An area is severely eroded if, in more than 25 percent of it, the surface layer consists almost entirely of material from underlying horizons. There may be many shallow gullies in the delineated area.

**First bottom.** The normal flood plain of a stream, subject to frequent or occasional flooding.

**Flood plain.** Nearly level land, consisting of stream sediment, that borders a stream and is subject to flooding unless protected artificially.

- 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.
- Genesis, soil.** The manner in which a soil originated, with special reference to the processes responsible for the development of the solum, or true soil, from the unconsolidated parent material.
- Green-manure crop.** A crop grown for the purpose of being turned under, while it is still green, for soil improvement.
- Horizon, soil.** A layer of soil that is approximately parallel to the surface and has distinct characteristics produced by soil-forming processes.
- Humus.** The well-decomposed, more or less stable part of organic matter in mineral soils.
- Leaching, soil.** The removal of soluble materials from soils or other soil material by percolating water.
- Lime.** Chemically, lime is calcium oxide (CaO), but its meaning has been extended to include all limestone-derived materials applied to neutralize acid soils. Agricultural lime can be obtained as ground limestone, hydrated lime, or burned lime, with or without magnesium minerals. Basic slag, oystershells, and marl also contain calcium.
- Loam.** See Texture, soil.
- Mapping unit.** Any soil, miscellaneous land type, soil complex, or undifferentiated soil group delineated on the detailed soil map and identified by symbol.
- Moisture-supplying capacity.** The relative capacity of the soil to take in and supply moisture in amounts favorable for the growth of most plants. It is related to the amount of runoff, rate of infiltration, available water capacity, and depth of root zone, and to the moisture extraction pattern of plant roots. It is expressed as *very high*, *high*, *moderately high*, *moderately low*, *low*, and *very low*.
- Morphology, soil.** The makeup of the soil, including the texture, structure, consistence, color, and other physical, chemical, mineralogical, and biological properties of the various horizons that make up the soil profile.
- Mottled.** Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and 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 *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; and *coarse*, more than 15 millimeters in diameter.
- Parent material.** The horizon of weathered rock or partly weathered soil material from which soil has formed; horizon C in the soil profile.
- Pasture, proper use of.** Grazing pasture at a rate that will maintain grasses and legumes of high quality. Adjusting the stocking rates or season of use to favor maximum growth and survival of desired plants.
- Permeability, soil.** The quality of a soil that enables water or air to move through it. Terms used to describe permeability are: *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. See Horizon, soil.
- Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. In words, the degree of acidity or alkalinity are expressed thus:
- | pH                    |            | pH                          |                |
|-----------------------|------------|-----------------------------|----------------|
| Extremely acid.....   | Below 4.5  | Neutral .....               | 6.6 to 7.3     |
| Very strongly acid... | 4.5 to 5.0 | Mildly alkaline.....        | 7.4 to 7.8     |
| Strongly acid.....    | 5.1 to 5.5 | Moderately alkaline..       | 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 alkaline..... | 9.1 and higher |
- Relief.** The elevations or inequalities of a land surface, considered collectively.
- Residual material (residuum).** Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is frequently the material in which a soil forms.
- Root zone.** The part of the soil that is penetrated, or can be penetrated, by plant roots. Height of water table, clay content, fragipan, and depth to bedrock are features that limit the depth of the root zone. The following terms are used in this report to indicate the depth of root zone: *very shallow*—less than 10 inches; *shallow*—10 to 20 inches; *moderately deep*—20 to 36 inches; *deep*—36 inches or more.
- Runoff.** The part of the precipitation upon a drainage area that is discharged from the area in stream channels.
- Sand.** See Texture, soil.
- Second bottom.** The first terrace above the normal flood plain of a stream.
- Silt.** See Texture, soil.
- Slope.** The incline of the surface of a soil. It is usually expressed in percentage of slope, which equals the number of feet of fall per 100 feet of horizontal distance.
- Sod waterway.** A grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.
- Soil.** A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting upon parent material, as conditioned by relief over periods of time.
- Solum.** The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying parent material. The living roots and other plant and animal life that are characteristic of the soil are largely confined to the solum.
- 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 axes of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. Structureless soils are *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many clay-pans and hardpans).
- Subsoil.** Technically, the B horizon; roughly, the part of the profile below plow depth.
- Substratum.** Any layer lying beneath the solum, or true soil; the C or D horizon.
- Surface layer.** A term used in nontechnical soil descriptions for one or more upper layers of the soil. Includes the A horizon and part of the B horizon; has no depth limit.
- Surface runoff.** See Runoff.
- Surface soil.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, usually about 5 to 8 inches in thickness. The plow layer.
- Terrace.** An embankment, or ridge, constructed across a sloping soil 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 eroding the soil. 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. (See Diversion channel.)
- Terrace (geological).** 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 to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and generally are wide.
- Texture, soil.** The proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles are as follows: *Sand*, *loamy sand*, *sandy loam*, *loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

*Clay.* As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

*Loam.* Soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

*Sand.* Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. Soil material that contains 85 percent or more of sand and not more than 10 percent clay.

*Silt.* Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

**Topography.** See Relief.

**Upland (geologic).** Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.



GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND WOODLAND SUITABILITY GROUPS

[See table 1 , p. 5 , for the approximate acreage and proportionate extent of the soils; table 2 , p. 26 , for estimated average acre yields; table 3 , p. 27 , for estimated yields of wood products; and table 7, p. 40, for information about the engineering properties of the soils]

| Map symbol | Mapping unit  | Page | Capability unit |      | Woodland suitability group |        |
|------------|---|------|-----------------|------|----------------------------|--------|
|            |   |      | Symbol          | Page | Group                      | Page   |
| AgB        | Allegheny loam, 2 to 6 percent slopes-----  | 6    | IIe-1           | 20   | 1                          | 29     |
| AgC        | Allegheny loam, 6 to 12 percent slopes-----   | 6    | IIIe-1          | 22   | 1                          | 29     |
| AgC2       | Allegheny loam, 6 to 12 percent slopes, eroded-----   | 6    | IIIe-1          | 22   | 1                          | 29     |
| At         | Atkins loam-----  | 7    | IIIw-5          | 24   | 2                          | 29     |
| BaB        | Barbourville gravelly loam, 2 to 6 percent slopes---  | 7    | IIe-3           | 21   | 1                          | 29     |
| BaC        | Barbourville gravelly loam, 6 to 12 percent slopes--  | 7    | IIIe-5          | 23   | 1                          | 29     |
| Br         | Bruno loamy sand-----   | 8    | IIIs-1          | 24   | 1                          | 29     |
| CoB        | Cotaco gravelly loam, 2 to 6 percent slopes-----  | 8    | IIw-3           | 22   | 1                          | 29     |
| Gu         | Gullied land-----   | 8    | VIIe-4          | 25   | 8                          | 31     |
| JfC        | Jefferson gravelly loam, 6 to 12 percent slopes-----  | 9    | IIIe-5          | 23   | 1                          | 29     |
| JfD        | Jefferson gravelly loam, 12 to 20 percent slopes----  | 9    | IVe-4           | 24   | 1                          | 29     |
| JfE        | Jefferson gravelly loam, 20 to 30 percent slopes----  | 9    | VIIe-8          | 25   | 1                          | 29     |
| MfB        | Monongahela fine sandy loam, 2 to 6 percent slopes--  | 10   | IIe-7           | 21   | 4                          | 30     |
| MgB        | Monongahela silt loam, 2 to 6 percent slopes-----   | 10   | IIe-7           | 21   | 4                          | 30     |
| MgC        | Monongahela silt loam, 6 to 12 percent slopes-----  | 10   | IIIe-9          | 23   | 4                          | 30     |
| MkC        | Muskingum silt loam, 6 to 12 percent slopes-----  | 11   | IIIe-7          | 23   | 3                          | 30     |
| MrD        | Muskingum-Ramsey complex, 12 to 20 percent slopes---  | 11   | IVe-4           | 24   | 3                          | 30     |
| MrE        | Muskingum-Ramsey complex, 20 to 30 percent slopes---  | 12   | VIIe-8          | 25   | 6, 7, 8                    | 30, 31 |
| MvF        | Muskingum, Montevallo, and Ramsey stony soils, 30<br>to 50 percent slopes-----                  | 12   | VIIIs-1         | 25   | 6, 7, 8                    | 30, 31 |
| MvF3       | Muskingum, Montevallo, and Ramsey stony soils, 30<br>to 50 percent slopes, severely eroded----- | 12   | VIIIs-3         | 25   | 8                          | 31     |
| PfA        | Pope fine sandy loam, 0 to 3 percent slopes-----  | 13   | I-1             | 20   | 1                          | 29     |
| PfB        | Pope fine sandy loam, 3 to 6 percent slopes-----  | 13   | IIe-8           | 21   | 1                          | 29     |
| Pg         | Pope gravelly fine sandy loam-----  | 13   | IIIs-1          | 22   | 1                          | 29     |
| RaC        | Ramsey fine sandy loam, 6 to 12 percent slopes-----   | 14   | IVe-7           | 25   | 3                          | 30     |
| RdC        | Rarden silt loam, 5 to 15 percent slopes-----   | 14   | IVe-7           | 25   | 5                          | 30     |
| Rk         | Rock land-----  | 14   | VIIIs-5         | 25   | 8                          | 31     |
| SfA        | Sequatchie fine sandy loam, 0 to 4 percent slopes---  | 15   | I-1             | 20   | 1                          | 29     |
| Sd         | Stendal fine sandy loam-----  | 15   | IIw-4           | 22   | 2                          | 29     |
| Sg         | Stendal gravelly fine sandy loam-----   | 15   | IIw-4           | 22   | 2                          | 29     |
| St         | Stendal silt loam-----  | 16   | IIw-4           | 22   | 2                          | 29     |
| Ty         | Tyler silt loam-----  | 16   | IIIw-1          | 23   | 2                          | 29     |
| WnB        | Wellston silt loam, 2 to 6 percent slopes-----  | 17   | IIe-1           | 20   | 3                          | 30     |
| WnC        | Wellston silt loam, 6 to 12 percent slopes-----   | 17   | IIIe-7          | 23   | 3                          | 30     |
| Wh         | Whitwell loam-----  | 17   | IIw-4           | 24   | 1                          | 29     |

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