Series 1960, No. 7

Issued November 1963

SOIL SURVEY

Putnam County, Tennessee

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

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of Putnam County will serve several groups of readers. It will help farmers in planning the kind of management that will protect and improve their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; serve as a reference for students and teachers; aid foresters in managing woodland; help county planning or development boards to decide on future development of the area; and add to the soil scientist's fund of knowledge.

Locating the Soils

Use the index to map sheets to locate areas on the large map. The index is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located. When you find the correct sheet of the large map, you will see that boundaries of the soils are outlined and that there is a symbol for each kind of soil. The symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where it belongs. All areas marked with the same symbol are the same kind of soil, wherever they appear on the map. Suppose, for example, an area located on the map has the symbol (Dk). The legend for the detailed soil map shows that this symbol identifies Dickson silt loam. This soil and all others mapped in the county are described in the section "Descriptions of Soils." The "Guide to Mapping Units," at the back of the report, gives the map symbol for each soil, the name of the soil, and the capability unit and woodland suitability group in which it has been placed.

Finding Information

Some readers will be more interested in one part of the report than another, for the report has special sections for different groups, as well as sections that may be of value to all.

Farmers and those who work with farmers will want to refer to "Descriptions of Soils" to learn about the soils on their farms. They can then turn to the section "Use and Management of Soils" to find how those soils can be managed and what yields can be expected.

Foresters and others interested in woodland can refer to the "Woodland" subsection, in which the soils are grouped according to their suitability for trees and in which factors affecting the management of woodland are explained.

Engineers will want to refer to the subsection "Engineering," which evaluates the soils in terms of characteristics that affect engineering.

Scientists will find information about how the soils were formed and how they are classified by reading the section "Formation and Classification of Soils."

Students, teachers, and other readers will find information about soils and their management in various parts of the report, depending on their particular interest. Those not familiar with the county may want to refer to the section "General Soil Map," which describes broad areas of soils. They may also want to refer to "General Nature of the Area" for information about climate, physiography, geology, and drainage. That section also summarizes briefly the settlement of the county and gives some statistics on agriculture.

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This soil survey of Putnam County was made cooperatively by the United States Department of Agriculture and the Tennessee Agricultural Experiment Station.

The survey is a part of the technical assistance furnished by the Soil Conservation Service to the Putnam County Soil Conservation District.

Fieldwork for the survey was completed in 1960. Unless otherwise indicated, all statements in the report refer to conditions in Putnam County at that time.

Cover picture: **Typical view of Waynesboro-Holston-Baxter soil association.**

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SOIL SURVEY OF PUTNAM COUNTY, TENNESSEE

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

PUTNAM COUNTY is in the northeastern part of the area called Middle Tennessee (fig. 1). It is bordered on the north by Jackson and Overton Counties, on the east by Fentress and Cumberland Counties, on the south by White and DeKalb Counties, and on the west by Smith County. The county is about 40 miles long in an east-west direction, and it measures about 14 miles from north to south in the widest part. The total land area of the county is 259,840 acres, or 406 square miles. Cookeville, the county seat, is about 87 miles east of Nashville on U.S. Highway 70 N.

The county is largely agricultural. In 1959, there were 1,997 farms averaging about 86 acres. The principal crops were corn, tobacco, oats, wheat, and soybeans.

How Soils Are Named, Mapped, and Classified

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

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug 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.

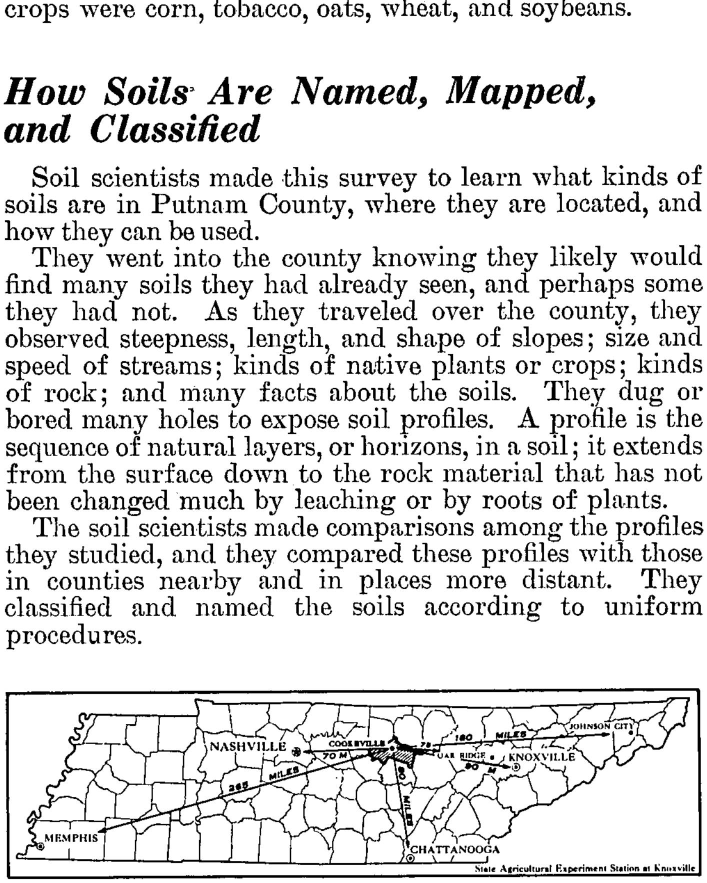

Figure 1.—**Location of Putnam County in Tennessee.**

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 a soil of that series was first observed and mapped. Allen, for example, is the name of a soil series. All the soils in the United States having the same series name are essentially alike in natural characteristics.

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

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into soil phases. The name of a soil phase indicates a feature that affects management. For example, Allen loam, 2 to 5 percent slopes, is one phase of Allen loam, a soil type that ranges from nearly level to steep.

After a fairly detailed guide for classifying and naming the soils had been worked out, the soil scientists drew soil boundaries on aerial photographs. They used photos for their base map because these show woodlands, buildings, field borders, trees, and similar detail 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 most counties, there are some areas that are so rocky or shallow that they cannot be called soils. These areas are shown on the 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.

Only part of the soil survey was done when the soil scientists had named and described the soil series and mapping units, and had shown the location of the mapping units on the soil map. The mass of detailed information then had to be presented in different ways for different groups of people, among them farmers, managers of woodland, and engineers.

To do this efficiently, the soil scientists had to consult with persons in other fields of work and prepare with them groupings that would be of practical value to people who manage soil. Such groupings are the capability classes, subclasses, and units, designed to help farmers manage crops and pastures; woodland suitability groups, for those who manage wooded tracts; and the engineering soil classifications, for engineers who build highways or structures that conserve soil and water.

General Soil Map

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

The soils within any one association are likely to differ greatly among themselves in some properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general map does not show the kind of soil at any particular place, but a pattern that has in it several kinds of different soils.

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

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

The general soil map of Putnam County shows nine soil associations, which are described in the following pages.

Dellrose-Rock land-Mimosa association: Rolling to steep, cherty, rocky soils, and rocky land underlain by phosphatic limestone

This soil association is in the extreme western part of the county. It amounts to about 13 percent of the county and is in only the outer Central Basin physiographic area. Narrow, winding ridges and rounded knobs separate deeply cut, steep, V-shaped valleys (fig. 2). The drainage is to the west, and the valleys are broadest at the county line.

The cherty Dellrose soils; the clayey, phosphatic Mimosa soils; and Rock land, limestone, make up most of the acreage of this association. The Dellrose soils are the most extensive and are on the rolling to steep hillsides that extend into the valleys. They are generally below the Bodine soils and are at the heads and sides of hollows that have been cut back into the Highland Rim by geologic erosion. The Dellrose soils are dark brown. They have formed from old local alluvium or from creep that has sloughed or drifted downhill from the higher lying Bodine and Baxter soils. The Dellrose soils are underlain by residuum from phosphatic limestone.

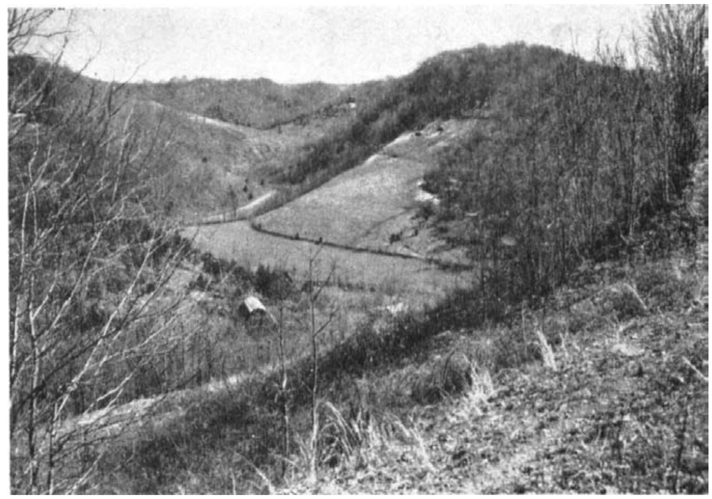

Figure 2.—**Typical view of Dellrose-Rock land-Mimosa soil association. Dellrose soils on steep, cleared slopes; Bodine soils on forested ridge caps; Mimosa soils and Rock land, limestone, on steep, forested slopes; Huntington silt loam, phosphatic, on narrow strip of bottom land.**

The Mimosa soils are on steep to rolling, convex slopes, commonly at the foot of ridges and below the Dellrose soils. In most places the Mimosa soils are rocky. They have a brown, friable, silt loam surface layer and a yellowish-brown clay subsoil. Common on south- and west-facing slopes are large areas of Rock land, limestone, that contain little soil other than that in limestone fissures (fig. 3).

Also in this association, in the valleys, are the well drained Armour and Huntington soils and the moderately well drained Landisburg and Lindside soils. The

Figure 3.—**Rock land, limestone. Spring issuing from tubular limestone.**

Armour and Landisburg soils are on the stream terraces, and the Lindside and Huntington soils are on nearly level first bottoms. The soils on the stream bottoms are accumulations of wash from the phosphatic soils on adjoining slopes.

Since this is an association of steep, rocky, or severely eroded soils, only a small acreage is suited to row crops. Most of the cultivated fields are along Martin Creek, Indian Creek, and their tributaries. The size of most farms is between 80 and 100 acres, and farming is of the general type. Some livestock is raised, mostly beef cattle and some sheep. Hogs are produced on most farms that have bottom land suitable for corn.

The Dellrose soils that are wooded support chiefly white oak, red oak, and hickory, although black locust, yellow-poplar, boxelder, hackberry, black walnut, and chestnut oak are also common. Stands consisting mostly of black locust or yellow-poplar generally grow in abandoned fields. Mixed stands of eastern redcedar and hardwoods are common on Rock land, limestone, and on Mimosa soils; the hardwoods are hackberry, black locust, blackgum, red oak, white oak, and hickory.

Bodine-Baxter-Mountview association: Soils on narrow ridge crests; and steep, shallow, cherty soils, all underlain by very cherty limestone

Narrow, winding ridges and steep-walled valleys make up this soil association. Most of the ridge crests are rounded, and some are as much as one-half mile wide. This association amounts to 12 percent of the county and covers the intensively dissected western edge of the Highland Rim (fig. 4).

Chert is scattered in varied amounts on the surface and throughout the profile of nearly all of the soils in this association. The steeper soils generally contain more chert than the more gently sloping ones.

The Bodine soils make up about half of the area of this association. They are on the steep hillsides and the very narrow ridge crests and knobs. They are light colored and shallow and are on very cherty limestone. The Baxter and Mountview soils are on the rolling ridgetops above the Bodine soils. The Baxter soils have a brown, cherty, silt loam surface layer and a yellowish-red, cherty, clay subsoil. The Mountview soils have formed from a thin mantle of loess over very cherty limestone. They have a light yellowish-brown, friable, silt loam surface layer and a yellowish-brown, friable, silty clay loam subsoil.

Also in this association are the Dickson, Sango, Lawrence, and Guthrie soils. These soils are in small tracts on upland flats. Their drainage is impeded.

Most of the soils in this association are cherty. The chert interferes with tilling and mowing and reduces the capacity of the soils to supply moisture to plants. It probably reduces erosion by increasing porosity and the amount of water that passes through the soils. The chert on the surface reduces splash and consequent erosion caused by falling rain.

The few people in this association live mostly along the roads on the ridgetops. Most of the farms are small, and most products are consumed on the farms. There are, however, a few dairy farms. The pasture is generally poor, but under good management, fairly good pasture can be established.

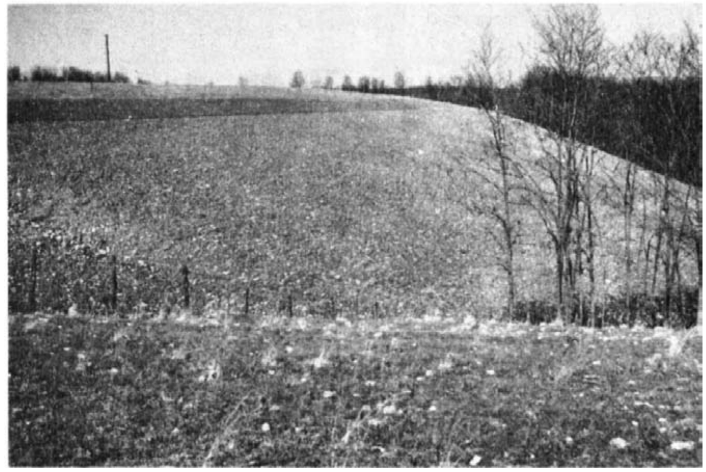

***Figure 4.*—View of Bodine-Baxter-Mountview soil association. Mountview soils on hilltops; cherty Bodine and Baxter soils on steep slopes.**

Most of this association is woodland that has been cut over several times. The stands generally are mixed white oak, red oak, and hickory. On the ridge crests are black oak, chestnut oak, red oak, post oak, and scarlet oak. Below the crests, scarlet oak occurs with white oak, pignut hickory, sassafras, blackgum, dogwood, red maple, and sugar maple. Yellow-poplar is common near the bottom of the slopes in cool moist areas.

Dickson-Mountview-Guthrie association: Light-colored soils on broad, gently sloping uplands, formed in loess underlain by cherty limestone

This soil association covers about 5 percent of the county and is on the Highland Rim near Baxter and Double Springs. It is a broad, chiefly undulating, plateaulike area with many nearly level depressions. A dendritic drainage pattern has formed, but the drains are few and are not well entrenched. The difference in elevation between the highest and lowest point in any area rarely exceeds 40 feet (fig. 5).

The dominant soils have developed in a 20- to 30-inch layer of loess that is underlain by cherty residuum from limestone. In most areas the surface layer is silt loam that is free of chert.

***Figure 5.* Typical landscape of the Dickson-Mountview-Guthrie soil association.**

The Dickson and Mountview soils make up about two-thirds of the association. They are in the broad, undulating areas. The Guthrie soils are mainly in depressions, some without outlets. Sango soils are commonly adjacent to Dickson soils, and Lawrence soils are between Sango soils and Guthrie soils.

In this area differences in soils are mainly the result of differences in internal drainage. The Dickson soils are yellowish brown in the subsoil, are moderately well drained to well drained, and have a brittle, mottled fragipan in the lower part of the subsoil. The Mountview soils are also yellowish brown in the subsoil, but they are well drained and do not have a fragipan. The Sango soils have a light yellowish-brown subsoil, are moderately well drained, and have a fragipan closer to the surface than that in the Dickson soils. Lawrence soils are mottled throughout the subsoil and are somewhat poorly drained. The Guthrie is gray throughout its profile and poorly drained.

The Bewleyville, Christian, Landisburg, Lindside, and Melvin soils occur in small areas. The Bewleyville and the Christian soils are on the rolling uplands, and the Landisburg soils are on foot slopes and in depressions. The moderately well drained Lindside soils and the poorly drained Melvin soils are on the nearly level first bottoms.

Most of the soils in this association dry slowly in spring. Farmers in the area usually plow about two weeks later than do the farmers in most other areas of the county. Much of this association is in cultivated crops or pasture. Corn, tobacco, and small grains are the main crops. A few farms are large, but most farms are small or average sized. Much of the farming is part time and is mostly of the general or the general-livestock type. The area is fairly well populated, and roads are numerous.

Forests of pin oak and sweetgum are on Guthrie and Lawrence soils. Also in the association are water oak, willow oak, red maple, and blackgum. Most of the woodland is poorly drained, but in many places it has been cleared and sowed to pasture.

Mountview-Bewleyville-Baxter association: Rolling soils on loess-capped ridges, and hilly soils of the uplands that are underlain by cherty limestone

This association is on the Highland Rim in the central part of the county and extends from northeast to southwest. It occupies about 16 percent of the county. It is mainly rolling but is hilly to steep near the large drainageways and is undulating on the ridgetops. The drainage pattern is dendritic. The association is more dissected and steeper than the Dickson-Mountview-Guthrie association. The difference in elevation between the high and low points averages about 100 feet.

Most of the soils on the upper parts of hills have formed in a layer of loess that is 20 to 30 inches thick and overlies cherty limestone residuum. The soils on the adjoining rolling to steep slopes have formed from cherty residuum of limestone. The well-drained Mountview and Bewleyville soils dominate in the area and are chiefly on the undulating hilltops and milder slopes. The Mountview and Bewleyville soils are fairly similar. The silty clay loam subsoil is yellowish brown in the Mountview soils and yellowish red in the Bewleyville soils. Baxter soils are on strong slopes near drainageways. They are cherty and have a yellowish-red clay subsoil.

The Cookeville and the Christian soils are not extensive but are agriculturally important. They are on some of the rolling to hilly slopes. Dickson, Sango, Lawrence, and Guthrie soils are on the nearly level parts of the broader ridges. Small areas of Landisburg and Minvale soils have formed from old local alluvium at the foot slopes of the ridges. Ennis soils are in intermittent drains and depressions that consist of young local alluvium. Huntington, Lindside, and Melvin soils are on the first bottoms.

An estimated 80 percent of this area is cleared. The farms average about 80 acres in size. Farming is chiefly of the general type, although there are some livestock and dairy farms. Some farms are operated only part time, and only the best fields are used. Most of the farms have some improved pasture. Erosion has been moderate to severe over much of the cleared rolling and hilly soils. Nearly all farms have a small acreage allotment of tobacco, a principal cash crop. Other crops are corn, small grains, sorghum, lespedeza, alfalfa, crimson clover, and vetch.

The relatively small acreage of forest in this association is mainly in hilly areas and in small, poorly drained areas. Most of the forests have been cut over two or three times, and only scattered stands of merchantable timber remain. Forests of mixed white oak, red oak, and hickory dominate on the uplands. On the Guthrie, Lawrence, and Melvin soils the pin oak-sweetgum forest type is common.

Christian-Mountview association: Rolling to steep, cherty, sandy soils on uplands, underlain by sandy and shaly limestone

The Christian-Mountview association covers about 5 percent of the county. It is in two separate tracts in the north-central part. These tracts are along East Blackburn Fork and Bear Creek and their tributaries. This soil association is moderately dissected by a well-developed pattern of dendritic drainage. It is dominantly hilly but ranges from rolling to steep. The soils are underlain by sandy and shaly limestone.

Christian soils are on most of the rolling to steep slopes. They have a yellowish-brown loam or silt loam surface layer and a strong-brown to yellowish-red clay loam or clay subsoil. Mountview and Bewleyville soils intermingle on the rolling ridgetops where they formed in a thin cap of loess that overlies residuum from sandy limestone. Mountview soils have a light yellowish-brown silt loam surface layer and a yellowish-brown silty clay loam subsoil.

Of minor extent in this association are the Baxter soils. These soils are in areas that contain considerable chert. Christian soils that have a silty clay subsoil are in rolling to steep areas and are underlain by shaly limestone. Small areas of the moderately well drained Landisburg soils and the well drained Minvale and Jefferson soils have formed in old local alluvium at the foot of long slopes. Well-drained Ennis soils occupy drainageways and depressions. Huntington, Lindside, and Melvin soils are on the first bottoms.

Most of the farms are of the small, general type on which some livestock is raised, but there are a few large beef-cattle farms. About 60 percent of the association has been cleared and is used for crops and pasture. Much of the cleared acreage is in unimproved pasture. In places small abandoned areas support stands of naturally seeded Virginia pine. A considerable part of this association, particularly on Christian soils, is eroded. Forests of mixed white oak, red oak, and hickory dominate. Black oak, southern red oak, and scarlet oak are also common.

Waynesboro-Holston-Baxter association: Undulating to hilly soils on high terraces derived from limestone materials

This fairly extensive association is on the eastern part of the Highland Rim; it occupies 14 percent of the county. It consists mainly of soils that developed on old terraces that are 100 to 120 feet higher than the present stream bottoms. (See picture on cover.) The material on these terraces appears to have been deposited over limestone residuum by an old drainage system. On some of the adjoining steeper slopes, streams have cut through the deposits and have exposed residual soils. Lower terraces occur adjacent to the present drainage system, especially along Cane Creek and its tributaries in Calfkiller Valley. Much water drains into sinkholes. The valley is commonly undulating to rolling, and the steeper slopes are near the longer drainageways and the sinkholes.

The well-drained Waynesboro and Holston soils cap the undulating to rolling hills. The Waynesboro soils have a brown to dark grayish-brown silt loam or loam surface layer and a yellowish to dark-red clay loam subsoil. The Holston soils have a light yellowish-brown silt loam or loam surface layer and a yellowish-brown silty clay loam or clay loam subsoil. Baxter soils are on the rolling to steep slopes near large drainageways. They are well drained and have a brown cherty silt loam surface layer and a yellowish-red cherty clay subsoil.

Christian and Bewleyville soils that formed over limestone residuum are also in the area. The moderately well drained Monongahela, the somewhat poorly drained Tyler, and the poorly drained Purdy soils are on nearly level to undulating terraces. The brown Sequatchie soils are common on low-lying terraces in coves that extend into the Cumberland Plateau escarpment. The Hermitage, Minvale, and Allen soils are well-drained soils in old alluvium on foot slopes of the Cumberland Plateau escarpment. The well drained Huntington, the moderately well drained Lindside, and the poorly drained Melvin soils are on first bottoms along the major drainageways.

Most of the association has been cleared and is in crops and pasture. The farming is diversified. The most common type is general farming that includes the raising of beef cattle, hogs, and other livestock. Dairying and the growing of grain are also common. A small acreage of burley tobacco is grown on most farms. A small amount of alfalfa is produced, chiefly on Waynesboro and Hermitage soils. Farm management is generally better on this soil association than on the others in the county, and crop yields are relatively high. This soil association has a large rural population and some of the most productive farms in the county.

The forests are mainly on the poorly drained soils, on Rock land, limestone, and on steep soils on the uplands. Few areas are larger than 40 acres. Mixed stands of white oak, red oak, and hickory dominate in the well-drained sites. Also important are scarlet oak, black oak, post oak, sweetgum, and elm. Pin oak and sweetgum are in the somewhat poorly drained and poorly drained sites, where there are also red maple, swamp white oak, and willow oak. A large part of the merchantable timber has been removed.

Stony colluvial land-Rock land association: Steep, rocky and stony land on the Cumberland Plateau escarpment

This association is on the Cumberland Plateau escarpment. It occupies about 18 percent of the county and lies between the high sandstone plateaus and the lower limestone valleys of the Highland Rim. In places elevation rises 1,000 feet in less than three-fourths of a mile. Slopes are steep and rough, and the association is intensively dissected. There are many rock outcrops, loose stones, and boulders. Soil drainage is very rapid.

The highest part of this association consists of a nearly barren, very steep to vertical escarpment of sandstone. Below the sandstone outcrops are steep to hilly slopes of stony and very stony talus. The lower slopes consist chiefly of steep Rock land, limestone. In places the stony talus reaches to the base of the escarpment and covers the Rock land, limestone.

Rocky Talbott soils on limestone spurs are included in this association. Small acreages of cobbly Jefferson and Allen soils have formed in old colluvium on foot slopes in the coves and hollows.

About one-half of this acreage is Stony colluvial land, and most of the rest is Rock land, limestone, and Rock land, sandstone.

Less than 3 percent of this association has been cleared. Forest products are a source of income for many of the farmers. Because of extreme rockiness and steep slopes, agriculture is not likely to develop in this association. Forestry is probably the best use.

The Rock land, limestone, is covered by eastern redcedar and hardwoods, including red oak, white oak, hickory, blackgum, and dogwood. Stands of these trees are in narrow strips along the lower strata of the Cumberland Plateau escarpment. Cedar is less abundant on the higher elevations.

The Stony colluvial land supports forests of yellow-poplar, white oak, and northern red oak. These forests also include white oak, red maple, and hickory, which grow on cool, moist, northerly slopes of the coves.

Holston-Allen-Monongahela association: Undulating to rolling, well drained to moderately well drained soils in old alluvium derived from sandstone, on high benches

This association is on small, isolated benches on the sides of the escarpment of the Cumberland Plateau. It covers about 4 percent of the county. The elevation is approximately 1,400 feet above sea level and is about midway between the Cumberland Plateau and the Highland Rim. The relief is undulating to rolling. Drainageways are shallow and, in places, empty into sinkholes. The largest acreage is near Brotherton and is locally called Brotherton Bench.

The soils have formed mainly in local alluvium or colluvium derived mostly from sandstone. In some places the alluvium has been affected by limestone material and, in other places, by a covering of loess.

Holston and Allen soils make up about two-thirds of the acreage. The Holston soils are well drained and have a yellowish-brown loam surface layer and a yellowish-brown clay loam subsoil. Allen soils have a yellowish-brown to brown loam surface layer and a yellowish-red to red clay loam subsoil. The Monongahela soils are undulating to nearly level. They are moderately well drained and have a pale-brown loam surface layer and a yellowish-brown loam or clay loam subsoil. The lower part of the subsoil is a mottled, brittle fragipan.

Other soils are also in this association. Muskingum soils are on the steep fringes of the benches and in deep, steep sinkholes. The Jefferson, Swaim, and Minvale soils have formed on foot slopes in old local alluvium. The somewhat poorly drained Tyler soils and the poorly drained Purdy soils are on the nearly level flats and in depressions.

A great part of the acreage is cultivated or pastured, though some small areas are not suitable for easy use of farm machinery. Nearly all the soils are free of chert and are fairly easy to till. The well-drained soils are moderately productive if well fertilized. Adequately draining the soils is a problem on several farms.

This association is sparsely populated. Many of the farms are small. General farms prevail, and most of the crops are used on the farms. Several farms are operated only part time. Corn is the main row crop, and most of it is fed to livestock on the farm. A large acreage is in unimproved pasture.

A fairly large acreage is in cutover forest, particularly the areas that are too steep or too rocky for tillage. Some of the forests are on soils with poor drainage. Forests of yellow-poplar, white oak, and northern red oak are on the well-drained soils. On the poorly drained soils are pin oak and sweetgum.

Muskingum-Hartsells association: Well-drained to excessively drained soils underlain by shale, on the rolling to steep high plateau

This association is on the Cumberland Plateau and covers about 13 percent of the county. It is dominantly undulating to hilly but is very steep along the drainageways. Much of it is deeply dissected by streams that form a dendritic pattern of drainage.

The Muskingum soils are the most extensive in this association. These shallow, droughty soils are dissected and hilly to very steep. They are silty and fine textured where they formed from shale and are sandy or rocky where they formed from sandstone. The Hartsells soils occupy areas of broad, undulating and rolling divides between streams and are underlain by sandstone.

Among other soils in the association are the well-drained Linker and Wellston soils. These soils are on narrow, rolling ridges, and the Wellston soil is at slightly higher positions than the Linker. Linker soils have formed from sandstone, and the Wellston soils, from shale. Jefferson soils occur on colluvial foot slopes in several areas. The poorly drained Atkins and Elkins soils consist of recent local alluvium in narrow bottoms along intermittent drains.

This association is sparsely populated. Less than 3 percent of it has been cleared. The few widely scattered farms are along the main highways and are operated largely by part-time farmers. Crops are grown mainly for home use. A few farms have small herds of beef cattle. Much of the income for the people in this association comes directly or indirectly from coal mining and lumbering. Many of the roads are logging trails.

Forests have been cut over two or more times. Those of shortleaf pine and oak are widespread, but most of the shortleaf pine has been cut for lumber. White, scarlet, black, southern red, post, and blackjack oaks are in forests of shortleaf pine and oak. Long-abandoned fields have reforested naturally to Virginia pine and some shortleaf pine. Large burned-over areas are now covered with stands of post oak and black oak. Other species in the stands are scarlet oak, southern red oak, white oak, blackjack oak, hickory, and blackgum. A few forests consist mainly of yellow-poplar and hemlock but include mountain-laurel, white pine, and some holly. These forests are on the cool, moist sides of ravines along large, deep drainageways such as Blaylock Branch, Dripping Springs Creek, Officer Branch, and Little Piney Creek. In the ravines are rocky Muskingum soils and Rock land, sandstone, separated by a narrow strip of local alluvium.

Also in this association is a large acreage of Hartsells and Jefferson soils suitable for farming. This acreage has not been developed, probably because of its low natural fertility, the lack of good roads, the ownership pattern, or the cost of clearing the trees. In some other counties, however, many good farms have been developed on these soils.

Just west of Monterey, there are several sand pits in this association.

Descriptions of Soils

This section describes the soils in the county and defines terms needed to understand the soil descriptions. Many other terms are defined in the Glossary. Table 1 lists the acreage and proportionate extent of each mapping unit, and the detailed map at the back of this report shows the location of each unit. At the end of each soil description, a number in parentheses identifies the capability unit in which the soil has been placed so that management can be described more readily. Further information about managing soils is given in the section "Use and Management of Soils." At the back of the report a "Guide to Mapping Units" lists the soils and the page numbers where they are described, as well as the page numbers of the capability units and woodland suitability groups.

In this section the soil series are described in alphabetical order. An important part of each series description is the soil profile, a record of what the soil scientist saw when he examined the soil. If only one profile is given for a series, you may assume that all other mapping units in the series have essentially the same kind of profile and that differences, if any, are indicated in the name of the unit or in the description of the unit.

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

Soil	Area	Extent
	Acres	*Percent*
Allen clay loam, 5 to 12 percent slopes, severely eroded	232	0. 1
Allen clay loam, 12 to 30 percent slopes, severely eroded	381	. 1
Allen cobbly loam, 5 to 20 percent slopes	393	. 2
Allen cobbly loam, 20 to 30 percent slopes	1, 434	. 6
Allen loam, 2 to 5 percent slopes	481	. 2
Allen loam, 5 to 12 percent slopes	1, 136	. 4
Allen loam, 12 to 20 percent slopes	323	. 1
Allen loam, 20 to 30 percent slopes	383	. 1
Armour silt loam, 2 to 5 percent slopes	224	. 1
Armour silt loam, 5 to 12 percent slopes, eroded	563	. 2
Armour silt loam, 12 to 20 percent slopes, eroded	189	. 1
Atkins silt loam	925	. 4
Baxter cherty silt loam, 5 to 12 percent slopes, eroded	3, 380	1. 3
Baxter cherty silt loam, 12 to 20 percent slopes	794	. 3
Baxter cherty silt loam, 12 to 20 percent slopes, eroded	3, 619	1. 4
Baxter cherty silt loam, 20 to 30 percent slopes	2, 826	1. 1
Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded	559	. 2
Baxter cherty silty clay loam, 20 to 30 percent slopes, severely eroded	1, 020	. 4
Bewleyville silt loam, 2 to 5 percent slopes	3, 203	1. 2
Bewleyville silt loam, 5 to 12 percent slopes	756	. 3
Bewleyville silt loam, 5 to 12 percent slopes, eroded	6, 888	2. 7
Bewleyville silt loam, 12 to 20 percent slopes, eroded	523	. 2
Bewleyville silty clay loam, 5 to 12 percent slopes, severely eroded	1, 525	. 6
Bewleyville silty clay loam, 12 to 20 percent slopes, severely eroded	332	. 1
Bodine cherty silt loam, 5 to 12 percent slopes	3, 097	1. 2
Bodine cherty silt loam, 12 to 20 percent slopes	2, 068	. 8
Bodine cherty silt loam, 20 to 40 percent slopes	19, 173	7. 4
Bruno loamy sand	160	. 1
Christian loam, 2 to 5 percent slopes	249	. 1
Christian loam, 5 to 12 percent slopes	215	. 1
Christian loam, 5 to 12 percent slopes, eroded	1, 786	. 7
Christian loam, 12 to 20 percent slopes, eroded	945	. 4
Christian loam, 20 to 30 percent slopes	983	. 4
Christian silt loam, 2 to 5 percent slopes, eroded	482	. 2
Christian silt loam, 5 to 12 percent slopes	485	. 2
Christian silt loam, 5 to 12 percent slopes, eroded	3, 007	1. 2
Christian silt loam, 12 to 20 percent slopes	507	. 2
Christian silt loam, 12 to 20 percent slopes, eroded	1, 380	. 5
Christian silty clay loam, 5 to 12 percent slopes, severely eroded	2, 006	. 8
Christian silty clay loam, 12 to 20 percent slopes, severely eroded	2, 981	1. 1
Christian silty clay loam, 20 to 30 percent slopes, severely eroded	624	. 2
Cookeville silt loam, 5 to 12 percent slopes, eroded	393	. 2
Cookeville silty clay loam, 5 to 12 percent slopes, severely eroded	455	. 2
Cookeville silty clay loam, 12 to 20 percent slopes, severely eroded	330	. 1
Cumberland silt loam, 2 to 5 percent slopes	560	. 2
Cumberland silt loam, 5 to 12 percent slopes, eroded	247	. 1
Cumberland silty clay loam, 5 to 12 percent slopes, severely eroded	168	. 1
Dellrose cherty silt loam, 12 to 20 percent slopes	293	. 1
Dellrose cherty silt loam, 20 to 30 percent slopes	933	. 4
Dellrose cherty silt loam, 30 to 45 percent slopes	6, 800	2. 6
Dickson silt loam	4, 995	1. 9
Elkins silt loam	195	. 1
Ennis silt loam, local alluvium	1, 637	. 6
Gullied land	1, 073	. 4
Guthrie silt loam	986	. 4
Hartsells loam, 2 to 5 percent slopes	6, 015	2. 3
Hartsells loam, 5 to 12 percent slopes	6, 412	2. 5
Hartsells loam, 5 to 12 percent slopes, eroded	1, 459	. 6
Hermitage cherty silt loam, 5 to 12 percent slopes	718	. 3
Hermitage cherty silt loam, 12 to 20 percent slopes	942	. 4
Hermitage cherty silt loam, 20 to 30 percent slopes, eroded	1, 152	. 4
Hermitage silt loam, 2 to 5 percent slopes	494	. 2
Hermitage silt loam, 5 to 12 percent slopes	812	. 3
Hermitage silt loam, 12 to 20 percent slopes, eroded	320	. 1
Holston loam, 2 to 5 percent slopes	1, 107	. 4
Holston loam, 5 to 12 percent slopes, eroded	478	. 2
Holston silt loam, 2 to 5 percent slopes	2, 906	1. 1
Holston silt loam, 5 to 12 percent slopes	1, 513	. 6
Holston silt loam, 5 to 12 percent sopes, eroded	553	. 2
Huntington cherty silt loam	386	. 1
Huntington cherty silt loam, phosphatic	781	. 3
Huntington fine sandy loam	1, 334	. 5
Huntington silt loam	813	. 3
Huntington silt loam, local alluvium	1, 893	. 7
Huntington silt loam, phosphatic	1, 282	. 5
Jefferson loam, 2 to 5 percent slopes	3, 162	1. 2
Jefferson loam, 5 to 12 percent slopes	1, 892	. 7
Jefferson loam, 12 to 20 percent slopes, eroded	236	. 1
Jefferson cobbly sandy loam, 5 to 12 percent slopes	313	. 1
Jefferson cobbly sandy loam, 12 to 20 percent slopes	270	. 1
Jefferson cobbly sandy loam, 20 to 30 percent slopes	334	. 1
Landisburg silt loam, 2 to 5 percent slopes	2, 687	1. 0
Landisburg silt loam, 5 to 12 percent slopes	1, 065	. 4
Lawrence silt loam	838	. 3
Lindside silt loam	2, 825	1. 1
Linker loam, 5 to 12 percent slopes	236	. 1
Linker loam, 5 to 12 percent slopes, eroded	468	. 2
Melvin silt loam	1, 843	. 7
Mimosa silt loam, 12 to 20 percent slopes, eroded	240	. 1
Mimosa silt loam, 20 to 35 percent slopes, eroded	263	. 1
Mimosa very rocky silty clay loam, 5 to 20 percent slopes, eroded	1, 170	. 5
Mimosa very rocky silty clay loam, 20 to 30 percent slopes, eroded	9, 959	3. 8
Mine pits and dumps	115	[1]
Minvale cherty silt loam, 2 to 12 percent slopes	484	. 2
Minvale cherty silt loam, 12 to 20 percent slopes, eroded	390	. 2
Minvale silt loam, 2 to 5 percent slopes	250	. 1
Minvale silt loam, 5 to 12 percent slopes	532	. 2
Monongahela silt loam, 2 to 5 percent slopes	2, 801	1. 1
Mountview silt loam, 2 to 5 percent slopes	7, 998	3. 1
Mountview silt loam, 5 to 12 percent slopes	554	. 2
Mountview silt loam, 5 to 12 percent slopes, eroded	4, 066	1. 6

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

Soil	Area	Extent
	Acres	*Percent*
Mountview silt loam, 5 to 12 percent slopes, severely eroded	235	.1
Mountview silt loam, shallow, 2 to 5 percent slopes	944	.4
Mountview silt loam, shallow, 5 to 12 percent slopes	367	.1
Mountview silt loam, shallow, 5 to 12 percent slopes, eroded	2,646	1.0
Mountview silt loam, shallow, 5 to 12 percent slopes, severely eroded	196	.1
Mountview silt loam, shallow, 12 to 20 percent slopes, eroded	443	.2
Muskingum sandy loam, 5 to 12 percent slopes	2,415	.9
Muskingum sandy loam, 12 to 20 percent slopes	3,433	1.3
Muskingum sandy loam, 20 to 30 percent slopes	1,146	.4
Muskingum silt loam, 5 to 12 percent slopes	652	.3
Muskingum silt loam, 12 to 20 percent slopes	1,693	.7
Muskingum silt loam, 20 to 30 percent slopes	4,712	1.8
Muskingum very rocky sandy loam, 12 to 20 percent slopes	1,793	.7
Muskingum very rocky sandy loam, 20 to 30 percent slopes	4,289	1.7
Purdy silt loam	1,668	.6
Rock land, limestone	16,902	6.5
Rock land, sandstone	3,521	1.4
Sango silt loam	805	.3
Sequatchie loam, 2 to 5 percent slopes	831	.3
Sequatchie loam, 5 to 12 percent slopes, eroded	224	.1
Stony colluvial land	25,717	9.9
Swaim silt loam, 5 to 12 percent slopes, eroded	315	.1
Talbott silty clay loam, 5 to 20 percent slopes, eroded	345	.1
Talbott very rocky silty clay loam, 5 to 20 percent slopes	1,179	.5
Talbott very rocky silty clay loam, 20 to 30 percent slopes	3,575	1.4
Tyler silt loam	977	.4
Waynesboro silt loam, 2 to 5 percent slopes	2,210	.8
Waynesboro silt loam, 5 to 12 percent slopes	375	.1
Waynesboro silt loam, 5 to 12 percent slopes, eroded	5,050	1.9
Waynesboro silt loam, 12 to 20 percent slopes, eroded	858	.3
Waynesboro silty clay loam, 5 to 12 percent slopes, severely eroded	1,127	.4
Waynesboro silty clay loam, 12 to 20 percent slopes, severely eroded	640	.2
Wellston silt loam, 2 to 5 percent slopes	231 [1]	.1
Wellston silt loam, 5 to 12 percent slopes	357	.1
Wellston silt loam, 5 to 12 percent slopes, eroded	306	.1
Total land area	259,840	100.0
Water	1,664	--------

[1] Less than 0.1 percent.

In describing the soils, the scientist assigns letter symbols, for example, "A_1," to the various layers. These letter symbols have special meanings that concern scientists and others who desire to make a special study of soils. Most readers need to remember only that all letter symbols beginning with "A" are surface soil and subsurface soil; those beginning with "B" are subsoil; and those beginning with "C" are substratum, or parent material. It may also be helpful to remember that the small letter "p" indicates a plowed layer and that the small letter "m" indicates a dense layer or fragipan.

Soil scientists use Munsell notations to indicate the color of a soil precisely, and they provide the equivalent in words for those not familiar with the system. They compare the sample of the soil with a standard color chart. The Munsell notation and its less exact approximation in words are read from the chart; for example, "light gray (10 YR 7/2)." In the example given, "10 YR" is the hue, and 7 and 2 are the value and chroma, respectively.

The texture of soil depends on the content of sand, silt, and clay. Texture is determined by the way soil feels when rubbed between the fingers, and it is checked by laboratory analysis. Each mapping unit is identified by a texture name, such as "silt loam." This refers to the texture of the surface layer, or A horizon.

Soil structure is the arrangement of individual soil particles in larger grains or aggregates. The structure of soil is described according to the strength, size, and shape of the aggregates. For example, the soil in a horizon may have a "weak, fine, subangular blocky structure."

Allen Series

The soils of the Allen series are deep and well drained. They have formed in old local alluvium or colluvium. This material washed, rolled, or slid from soils underlain by sandstone, shale, and some limestone. Allen soils are in small or medium areas on benches and foot slopes that are on the escarpment of the Cumberland Plateau in places where sediments derived through geologic erosion have accumulated. Slopes range from 2 to 30 percent or more. The colluvium extends to a depth of 2 to about 15 feet and is underlain by 2 to 5 feet of yellowish-red clay that overlies limestone bedrock.

Uneroded Allen soils have a brown, very friable, loam surface soil. The subsoil is friable, yellowish-red clay loam. In some areas many angular cobbles of sandstone are on the surface and throughout the profile.

Allen soils are adjacent to the Jefferson, Hermitage, and Talbott soils. Their subsoil is redder than that of the Jefferson soils. They are coarser textured than the Hermitage soils and have a lighter colored surface soil. The native vegetation on the Allen soils was mixed hardwoods and some pine.

Allen soils are strongly acid to very strongly acid throughout their profile. They are low in natural fertility, but mildly sloping fields produce good yields of a wide variety of crops if they are well fertilized. The steeper, more eroded areas are suited to pasture and trees.

Allen loam, 2 to 5 percent slopes (AmB).—This soil is on colluvial slopes and is well drained. It is in irregularly shaped areas of small and medium size, mostly on benches and foot slopes along the escarpment of the Cumberland Plateau.

Soil profile:

A_p 0 to 10 inches, brown (10YR 5/3) loam; weak, fine, granular structure; very friable; strongly acid to very strongly acid.

B_1 10 to 13 inches, strong-brown (7.5YR 5/6) loam; weak, fine, subangular blocky structure; friable; strongly acid to very strongly acid.

B_2 13 to 40 inches, yellowish-red (5YR 5/6) clay loam; moderate, medium, subangular blocky structure; friable; few small quartzite pebbles and chert fragments; strongly acid to very strongly acid.

B_3 40 to 46 inches, yellowish-red (5YR 5/6) clay loam with few, medium, faint mottles of red (2.5YR 4/6); moderate, medium, subangular and angular blocky structure; friable; strongly acid to very strongly acid.

C 46 to 60 inches +, red (2.5YR 4/6) clay loam with few, medium, distinct mottles of strong brown (7.5YR 5/6) and yellowish red (5YR 5/6); moderate, medium, angular blocky structure; friable; strongly acid to very strongly acid.

In some areas the deep colluvial material typical of Allen soils is gradually transitional to shallow material over limestone residuum in which Talbott soils generally form. Included with this soil are a few areas of silt loam and of fine sandy loam. Also included are a few severely eroded areas that have a yellowish-red plow layer.

This soil is strongly acid to very strongly acid. It is low in natural fertility and in organic matter. A few small fragments of sandstone may be scattered on the surface and through the soil, but they do not interfere with tillage. Permeability is moderate, the moisture-supplying capacity is moderately high, and the root zone is thick and friable. This soil responds well to management, especially to high fertilization.

Most of this soil has been cleared and is cultivated. It is planted to corn, tobacco, and small grains. About 20 percent is in pasture, and 20 percent is idle.

This soil is well suited to the crops grown in the area. Because it is sloping and susceptible to erosion, it is not well suited to intensive use for row crops. (Capability unit IIe–2)

Allen loam, 5 to 12 percent slopes (AmC).—This soil has a thinner surface layer than that of Allen loam, 2 to 5 percent slopes. The surface layer is commonly 4 to 5 inches thick, but in small spots the yellowish-red subsoil is exposed. Most of this soil is on benches along the escarpment of the Cumberland Plateau.

Natural fertility is low, but the moisture-supplying capacity is high and the root zone is thick and friable. This soil responds very well to management, especially fertilization.

Nearly all of this soil has been cropped. Most of it is in corn, small grains, and hay. It is well suited to all common crops but is not suited to intensive cultivation. Yields of crops locally grown are good if the soil is well fertilized and otherwise well managed. (Capability unit IIIe–2)

Allen loam, 12 to 20 percent slopes (AmD).—This soil is on the foot slopes at the base of the Cumberland Plateau escarpment. It has a profile similar to that of Allen loam, 2 to 5 percent slopes.

Natural fertility is low, and the moisture-supplying capacity is fair. Because slopes are moderately steep, runoff is rapid. The root zone is friable and fairly thick. The response to fertilization is moderately high.

Much of this soil is in row crops and unimproved pasture, but a sizable acreage is idle. If adequately fertilized, the soil is suited to close-growing crops and to pasture. It is not a good soil for row crops, but fair to good yields can be produced in a long cropping system. Because of runoff there is risk of erosion on cultivated fields. (Capability unit IVe–2)

Allen loam, 20 to 30 percent slopes (AmE).—This soil has a thinner surface layer than has Allen loam, 2 to 5 percent slopes, and is shallower to limestone residuum. The surface layer is friable, yellowish brown to brown, and about 5 to 7 inches thick. It is underlain by yellowish-red to red, friable clay loam. This soil has formed in alluvium that is 2 to 6 feet thick over limestone residuum. A few sandstone fragments and cobbles are on the surface and in the subsoil. Clayey residuum of limestone is exposed in small areas adjacent to Talbott soils and to Rock land, limestone. This soil is on the foothills of the Cumberland Plateau escarpment.

Natural fertility is low, and the moisture-supplying capacity is moderately low. The root zone is fairly thick and is permeable. Because runoff is rapid, the soil erodes readily. It responds moderately well to management.

Much of this soil has been cleared and is idle or is in unimproved pasture. An estimated 30 percent is wooded. Slopes are too steep for row crops. The soil is best suited to pasture or trees. It is productive of all common pasture plants if it is well fertilized and otherwise well managed. (Capability unit VIe–1)

Allen clay loam, 5 to 12 percent slopes, severely eroded (AoC3).—This soil is in small areas on foot slopes and benches. The present plow layer is mostly yellowish-red, clay loam subsoil material and is finer in texture than the plow layer of Allen loam, 2 to 5 percent slopes. The average depth to bedrock is about 36 inches, but the depth is as little as 24 inches in a few spots. A few shallow gullies are in some areas.

This soil is low in organic matter and in natural fertility. It is strongly acid to very strongly acid. Tilth is generally poor because the plow layer is mostly subsoil material. Permeability is moderately slow, runoff is rapid, and the moisture-supplying capacity is low.

Many areas of this soil are idle or are in native pasture. A few areas have been planted or are naturally reverting to pine trees. A small acreage is in corn, small grains, and hay. Average yields are low.

Because it does not furnish enough moisture to plants, this soil is not productive of tilled crops. It is suited to small grains, grass-legume hay, and pasture. These crops respond well to additions of fertilizer, but tilled crops do not. (Capability unit IVe–2)

Allen clay loam, 12 to 30 percent slopes, severely eroded (AoE3).—Most of this soil is on steep foot slopes and benches of the Cumberland Plateau escarpment. Becaue of severe erosion, the 5- or 6-inch plow layer is subsoil material that is yellowish-red, friable clay loam. Bedrock is at a depth of 24 to 36 inches. Shallow gullies are common.

The natural fertility of this soil is low. Tilth is poor, and the moisture supply is low.

Nearly all of the soil has been planted to crops, but now much of it is idle or is reverting to pine trees. A small part is in crops and pasture.

This soil is poorly suited to tilled crops. If adequately fertilized and otherwise well managed, most of the acreage could produce good to fair yields of orchardgrass or tall fescue and whiteclover for pasture. (Capability unit VIe-1)

Allen cobbly loam, 5 to 20 percent slopes (AcD).—This soil is on mountain foot slopes. It is deep, friable, and well drained but has many sandstone fragments, 3 to 10 inches long, on the surface and throughout the soil profile. In most areas the old local alluvium or colluvium is underlain by limestone bedrock at a depth of 5 feet or more.

Soil profile in a forested area:

A_1 0 to 1 inch, grayish-brown (10YR 5/2) cobbly loam; weak fine, crumb structure; very friable; strongly acid to very strongly acid.

A_2 1 inch to 8 inches, brown (10YR 5/3) cobbly loam; weak, fine, granular structure; very friable; strongly acid to very strongly acid.

A_3 8 to 13 inches, strong-brown (7.5YR 5/8) cobbly loam or cobbly clay loam; moderate, fine, subangular blocky structure; friable; strongly acid to very strongly acid.

B_1 13 to 18 inches, yellowish-red (5YR 5/6) cobbly clay loam; moderate, medium, subangular blocky structure; friable; strongly acid to very strongly acid.

B_2 18 to 32 inches, yellowish-red (5YR 4/6) to red (2.5YR 4/8) cobbly clay loam; moderate, medium, subangular blocky structure; friable; strongly acid to very strongly acid.

B_3 32 to 40 inches, red (2.5YR 4/8) cobbly clay loam; few, medium, distinct mottles of strong brown (7.5YR 5/6) and yellowish red (5YR 4/6); moderate, medium, subangular and angular blocky structure; friable; strongly acid to very strongly acid.

C 40 to 50 inches +, red (2.5YR 4/8) cobbly clay loam or cobbly sandy clay mottled with yellowish red, strong brown, and yellowish brown; moderate, medium, angular blocky structure; this layer is transitional to limestone residuum.

Normally, more than 15 percent of the soil mass is cobbles.

This soil is low in organic matter and in natural fertility. It is strongly acid to very strongly acid. The soil is permeable and easily penetrated by roots. It absorbs rainfall quickly, but because it is porous and has many coarse fragments, the moisture-supplying capacity is moderately low.

Forest covers most of this soil, but several areas have been cleared and are used for pasture.

Because they are difficult to till, the steeper cobbly areas of this soil are not suited to cultivated crops. Though the areas with slopes of less than 12 percent are moderately well suited to tilled crops, cobbles interfere with tillage. The cobbles on the surface make it difficult to clip pasture. This soil produces fair to good pasture if adequate amounts of lime and complete fertilizers are applied. (Capability unit IVs-1)

Allen cobbly loam, 20 to 30 percent slopes (AcE).—This soil formed in a thinner deposit of old colluvium than did Allen cobbly loam, 5 to 20 percent slopes. It is on the rims of mountain coves at the base of the Cumberland Plateau escarpment. Included with this soil are about 160 acres that are severely eroded and about 150 acres that are on slopes of more than 30 percent. In some places, erosion has removed the old colluvium and has exposed the weathered limestone.

This soil is low in natural fertility and in organic matter. Surface runoff is rapid, and the moisture-supplying capacity is low. The soil is permeable and somewhat droughty.

Nearly all of this soil remains in forest that has been cut over and burned several times. The few cleared areas are idle or are in permanent pasture.

Because this soil is steep and cobbly, it is poorly suited to tilled crops. It is suited to all the common pasture plants, and fair pasture can be maintained if it is well fertilized and otherwise well managed. However, unless additional pasture is urgently needed, this soil might best be used to produce trees. (Capability unit VIs-1)

Armour Series

The Armour series consists of deep, well-drained, highly phosphatic soils. These soils are on terraces and foot slopes in the valleys of the Central Basin, mainly along Martin Creek and Indian Creek and their tributaries. Most of the parent materials have washed from Mimosa soils, which formed over phosphatic limestone. The total acreage of Armour soils in Putnam County is not extensive.

These soils have a surface layer of dark-brown, friable silt loam. Their subsoil is strong-brown to dark-brown, friable silty clay loam. The profile is 2 to 12 feet or more thick. A few areas contain some chert.

Armour soils are next to the Mimosa, Dellrose, and Huntington soils. They contain more clay in the subsoil than do Dellrose soils.

These soils are moderately high in fertility and organic matter, and they are medium acid. They are easily kept in good tilth and respond well to fertilization and other management.

The native vegetation was chiefly various oaks, hickory, hackberry, black locust, and beech. However, because these soils are among the most productive in the county, nearly all of the acreage has been cleared and is farmed intensively. These soils are well suited to tobacco, vegetables, and other crops of high value.

Armour silt loam, 2 to 5 percent slopes (ArB).—This deep, well-drained, phosphatic soil is on low terraces and foot slopes in the Central Basin.

Soil profile:

A_p 0 to 10 inches, dark-brown (10YR 3/3 to 4/3) silt loam; weak, fine, granular structure; friable; medium acid.

B_1 10 to 16 inches, dark-brown (7.5YR 4/4) silty clay loam; weak to moderate, medium, subangular blocky structure; friable; few, fine, subangular chert fragments; medium acid.

B_2 16 to 38 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable; few, small, subangular fragments of chert; few faint splotches of yellowish brown in lower part.

B_3 38 to 48 inches, strong-brown (7.5YR 5/6) silty clay loam; few, fine, faint mottles of pale brown (10YR 6/3) and yellowish brown (10YR 5/4); moderate, medium, subangular blocky structure; friable; common, small, subangular fragments of chert; medium acid.

C 48 to 60 inches +, strong-brown (7.5YR 5/6) silty clay loam or silty clay; common, medium, distinct mottles of reddish brown (5YR 4/4), yellowish brown (10YR 5/4), and pale brown (10YR 6/3); weak, medium, angular blocky structure; friable to firm; few, small, angular fragments of chert; medium acid.

The content of phosphorus normally is high to medium but, in places, is low. In a few places, soils that have a weak pan layer below the subsoil are included.

This soil is moderate in organic matter, moderately high in natural fertility, and is medium acid. It is friable, is easily tilled, and supplies much moisture to plants. The risk of erosion is slight to moderate. This soil responds well to management, especially to adequate fertilization.

Nearly all of this soil has been cleared and is used intensively for corn, tobacco, and other row crops. This is one of the most productive soils in the county and is especially well suited to tobacco and truck crops. A few areas on foot slopes that receive seepage are not well suited to deep-rooted crops. This soil requires moderate applications of lime, nitrogen, and potash. (Capability unit IIe–1)

Armour silt loam, 5 to 12 percent slopes, eroded (ArC2).—This moderately sloping soil has a thinner surface layer than Armour silt loam, 2 to 5 percent slopes. The 4- to 6-inch plow layer is brown to dark-brown, friable silt loam. It has been mixed with the upper part of the subsoil, which is strong-brown to reddish-brown, friable silty clay loam. In a few severely eroded spots the subsoil is exposed. A few areas are cherty.

This soil is moderate in organic matter, is moderately high in natural fertility, and is medium acid. Its profile is permeable, and the root zone is thick and well aerated. The moisture-supplying capacity is high. The soil is easily worked and can be tilled within a wide range of moisture content. It responds well to management.

Nearly all of this soil has been cleared and is in crops. Corn, tobacco, and common lespedeza are the principal crops, although other crops are grown. This soil is well suited to all of the common crops and to pasture. Fertilizers are needed for continuous high yields. The soil is deficient in lime and potassium but generally is well supplied with phosphorus. (Capability unit IIIe–1)

Armour silt loam, 12 to 20 percent slopes, eroded (ArD2).—This soil is on strongly sloping foothills of ridges and knobs in the outer part of the Central Basin. Because of its slope and erosion, it is more variable in depth and normally shallower than Armour silt loam, 2 to 5 percent slopes. The surface soil in cultivated areas is dark-brown, friable silt loam, 3 to 6 inches thick. The subsoil is strong-brown to reddish-brown, friable silty clay loam. Several areas contain angular fragments of chert in small amounts, but they do not lower production.

This soil is moderately low in organic matter, moderate in natural fertility, and medium acid in reaction. It is moderately permeable and can supply much moisture to plants, probably because water seeps slowly from adjacent higher lying slopes. The root zone is thick. The soil responds well to management.

Nearly all of this soil has been cleared, and many areas are in permanent pasture.

This soil is only fairly well suited to row crops but is well suited to pasture, small grains, and hay. Suitable pasture plants are white clover, red clover, orchardgrass, fescue, lespedeza, and alfalfa. The soil is naturally well supplied with phosphorus but requires moderate applications of lime, nitrogen, and potash. (Capability unit IVe–1)

Atkins Series

In the Atkins series are gray, poorly drained soils on first bottoms along streams in the Cumberland Plateau. These soils formed in recent alluvium that washed from soils on uplands underlain mainly by acid sandstone and shale. Most of the alluvial material came from the Hartsells, Wellston, and Muskingum soils.

Atkins soils have a surface layer of gray, friable silt loam. Their subsoil is mottled gray to light brownish-gray, friable silt loam. The depth to bedrock ranges from 2 to 5 feet. Slopes range from 0 to 2 percent.

Atkins silt loam is the only Atkins soil mapped in Putnam County. It is minor in extent and in agricultural importance. Except for a small acreage near Monterey, it is largely in forest. The natural vegetation was mixed water-tolerant hardwoods.

Atkins silt loam (0 to 2 percent slopes) (At).—This is a poorly drained soil on narrow first bottoms of the Cumberland Plateau.

Soil profile:

A_1 0 to 6 inches, gray (10YR 6/1) silt loam; few, fine, distinct mottles of strong brown (7.5YR 5/6) along root channels; weak, fine, granular structure; friable; strongly acid.

C_{1g} 6 to 25 inches, gray (10YR 5/1) silt loam; common, medium, distinct mottles of yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6); structureless; friable; strongly acid.

C_{2g} 25 to 36 inches, gray (10YR 5/1) stratified silt loam, loam, and sandy loam; structureless; friable; strongly acid.

D_r 36 inches +, sandstone bedrock.

The surface layer is moderately permeable. Surface runoff is very slow to slow, and internal drainage is slow. Because the water table fluctuates, this soil is frequently saturated. A few small areas are swampy most of the time. During wet seasons the soil is waterlogged and is ponded in depressions. It is strongly acid, moderate in organic matter, and low in natural fertility. Tilth is good when moisture conditions are favorable.

About 90 percent of the Atkins soil remains in forest, and 10 percent is cleared.

Unless the excess water is removed, this soil is poorly suited to intertilled crops, but it produces good yields of hay, especially tall fescue and ladino clover. Artificial drainage would improve this soil for pasture and would make it suitable for intertilled crops. (Capability unit IIIw–1)

Baxter Series

The soils of the Baxter series are deep, well drained, and gently sloping to moderately steep. They formed on uplands in residuum from cherty limestone.

In uneroded areas the surface layer of these soils is yellowish-brown or brown, friable cherty silt loam. The subsoil is yellowish-red, firm cherty clay. Bedrock is 5 to 15 feet or more from the surface. The slope ranges from 5 to 30 percent. Angular fragments of chert as much as 5 inches in diameter are on the surface and throughout the soil profile.

The Baxter soils in this county are next to Bodine soils in the western part of the Highland Rim. They adjoin the Bewleyville, Mountview, and Christian soils in many of the more dissected parts of the rim. The Baxter soils are redder, deeper, and less cherty than the Bodine soils. They lack the layer of loess in which the Mountview and Bewleyville soils have formed. They have much more chert in the surface layer than have the Christian soils, and in most places they have more chert in the subsoil.

Most Baxter soils are strongly acid and low in natural fertility and in organic matter. Some are very strongly acid. They are cherty enough to make tillage slightly difficult, but slopes that are not too steep can be cultivated. The response to fertilization is fair.

The native vegetation is mixed hardwoods, mainly white oak, southern red oak, scarlet oak, hickory, and tulip-poplar.

These soils are fair to good for pasture and poor to fair for cultivated crops. Most areas are too steep or too small for cultivated crops.

Baxter cherty silt loam, 5 to 12 percent slopes, eroded (BaC2).—This is a well-drained soil that formed in residuum of cherty limestone on uplands.

Soil profile:

A_p 0 to 7 inches, brown (10YR 5/3) cherty silt loam; weak, fine, granular structure; friable; strongly acid.

B_1 7 to 12 inches, strong-brown (7.5YR 5/6) cherty silty clay loam; weak, medium and fine, subangular blocky structure; friable; strongly acid.

B_{21} 12 to 20 inches, yellowish-red (5YR 4/8 to 5/8) cherty silty clay loam or cherty clay; moderate, medium, angular and subangular blocky structure; firm; few, small, black concretions; strongly acid.

B_{22} 20 to 28 inches, red (2.5YR 4/8) cherty clay; common, medium, distinct mottles of strong brown (7.5YR 5/8); moderate to strong, medium, angular blocky structure; firm; few, small, black concretions; strongly acid.

B_3 28 to 42 inches, red (2.5YR 4/8) cherty clay; common, medium, distinct mottles of strong brown (7.5YR 5/6) and yellowish red (5YR 5/8); weak, platy structure and fine, angular blocky structure; firm; strongly acid.

C 42 to 60 inches +, very cherty clay mottled with red, yellowish red, strong brown, and yellowish brown; firm; very strongly acid.

Some areas have considerable chert in the surface soil but little in the subsoil.

This soil is low in organic matter and in natural fertility and is strongly acid. Many chert fragments are on the surface and in the soil profile. The root zone is thick and well aerated, but the soil cannot supply enough moisture to permit high response to fertilization.

The soil is moderately well suited to all crops commonly grown in the county, but it requires large amounts of fertilizer. The yields of small grains and hay are better than those of corn, tobacco, and other row crops. (Capability unit IIIe-4)

Baxter cherty silt loam, 12 to 20 percent slopes (BaD).—This soil contains more chert than Baxter cherty silt loam, 5 to 12 percent slopes, eroded.

Natural fertility is low, and the moisture-supplying capacity is moderately low to low. The surface layer is 4 to 6 inches thick and is permeable, but roots penetrate the clayey subsoil rather slowly. In some areas where it adjoins Christian soils, this soil is less cherty in the subsoil than Baxter cherty silt loam, 5 to 12 percent slopes, eroded.

Most of this soil is in cutover forest, but some is in pasture or is idle. This is not a good soil for cultivated crops, but it produces fair to good yields of small grains, hay, and pasture. The steeper areas are probably best suited to pasture. Unless the soil is heavily fertilized, yields of permanent pasture are low. Orchardgrass, tall fescue, whiteclover, and lespedeza are suitable pasture plants. (Capability unit IVe-3)

Baxter cherty silt loam, 12 to 20 percent slopes, eroded (BaD2).—This soil is generally next to Bodine and Christian soils and other Baxter soils. It varies more in depth and is shallower than Baxter cherty silt loam, 5 to 12 percent slopes, eroded. The surface layer is yellowish-brown, friable cherty silt loam, 4 to 7 inches thick. The subsoil is yellowish-red to red cherty clay. In small, severely eroded spots, the subsoil is exposed.

The soil erodes readily because surface runoff is rapid. It is low in organic matter, in plant nutrients, and in moisture-supplying capacity. The response to fertilization and other management is only fair.

Nearly all of this soil has been cleared. Most of it is in pasture or is idle; about 15 percent is in crops. It is rather poorly suited to tilled crops, but small grains, hay, and pasture can be grown. Yields are low unless a complete fertilizer and lime are added in large amounts. (Capability unit IVe-3)

Baxter cherty silt loam, 20 to 30 percent slopes (BaE).—Nearly all of this steeply sloping soil is on the Highland Rim. It has thinner soil layers and is shallower to bedrock than Baxter cherty silt loam, 5 to 12 percent slopes, eroded. The surface layer is yellowish-brown, friable cherty silt loam, about 5 inches thick. The subsoil is yellowish-red cherty silty clay loam or cherty clay. The limestone bedrock is at a depth of 5 to 12 feet.

This soil is permeable, but it has only a fair moisture-supplying capacity and is rather droughty, especially on south- and west-facing slopes. It is low in organic matter and in natural fertility and is strongly acid. Many chert fragments are scattered on the surface and, normally, throughout the soil.

Nearly all of this soil is in cutover deciduous forest. It is a poor soil for cultivated crops, but if well fertilized, it can produce fair to good yields of pasture. Fescue, orchardgrass, whiteclover, and lespedeza are suitable pasture plants. Because fertility is low and moisture is scarce during summer, fescue lasts longer than orchardgrass unless the pasture is fertilized and otherwise well managed. (Capability unit VIe-2)

Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded (BcD3).—This soil has a finer textured plow layer than Baxter cherty silt loam, 5 to 12 percent slopes, eroded. The plow layer, 4 to 5 inches thick, is yellowish-red to red, firm cherty silty clay loam that is mostly subsoil material. Below this is mottled red, strong-brown, and yellowish-red, firm cherty clay.

Shallow gullies are numerous, and a few deep ones have formed where water accumulates and surface runoff is rapid. Tilth is poor in the plow layer because of the high clay content. The soil clods if it is cultivated when wet. The moisture-supplying capacity is very low.

Most of this soil is idle or abandoned and sparsely covered by weeds or brush. Part of the acreage is in pasture. Some of it is still used for crops, but yields are very low. The soil is poorly suited to cultivated crops. It is better suited to pasture. Fair to good stands of pasture can be maintained, but the fertilizer requirements are high. Fescue, whiteclover, orchardgrass, and lespedeza are suitable pasture plants. Because the soil is droughty, fescue ordinarily lasts longer than orchardgrass. (Capability unit VIe–2)

Baxter cherty silty clay loam, 20 to 30 percent slopes, severely eroded (BcE3).—The plow layer of this soil consists mainly of subsoil material that is yellowish-red cherty silty clay loam or cherty clay. All, or nearly all, of the original surface soil has been removed through erosion. Gullies that cannot be filled by ordinary tillage are common.

The soil is strongly acid and low in natural fertility and in moisture-supplying capacity. It absorbs water slowly and loses much of it in surface runoff, which is difficult to control. The tilth of the plow layer generally is poor, and the soil clods if it is cultivated when moisture conditions are unfavorable.

Most areas have been planted to crops but are now abandoned to forests or unimproved pasture. This soil is very poorly suited to tilled crops and is only fairly well suited to pasture. Obtaining a good stand of pasture is expensive because large quantities of lime, fertilizer, and manure are needed. Tall fescue and whiteclover are among the best suited pasture plants. Orchardgrass can be grown, but the life of the stand is generally rather short because the soil is droughty. (Capability unit VIIe–1)

Bewleyville Series

The Bewleyville series consists of deep, well-drained soils on uplands. These soils have formed in a thin mantle of loess over cherty and noncherty limestone residuum. They are on broad, low hills in the less dissected parts of the Highland Rim.

The surface layer of these soils is yellowish-brown to brown, friable silt loam. The subsoil is strong-brown to yellowish-red, friable silty clay loam. At a depth of about 3 feet, the soil material is silty clay or clay and is mottled with yellowish red, red, strong brown, and yellowish brown. The slope ranges from 2 to 20 percent but generally is 4 to 8 percent. The depth to limestone bedrock is commonly more than 10 feet.

The Bewleyville soils are next to the Mountview, Dickson, Christian, Cookeville, and Baxter soils. They are redder and better drained than the Mountview and Dickson soils. They lack the fragipan that occurs in the Dickson soils.

The Bewleyville soils are strongly acid, and they are moderately low to low in natural fertility and in organic matter.

These soils are extensive in this county and are important agriculturally. The native vegetation was deciduous forest consisting mainly of post oak, white oak, southern red oak, black oak, hickory, blackgum, and maple. These soils are suited to row crops, hay, and pasture, but they require large amounts of fertilizer and lime.

Bewleyville silt loam, 2 to 5 percent slopes (BeB).—This deep, well-drained soil is on broad interstream divides of the Highland Rim. It has formed in loess over residuum from limestone.

Soil profile:

A_p 0 to 6 inches, yellowish-brown (10YR 5/4) to brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; strongly acid.

B_1 6 to 9 inches, strong-brown (7.5YR 5/6) silt loam; weak to moderate, fine, subangular blocky structure; friable; strongly acid.

B_{21} 9 to 15 inches, strong-brown (7.5YR 5/6) to yellowish-red (5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable; strongly acid.

B_{22} 15 to 28 inches, yellowish-red (5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable; few, fine, angular fragments of chert; strongly acid.

B_3 28 to 36 inches, yellowish-red (5YR 5/6) silty clay loam; few, fine, faint mottles of red (2.5YR 4/6), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6); moderate to strong, angular and subangular blocky structure; firm; few small fragments of chert; strongly acid.

B_{3b} 36 to 48 inches +, mottled yellowish-red (5YR 5/6), red (2.5YR 4/8), and yellowish-brown (10YR 5/6) silty clay or clay; mottles are common, medium, and prominent; strong, angular blocky structure; firm; few, fine and medium, angular fragments of chert; strongly acid.

In some areas in the north-central part of the county, the surface layer is dark brown and is more than 6 inches thick.

This soil is moderately high in moisture-supplying capacity and is moderately permeable. It is easy to work and to keep in good tilth. The natural fertility is moderately low, but this soil responds well to additions of fertilizer because it has a good moisture supply and a thick, friable root zone.

A large part of this soil has been cleared and is mostly used for crops and pasture.

This soil is well suited to all crops grown in the county, especially corn, tobacco, soybeans, common lespedeza, and alfalfa. Lime and a complete fertilizer are needed to maintain high yields of all crops and pasture. (Capability unit IIe–2)

Bewleyville silt loam, 5 to 12 percent slopes (BeC).—This soil is similar to Bewleyville silt loam, 2 to 5 percent slopes, but it is on ridge crests in the more dissected areas and on short, winding slopes along the smaller drains.

The soil is low in natural fertility, but the thick, friable root zone can supply plenty of moisture to plants. It is easy to work and to keep in good tilth.

About 80 percent of this soil is in forest. The rest is used for crops and pasture.

This soil is suited to corn, tobacco, small grains, and hay and pasture plants. Although it is not naturally fertile, it responds well to additions of fertilizer. Heavy applications of nitrogen, phosphate, and potash are necessary for good yields of nearly all crops. (Capability unit IIIe–2)

Bewleyville silt loam, 5 to 12 percent slopes, eroded (BeC2).—This soil has a thinner surface layer than has Bewleyville silt loam, 2 to 5 percent slopes. The surface layer, 4 to 5 inches thick, is friable silt loam. The subsoil is friable silty clay loam, 15 to 20 inches thick. It is underlain by clay or cherty clay limestone residuum.

This soil is low in natural fertility, but it responds well to management. The moisture-supplying capacity is moderate to moderately high. Roots easily penetrate the fairly thick root zone, tilth generally is good; and the soil is easy to work.

Nearly all of this soil is used for crops, mainly corn, lespedeza, small grains, and soybeans. Some of it is in pasture.

This soil is suited to all of the crops commonly grown in the county and is well suited to pasture. If fertilized and otherwise well managed, it produces good yields of corn, tobacco, small grains, hay, and pasture. (Capability unit IIIe–2)

Bewleyville silt loam, 12 to 20 percent slopes, eroded (BeD2).—This soil is on the Highland Rim. It lies on shoulders of ridge crests in the more dissected parts of the rim and on slopes along very narrow drainageways in the less dissected parts.

Except that it is steeper, has thinner soil layers, and is shallower over limestone residuum, this soil is similar to Bewleyville silt loam, 2 to 5 percent slopes. Its plow layer is predominantly yellowish-brown and strong-brown, friable silt loam, 4 to 7 inches thick. In small, severely eroded spots the yellowish-red, friable silty clay loam subsoil is exposed.

This soil is strongly acid and is low in organic matter and in natural fertility. The moisture-supplying capacity is moderately low, and surface runoff is rapid.

Nearly all of this soil has been cleared and is cultivated. A few areas are idle, and a small part is in cutover hardwoods.

Mainly because of the strong slopes, this soil is only fairly well suited to cultivated crops. If it is fertilized and properly managed, however, it produces good yields of small grains, hay, and pasture. Suitable pasture plants are alfalfa, red clover, white clover, orchardgrass, fescue, and lespedeza. (Capability unit IVe–2)

Bewleyville silty clay loam, 5 to 12 percent slopes, severely eroded (BmC3).—This soil is shallower and varies more in depth than Bewleyville silt loam, 2 to 5 percent slopes.

Nearly all of the original surface soil has been lost through erosion and, in places, part of the subsoil. The present surface layer is mostly strong-brown to yellowish-red, friable silty clay loam. The underlying material generally is firm, mottled silty clay. Tillage is mostly in the subsoil. Many short, shallow gullies have formed.

Surface runoff is rapid, permeability is moderate, and the moisture-supplying capacity is moderately low. This soil is strongly acid. It is low in natural fertility, it generally is hard to work, and its response to management is moderately low.

This soil is best suited to pasture, hay, small grains, and other close-growing crops. It is not well suited to cultivated crops. Pasture plants that grow well are alfalfa, red clover, white clover, orchardgrass, tall fescue, and lespedeza. (Capability unit IVe–2)

Bewleyville silty clay loam, 12 to 20 percent slopes, severely eroded (BmD3).—This soil is on shoulders of ridge crests in the more dissected parts of the Highland Rim and on slopes along narrow drainageways in the less dissected parts.

Most of the plow layer is subsoil material that is yellowish-red, friable silty clay loam. Depending on the degree of erosion, the underlying material is yellowish-red, friable silty clay loam or variegated, red silty clay. Some angular chert fragments are scattered throughout the underlying layers. Most areas are gullied. The gullies generally are few and small, but occasionally one is 3 to 5 feet deep.

This soil is strongly acid. It is low in organic matter and in natural fertility. Water permeates the soil slowly and runs off rapidly. The moisture-supplying capacity is low, and the response to management is moderately low.

Most of this soil is in pasture or is idle, but a few small areas are planted to corn or other row crops.

This soil is not suited to cultivated crops. If it is well fertilized and grazing is controlled, it produces fair to good pasture. Tall fescue, orchardgrass, whiteclover, and lespedeza are suited, but orchardgrass is often difficult to maintain because the soil is droughty. (Capability unit VIe–1)

Bodine Series

The soils of the Bodine series are moderately shallow to deep and very cherty. They are on ridge crests and steep hillsides in deeply dissected areas of the Highland Rim. These soils are extensive in the western part of the county. They have formed in residuum from very cherty limestone.

Bodine soils have a pale-brown to brown cherty silt loam surface layer over a subsoil that is mottled cherty silt loam or cherty silty clay loam. The slope ranges from 5 to 40 percent but is 20 to 40 percent in most areas.

Bodine soils adjoin the Baxter soils and the Dellrose soils. They generally are above the steep Dellrose soils. Bodine soils are coarser than the Baxter soils and are yellow in the subsoil rather than red or yellowish red.

These soils are strongly acid to very stongly acid and are very low in organic matter and in natural fertility. The native vegetation was deciduous forest, mainly oak and hickory. Much of the forest has been cut over. The cleared areas are mostly in pasture or are idle.

Bodine cherty silt loam, 20 to 40 percent slopes (BoE).—Coarse fragments of chert make up 15 to 60 percent of this steep soil. The chert fragments range from ½ inch to 6 inches in diameter.

Soil profile:

A_1 0 to ½ inch, dark grayish-brown (10YR 4/2) cherty silt loam; weak, fine, granular structure; very friable; strongly acid.

A_2 ½ inch to 8 inches, pale-brown (10YR 6/3) to brown (10YR 5/3) cherty silt loam; weak, medium, granular structure; very friable; strongly acid.

C 8 to 20 inches +, mottled brownish-yellow (10YR 6/8), pale-brown (10YR 6/3), and yellowish-brown (10YR 5/6) cherty silt loam or cherty silty clay loam; friable; massive; angular fragments of chert make up more than half of horizon; very strongly acid.

Beds of chert are 6 inches to 2 feet from the surface. The depth to cherty limestone bedrock is commonly 3 to 10 feet, but bedrock is exposed in some places. In other places, particularly at the foot of slopes where colluvium has accumulated, the surface layer is as much as 18 inches thick. Included with this soil are narrow bands of shallow, chert-free soils that formed over shale. These bands occur between the Bodine and Dellrose soils.

This soil has very low moisture-supplying capacity, rapid permeability, and very rapid internal drainage. It is strongly acid to very strongly acid and is very low in natural fertility.

This cherty, steep soil is not suited to tilled crops. Most of it is in forest. The less steep slopes can be seeded to pasture, but yields are only fair and most of the growth is in spring. Tall fescue and whiteclover are suitable pasture plants, but moderate additions of fertilizer are required to establish and maintain them. The moisture supply is too low to justify heavy fertilization.

This soil produces good timber on the north- and east-facing slopes. (Capability unit VIIs–1)

Bodine cherty silt loam, 5 to 12 percent slopes (BoC).—This excessively drained soil has formed from cherty materials on sloping upland ridges. It adjoins Baxter, Mountview, and other Bodine soils. It is generally deeper over chert beds or bedrock than other Bodine soils. In uneroded areas the surface layer is light yellowish-brown cherty silt loam about 8 inches thick. The subsoil is pale-brown to yellowish-brown cherty silt loam or cherty silty clay loam 1 to 3 feet thick.

This soil is strongly acid to very strongly acid. Except in forested areas where there is a thin surface layer of leaves and partly decomposed litter, the soil is low in organic matter. It is rapidly permeable and droughty. Surface runoff and internal drainage are rapid, and the available moisture-holding capacity is low.

Many of the more accessible areas have been cleared and are used for pasture, corn, and tobacco. Areas of limited access are left in forest that has been cut over many times. This soil is better suited to pasture or hay than to row crops. It is next to other steep, cherty soils that are poorly suited to crops. In Putnam County, fields of this soil generally are less than 10 acres. (Capability unit IVs–1)

Bodine cherty silt loam, 12 to 20 percent slopes (BoD).—This soil is somewhat deeper over chert beds or bedrock than Bodine cherty silt loam, 20 to 40 percent slopes. It is on the moderately steep slopes of ridge crests and lies next to and generally above steep Bodine soils. In a few eroded areas the plow layer is yellowish brown, very cherty, and only 3 to 5 inches thick.

This soil is strongly acid to very strongly acid and is low in organic matter. Runoff and internal drainage are rapid to very rapid. The soil is low in moisture-supplying capacity and very low in natural fertility.

A large part of this soil is in cutover, hardwood forest, but the stands are thin and only a few of the trees are good enough to market. Most of the cleared areas are in pasture or are idle, but some corn is grown. This soil is not suited to tilled crops. It is best suited to pasture or to trees. Pasture can be established, but even under good management, it is hard to maintain. Yields are low in dry periods; most of the growth is in spring. Because the moisture supply is low, heavy fertilization is not profitable. (Capability unit VIs–1)

Bruno Series

The soils of the Bruno series are excessively drained and sandy. They are forming in very young alluvium on bottom land along streams.

Bruno soils have a pale-brown, loose loamy sand surface layer. The subsoil is light yellowish-brown, loose fine sand or loamy fine sand.

These soils adjoin the Huntington, Lindside, Melvin, and Sequatchie soils. They are coarser textured, lighter colored, droughtier, and less fertile than any of those soils. They are very low in organic matter and in natural fertility, and they are medium acid.

Only one Bruno soil is mapped in Putnam County, and it is inextensive.

Bruno loamy sand (0 to 3 percent slopes) (Br).—This is a sandy soil that generally is in narrow strips along stream channels.

Soil profile:

A_1 0 to 10 inches, pale-brown (10YR 6/3) to brown (10YR 5/3) loamy sand; single grain (structureless); loose; medium acid.

C_1 10 to 38 inches, light yellowish-brown (10YR 6/4) loamy sand; few, fine, faint mottles of brownish yellow (10 YR 6/6); loose or very friable; medium acid.

C_2 38 to 50 inches +, mottled yellowish-brown, strong-brown, and pale-yellow strata of sand, silt, and gravel.

A few pebbles of quartzite and small pieces of other rock are scattered through the soil.

This soil has very rapid internal drainage and a very low capacity to supply moisture. Best yields can be obtained from crops that mature early, but the soil is not well suited to crops or pasture. Heavy fertilization is not profitable, because the moisture supply is low. (Capability unit IIIs–1)

Christian Series

The Christian series consists of deep and moderately deep, well-drained soils on uplands. These soils formed in materials weathered mainly from level-bedded siltstone and shaly limestone. In places these parent rocks are interbedded with layers of sandy limestone. Bedrock commonly is at a depth of 2½ to 6 feet.

Christian soils have a yellowish-brown, friable silt loam or loam surface soil. The subsoil is strong-brown to yellowish-red clay loam to silty clay. These soils are on gentle to steep slopes and are next to Mountview, Bewleyville, and Baxter soils. They lack the loess mantle in which the Mountview and Bewleyville soils have developed. They are not so cherty as the Baxter soils.

The Christian soils in Putnam County are widely scattered throughout the Highland Rim and are important agriculturally. They are strongly acid and low in natural fertility. They respond moderately well to fertilization and other good management. They are not well suited to cultivated crops, but they produce fair to good yields of close-growing crops and pasture.

Christian loam, 2 to 5 percent slopes (ChB).—This is a deep to moderately deep, well-drained soil on uplands. It formed in residuum from sandy limestone.

Soil profile:

A_p 0 to 8 inches, yellowish-brown (10YR 5/4) loam; weak, medium, granular structure; very friable; strongly acid.

B_1 8 to 12 inches, strong-brown (7.5YR 5/6) clay loam; weak, medium, subangular blocky structure; friable; strongly acid.

B_2 12 to 22 inches, strong-brown (7.5YR 5/6) to yellowish-red (5YR 5/6) clay loam; moderate, medium, subangular blocky structure; firm; strongly acid.

B_3 22 to 26 inches, yellowish-red (5YR 5/6) to red (2.5YR 5/6) clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6); strong, medium, angular and subangular blocky structure; firm; strongly acid.

C 26 to 42 inches +, mottled yellowish-red (5YR 4/6), yellowish-brown (10YR 5/6), strong-brown (7.5YR 5/6), and gray (10YR 5/1) sandy clay loam or loam; moderate, medium, angular blocky structure; friable to firm; strongly acid.

The texture of this soil is varied because the soil developed from parent material that contained variable proportions of weathered sandy limestone, siltstone, and shaly limestone. Some included areas have a surface layer of sandy loam. The subsoil generally is clay loam but ranges to silty clay loam.

This soil is strongly acid, is low in natural fertility, and contains a small amount of organic matter. It is moderately permeable and is moderate to moderately high in moisture-supplying capacity. Tilth generally is good, and the root zone is about 30 inches thick.

Although most of the acreage has been planted to crops, about half of it is now in pasture, mainly unimproved. Corn, tobacco, and small grains are the main crops. A small acreage is idle each year, and a few areas are in forest.

If this soil is heavily fertilized and otherwise well managed, it produces good yields of all crops commonly grown in the county. (Capability unit IIe–2)

Christian loam, 5 to 12 percent slopes (ChC).—This is a well-drained, moderately deep to deep soil on the crests and shoulders of low ridges. It is slightly shallower to bedrock than Christian loam, 2 to 5 percent slopes.

The moisture-supplying capacity of this soil is good, but the natural fertility is low. Good tilth is easy to maintain.

This soil is mainly in the north-central part of the county. It is not extensive and is mostly in forest. If cleared, this soil would be suited to all crops grown in the county. (Capability unit IIIe–2)

Christian loam, 5 to 12 percent slopes, eroded (ChC2).—This well-drained, moderately deep soil is on crests and shoulders of low ridges. It is shallower to bedrock than Christian loam, 2 to 5 percent slopes, and has a thinner surface layer. The original loam surface soil has been mixed with the upper part of the subsoil. This mixture forms a plow layer of brown loam that is about 6 inches thick. It is underlain by a subsoil of friable, yellowish-red clay loam.

This soil is low in natural fertility. It is permeable and supplies a fair to good amount of moisture to plants. The root zone is moderately thick and friable. This soil responds well to management.

The small areas of this soil are mostly in the north-central part of the county. Nearly all of the soil has been cleared and is used for corn, small grains, hay, pasture, and tobacco.

This soil is suited to all crops grown in the area. With proper fertilization and other good management, it produces fair to good yields of corn, tobacco, and small grains, as well as alfalfa and other hay and pasture plants. (Capability unit IIIe–2)

Christian loam, 12 to 20 percent slopes, eroded (ChD2).—This soil has a brown, friable loam or sandy loam surface soil, 5 to 6 inches thick. The subsoil is yellowish-red or red, friable clay loam. Bedrock of sandy limestone is 2 to 5 feet from the surface, but the average depth to bedrock is about 3 feet.

This soil is low in natural fertility and is moderately low in moisture-supplying capacity. The root zone averages about 30 inches in thickness and is friable and permeable. The soil responds well to management, especially to adequate fertilization.

Much of the acreage is in hay and pasture. Because of the moderately steep slope and the risk of erosion, the soil is only fairly well to poorly suited to row crops. It produces good yields of small grains, hay, and pasture if fairly large amounts of fertilizer are added. (Capability unit IVe–2)

Christian loam, 20 to 30 percent slopes (ChE).—This soil is 8 to 26 inches deep to sandy parent material and is generally shallower to this material than Christian loam, 2 to 5 percent slopes. The surface layer is brown or dark grayish-brown, friable loam, 5 to 7 inches thick. The subsoil is yellowish-red or red, moderately friable clay loam. In some areas the redder part of the subsoil has been mixed with the plow layer. Except for a few weathered fragments of sandstone, this soil is practically free of stones. It adjoins Baxter, Mountview, and other Christian soils.

This soil is low in natural fertility. The good tilth of the plow layer is easy to maintain. Although the soil is permeable and water infiltrates the surface layer moderately rapidly, surface runoff builds up quickly because of the steep slopes.

Nearly all of this soil has been cleared, and most of it is used for hay and pasture. It is fairly well suited to pasture but is too steep for row crops. If it were adequately fertilized and otherwise well managed, most of this soil would produce a fair cover of the common grasses and legumes. (Capability unit VIe–1)

Christian silt loam, 2 to 5 percent slopes, eroded (CrB2).—This deep to moderately deep, well-drained soil of the uplands formed in residuum derived mainly from siltstone and shaly limestone. Most of it is on top of low hills. It has more clay and less sand throughout the profile than have the Christian loams. The depth to soft siltstone and shaly material is 2 to 5 feet.

This soil adjoins Baxter and Bewleyville soils, as well as other Christian soils. It is not so cherty throughout the profile as the Baxter soils and has a finer textured, more plastic subsoil than the Bewleyville soils.

Small areas, generally less than 3 acres in size, are widely distributed on the Highland Rim. The native vegetation was mixed upland oaks and pines.

Soil profile:

A_p 0 to 7 inches, light yellowish-brown (10YR 6/4) to yellowish-brown (10YR 5/4) silt loam; weak, medium, granular structure; very friable; strongly acid.

B_1 7 to 10 inches, strong-brown (7.5YR 5/6) silty clay loam; weak, fine, subangular blocky structure; friable to firm; strongly acid.

B_2 10 to 26 inches, yellowish-red (5YR 5/6) silty clay; few, medium, distinct mottles of brownish yellow (10YR 6/8); moderate to strong, fine and medium, mostly angular blocky structure; firm; strongly acid.

B_3 26 to 36 inches, red (2.5YR 4/8) silty clay or clay; common, medium, prominent mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and light olive brown (2.5Y 5/6); strong, medium and coarse, angular blocky structure; firm; strongly acid.

C 36 to 56 inches, mottled yellowish-brown, yellowish-red, and gray silty clay or clay; moderate to strong, angular blocky structure; firm; small fragments of shale.

D_r 56 inches +, weathered shaly limestone interbedded with weathered sandy limestone and siltstone.

In places the surface layer contains a few angular fragments of chert. The surface layer is permeable and is easy to keep in good tilth. Although the subsoil is slowly permeable, internal drainage is adequate for the growth of all crops. The moisture-supplying capacity is moderately low to low and is probably lower than that of the Christian loams. The soil is low in natural fertility and in organic matter. It is strongly acid.

Most of this soil is in crops and pasture. About 30 percent is in forest. It is suited to general crops and to legumes and grasses, but yields of row crops are low because this soil is slightly droughty and its subsoil is clayey. If the soil is limed, fertilized, and otherwise well managed, yields of legumes, grasses, and small grains are good. (Capability unit IIIe-4)

Christian silt loam, 5 to 12 percent slopes (CrC).—This soil has a thicker surface layer but is slightly shallower to rock than Christian silt loam, 2 to 5 percent slopes, eroded. The surface layer is dark grayish-brown to brown, friable silt loam, 8 to 9 inches thick. Weathered, shaly parent material is at a depth of 2 to 4 feet.

Nearly all of this soil is in forest. If cleared, it would be suited to all common crops. Small grains, grasses, alfalfa, and other legumes are especially well suited. Because this soil has a clayey subsoil and is somewhat droughty, yields of crops that mature late are rather low. (Capability unit IIIe-4)

Christian silt loam, 5 to 12 percent slopes, eroded (CrC2).—This soil is shallower to the shaly parent material than Christian silt loam, 2 to 5 percent slopes, eroded. The surface soil, or plow layer, is mostly yellowish-brown or brown, friable silt loam, but in a few spots it is strong-brown to yellowish-red silty clay loam.

The natural fertility of this soil is low. Because the moderate slopes and the clayey subsoil lessen infiltration, surface runoff is rapid. The moisture-supplying capacity is moderately low. The soil retains considerable moisture, but much of this is held by the clayey subsoil and is not available to plants.

Nearly all of this soil is in corn, small grains, hay, and pasture. Most crops can be grown, but the soil is not suitable for intensive cropping. Because the moisture supply is limited, corn and other row crops do not consistently produce high yields. Truck crops are not suited, because the subsoil is fine textured. Yields of small grains, hay, and pasture are good if fertilizers are applied in moderate to large amounts. (Capability unit IIIe-4)

Christian silt loam, 12 to 20 percent slopes (CrD).—This soil has slightly thinner layers and is slightly shallower to bedrock than Christian silt loam, 2 to 5 percent slopes, eroded. It is in small- to medium-sized, irregular areas on the slopes of low ridges.

The soil is low in organic matter and in natural fertility. It is strongly acid. Water passes through the surface soil rapidly but is slowed by the clay in the subsoil. Droughtiness restricts plant growth during long dry periods.

Most of this soil is in cutover deciduous forest. If it were cleared, it would not be well suited to tilled crops. It produces fair to good yields of small grains, hay, and pasture. Unless permanent pasture is heavily fertilized, yields are low. Tall fescue, orchardgrass, whiteclover, and lespedeza are suitable pasture plants. (Capability unit IVe-3)

Christian silt loam, 12 to 20 percent slopes, eroded (CrD2).—This soil has a thinner surface layer than Christian silt loam, 2 to 5 percent slopes, eroded. Tillage has mixed the surface soil and the upper part of the subsoil, and the plow layer is friable, brown to strong-brown silt loam, 5 to 6 inches thick. The underlying material is firm, yellowish-red silty clay that is exposed in places.

This soil is strongly acid and is low in natural fertility. Runoff is rapid. Permeability is moderate in the plow layer but is slow in the subsoil. The moisture-supplying capacity is low.

Nearly all of this soil has been cleared. About 60 percent is in pasture, 30 percent is idle, and the rest is in crops.

This soil is rather poor for corn, tobacco, and other row crops. If it is adequately limed and fertilized, however, it produces fair to good yields of small grains, hay, and pasture. Suitable pasture plants are alfalfa, red clover, white clover, lespedeza, tall fescue, and orchardgrass. (Capability unit IVe-3)

Christian silty clay loam, 5 to 12 percent slopes, severely eroded (CcC3).—This soil has lost, through erosion, all of the original surface soil and, in places, part of the subsoil. The plow layer is strong-brown to yellowish-red, firm silty clay loam. It is underlain by firm silty clay or clay that is mottled with yellowish red, red, yellowish brown, and gray. Raw, weathered parent material occurs at a depth of 1½ to 2 feet. In some places shaly material outcrops on the surface. Shallow gullies are common.

This soil is low in natural fertility and is generally poor in tilth. It is droughty because it is slowly permeable. The moisture-supplying capacity is low, partly because much of the moisture in the soil is held firmly and is not available to plants.

All of this soil has been cultivated, but much of it is now idle. Some is in native wild pasture, and a very small acreage is in crops.

This soil is poor for row crops. If properly fertilized and otherwise well managed, it is fairly productive of small grains, hay, and pasture. Pasture plants, however, grow slowly in the summer because moisture is scarce. (Capability unit IVe-3)

Christian silty clay loam, 12 to 20 percent slopes, severely eroded (CcD3).—The plow layer of this soil is a mixture of the subsoil and part of the original surface soil. It is finer textured and redder than that of Christian silt loam, 2 to 5 percent slopes, eroded. Shallow gullies are common.

This soil is strongly acid, low in natural fertility, and very low in organic matter. It generally is in poor tilth and clods if plowed when moist. The moisture supply is very low because surface runoff is excessive and the surface layer and subsoil are clayey.

All of this soil has been cleared. Several areas have been planted to pine trees (fig. 6). A large acreage is idle.

This soil is not suited to row crops; it is strongly sloping, eroded, and droughty. It is probably best suited to permanent hay or pasture. (Capability unit VIe-2)

Christian silty clay loam, 20 to 30 percent slopes, severely eroded (CcE3).—This steep soil is on ridge slopes of the Highland Rim. It varies in profile characteristics, especially in thickness of the solum over siltstone or shaly parent material. In most places the plow layer is brown

Figure 6.—**Two-year-old loblolly pines on Christian silty clay loam, 12 to 20 percent slopes.**

to yellowish-red, firm silty clay loam. The underlying material is variegated, firm clay or silty clay that consists mainly of residuum from shaly limestone. Because erosion has removed nearly all of the original silt loam surface soil, plants grow almost wholly in subsoil material. Many shallow gullies have formed, and a few are so deep that heavy farm machinery cannot cross them.

Because surface runoff is very rapid and permeability is slow, this soil is highly susceptible to further erosion. The moisture-supplying capacity is low, and the soil is droughty. The soil is strongly acid and is low in natural fertility and in organic matter. It is very difficult to work, and tilth is generally poor.

Nearly all of this soil has been cleared and used for pasture. Large areas are now idle, abandoned, or in unimproved pasture. Only a few fields are in crops. In some areas pine seedlings have been planted. The soil is poorly suited to tilled crops and can be most profitably used for pasture or trees. (Capability unit VIe–2)

Cookeville Series

The Cookeville series consists of deep, well-drained soils that formed in residuum weathered from noncherty limestone. In uneroded areas, the surface layer is brown to yellowish-brown, friable silt loam, and the subsoil is red, firm clay.

Cookeville soils are gently sloping to moderately steep and adjoin the Bewleyville, Baxter, and Christian soils. They are not capped with loess as are the Bewleyville soils, and they are redder, firmer, and finer textured in the subsoil. They are not so cherty as the Baxter soils and are commonly redder throughout the profile. Most of the red parent material of the Cookeville soils was derived from noncherty limestone, but the parent material of the Christian soils was derived from several kinds of siltstone and from sandy and shaly limestone.

The total acreage of the Cookeville soils is small and is widely scattered throughout the Highland Rim in Putnam County. The native vegetation was mixed upland oak, hickory, poplar, maple, and other deciduous trees.

Except for a small acreage in farm woodlots, most areas of these soils have been cultivated and are now in row crops or pasture.

Cookeville silt loam, 5 to 12 percent slopes, eroded (CkC2).—This deep, red soil is on uplands and formed in material derived from noncherty limestone.

Soil profile:

A_p 0 to 7 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, granular structure; very friable; strongly acid.

B_1 7 to 11 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable; strongly acid.

B_2 11 to 25 inches, red (2.5YR 4/6) clay; moderate to strong, medium, angular and subangular blocky structure; firm; few, small, black, round concretions; few, small chert fragments; strongly acid.

B_3 25 to 38 inches, dark-red (2.5YR 3/6) silty clay or clay; few, fine, distinct mottles of yellowish brown (10YR 5/6), light yellowish brown (10YR 6/4), and olive yellow (2.5YR 6/6); strong, fine and medium, angular blocky structure; firm; few, small fragments of chert and few, small, black concretions; strongly acid.

C 38 to 48 inches, mottled dark-red (2.5YR 3/6), yellowish-brown (10YR 5/6), and strong-brown (7.5YR 5/6) silty clay or clay; strong, fine, angular blocky structure; common, small and medium fragments of angular chert; very firm; strongly acid.

This soil is moderately permeable to slowly permeable, partly because of the fine-textured subsoil. Water infiltrates the soil slowly and runs off rapidly. The soil holds much moisture but supplies a moderately small amount to plants. It is strongly acid throughout the profile and has a moderate amount of organic matter in the surface layer. The natural fertility is moderate.

Nearly all of this soil is in cutover forest, mainly oak, hickory, poplar, and other deciduous trees. This soil is well suited to all crops grown in the county, especially grasses and legumes. Yields of alfalfa, red clover, ladino clover, and orchardgrass are good if the soil is properly fertilized and limed. Row crops should be grown in a suitable cropping system. (Capability unit IIIe–1)

Cookeville silty clay loam, 5 to 12 percent slopes, severely eroded (CoC3).—This soil is similar to Cookeville silt loam, 5 to 12 percent slopes, eroded, except that the plow layer is mostly subsoil material. The plow layer is strong-brown to yellowish-red silty clay loam. The subsoil is firm, red silty clay or clay. Limestone bedrock is at a depth ranging from 5 to 20 feet. Small gullies are common, but many are periodically filled in by tillage, and nearly all can be crossed by farm machinery.

Fertility is moderate, organic matter is low, and the reaction is strongly acid. Runoff is rapid. Although permeability is slow, roots penetrate the soil if the moisture content is favorable. This soil holds a great deal of moisture, but much of this is held tightly by the clay and is not available to plants.

All of this soil has been cleared and cultivated, but much of it is now idle. Most of the cleared acreage is in corn, hay, or pasture. Because it has a low moisture supply and is in poor tilth, this soil produces yields of row crops that are not consistently profitable. If fertilized and well managed, this soil produces fair to good yields of small grains, alfalfa, tall fescue, whiteclover, orchardgrass, and other close-growing crops. (Capability unit IVe–1)

Cookeville silty clay loam, 12 to 20 percent slopes, severely eroded (CoD3).—This soil has a redder, finer textured plow layer than Cookeville silt loam, 5 to 12 percent slopes, eroded. The plow layer is yellowish-red to red, firm silty clay loam. The subsoil of red, firm silty clay or clay is exposed in most areas. A few shallow gullies have formed.

Because of the rapid surface runoff, low capacity for supplying moisture, poor tilth, firm consistence, and high erosion hazard, this soil is poorly suited to tilled crops. Pasture is fair to good but grows slowly in summer. (Capability unit VIe–1)

Cumberland Series

The Cumberland series consists of deep, well-drained soils on high stream terraces. These soils have formed in very old deposits of mixed alluvium. This alluvium washed from uplands in areas of soils derived mainly from limestone and, to some extent, from shale and standstone.

In areas that are not severely eroded, the surface layer is dark-brown to dark reddish-brown, friable silt loam. The subsoil is dark-red, friable to firm silty clay loam to clay. In some areas rounded chert fragments and quartzite pebbles are on the surface and in the soil. The alluvium in which these soils formed is 2 to 15 feet thick and is underlain by limestone residuum in most places.

Cumberland soils adjoin the Waynesboro and Holston soils on terraces and adjoin the Christian, Cookeville, and Baxter soils on uplands. The Cumberland soils have a browner surface soil and a redder, finer textured subsoil than the Waynesboro soils.

These soils are mainly gently sloping but are moderately steep in a few areas. Some of the relief is of a karst type. Though of small total acreage in Putnam County, these soils are among the most productive in the county. The native vegetation was mixed hardwoods, chiefly oak, hickory, chestnut, yellow-poplar, and maple. Nearly all of the acreage of the Cumberland soils has been cleared and is now used for a wide variety of crops.

Cumberland soils are relatively high in natural fertility and are medium acid to strongly acid. They have a thick, well-aerated root zone and respond well to management. They are especially productive of grass and legumes, and they are probably the best soils in the county for alfalfa.

Cumberland silt loam, 2 to 5 percent slopes (CsB).—This deep, well-drained soil is one of the most fertile and productive soils in the county. It is dark red and developed on terraces in old alluvium.

Soil profile:

A_p 0 to 6 inches, dark-brown (7.5YR 3/2) silt loam; weak, fine, granular structure; very friable; medium acid.

A_3 6 to 10 inches, reddish-brown (5YR 4/4) silt loam; weak to moderate, medium, subangular blocky structure; friable; strongly acid.

B_1 10 to 15 inches, dark reddish-brown (2.5YR 3/4) silty clay loam; moderate, medium, subangular blocky structure; friable; strongly acid.

B_{21} 15 to 30 inches, dark-red (2.5YR 3/6) silty clay loam or clay; moderate, medium, subangular and angular blocky structure; friable; few, small concretions and quartzose pebbles; strongly acid.

B_{22} 30 to 50 inches, dark-red (2.5YR 3/6) clay; moderate to strong, medium, angular blocky structure; friable to firm; few, small, round concretions and quartzose pebbles; strongly acid.

B_3 50 inches +, dark-red (10R 3/6) clay with streaks of yellowish brown (10YR 5/6); moderate, medium, angular blocky structure; firm; few, small, round concretions; angular chert fragments and quartzose pebbles.

In nearly level to very gently sloping areas the subsoil in some profiles is not so red as it is in the profile described. Included with this soil are areas that have a loam surface soil and a clay loam subsoil.

This soil has good surface and internal drainage. It is medium acid to strongly acid. It is moderately high in natural fertility and is easy to work and conserve. The soil is permeable, and its moisture-supplying capacity is moderately high.

Nearly all of this soil is used for crops and pasture. It is well suited to all crops, including alfalfa. If adequately limed and well fertilized, this soil produces excellent pasture of orchardgrass, bluegrass, alfalfa, red clover, white clover, or ladino clover. (Capability unit IIe–1)

Cumberland silt loam, 5 to 12 percent slopes, eroded (CsC2).—This is a well-drained, fertile soil on high stream terraces. The old alluvium in which it formed is 2 to 8 feet thick and, in most places, is thinner than the alluvium in which Cumberland silt loam, 2 to 5 percent slopes, formed. The plow layer has been mixed with the upper part of the subsoil and is a reddish-brown, friable silt loam. Beneath it lies red or dark-red, friable to firm silty clay loam or clay.

This productive soil responds well to management. The tilth is good, though somewhat less so than that of Cumberland silt loam, 2 to 5 percent slopes. The soil is permeable. It has good internal drainage and moderately high moisture-supplying capacity. The root zone is thick, well aerated, and fairly easy for roots to penetrate.

This soil is used for the commonly grown crops and for pasture. Very little remains in forest or is idle. It is suited to many different crops, including alfalfa and red clover. Chiefly because of the slopes and the erosion hazard, this soil is not suited to intensive use. Rotations should be of moderate length and should include close-growing crops. Although the soil is fertile, additions of lime and fertilizer are needed to maintain high yields. (Capability unit IIIe–1)

Cumberland silty clay loam, 5 to 12 percent slopes, severely eroded (CuC3).—The plow layer of this soil is finer textured than that in Cumberland silt loam, 2 to 5 percent slopes. It is red to reddish-brown silty clay loam, 4 to 6 inches thick, and is predominantly subsoil material. Below this is red to dark-red, firm silty clay or clay.

Shallow gullies are numerous, and a few deep ones have formed where runoff accumulates. The plow layer generally is poor in tilth, and it clods if cultivated when wet. The moisture-supplying capacity is low. The soil is strongly acid and is moderate in natural fertility. Because surface runoff is rapid, erosion is a severe hazard. Included with this soil are several acres on slopes of 12 to 20 percent. Yields of row crops ordinarily are not high. If properly fertilized, limed, and seeded, this soil produces profitable yields of small grains, alfalfa, and other legumes and grasses for hay and pasture. (Capability unit IVe–1)

Dellrose Series

The Dellrose series consists of deep, well-drained, cherty soils on hillsides that extend from the Highland Rim into the Central Basin. These soils formed in old cherty colluvium that washed and drifted downslope from adjoining

Bodine and Baxter soils. This drifted soil material, or creep, was deposited in layers of variable thickness over residuum from phosphatic limestone.

Dellrose soils are weakly to moderately developed and vary in depth from 24 inches to as much as 30 feet. The surface layer is dark-brown, friable cherty silt loam. The subsoil is brown to strong-brown, friable cherty silty clay loam or silt loam.

In addition to the Bodine and Baxter soils, the Armour and Mimosa soils adjoin Dellrose soils, but generally are lower.

The Dellrose soils contain phosphorus that probably was brought up by seepage from the underlying residuum that was derived from level-bedded Catheys and Leipers limestones.

These soils are medium acid to strongly acid. They are commonly on slopes of 12 to 45 percent, but they are only moderately susceptible to erosion because their profile is loose, friable, and contains a large amount of chert. Dellrose soils are generally on cool, moist, north- and east-facing slopes. Many of the slopes are concave and at the head of steep hollows.

A fairly large acreage of Dellrose soils is in the western part of the county. They are important to the agriculture of this area because, except for soils on valley bottoms, only the Dellrose soils are sufficiently free of bedrock and deep enough for crops or pasture.

The original vegetation was deciduous forest, mainly beech, hickory, tulip-poplar, red oak, white oak, black oak, black walnut, and maple. About 95 percent of the acreage has been cleared. These soils are mostly in pasture, but many farmers consider them well suited to corn.

Dellrose cherty silt loam, 12 to 20 percent slopes (DeD).—Areas of this fertile soil are fairly extensive in the western part of the county. Chert fragments, ½ inch to 4 inches in diameter, make up 15 to 30 percent of the soil.

Soil profile:

A_{1p} 0 to 16 inches, dark-brown (10YR 3/3) cherty silt loam; weak, fine, granular structure; very friable; medium acid.

A_3 16 to 20 inches, dark-brown (7.5YR 4/4) cherty silt loam; weak, fine, granular structure; friable; medium acid.

B_2 20 to 36 inches +, strong-brown (7.5YR 5/6) cherty silty clay loam; weak, fine, subangular blocky structure; friable; strongly acid.

Limestone bedrock is at a depth of 27 feet.

In many places the surface layer is lighter colored than that in the profile described. The subsoil ranges from yellowish brown to yellowish red. The profile development is not apparent in some places. Some areas contain small quantities of shale. The content of phosphorus ranges from moderate to high, but in a few places it is low.

This soil is moderately high in organic matter and in natural fertility. Soil tests normally indicate medium to large amounts of potassium and phosphorus. The soil is strongly acid to medium acid. The rather rapid absorption of water and the high content of chert reduce the hazard of erosion. In many places slow seepage from the underlying rocks apparently improves the fertility and moisture-supplying capacity of this soil because crop yields are good even during dry seasons. This soil is somewhat difficult to work because of the chert fragments on the surface and throughout the profile. On the surface in a few places, many large fragments of chert prevent cultivation.

Nearly all of this soil has been cleared. A large acreage is planted to corn each year, and other areas are in pasture. Fertilizers generally are not used.

Although this soil is rather steep and cherty for row crops, it produces high yields of corn, tobacco, truck crops, and other row crops. It is an excellent soil for pasture, and high yields can be obtained if moderate amounts of lime and nitrogen are added. The response to fertilization and other good management is excellent. (Capability unit IVe–4)

Dellrose cherty silt loam, 20 to 30 percent slopes (DeE).—This soil generally is more cherty than Dellrose cherty silt loam, 12 to 20 percent slopes.

Erosion is severe in only a few spots. Water infiltrates the profile quickly, and the cherty surface helps prevent raindrops from moving the soil. The soil is not highly susceptible to sheet erosion, but it is susceptible to gully erosion where runoff accumulates from higher lying slopes. In road cuts this soil is unstable and tends to slip when it is saturated. Narrow ledges of limestone are common in some areas.

Most of this soil has been cleared and is used for crops and pasture. Much of it has reverted to permanent pasture of native grasses. Yields of all common pasture plants are high if moderate amounts of lime and a nitrogen fertilizer are added. Tulip-poplar also grows well on this soil. (Capability unit VIe–1)

Dellrose cherty silt loam, 30 to 45 percent slopes (DeF).—This is one of the most extensive soils in the Central Basin area of the county. In many places it covers an entire hillside.

The creep or colluvial material in which this soil formed varies in thickness. In a few places it is less than 1 foot thick between limestone ledges, but in other places it is as much as 15 feet thick. This material overlies phosphatic limestone. The soil is loose, friable, and very permeable. It is naturally high in phosphorus and contains a fairly large amount of organic matter. However, much chert is on the surface and throughout the soil.

About 90 percent of this soil has been cleared and is mostly in pasture, but some corn and a few other crops are grown. This soil produces high yields of pasture if moderate amounts of fertilizer are applied. Because of the steep slope and the chert, however, management of pasture is a little difficult, especially the control of weeds. This is an excellent soil for trees. (Capability unit VIe–1)

Dickson Series

The Dickson series consists of moderately well drained to well drained soils on uplands. These soils formed in a mantle of loess, about 3 feet thick, that is underlain by residuum from cherty limestone.

Dickson soils have a surface layer of yellowish-brown to pale-brown silt loam and a subsoil of yellowish-brown, friable silt loam or silty clay loam. A fragipan is at a depth of about 24 inches. The depth to limestone is 6 feet or more. Drillings for water wells indicate that the depth to limestone bedrock is 40 feet in some places. Slope ranges from 2 to 5 percent but is less than 5 percent in most places.

The fragipan of the Dickson soils is not a zone of clay cementation, for the clay content is low and the soil material is compact but is not cemented. The underlying material has varied degrees of permeability, and above this material the fragipan varies in thickness. It is thicker above the less permeable silty clay than it is above the more permeable clay loam or silty clay loam.

These soils are low in organic matter and in natural fertility. They are very strongly acid throughout the profile.

Dickson soils adjoin the Mountview, Bewleyville, Baxter, Sango, and Guthrie soils. They are distinguished from the Mountview soils by their brittle, mottled fragipan. They have better internal and surface drainage and a browner subsoil than the Sango soils.

Only one Dickson soil is mapped in Putnam County. This soil is extensive on the Highland Rim. Because it is gently sloping, it is widely cultivated, despite low natural fertility (fig. 7). It is used for corn, small grains, hay, tobacco, grain sorghum, and pasture. Prior to cultivation this soil was in forest. The native vegetation was white, chestnut, post, and red oaks, hickory, blackgum, and redgum.

Dickson silt loam (2 to 5 percent slopes) (Dk).—This is a moderately well drained to well drained soil that has a fragipan at a depth of about 2 feet.

Soil profile:

A_1 0 to 1 inch, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; very friable; strongly acid.

A_2 1 inch to 6 inches, yellowish-brown (10YR 5/4) or pale-brown (10YR 6/3) silt loam; weak, fine, granular structure; very friable; very strongly acid.

B_1 6 to 10 inches, yellowish-brown (10YR 5/4–5/6) silt loam; weak, fine, subangular blocky structure; friable; very strongly acid.

B_2 10 to 23 inches, yellowish-brown (10YR 5/6) coarse silty clay loam or silt loam; moderate, medium, subangular blocky structure; friable; very strongly acid.

B_{3m} 23 to 38 inches, brownish-yellow (10YR 6/6) silt loam; common, medium, distinct mottles of light brownish gray (10YR 6/2) and light gray (10YR 7/2); massive (structureless); friable when moist, hard and brittle when dry; very strongly acid.

C 38 inches +, mottled yellowish-red, yellowish-brown, and gray silty clay loam; mottles are many, medium, and distinct; moderate, medium, angular blocky structure; firm; chert fragments.

Figure 7.—**Gently sloping Dickson silt loam.**

The silt loam surface layer of this soil varies little in texture but ranges from pale brown to dark brown in color. The subsoil ranges from yellowish brown to strong brown in color and from silt loam to silty clay loam in texture. The fragipan begins at a depth of 24 to 32 inches and ranges from 2 to about 18 inches in thickness. It is slightly compact in some places and is nearly cemented in others.

Surface runoff is moderate, and internal drainage is moderate to slow. The moisture-supplying capacity is moderately low. Permeability is moderate above the fragipan, but the fragipan retards further penetration by water or plant roots. Chiefly because the lower subsoil is waterlogged periodically and the root zone is moderately shallow, the number of suitable crops is somewhat limited. Alfalfa and other deep-rooted crops ordinarily do not last for more than 2 years. This soil produces good yields of corn, soybeans, tobacco, small grains, red clover, white clover, lespedeza, tall fescue, and orchardgrass, but the fertilizer requirements are high. Yields vary considerably from year to year because the pan limits the available water to the upper foot or two of soil. (Capability unit IIe–3)

Elkins Series

This series consists of very poorly drained soils on first bottoms of the Cumberland Plateau. These soils formed in local alluvium that washed from the Muskingum, Hartsells, Wellston, and other soils derived from sandstone and shale residuum.

The Elkins soils have a very dark gray or nearly black surface layer of friable silt loam. This is underlain by a dark-gray, friable silt loam to loam subsoil. Sandstone bedrock is at a depth of 2 to 4 feet. The soils are nearly level and in some areas are depressional.

The Elkins soils are low in natural fertility, are strongly acid, and contain much organic matter in the surface layer. These soils occupy positions similar to those of the Atkins soils but have a darker surface layer.

Only one Elkins soil is mapped in Putnam County. This soil is in small areas and has a small total acreage. The native vegetation was water-tolerant hardwoods.

Elkins silt loam (0 to 2 percent slopes) (Ek).—This very poorly drained soil is on first bottoms. The surface layer is high in organic matter.

Soil profile:

A_1 0 to 8 inches, very dark gray (10YR 3/1) silt loam; weak, fine, crumb structure; very friable; strongly acid.

C_{1g} 8 to 22 inches, dark-gray (10YR 4/1) loam; structureless; friable; strongly acid.

C_{2g} 22 to 36 inches +, dark-gray (10YR 4/1) loam; common, medium, distinct mottles of strong brown (7.5YR 5/6) and brown (10YR 5/3); structureless; friable; strongly acid.

The A_1 horizon ranges from 4 to 10 inches in thickness but is normally about 5 inches thick. The underlying material is light gray in places. Included with this soil are areas that have a loam surface layer.

Surface runoff is very slow, and permeability is moderate. The soil is low in natural fertility and is strongly acid. During wet periods and throughout most of the dry periods the water table stays close to the surface.

All of this soil is in forest. Unless excess water is removed, this soil is probably best suited to pasture. It is saturated much of the growing season. (Capability unit IIIw-1)

Ennis Series

The Ennis series consists of deep, well-drained soils along small drainageways. These soils are forming in alluvium that washed mainly from soils of the uplands that are underlain by cherty limestone. In some places small amounts of the alluvium are from soils formed in loess or other material. Ennis soils are flooded occasionally in some places.

The surface layer is brown to grayish-brown, very friable silt loam, and the subsoil is brown to dark yellowish-brown, friable silt loam. At a depth of about 30 inches in some places, the soil consists of stratified alluvium that is chiefly chert but is interspersed with sand and silt. The alluvium ranges from 3 to 6 feet or more in thickness. Slope ranges from 0 to 3 percent. Ennis soils have varied reaction but generally are medium acid. They are moderate in organic matter and in natural fertility.

Only one Ennis soil is mapped in Putnam County. This soil is along some of the smaller drains in the Highland Rim. It adjoins the Lindside and Melvin soils but is better drained than those soils. It is of limited extent in the county but is of local importance to agriculture. On some farms it is the main soil used for crops. Nearly all of it has been cleared and is in tilled crops or pasture.

Ennis silt loam, local alluvium (0 to 3 percent slopes) (En).—This soil is in upland depressions, on toe slopes, and in narrow, intermittent drains. The local alluvium washed mainly from soils of the uplands that are underlain by cherty limestone. Smaller amounts came from soils formed from siltstone and loess.

Soil profile:

A_p, A_1 0 to 21 inches, brown (10YR 5/3) to grayish-brown (10YR 5/2) silt loam; weak, fine, granular structure; very friable; medium acid.

C_1 21 to 28 inches, brown (10YR 5/3) to pale-brown (10YR 6/3) silt loam; few, fine, faint mottles of dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/6); weak, fine, granular structure; friable; medium acid.

C_2 28 to 42 inches +, yellowish-brown (10YR 5/6) silt loam or coarse silty clay loam; faint mottles of grayish brown (10YR 5/2); friable; medium acid

The thickness of the surface layer ranges from 8 to 24 inches. Included with this soil is a small acreage that is cherty on the surface and throughout the profile.

This soil generally is medium acid but is strongly acid in a few areas. Its natural fertility is medium. Surface runoff is medium to slow. The moisture-supplying capacity is high, except in the included cherty areas, where it is medium to low. Permeability is moderate.

This soil is easy to work and, if well managed, can be planted to crops intensively. It is well suited to corn, tobacco, and truck crops. It responds well to management. (Capability unit I-1)

Gullied Land

This land type, before erosion, consisted of soils derived from limestone material. It is made up of gullied areas of the Cookeville, Waynesboro, Bewleyville, Christian, Talbott, Mimosa, Allen, and Swaim soils.

Gullied land (Gu).—Nearly all of the original surface soil and much of the subsoil of this land have been removed through erosion. Gullies 1 to 10 feet deep form an intricate pattern that prevents the operation of farm machinery (fig. 8). Slope ranges from 5 to 40 percent.

The surface material is highly variable in color, texture, consistence, and content of chert. Most of the areas between gullies are severely eroded. Between some gullies, erosion is only slight and the exposed profile in the gullies resembles the profile of the original soil. Limestone outcrops occur in many places.

In Putnam County only a few areas of this land type are larger than 5 acres. The total area in the county amounts to about 1,000 acres. (Capability unit VIIe-1)

Guthrie Series

In the Guthrie series are poorly drained soils on uplands. These soils have formed in a thin mantle of loess or loesslike silt that is underlain by residuum from cherty limestone.

Guthrie soils have a gray, friable silt loam surface layer. The upper part of the subsoil is mottled, friable silt loam, and the lower part is firm, mottled gray and yellow silty clay loam. A discontinuous, compact fragipan is at a depth of about 2 feet. In most places the depth to bedrock is more than 10 feet.

These soils are in level or nearly level upland areas along incipient drainageways, in slight depressions, and on flats. They are next to the Mountview, Dickson, Sango, and Lawrence soils. Guthrie soils are grayer and more poorly drained than the Lawrence soils. They are similar to the Purdy soils but have formed from different kinds of parent material.

Figure 8.—**Gullied land in Swaim silt loam soil material.**

Only one Guthrie soil has been mapped in Putnam County. This soil is moderately extensive in the Highland Rim part of the county. All areas are uneroded or have a thin layer of overwash. About half of the acreage remains in water-tolerant hardwoods, chiefly oak, sweetgum, blackgum, and red maple. Most of the cleared areas are in pasture.

Guthrie silt loam (0 to 2 percent slopes) (Gs).—This poorly drained soil on uplands has formed in loess that is underlain by residuum from cherty limestone.

Soil profile:

A_1 0 to 2 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; very friable; very strongly acid.

A_2 2 to 12 inches, gray (10YR 5/1) to light brownish-gray (10YR 6/2) silt loam; few, fine, faint mottles of yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/6); weak, medium, granular structure; friable; very strongly acid.

B_{2g} 12 to 35 inches, mottled grayish-brown (10YR 5/2), yellowish-brown (10YR 5/6), and gray (10YR 5/1) silt loam; common, medium, distinct mottles; weak to moderate, medium, angular blocky structure; friable to firm; few, very dark brown, small, rounded concretions; very strongly acid.

B_{3m} 35 to 50 inches, mottled gray (10YR 6/1), light olive-brown (2.5Y 5/4), yellowish-brown (10YR 5/6), and strong-brown (7.5YR 5/6) silt loam or silty clay loam; moderate, medium and coarse, angular blocky structure; firm; very strongly acid.

B_b 50 to 60 inches +, mottled yellowish-red (5YR 4/6), gray (10YR 6/1), strong-brown (7.5YR 5/6), and red (2.5YR 4/6) silty clay; strong, fine, angular blocky structure; firm; few, small, angular fragments of chert; very strongly acid.

The fragipan is weak in some places and strong in others. In places it is about 15 inches or less from the surface, but several feet away it may be absent. It is compact when moist and brittle when dry. The texture of this layer ranges from silt loam to silty clay. Small areas of this soil on the outer rim of larger areas have recent overwash, 5 to 10 inches thick.

Surface runoff is very slow, and the soil is ponded in places. Many areas are flooded for long periods when rainfall is abundant. The subsoil is poorly aerated and very slowly permeable. During long dry periods, the soil is droughty and the subsoil becomes compact, hard, and dry. This soil is very strongly acid and very low in organic matter. It is generally too wet to work before midsummer. Very low natural fertility, poor drainage, and low moisture-supplying capacity restrict the use of this soil.

Nearly all of it is in forest or pasture. A very small acreage is planted to corn, soybeans, and other crops. Unless drainage is improved, this soil is poorly suited to many crops (fig. 9). It is suited to tall fescue, whiteclover, and common lespedeza. (Capability unit IVw–1)

Hartsells Series

In the Hartsells series are moderately deep, well-drained soils that have developed from level-bedded, acid sandstone and sandy shale. These soils are on uplands. They have a yellowish-brown, loam surface layer and a yellowish-brown, friable clay loam or loam subsoil. Bedrock is at a depth of about 2 to 4 feet.

Slope ranges from 2 to 12 percent but is dominantly 2 to 5 percent. The natural fertility and content of organic matter are low. These soils have a moderate to moderately high moisture-supplying capacity. They are very strongly acid.

Hartsells soils are in broad areas on the Cumberland Plateau and on benches of the escarpment. They occur with the Muskingum, Wellston, and Linker soils. They are deeper than the Muskingum soils and are more friable and coarser textured than the Wellston soils.

These soils are extensive in the eastern part of the county. Most areas of the Hartsells soils are in mixed pine and oak forest that has been cut over many times. These soils generally are in excellent tilth and are suited to many crops.

Hartsells loam, 2 to 5 percent slopes (HaB).—This well-drained soil on uplands has formed from acid sandstone and sandy shale on the Cumberland Plateau and on benches of the escarpment.

Soil profile under forest:

A_1 0 to 1 inch, black (10YR 2/1) loam; weak, fine, granular structure; very friable; very strongly acid.

A_2 1 inch to 8 inches, yellowish-brown (10YR 5/4) to dark yellowish-brown (10YR 4/4) loam; weak, fine, granular structure; very friable; very strongly acid.

B_1 8 to 12 inches, yellowish-brown (10YR 5/6) loam; weak, fine, subangular blocky structure; friable; strongly acid.

B_2 12 to 30 inches, yellowish-brown (10YR 5/6) clay loam or loam; moderate, medium, subangular blocky structure; friable; very strongly acid.

C_1 30 to 36 inches, yellowish-brown (10YR 5/8) loam or fine sandy loam; weak, fine, subangular blocky structure; very friable; very strongly acid; mottled with strong brown and yellowish red in many places.

D_r 36 inches +, horizontally bedded sandstone bedrock.

The surface layer ranges from loam to fine sandy loam in texture and from dark grayish brown to dark yellowish brown in color. The subsoil is clay loam to loam and is yellowish brown to strong brown. The depth to bedrock ranges from 20 to 48 inches.

This soil is low in natural fertility and in organic matter. It is very strongly acid. It has excellent tilth and

Figure 9.—**The corn in foreground is on Guthrie silt loam, which is poorly suited to corn. Taller corn is in the background on slopes of Bewleyville soils.**

can be cultivated within a wide range of moisture content. This soil responds very well to fertilization and other practices of good management. It is permeable and supplies a moderately large amount of moisture to plants. Roots penetrate it easily. Water soaks quickly into the soil, and runoff is medium.

This soil is extensive on the Cumberland Plateau. Less than 5 percent of the acreage is cleared. Some areas that were formerly cleared now support thick stands of Virginia and shortleaf pines. These areas were reforested naturally and artificially.

If this soil were cleared, it would be well suited to crops. It responds well to fertilization. The feeding zone for deep-rooted legumes is somewhat restricted in the shallowest areas. (Capability unit IIe–2)

Hartsells loam, 5 to 12 percent slopes (HaC).—This soil is shallower than Hartsells loam, 2 to 5 percent slopes. The average depth to bedrock is about 24 inches. This soil is on the upper shoulders and lower slopes of ridges.

The soil has moderate to rapid surface runoff and moderate internal drainage. It is very strongly acid. The entire soil profile is well aerated and easily penetrated by plant roots. Although it is very low in natural fertility, this soil supplies a moderately large amount of moisture to plants and it responds very well to fertilization and other management.

Much of this soil is in oak and hickory forest. The greater part of the cleared area is used for pasture or is idle. This soil is suited to occasional cultivation and to all common crops. The response to fertilization justifies applying the large amounts of fertilizer needed for high yields. (Capability unit IIIe–2)

Hartsells loam, 5 to 12 percent slopes, eroded (HaC2).—This soil has a thinner surface layer than has Hartsells loam, 2 to 5 percent slopes, and is a little shallower to sandstone bedrock. The surface layer, or plow layer, ranges from 4 to 6 inches in thickness, and the depth to bedrock is 20 to 30 inches.

This soil is fairly well suited to row crops and is well suited to pasture. Good yields of row crops can be grown, but the natural fertility is very low and much fertilizer is needed. Because it is moderately sloping and rather shallow, this soil should not be cultivated frequently. However, it responds well to management. Plant roots can penetrate the entire soil profile, and the soil has a moderately high capacity to supply moisture. Corn, tobacco, and truck crops are well suited. Small grains, orchardgrass, tall fescue, white clover, red clover, lespedeza, and alfalfa grow well if the soil is adequately fertilized. (Capability unit IIIe–2)

Hermitage Series

The Hermitage series consists of deep, well-drained soils. These soils have developed in old local alluvium or colluvium that was derived chiefly from limestone residuum. Uneroded Hermitage soils have a surface layer of dark-brown, friable silt loam and a subsoil of reddish-brown or yellowish-red, friable silty clay loam. The alluvium washed mainly from the Cumberland and Waynesboro soils on terraces and the Cookeville and Bewleyville soils on uplands. In some areas it washed from Rock land, limestone. The depth of the deposits ranges from 4 to 10 feet or more.

These soils are on foot slopes and adjoin the Huntington soils on first bottoms. The Hermitage and Huntington soils formed in similar parent material, but the Hermitage soils have well-defined layers and are the older soils. They have a browner surface layer and a darker red subsoil than have the Minvale soils, which are nearby.

The Hermitage soils are among the most fertile and productive soils in the county. They are medium acid to strongly acid and have a relatively high content of organic matter. They have a thick, well-aerated root zone and a high capacity for supplying moisture.

Most areas of these soils in Putnam County are 5 to 10 acres in size. The native vegetation was chiefly various oaks, beech, poplar, hickory, and maple. Nearly all of the acreage in Hermitage soils has been cleared. Cleared areas produce very good yields of row crops, small grains, hay, and pasture.

Hermitage silt loam, 2 to 5 percent slopes (HeB).—This is a deep, well-drained, fertile soil on foot slopes and benches.

Soil profile:

A_p 0 to 9 inches, dark-brown (7.5YR 3/2) silt loam; weak, fine, granular structure; friable; medium acid.

B_1 9 to 14 inches, brown to dark-brown (7.5YR 4/4) silt loam; weak to moderate, medium, subangular blocky structure; friable; medium acid.

B_{21} 14 to 23 inches, reddish-brown (5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; friable; few black concretions 2 to 4 millimeters across; strongly acid.

B_{22} 23 to 32 inches, reddish-brown (5YR 4/4) to dark reddish-brown (5YR 3/4) silty clay loam; moderate, medium, subangular blocky structure; friable; few black concretions 2 to 4 millimeters across; strongly acid.

B_3 32 to 40 inches, dark reddish-brown (5YR 3/4) silty clay loam; common, medium, distinct mottles of light yellowish brown (10YR 6/4) and reddish brown (5YR 4/4); moderate, medium, subangular blocky structure; friable; few black concretions 2 to 4 millimeters across; strongly acid.

C 40 to 50 inches +, red (2.5YR 4/6) silty clay loam; many mottles of light yellowish brown (10YR 6/4) and dark red (2.5YR 3/6); moderate, medium, blocky and subangular blocky structure; friable to firm; few black concretions 2 to 4 millimeters across; few small fragments of chert.

The surface layer ranges from dark brown to dark reddish brown. The subsoil is generally yellowish red to dark red but is strong brown in some areas. A few small areas of this soil are on low-lying terraces in the coves of the Cumberland Plateau escarpment.

This naturally fertile soil contains a moderate amount of organic matter. It is medium acid to strongly acid. The surface layer and the subsoil are moderately permeable and have a high moisture-supplying capacity. Surface runoff is slow to medium, and the erosion hazard is slight. The soil is nearly free of stones, and it is easy to work and to keep in good tilth.

Nearly all of this soil is cultivated. About 80 percent of the acreage is in row crops, and 20 percent is in hay and pasture. This soil is well suited to tobacco, alfalfa, corn, and other crops ordinarily grown. Although the soil is fertile, it responds well to additions of fertilizer. (Capability unit IIe–1)

Hermitage silt loam, 5 to 12 percent slopes (HeC).—The surface layer of this soil is thinner than that in Hermitage silt loam, 2 to 5 percent slopes. In most places it is reddish brown to brown and about 6 inches thick. Some material from the upper subsoil has been mixed with it.

This productive soil has a moderately high moisture-supplying capacity and responds well to management. Plant roots easily penetrate the thick, well-aerated root zone. The soil is easy to work and to keep in good tilth.

Nearly all of this soil has been cleared and is planted to row crops, hay, small grains, and pasture. It is well suited to tobacco, alfalfa, and other crops commonly grown in the county. However, it should not be cultivated intensively. (Capability unit IIIe–1)

Hermitage silt loam, 12 to 20 percent slopes, eroded (HeD2).—This soil generally is on foot slopes of the Cumberland Plateau escarpment and its outliers. It adjoins the Talbott soils and Rock land, limestone.

The surface layer, a reddish-brown silt loam about 3 to 5 inches thick, has been mixed with the upper part of the subsoil in places. The subsoil is yellowish-red to red, friable silty clay loam. The old local alluvium, in which this soil formed, is normally more than 3 feet thick. Most of it is underlain by residuum from limestone.

This soil is moderately high in natural fertility and in moisture-supplying capacity. Water permeates the surface layer quickly but runs off the strong slopes in large amounts.

Nearly all of this soil has been cleared and cultivated. About 60 percent of it is in hay or pasture, and the rest is in crops.

This productive soil is fairly well suited to most crops but is probably best suited to small grains, hay, pasture, and other close-growing crops. The moderately strong slopes make the soil difficult to work and highly susceptible to erosion, especially if it is bare of vegetation or is used for intertilled crops. This soil responds to fertilization and other good management. (Capability unit IVe–1)

Hermitage cherty silt loam, 5 to 12 percent slopes (HcC).—This is a deep, well-drained, cherty soil that has formed in deposits of local alluvium or colluvium on foothills and toe slopes of the Cumberland Plateau escarpment. These deposits washed or drifted from soils that formed in residuum from limestone. They range from 2 to 10 feet in thickness and in most places are underlain by Talbott soil materials.

This soil adjoins the Allen soils on the hillsides and the Waynesboro soils on the valley floors. It also adjoins Stony colluvial land and Rock land, limestone.

Soil profile:

A_p 0 to 10 inches, dark-brown to brown (10YR 4/3 to 5/3) cherty silt loam; weak, fine, granular structure; friable; medium acid.

B_1 10 to 16 inches, dark-brown (7.5YR 3/2) cherty silt loam; weak, fine, granular to weak, fine, subangular blocky structure; friable; medium acid.

B_2 16 to 42 inches +, dark reddish-brown (5YR 3/4) cherty silty clay loam; weak to moderate, fine and medium, subangular blocky structure; friable; strongly acid.

In places remnants of the Talbott soils are exposed. The content of chert varies, but in most places it is more than 15 percent of the soil mass.

This soil is moderate in organic matter, moderately high in natural fertility, and is medium acid to strongly acid. It receives seepage from higher slopes and supplies a moderately large amount of moisture to plants. It is moderately to rapidly permeable. Surface runoff is medium.

The soil is not extensive in Putnam County, but it is important agriculturally. Nearly all of it has been cleared and is in pasture or tilled crops. Corn, small grains, soybeans, and alfalfa are the main crops. The soil is well suited to pasture and produces moderate yields of tilled crops. It responds well to management. (Capability unit IIIe–1)

Hermitage cherty silt loam, 12 to 20 percent slopes (HcD).—This is a well-drained soil on the foot slopes of the Cumberland Plateau escarpment. It has developed in cherty old local alluvium or colluvium on hillsides next to Stony colluvial land and Rock land, limestone. It also occurs next to the Allen and Waynesboro soils.

This soil generally is shallower than Hermitage cherty silt loam, 5 to 12 percent slopes, and it varies more in depth to limestone residuum.

It is medium acid to strongly acid. The content of organic matter is moderate, and the natural fertility is moderately high. The soil is rapidly permeable. The moisture-supplying capacity is moderately high.

Most of this soil has been cleared and is used for small grains, hay, and row crops. Because of its strong slope, this soil should be planted to tilled crops only occasionally. It is difficult to work because of the chert. It absorbs water quickly, however, and is not so difficult to conserve. If well fertilized and otherwise well managed, this soil produces high yields of most crops grown in the county. (Capability unit IVe–4)

Hermitage cherty silt loam, 20 to 30 percent slopes, eroded (HcE2).—This cherty, well-drained soil is on steep colluvial foothills of the Cumberland Plateau escarpment. It is shallower to limestone residuum than Hermitage cherty silt loam, 5 to 12 percent slopes, and varies more in content of chert.

The surface layer is brown, friable cherty silt loam. The subsoil is mostly red, friable cherty silty clay loam that is exposed in places by erosion. One-fourth to one-half of the soil mass is chert. Consequently, the moisture-supplying capacity is moderately low. The soil responds well to management, however, because the root zone is thick, friable, and easily penetrated.

About half of this soil has been cleared and is in pasture or crops. It is too steep for row crops. It is a very good soil for pasture and, if fertilized and otherwise well managed, produces high yields of orchardgrass, tall fescue, whiteclover, and lespedeza. (Capability unit VIe–1)

Holston Series

In the Holston series are deep, well-drained soils on low and high stream terraces. These soils have formed in old general alluvium washed from soils that formed in residuum from sandstone and limestone. On some high terraces, the Holston soils probably formed in a thin mantle of loess underlain by old general alluvium that was deposited by ancient drains and that is not related to alluvium deposited by the present drainage system.

Holston soils have a surface layer of brown to yellowish-brown loam or silt loam. Their subsoil is a yellowish-brown clay loam or silty clay loam. The alluvium is 4 to 15 feet thick.

These soils are on slopes of 2 to 12 percent and adjoin the Waynesboro, Monongahela, Tyler, and Purdy soils. Their yellowish-brown subsoil differs from the red subsoil in the Waynesboro soils. They are better drained than the Monongahela soils and lack the strong mottling and the fragipan in the lower part of the subsoil. They are similar to the Jefferson soils but have formed in old, more homogeneous general alluvium rather than in local alluvium. Large areas of Holston soils are in a broad belt of terraces roughly parallel to the Cumberland Plateau escarpment.

Holston soils are strongly acid to very strongly acid and are very poor in natural fertility. They are thick and friable, however, and respond well to fertilization. The uneroded areas generally are in good tilth and are very easy to work.

Most of the acreage in the Holston soils has been cleared and cultivated. Corn, small grains, tobacco, annual lespedeza, and pasture are the main crops.

Holston loam, 2 to 5 percent slopes (HnB).—This light-colored, well-drained soil is chiefly on low terraces, 5 to 15 feet above the adjacent flood plains.

Soil profile:

A_{p1} 0 to 6 inches, brown (10YR 5/3) loam; weak, fine, granular structure; very friable; strongly acid.

B_1 6 to 12 inches, yellowish-brown (10YR 5/4) loam; weak, medium, subangular blocky structure; friable; strongly acid.

B_2 12 to 30 inches, yellowish-brown (10YR 5/6) clay loam; moderate, fine and medium, subangular blocky structure; friable; strongly acid to very strongly acid.

B_3 30 to 40 inches, mottled yellowish-brown (10YR 5/8), dark-brown (7.5YR 4/4), and brown (10YR 5/3) clay loam; medium, angular and subangular blocky structure; firm; few, small, dark-brown concretions in lower part; very strongly acid.

C 40 to 58 inches +, light yellowish-brown (10YR 6/4) loam, somewhat mottled with strong brown, light gray, and yellowish red; angular and subangular blocky structure; friable to firm; common, rounded, waterworn fragments of chert.

In some of the gently sloping areas, a thin or very weak fragipan is 30 inches from the surface. In these places this soil grades to the Monongahela soil.

This soil generally is in excellent tilth and can be tilled within a wide range of moisture content. Surface runoff is slow to medium, and permeability is moderate throughout the profile. The soil is strongly acid to very strongly acid, low in natural fertility, and moderately high in moisture-supplying capacity. It responds well to management.

Nearly all of this soil has been cleared and planted to corn, small grains, tobacco, lespedeza, grain sorghum, soybeans, and other crops. Use of the soil can be moderately intensive, and nearly all crops commonly grown are suited. (Capability unit IIe–2)

Holston loam, 5 to 12 percent slopes, eroded (HnC2).—This soil is mainly on the edges and shoulders of low terraces. The surface layer is yellowish-brown, friable loam. The subsoil is yellowish-brown, friable clay loam. Thin beds of gravel are at various depths, generally near the bottom of the alluvial deposit. Included with this soil are a few severely eroded spots. In these places the plow layer is slightly finer than loam because the finer textured subsoil has been mixed in it by plowing. Also included is a very small uneroded acreage that is in forest.

This soil is strongly acid to very strongly acid, low in natural fertility, and low in organic matter. It absorbs water quickly, and the thick, permeable root zone supplies large amounts of water to plants. Surface runoff is medium.

Nearly all of this soil has been cleared and is used for crops or pasture. It is well suited to crops grown in the county but requires lime and large amounts of complete fertilizer. If well managed, it produces high yields of nearly all crops, but a good stand of alfalfa is rather difficult to maintain for more than 2 or 3 years. (Capability unit IIIe–2)

Holston silt loam, 2 to 5 percent slopes (HoB).—This soil has formed on low, broad ridges of old terraces that are a part of an ancient drainage system. It consists of a loess cap, about 18 to 35 inches thick, that overlies old general alluvium or colluvium. This soil is similar to the Mountview soils but is underlain by alluvium or colluvium instead of limestone residuum.

Soil profile:

A_p 0 to 6 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; strongly acid.

B_1 6 to 10 inches, yellowish-brown (10YR 5/4) to brown (10YR 4/3) silt loam; fine, granular structure; friable; strongly acid.

B_{21} 10 to 24 inches, yellowish-brown (10YR 5/6) fine silt loam or silty clay loam; moderate, medium, subangular blocky structure; friable; strongly acid to very strongly acid.

B_{22} 24 to 30 inches, strong-brown (7.5YR 5/6) silty clay loam with mottles of yellowish red (5YR 5/6); moderate, medium, subangular blocky structure; friable; very strongly acid.

B_3 30 to 40 inches, mottled strong-brown (7.5YR 5/6), yellowish-red (5YR 4/6), and brown (10YR 5/3) silty clay loam; moderate, medium and coarse, subangular blocky structure; friable to firm; slightly compact; few round pebbles; very strongly acid.

B_b 40 to 54 inches +, yellowish-red (5YR 4/8) silty clay loam with mottles of yellowish brown (10YR 5/8) and dark brown (10YR 4/3); massive (structureless) but breaks to angular blocky structure; firm to friable; few round pebbles; very strongly acid.

In many places, especially on the smoother gentle slopes, a weak fragipan is 30 to 40 inches below the surface. The underlying alluvium or colluvium is clay loam in places.

This soil is strongly acid to very strongly acid, low in natural fertility, and low in organic matter. Surface runoff is medium, and the erosion hazard is slight to moderate. The moisture-supplying capacity is moderately high. Plant roots easily penetrate the thick root zone.

Nearly all of this soil is in crops or pasture. It is well suited to crops commonly grown, especially tobacco and truck crops. This soil is easy to work. It responds very well to applications of lime and fertilizer and to other good management. (Capability unit IIe–2)

Holston silt loam, 5 to 12 percent slopes (HoC).—Except for the stronger slope, this soil is similar to Holston silt loam, 2 to 5 percent slopes. Much of it is on the benches of the Cumberland Plateau escarpment. Most areas are small and are on short slopes below broad hilltops. Nearly all of it is still under forest.

This is a fair to good soil for cultivated crops and is very good for small grains, hay, and pasture. Natural fertility is very low, but this soil responds well to fertilization and other good management because the root zone is thick and friable and supplies a large amount of moisture to plants. Under good management, yields of crops are high enough to justify large applications of lime and complete fertilizer. (Capability unit IIIe-2)

Holston silt loam, 5 to 12 percent slopes, eroded (HoC2).—This soil normally is not so deep as Holston silt loam, 2 to 5 percent slopes, and has thinner layers. Some of the original surface layer has been removed through erosion. The present surface layer is a yellowish-brown, friable silt loam, about 5 inches thick. The subsoil is a yellowish-brown to strong-brown, friable silty clay loam. Yellowish-red to red terrace deposits underlie the subsoil and are exposed in a few severely eroded areas.

This soil is strongly acid to very strongly acid, low in natural fertility, and low in organic matter. It is free of stones and is easy to keep in good tilth. Because the moisture-supplying capacity is moderately high and the root zone is thick and permeable, the soil responds well to large applications of fertilizer.

Most of this soil is in crops, mainly corn, small grains, and common lespedeza. A small acreage is in tobacco and vegetables. The crops commonly grown in the county are well suited. (Capability unit IIIe-2)

Huntington Series

The Huntington soils are deep, friable, and well drained. They consist of sediments that were recently deposited. These deposits are on level to gently sloping flood plains, in narrow strips along small drainageways, and at the base of slopes. Some areas are depressional.

These soils have a dark-brown surface layer and a friable, dark-brown to dark yellowish-brown subsoil. Beneath the subsoil are stratified layers of different texture that contain fine chert gravel, pebbles, and sand.

Huntington soils are alongside the somewhat poorly drained to moderately well drained Lindside soils and the poorly drained Melvin soils.

These soils are slightly acid to medium acid. They are high in natural fertility and in organic matter.

Huntington soils are not extensive in Putnam County, but they are important agriculturally. Most of the acreage has been cleared and is planted to corn. Some areas are flooded occasionally.

Huntington silt loam (0 to 2 percent slopes) (Hu).—This well-drained soil on bottom lands is deep and naturally fertile.

Soil profile:

A_p 0 to 12 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; slightly acid.

C_1 12 to 26 inches, dark-brown (10YR 4/3 to 3/3) fine silt loam; weak, fine, granular structure; friable; slightly acid to medium acid.

C_2 26 to 40 inches, dark-brown (10YR 3/3) to dark yellowish-brown (10YR 3/4) silt loam; weak, fine, granular structure; friable; slightly acid.

Huntington silt loam is slightly acid to medium acid throughout the profile. It is high in natural fertility and in organic matter. The soil is easy to work and to keep in good tilth. The deep, permeable root zone is well aerated and supplies a large amount of water to plants throughout the year.

Nearly all of this soil has been cleared. About 80 percent is in corn, and most of the rest is in annual hay. This soil is suited to most crops grown in the county. It is one of the best soils in the county for corn, and in many fields corn is grown continuously year after year (fig. 10).

Figure 10.—**Corn stubble on Huntington silt loam. Loblolly pines on Allen soil in left and right background. Hardwood forest on Rock land, limestone, in far background.**

Flooding in some places is the only restriction to use. This soil is also well suited to hay and forage crops. It is poorly suited to small grains because flooding, lodging, and disease are likely. (Capability unit I-1)

Huntington silt loam, phosphatic (0 to 2 percent slopes) (Hw).—This is a well-drained, fertile soil on first bottoms in the Central Basin part of the county.

Soil profile:

A_p 0 to 14 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; slightly acid.

C_1 14 to 26 inches, dark yellowish-brown (10YR 3/4) silt loam; weak, fine, granular structure; friable; slightly acid.

C_2 26 to 40 inches, brown (10YR 4/3) loam or silt loam; few, fine mottles of grayish brown (10YR 5/2); weak, fine and medium, granular structure; friable; slightly acid.

This soil is slightly acid throughout its profile. It is high in fertility and in organic matter. It contains a large amount of phosphorus because it is forming in alluvium that washed mostly from soils developed from phosphatic limestone on uplands. It has a very high capacity to supply moisture. The permeability is moderate to rapid throughout the profile; thus, the soil is seldom ponded for long periods following a flood or heavy rains. It generally is in good tilth and is easy to work.

Nearly all of the soil has been cleared, and most of it is used continuously for corn (fig. 11). It produces high yields of row crops and is excellent for pasture or hay. (Capability unit I-1)

Huntington silt loam, local alluvium (0 to 3 percent slopes) (Hv).—This soil is similar to Huntington silt loam except that it is along small drainageways and is not flooded.

Soil profile:

A_p 0 to 15 inches, dark-brown (7.5YR 4/4) silt loam; weak, fine, granular structure; friable; black specks of organic matter throughout layer; slightly acid to medium acid.

C_1 15 to 25 inches, dark-brown (7.5YR 4/4) to reddish-brown (5YR 4/4) silt loam or loam; weak, medium, granular structure; friable; slightly acid to medium acid.

C_2 25 to 40 inches, dark-brown (7.5YR 4/4) silt loam or loam; few mottles of very dark brown and few specks of gray; weak, medium, granular structure; very friable; few rounded quartz pebbles; medium acid.

The surface layer is dark brown to reddish brown. Depending on age and degree of profile development, the subsoil varies in color and in texture. The thickness of the solum varies between 18 inches and 5 feet or more. The substratum varies but generally is red silty clay residuum from limestone. Included with this soil are areas that have a loam surface layer.

This soil has a thick root zone and generally is in good tilth. It is suited to a wide range of crops and is highly responsive to good management. Row crops are grown in some areas for several years in succession, but some farmers follow a rotation that lasts 2 or 3 years. Good stands of alfalfa are more difficult to maintain on this soil than on some red soils of uplands and terraces. Planting alfalfa is risky in some areas that are drained rather slowly by underground sinks and channels. Pasture on this soil withstands dry periods better than on nearby soils of the uplands.

Not suited to tobacco are some sinkholes that have recently received from nearby steep slopes 12 to 18 inches of red or yellowish-red subsoil material. (Capability unit I–1)

Huntington cherty silt loam (0 to 2 percent slopes) (Hr).—This soil is along small streams in the Highland Rim part of the county. It is similar to Huntington silt loam but contains many fragments and waterworn pebbles of chert, ¼ inch to 3 inches in diameter, throughout the profile. The amount of chert varies greatly on the surface and throughout the profile. In a few places about half of the soil mass is chert. A few spots have more than the normal amount of chert because the chert has accumulated locally or has been left when overflowing streams have worked away the finer material. This soil is slightly acid to medium acid. It is low in phosphorus and moderately low in postassium. Although the chert is a hindrance, this soil is easy to work and responds well to management. The moisture-supplying capacity is high.

Figure 11.—**Recently plowed Huntington silt loam, phosphatic, in the foreground. Cedar grove on Rock land, limestone, in the background.**

This soil is suited to intensive cultivation and produces high yields of nearly all crops. Areas that are occasionally flooded are not well suited to small grains, alfalfa, and similar crops. (Capability unit I–1)

Huntington cherty silt loam, phosphatic (0 to 2 percent slopes) (Hs).—This soil is similar to Huntington silt loam, phosphatic, but angular fragments of chert, ¼ inch to 3 inches in diameter, are on the surface and throughout the profile. The soil is 15 to 30 percent chert. In many places the soil is underlain by gravel beds at a depth of 24 to 36 inches. A few spots have more than the normal amount of chert because the chert accumulated locally or has been left when swift, overflowing streams have washed away the finer material.

This soil is in narrow strips on bottom land along small streams in the Central Basin part of the county. Though it is cherty, this soil produces good yields of many crops. It can be used intensively for row crops or for hay and pasture. The main problems are chertiness and flooding of some areas. This soil is rich in phosphorus and ordinarily does not require lime. It requires small applications of nitrogen and potash. (Capability unit I–1)

Huntington fine sandy loam (0 to 2 percent slopes) (Ht).—This soil is coarser than Huntington silt loam. It is a deep, well-drained, fertile soil on nearly level first bottoms. It is in the valley of the Calfkiller River, in other deeply cut valleys that originate in the escarpment of the Cumberland Plateau, and on some of the bottom land of the Highland Rim.

Soil profile:

A 0 to 18 inches, dark-brown (10YR 4/3) fine sandy loam; weak, fine, granular structure; very friable; slightly acid.

C 18 to 36 inches, dark-brown (10YR 3/3) loam; weak, fine and medium, granular structure; friable; slightly acid.

This soil is generally stratified. In some places gravelly or sandy layers are below a depth of 30 inches. The soil is slightly acid in most places, but in some places it is medium acid. It is moderately high in organic matter and in natural fertility. Plant roots easily penetrate the thick, permeable root zone. The moisture-supplying capacity is very high. The soil is easily worked and can be kept in good tilth within a wide range of moisture content.

Nearly all of this soil has been cleared and is cultivated. About 70 or 80 percent of it is in corn, much of which is grown on the same fields every year. This soil is excellent for summer annual crops because its supply of moisture is high. It can be used intensively for row crops and is also one of the most productive soils for hay and pasture. The main limitation is the flooding of some areas. High rates of fertilization generally are justified on this soil. (Capability unit I–1)

Jefferson Series

The Jefferson series consists of well-drained soils that formed in old local alluvium deposited on mountain foot slopes and benches. This alluvium washed from soils underlain by sandstone, shale, and limestone. Jefferson soils have a surface layer of brown, friable loam and a subsoil of yellowish-brown, friable clay loam or silty clay loam. Bedrock is 3 to 12 feet from the surface. The slope is 2 to 30 percent.

These soils adjoin the Allen soils, Holston soils, Stony colluvial land, and Rock land, limestone, on the Cumberland Plateau escarpment. They are not so red in the subsoil as are the Allen soils.

Jefferson soils are low in organic matter and natural fertility. They are strongly acid to very strongly acid. They have a thick, friable root zone that is well aerated and easily penetrated by roots. These soils are generally easy to work and respond well to additions of fertilizer. In Putnam County they normally are widely scattered in small areas. The native vegetation was mixed pine and hardwood forest.

Jefferson loam, 2 to 5 percent slopes (JeB).—This deep, well-drained soil is on smooth foot slopes and benches.

Soil profile:

A_p 0 to 8 inches, brown (10YR 4/3 to 5/3) loam; weak, fine, granular structure; very friable; strongly acid.

B_1 8 to 16 inches, yellowish-brown (10YR 5/4 to 5/6) loam; weak, fine, subangular blocky structure; friable; strongly acid to very strongly acid.

B_2 16 to 28 inches, yellowish-brown (10YR 5/6) clay loam; weak to moderate, medium, subangular blocky structure; friable; few, small, black concretions; strongly acid to very strongly acid.

B_3 28 to 36 inches, yellowish-brown (10YR 5/6) to strong-brown (7.5YR 5/6) clay loam; few, fine, faint mottles of light yellowish brown (10YR 6/4); weak to moderate, fine, subangular blocky structure; friable; strongly acid to very strongly acid.

C 36 inches +, yellowish-brown (10YR 5/6) clay loam; few, fine, distinct mottles of light yellowish brown (10YR 6/4) and yellowish red (5YR 5/6); weak to moderate, fine, subangular blocky structure; friable; few black concretions, 1 millimeter to 2 millimeters across; strongly acid to very strongly acid.

The solum varies between 24 and 48 inches in thickness. The subsoil is yellowish brown to dark brown. Included with this soil are areas that have a fine sandy loam surface layer.

This soil is low in natural fertility and is strongly acid to very strongly acid. A few small stones are scattered on the surface and throughout the soil profile, but they do not hinder tillage. The soil is easy to work and to keep in good tilth. The deep, permeable root zone and high moisture supply make this soil highly responsive to good management.

Most of this soil has been cleared. Corn, wheat, soybeans, and lespedeza are the principal crops. Some of the soil is in pasture.

This soil is well suited to all the commonly grown crops and to pasture. It is one of the best soils in the county for tobacco and truck crops. It produces high yields of all crops but requires large amounts of fertilizer. (Capability unit IIe–2)

Jefferson loam, 5 to 12 percent slopes (JeC).—This soil is steeper than Jefferson loam, 2 to 5 percent slopes, and is slightly eroded. Most of the areas still have enough of the original surface layer for tillage to be within that layer. The upper 6 inches of this soil is yellowish-brown, friable loam, but in some included areas the surface layer is fine sandy loam. The subsoil is yellowish-brown to strong-brown, friable clay loam. This soil is mainly along the foot slopes surrounding coves and on benches of the Cumberland Plateau escarpment.

Natural fertility is low. The surface layer and subsoil are permeable, and the root zone is thick and friable. The moisture-supplying capacity and the response to fertilizer are moderately high. The soil generally is in good tilth and is easy to work.

Nearly all of this soil has been cultivated, but a large acreage is now in pasture and hay. Some areas are idle, especially those on isolated mountain benches that are hard to reach.

This soil is well suited to all crops commonly grown but requires large amounts of fertilizer for best yields. Because of the strong slopes and moderate hazard of erosion, it is not suited to intensive use. Corn, tobacco, and truck crops are suited, and also small grains, red clover, lespedeza, orchardgrass, and tall fescue. Yields of alfalfa are fair to good, but the stand is difficult to maintain for more than 2 or 3 years. (Capability unit IIIe–2)

Jefferson loam, 12 to 20 percent slopes, eroded (JeD2).—This soil is on benches and on moderately steep foothills at the base of the Cumberland Plateau escarpment. It has thinner soil layers than Jefferson loam, 2 to 5 percent slopes, and is shallower to bedrock. The surface layer is brown, friable loam about 6 inches thick. The subsoil is yellowish-brown to strong-brown, friable clay loam. Limestone or sandstone bedrock is 2½ to 6 feet from the surface. Included with this soil are some severely eroded areas where a few shallow to deep gullies have formed.

This soil is low in natural fertility, but it has a moderately thick, permeable root zone. Except for the limitations caused by the slope, the soil is easy to work and to keep in good tilth.

About half of this soil is in forest. The cleared areas are mostly in unimproved pasture.

This soil is suited to most crops. It produces good yields of row crops but is too strongly sloping for frequent cultivation. If the soil is heavily limed and fertilized, good pastures can be established. Alfalfa is expensive to maintain, however, because the soil is low in natural fertility. This soil responds well to management. (Capability unit IVe–2)

Jefferson cobbly sandy loam, 5 to 12 percent slopes (JcC).—This soil has thicker layers and a thicker profile than has Jefferson cobbly sandy loam, 12 to 20 percent slopes, and it developed in old local alluvium that is deeper in most places.

A small part of this soil has been cleared and is used mostly for pasture. Fair yields of crops commonly grown in the county can be produced if the soil is well limed and fertilized, but the moderate slopes prevent frequent cultivation. Also, the cobbles make tillage difficult. Because the moisture supply is moderately low, small grains, grasses, legumes, and other early growing plants are best suited. The response to fertilization is moderate. (Capability unit IVs–1)

Jefferson cobbly sandy loam, 12 to 20 percent slopes (JcD).—This deep, well-drained soil has formed in old local alluvium that slumped or washed from the Muskingum soils and Stony colluvial land. It is on the foothills and on benches of the Cumberland Plateau escarpment.

This soil has an 8-inch surface layer of light yellowish-brown cobbly sandy loam. The subsoil is yellowish-brown, friable cobbly clay loam. Sandstone cobbles, 3 to 10 inches in diameter, are on the surface and throughout the profile. They make up about 15 to 35 percent of the soil mass. The old local alluvium normally is 3 to 8 feet deep over bedrock of limestone and sandstone.

The soil is low in organic matter and in natural fertility, and it is strongly acid to very strongly acid. Although it is permeable and absorbs water quickly, it is too porous to retain moisture well. Because of the cobbles and the coarse soil material, the moisture-supplying capacity is low. Seepage from higher slopes provides a good supply of moisture in places.

This soil is not extensive in Putnam County and, except for a few pastured areas, is of little importance agriculturally. The native vegetation was mixed hardwoods and pine.

Most of this soil is in forest, but some of it has been cleared and is in permanent pasture. The soil is poorly suited to cultivated crops but is fairly well to well suited to small grains, hay, and pasture. Because the water supply is low, high yields of crops and pasture cannot be obtained, even if the soil is heavily fertilized. But yields of pasture are fair to moderate if lime and moderate amounts of fertilizer are added. (Capability unit VIs–1)

Jefferson cobbly sandy loam, 20 to 30 percent slopes (JcE).—Except for steeper slopes, thinner horizons, and a more variable depth to bedrock, this soil is similar to Jefferson cobbly sandy loam, 12 to 20 percent slopes. It is on steep foot slopes of the Cumberland Plateau escarpment. In coves it adjoins Stony colluvial land and the Allen soils. The surface layer is light yellowish-brown, friable cobbly sandy loam, about 6 inches thick. The subsoil is yellowish-brown, friable cobbly sandy loam to cobbly clay loam.

This soil is low in natural fertility. It absorbs moisture quickly but does not retain it well. The moisture-supplying capacity is low, and except in a few seepy areas the soil is droughty.

Nearly all of this soil is in forest. It is unsuited to row crops but produces fair to good pasture if well fertilized and limed. Orchardgrass, tall fescue, whiteclover, and lespedeza are suitable pasture plants. (Capability unit VIs–1)

Landisburg Series

The Landisburg series consists of moderately well drained soils that have a fragipan. They have formed in old local alluvium on toe slopes and fans of the Highland Rim. This alluvium washed or crept down from the Mountview, Baxter, and Christian soils on the adjoining upland slopes.

Landisburg soils have a surface layer of dark grayish-brown to brown, friable silt loam or cherty silt loam. The subsoil is yellowish-brown, friable silt loam or silty clay loam. The lower part of the subsoil is mottled and generally contains a fragipan. The slope of Landisburg soils ranges from 2 to 12 percent but is 3 to 8 percent in most places. Bedrock generally is more than 10 feet from the surface.

These soils occur with the Ennis, Huntington, and Minvale soils. They adjoin the Ennis and Huntington soils in depressions and on first bottoms. They have formed from materials similar to those of the Minvale soils, which are darker and better drained than the Landisburg soils and do not have a fragipan.

These soils are strongly acid and are low in natural fertility. The native vegetation was hardwoods, chiefly oak, hickory, sourwood, and yellow-poplar.

Nearly all of the acreage is cultivated and planted to corn, common lespedeza, small grains, and pasture. Use is somewhat limited by the slow internal drainage and slow permeability.

Landisburg silt loam, 2 to 5 percent slopes (LaB).—This moderately well drained soil is on foot slopes and benches. It generally has a fragipan and is mottled in the lower subsoil.

Soil profile:

A_p 0 to 8 inches, dark grayish-brown (10YR 4/2) to brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; strongly acid.

B_1 8 to 12 inches, yellowish-brown (10YR 5/4) silt loam or silty clay loam; weak, medium, subangular blocky structure; friable; strongly acid.

B_2 12 to 26 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable; few, rounded, brown concretions; strongly acid.

B_{3m1} 26 to 38 inches, yellowish-brown (10YR 5/6) silty clay loam; many, medium, distinct mottles of light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6); moderate, fine, angular blocky structure; compact when moist, brittle when dry; few, rounded, black concretions; very strongly acid.

B_{3m2} 38 to 50 inches, yellowish-brown (10YR 5/4) silty clay loam; many, medium, distinct mottles of pale brown (10YR 6/3) and strong brown (7.5YR 5/6); moderate, medium, angular blocky to platy structure; compact when moist, brittle when dry; few, rounded, dark concretions; very strongly acid.

The depth to the fragipan ranges from 18 to 28 inches. In some areas the fragipan varies in compactness, and in other areas it does not occur. Included are areas that have been recently covered by a layer of overwash as much as 18 inches thick. Also included are several areas of loam adjacent to the sandier Christian soils.

The lower subsoil normally has a high water table and is waterlogged during winter and other wet periods. Since this soil is on toe slopes and receives some seepage, the moisture-supplying capacity is moderately high. The soil is strongly acid and low in natural fertility but responds moderately well to fertilization. The root zone is mostly in the upper 20 to 24 inches; this part is friable and easily penetrated by roots.

Nearly all of the soil has been cleared and is planted to crops. Well-suited crops are corn, small grains, soybeans, orchardgrass, tall fescue, red clover, white clover, and lespedeza. Yields of tobacco generally are good, but some of the crop may be lost in the wettest years. The soil is poorly suited to alfalfa because of the high water table. If heavily fertilized, alfalfa may grow well for about 2 years. The soil responds well to management but requires large additions of fertilizer. (Capability unit IIe–3)

Landisburg silt loam, 5 to 12 percent slopes (LaC).—The surface layer of this soil is thinner than that in Landisburg silt loam, 2 to 5 percent slopes, and the fragipan is less compact and weaker. The average depth to the fragipan is about 20 inches.

Nearly all of this soil has been cleared and planted to crops. The restricted drainage limits the use. The soil is suited to corn, small grains, permanent pasture, soybeans, and hay. Alfalfa may grow well for a year or two if large amounts of fertilizer are added. Yields of tobacco ordinarily are good, but part of the crop may be lost in wet years. (Capability unit IIIe–3)

Lawrence Series

The soils of the Lawrence series are somewhat poorly drained. They are on broad, level upland plains and divides and along intermittent drains in the Highland Rim. These soils have formed in a thin mantle of loess that is underlain by cherty or shaly residuum of limestone. Bedrock is 15 to 25 feet or more from the surface.

The surface layer of these soils is friable silt loam that is grayish brown and faintly mottled. The subsoil is mottled gray and light yellowish-brown, friable silt loam that has a fragipan in the lower part. The slope ranges from 1 to 3 percent.

Lawrence soils adjoin the Dickson, Mountview, Sango, and Guthrie soils. They lie between the Sango and Guthrie soils. They are more poorly drained and shallower to mottling than the Dickson and Sango soils. They are better drained and less gray than the Guthrie soils.

In Putnam County only one Lawrence soil has been mapped. It is in small areas on the Highland Rim, and its total acreage is small. The native vegetation was deciduous forest that included a large proportion of water-tolerant trees, chiefly willow oak, white oak, post oak, blackgum, sweetgum, red maple, and beech.

Lawrence silt loam (1 to 3 percent slopes) (Lm).—This somewhat poorly drained soil is in depressions and intermittent drains in the uplands of the Highland Rim.

Soil profile:

A_p 0 to 8 inches, grayish-brown (2.5Y 5/2) silt loam; few, fine, faint mottles of yellowish brown (10YR 5/6); weak, fine, granular structure; friable; few, small, round concretions; very strongly acid.

B_1 8 to 14 inches, light yellowish-brown (2.5Y 6/4) silt loam; few, fine, faint mottles of grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/4); weak, fine, subangular blocky structure; friable; very strongly acid.

B_2 14 to 20 inches, mottled light yellowish-brown (2.5Y 6/4), yellowish-brown (10YR 5/4), light brownish-gray (10YR 6/2), and strong-brown (7.5YR 5/8) silt loam; many, medium, distinct mottles; weak to moderate, fine, subangular blocky structure; friable; very strongly acid.

B_{3m} 20 to 50 inches (fragipan), mottled gray (N 5/0), grayish-brown (2.5Y 5/2), and strong-brown (7.5YR 5/6) coarse silty clay loam; weak to moderate, medium, angular blocky structure or massive (structureless); compact when moist, brittle when dry; few, small, black concretions; fragments of chert; very strongly acid.

C 50 to 72 inches, mottled yellowish-red (5YR 4/6), grayish-brown (10YR 5/2), gray (10YR 5/1), and yellowish-brown (10YR 5/6) silty clay; massive (structureless); few, small, angular fragments of chert; very strongly acid.

The fragipan varies in structure, consistence, and thickness. In places it is weak or is absent, but generally it is 10 to 25 inches thick. The C horizon ranges from silty clay loam to clay and contains varied amounts of chert. Several areas have received 4 to 16 inches of pale-brown overwash from soils on higher, adjoining slopes.

Lawrence silt loam is very strongly acid throughout the profile. It is low in natural fertility and in organic matter. During wet periods, the soil is saturated and the water table is held at a high level by the very slowly permeable fragipan. Surface runoff is slow to very slow, and in places the soil is ponded after rains. The moisture supply is undependable because water is available only in the upper foot or two of soil. When the moisture content is satisfactory, the soil is easy to work and to keep in good tilth.

About one-third to one-half of this soil has been cleared and is mostly in pasture or hay. A small acreage is in corn, soybeans, and sorghum. The soil is poorly suited to tobacco, alfalfa, and truck crops. It is suited to tall fescue, whiteclover, and other pasture plants, and to soybeans and grain sorghum. If heavily fertilized, it produces moderate yields. (Capability unit IIIw–2)

Lindside Series

The soils of the Lindside series are on first bottoms and are moderately well drained to somewhat poorly drained. They consist of alluvium that recently washed from uplands and terraces where the soils were derived mostly from limestone residuum. Lindside soils are on level or nearly level plains, mostly in areas that are likely to be flooded periodically. Bedrock is 5 to 15 feet from the surface.

These soils have a brown to dark-brown, friable silt loam surface layer. This layer is about 15 inches thick and is over mottled grayish-brown, friable silt loam or silty clay loam. The grayish mottling generally increases with increasing depth.

These soils adjoin the poorly drained Melvin soils and the well-drained Huntington soils. Lindside soils are scattered throughout the limestone areas of the county, especially on the Highland Rim. Most of the soil material washed from the Waynesboro, Cumberland, Baxter, Hermitage, Bewleyville, and Mountview soils.

Only one Lindside soil has been mapped in Putnam County. This soil is limited in extent but is of local importance to agriculture.

Lindside silt loam (0 to 2 percent slopes) (Ln).—This moderately well drained to somewhat poorly drained soil is on bottom lands along streams. It is likely to be flooded occasionally.

Soil profile:

A_p 0 to 15 inches, brown (10YR 4/3) to dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; very friable; slightly acid to medium acid.

C_1 15 to 32 inches, mottled grayish-brown (10YR 5/2), yellowish-brown (10YR 5/4), dark-brown (7.5YR 4/4), and black (10YR 2/1) silt loam; weak, fine, subangular blocky structure; friable; slightly acid to medium acid.

C_2 32 to 48 inches +, mottled grayish-brown (10YR 5/2), strong-brown (7.5YR 5/6), gray (10YR 5/1), and yellowish-red (5YR 4/8) silt loam or silty clay loam; massive (structureless); friable; slightly acid to medium acid; grades to stratified layers of silt, sand, and gravel.

In a few small areas a firm, massive, dark-gray to nearly black layer of clay underlies the surface layer. These areas are seldom flooded.

Lindside silt loam is one of the most fertile soils in the county. It contains a moderately large amount of organic matter and is slightly acid to medium acid. The soil is moderately permeable and has a high moisture-supplying capacity. Low-lying areas are saturated in periods when the water table is high. Fieldwork is sometimes delayed in spring by excessive moisture and, occasionally, in summer by heavy rains. The soil is easy to conserve because it is nearly level. It is easy to keep in good tilth and to work with farm machinery. Although most areas

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are not susceptible to erosion, some areas receive overwash when they are flooded.

Nearly all of this soil is cultivated. It is mainly in corn, but hay, pasture, and small grains are also grown. The soil is well suited to corn and soybeans but is not so well suited to alfalfa, tobacco, and truck crops. It is suitable for intensive row cropping. Because the moisture-supplying capacity is high, this soil is well suited to crops that require a long growing season. (Capability unit I–1)

Linker Series

The Linker series consists of friable, well-drained soils on uplands of the Cumberland Plateau. In uneroded areas, the surface layer is dark yellowish-brown loam and the subsoil is yellowish-red to red clay loam. These soils have formed in residuum weathered mostly from acid, medium-grained sandstone and, in some places, from conglomerates. Most areas are on ridge crests that have slopes of about 5 to 12 percent. Sandstone bedrock is about 2½ to 5 feet from the surface. These soils are very strongly acid and are low in natural fertility.

Linker soils are next to the Hartsells soils. Their subsoil is much redder than that of the Hartsells soils, and their surface layer is slightly browner.

These soils are not extensive in Putnam County and are not important agriculturally. A fairly large acreage is near Sand Springs. The native vegetation was mixed hardwood forest, mostly oak and hickory.

Most of the acreage of the Linker soils has been cleared and is in row crops or pasture. Some ridge crests, however, cannot be easily reached by farm machinery, and the use of these areas is limited.

Linker loam, 5 to 12 percent slopes (LrC).—This soil is friable and well drained.

Soil profile:

A_p 0 to 6 inches, dark yellowish-brown (10YR 4/4) loam; weak, fine, granular structure; very friable; very strongly acid.

B_1 6 to 10 inches, strong-brown (7.5YR 5/6) to brown (7.5YR 4/4) clay loam; weak, fine, subangular blocky structure; friable; very strongly acid.

B_{21} 10 to 15 inches, yellowish-red (5YR 4/6) clay loam; weak to moderate, fine, subangular blocky structure; friable; very strongly acid.

B_{22} 15 to 20 inches, red (2.5YR 4/6) clay loam with streaks and pockets of dark brown (7.5YR 4/4); weak, medium, subangular blocky structure; friable; very strongly acid.

B_{23} 20 to 34 inches, red (2.5YR 4/6) clay loam; weak, medium, angular blocky structure; friable; very strongly acid.

B_3 34 to 48 inches, red (2.5YR 4/6) sandy clay loam; massive (structureless); friable; few, rounded, white pebbles; very strongly acid.

C_1 48 to 58 inches +, red (2.5YR 5/8) pebbly sandy loam; few dark-red (2.5YR 3/6) streaks; massive (structureless); friable to firm; very strongly acid.

In a few areas the soil is less than 3 feet deep. A few small areas with slopes of 2 to 5 percent are included.

This soil is very strongly acid and low in natural fertility. Except for the top 1 or 2 inches in forested areas, it is low in organic matter. It is permeable and absorbs rainfall rapidly. The moisture-supplying capacity is moderately high, and tilth generally is good. This soil is easy to work. It has a thick, friable root zone and responds well to fertilization and other management.

This soil is well suited to all of the common crops and pasture plants grown in the county. In a few places it is too shallow for deep-rooted plants. (Capability unit IIIe–2)

Linker loam, 5 to 12 percent slopes, eroded (LrC2).—This is a friable, well-drained soil on the uplands of the Cumberland Plateau. The surface layer is 4 or 5 inches thick and is thinner that that of Linker loam, 5 to 12 percent slopes. It is brown to strong brown and consists of the upper part of the subsoil mixed with the original surface soil by plowing. Included with this soil are some severely eroded patches where the red to yellowish-red, friable, clay loam subsoil is exposed.

Except in a few places where bedrock is within about 18 inches of the surface, this soil has a moderately thick, permeable root zone and a moderately high capacity for supplying moisture. It is easy to work, is generally in good tilth, and responds well to management.

Most of this soil is near Sand Springs, but a few patches are scattered on other narrow ridges. Nearly all of it has been cleared. It is suited to crops commonly grown in the county. (Capability unit IIIe–2)

Melvin Series

The soils of the Melvin series are poorly drained and are on nearly level first bottoms. These soils consist of alluvium that washed from uplands and terraces where the soils formed mostly in residuum from limestone. The alluvium is 5 to 15 feet thick in most places. Melvin soils are generally on the outer rim of the flood plain. Along some of the smaller streams and the intermittent drainageways, these soils may occupy the entire bottom.

Melvin soils have a surface layer of faintly mottled, grayish-brown, friable silt loam. The subsoil is light brownish-gray or gray silt loam that is mottled with shades of yellow and brown.

These soils adjoin the somewhat poorly drained to moderately well drained Lindside soils. They are grayer than the Lindside soils and are more distinctly mottled in the upper part.

Only one Melvin soil has been mapped in Putnam County. This soil occurs throughout the county except on the Cumberland Plateau. It is widely distributed in small tracts. The native vegetation was mostly water-tolerant oak, willow, and sweetgum.

Melvin silt loam (0 to 2 percent slopes) (Ma).—This is a gray, poorly drained soil on level bottom lands.

Soil profile:

A_p 0 to 8 inches, grayish-brown (10YR 5/2) silt loam; few, fine, distinct mottles of strong brown (7.5YR 5/6); weak, fine, granular structure; friable; slightly acid.

C_{1g} 8 to 27 inches, gray (10YR 5/1) silt loam; common, medium, distinct mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6); massive (structureless); friable; medium acid.

C_{2g} 27 to 48 inches +, gray (10YR 5/1 to 6/1) silty clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/6) that are arranged in streaks; massive (structureless); friable; medium acid.

The surface layer is slightly acid, but the subsoil is medium to slightly acid. The soil is moderate in natural fertility and is moderately high in organic matter. A few small areas have a black surface layer that is very high in organic matter. Plant roots do not penetrate very deeply, for the lower part of the profile is saturated with water and poorly aerated most of the time. Surface runoff and internal drainage are very slow.

A large part of Melvin silt loam has been cleared and is in unimproved pasture. Some of the wooded areas are grazed. Thickets of alder and willow have grown up on some cleared spaces. A few areas are in crops, mainly corn. Yields are low, and total failures are common.

This soil is fairly well suited to pasture because it supports vegetation during prolonged dry periods. Ladino clover, tall fescue, alsike clover, and lespedeza are suitable pasture plants. If this soil were drained in areas where drainage is practical, it would produce moderate yields of corn, grain sorghum, soybeans, and hay. In these places, however, the soil would still be susceptible to flooding. (Capability unit IIIw-I)

Mimosa Series

The Mimosa series consists of well-drained soils that have formed on uplands in clayey residuum of phosphatic limestone. Where these soils are not severely eroded, the surface layer is dark-brown, friable silt loam. The subsoil is variegated yellowish-brown and strong-brown, firm silty clay loam or clay. Bedrock is exposed in many places, but it may be as much as 3 to 8 feet from the surface. These soils are on the slopes of low ridges and on benches in valleys.

Mimosa soils are entirely within the Central Basin. They are strongly sloping and adjoin the Dellrose soils. They normally are above the Armour soils, which are on low terraces and foot slopes. The Mimosa soils are firmer and finer textured in the subsoil than are the Dellrose and Armour soils. They are agriculturally important near Buffalo Valley and Martin Creek. The native vegetation was chiefly eastern red-cedar, black walnut, hackberry, elm, hickory, black locust, and honey locust.

Nearly all the acreage of Mimosa soils has been cleared and is used principally for pasture. Most of the acreage consists of very rocky soils, which are generally on exposed south- and west-facing slopes. These exposed slopes apparently have lost more soil material, as a result of erosion after freezing and thawing, than have the north- and east-facing slopes.

Mimosa silt loam, 12 to 20 percent slopes, eroded (MoD2).—This is a clayey soil that developed on uplands in residuum from phosphatic limestone.

Soil profile:

A_p 0 to 9 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; medium acid.

B_{21} 9 to 18 inches, yellowish-brown (10YR 5/6) silty clay loam or clay; common, medium mottles of yellowish brown (10YR 5/8); moderate, medium, subangular and angular blocky structure; firm; thin, vertical projections of the A_p horizon; few, fine, black concretions; strongly acid.

B_{22} 18 to 24 inches, yellowish-brown (10YR 5/6) clay; common, medium, distinct mottles of strong brown (7.5YR 5/8) and pale brown (10YR 6/3); strong, medium, angular blocky structure; few, fine, black concretions; strongly acid.

B_3 24 to 27 inches; mottled pale-brown (10YR 6/3) and strong-brown (7.5YR 5/8) clay; strong, medium, angular blocky structure; very hard when dry, sticky and plastic when wet; strongly acid.

C_1 27 to 41 inches, highly mottled strong-brown, yellowish-brown, and grayish-brown clay; strong, fine and medium, angular blocky structure; very hard when dry, sticky and plastic when wet; common, fine, black concretions; strongly acid.

D_r 41 inches +, clayey phosphatic limestone.

The B_3 and C_1 horizons are massive in places, rather than angular blocky. Included with this soil are severely eroded areas that have a plow layer of yellowish-brown silty clay loam or clay. The areas at the base of long steep slopes occupied by cherty Dellrose soils contain some chert. There are a few outcrops of bedrock and a few shallow gullies.

This soil is medium acid to strongly acid. It is naturally rich in phosphorus but is low in potassium and nitrogen. Permeability is moderately slow in the surface layer and slow in the plastic, clayey subsoil. The moisture-supplying capacity is low, and the soil is droughty. Surface runoff is rapid, and the risk of erosion is high. Good tilth is difficult to maintain.

Nearly all of this soil has been cleared and cultivated. It is best suited to small grains, hay, pasture, and other close-growing crops. Yields of row crops are not consistently high. The soil can be brought to a high level of fertility by adding moderate amounts of lime, nitrogen, and potash. (Capability unit VIe-2)

Mimosa silt loam, 20 to 35 percent slopes, eroded (MoE2).—This soil is shallower to limestone bedrock than Mimosa silt loam, 5 to 20 percent slopes, eroded.

Permeability is slow, and runoff is very rapid. Little moisture is available to plants because the slope is steep and the subsoil consists of clay. This soil is medium acid to strongly acid. Included are a few cherty areas, a few outcrops of limestone bedrock, and some severely eroded areas where many shallow gullies have formed.

Nearly all of this soil is cleared. Most of it is in pasture, but some areas are cultivated. This soil is poorly suited to tilled crops. It is best suited to pasture. Fair to good pasture can be established and maintained if moderate amounts of lime, nitrogen, and potash are added. The soil is naturally rich in phosphorus. Orchardgrass, bluegrass, tall fescue, whiteclover, and lespedeza are suitable pasture plants. (Capability unit VIe-2)

Mimosa very rocky silty clay loam, 5 to 20 percent slopes, eroded (MmD2).—This mapping unit consists of soil and exposed bedrock of phosphatic limestone. The bedrock covers 15 to 50 percent of the surface. The soil has a brown, friable, silty clay loam surface soil and is 4 or 5 inches thick. The subsoil is yellowish-brown to strong-brown, plastic clay. Bedrock is near the surface. Included with this soil are areas of Rock land, limestone, less than one-half acre in size.

Because permeability is slow and runoff is rapid, this soil is highly susceptible to erosion. The penetration of roots is limited by the thin, clayey subsoil and the bedrock. The soil is low in moisture-supplying capacity and is droughty. It is medium acid to strongly acid and, in most places, is phosphatic.

Although a few patches less than one-half acre in size can be cultivated with hand implements, this soil is poorly suited to crops. Its best use is for permanent pasture or trees. There is enough soil material between the rocks to grow a fair amount of pasture. Bluegrass and whiteclover grow well in most areas that can be fertilized, but pasture is difficult to manage because of the rocks. (Capability unit VIs–2)

Mimosa very rocky silty clay loam, 20 to 30 percent slopes, eroded (MmE2).—From 15 to 50 percent of the surface of this mapping unit is bedrock of phosphatic limestone. Between the rocks, the surface layer is brown, friable silty clay loam underlain by yellowish-brown, plastic clay. The bedrock generally is less than 2 feet from the surface. There are shallow gullies in a few areas.

This soil occurs in medium to large areas next to Dellrose soils, Rock land, limestone, and other Mimosa soils.

Permeability is slow, and surface runoff is very rapid. Tilth is poor, the root zone is thin, and the moisture-supplying capacity is low.

A large part of this soil has been cleared of its original forest. The cleared area is now in brushy pasture, much of which is reverting to trees. One part of the area supports a young stand of eastern redcedar.

This soil is not suited to crops and is poorly suited to pasture. It is probably best to allow the soil to revert to black locust and cedar. The growth of trees, however, is slow. (Capability unit VIIs–1)

Mine Pits and Dumps

The pits and dumps that make up this land type are the result of strip mining and excavating for construction materials. The acreage is very small.

Mine pits and dumps (Mp).—On the Cumberland Plateau there are a few areas where soil materials have been removed or dumped in the process of strip mining, excavating for sand, or borrowing for road fill. The depth of the excavations into the weathered sandstone is 3 to 30 feet or more.

Minvale Series

The Minvale series consists of deep, well-drained soils formed in old local alluvium that washed or rolled chiefly from uplands underlain by limestone. These soils are on foot slopes, benches, and fans below upland slopes. The parent materials have been in place long enough for moderately distinct soil layers to have developed. The slope ranges from 2 to 20 percent but generally is 3 to 10 percent. Bedrock is 5 to 15 feet or more from the surface.

Where these soils are uneroded, the surface layer is brown, friable silt loam or cherty silt loam. The subsoil is yellowish-red, friable silty clay loam that contains variable amounts of chert.

Minvale soils adjoin the Hermitage and Landisburg soils. They are lighter colored than the Hermitage soils and are better drained than the Landisburg soils.

Minvale soils are strongly acid and low in natural fertility, but where their moisture-supplying capacity is high and their root zone is thick and permeable, they respond well to management. Where they are not too cherty or severely eroded, they are easy to work and to keep in good tilth.

These soils are in small, irregularly shaped tracts in the Highland Rim part of the county.

The native vegetation was mainly deciduous forest of mixed oak, hickory, and yellow-poplar.

Minvale silt loam, 2 to 5 percent slopes (MeB).—This soil is deep and well drained. It formed in old local alluvium on gently sloping foot slopes and benches.

Soil profile:

A_p 0 to 8 inches, brown (10YR 4/3–5/3) silt loam; moderate, medium, granular structure; very friable; strongly acid.

B_1 8 to 12 inches, yellowish-brown (10YR 5/6) to strong-brown (7.5YR 5/6) silty clay loam; weak, fine, subangular blocky structure; friable; strongly acid.

B_2 12 to 33 inches, yellowish-red (5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable; few, fine, angular fragments of chert; strongly acid.

C 33 to 50 inches, yellowish-red (5YR 4/6) to strong-brown (7.5YR 5/6) silty clay loam;, common, medium, distinct mottles of light yellowish brown (2.5YR 6/4), red (2.5YR 4/8), and brownish yellow (10YR 6/6); moderate, medium, angular blocky structure; firm; few to common, angular fragments of chert; strongly acid; horizon may be limestone residuum.

The local alluvium varies between 2 and 10 feet or more in thickness. It was transported mainly from the Baxter and Christian soils and from Rock land, limestone. The content of chert varies between 2 and 15 percent of the soil mass. The texture of the C horizon ranges from silty clay loam to clay. About 140 acres of this soil are on low terraces and are mostly cherty.

This soil is strongly acid and is low in natural fertility. It absorbs moisture rapidly and has a high moisture-supplying capacity. In places it receives moisture through seepage from adjacent high-lying soils. It is permeable throughout the profile. Surface runoff is medium, and the hazard of erosion is slight.

Most of this soil has been cultivated; it is planted to corn, small grain, lespedeza, and tobacco. Some alfalfa is grown. This soil is well suited to all of the general farm crops and to alfalfa. It responds well to fertilizer and can be used in moderately short rotations. (Capability unit IIe–2)

Minvale silt loam, 5 to 12 percent slopes (MeC).—The surface layer of this soil is thinner than that of Minvale silt loam, 2 to 5 percent slopes. It is yellowish-brown, friable silt loam, about 3 to 6 inches thick. In some places the surface layer has been mixed with the upper part of the subsoil, which is yellowish-red, moderately friable silty clay loam.

The natural fertility is low, but the moisture-supplying capacity is moderately high. The soil can be easily conserved, worked, and kept in good tilth. It responds well to fertilization and other good management.

Pasture, alfalfa, tobacco, truck crops, and other general crops grow well on this soil if it is fertilized. The moisture supply is enough to justify heavy rates of fertilization. (Capability unit IIIe–2)

Minvale cherty silt loam, 2 to 12 percent slopes (McC).—This soil is more cherty than Minvale silt loam, 2 to 5 percent slopes. The surface layer is friable, brown cherty silt loam that is about 4 to 7 inches thick. The subsoil is cherty, friable, yellowish-red silty clay loam.

This soil is strongly acid and low in natural fertility, but it responds well to fertilization and other good management. Surface runoff is moderate. The chert apparently retards sheet erosion to some extent. The moisture-supplying capacity is moderately high, and seepage from higher slopes helps maintain soil moisture.

Small areas of this soil are widely distributed on the Highland Rim, and the total area is small in Putnam County. Most of the soil has been cleared and is cultivated intensively. It is well suited to general crops and pasture and, under good management, produces moderately high yields. (Capability unit IIIe-2)

Minvale cherty silt loam, 12 to 20 percent slopes, eroded (McD2).—This soil has a thinner surface layer and is much chertier than Minvale silt loam, 2 to 5 percent slopes.

This cherty soil produces fair to poor yields of row crops, but yields of small grains, hay, and pasture are good to very good. The strong slope and chertiness make this soil a little difficult to work. Because its moisture supply is lower than that in other Minvale soils, crops that mature early are best suited. Good yields of small grains, alfalfa, red clover, orchardgrass, tall fescue, and lespedeza can be grown, but the fertilizer requirements are high. The soil responds well enough, however, to justify use of lime, nitrogen, phosphate, and potash at moderately high rates. (Capability unit IVe-2)

Monongahela Series

The Monongahela series consists of moderately well drained soils on old terraces. The most marked characteristic of these soils is a fragipan in the lower subsoil, at an average depth of 26 inches. The surface layer is brown, friable silt loam, and the subsoil is yellowish-brown silt loam or silty clay loam. These soils have formed in old general alluvium that washed from soils underlain by sandstone, shale, and some limestone. The alluvium is 5 to 15 feet thick over limestone residuum.

These soils have formed next to the well-drained Holston and Waynesboro soils, the somewhat poorly drained Tyler soils, and the poorly drained Purdy soils. Monongahela soils are very strongly acid, low in organic matter, and very low in natural fertility.

Only one Monongahela soil has been mapped in Putnam County. It is fairly extensive on the eastern part of the Highland Rim, mainly south of Algood and along the larger streams. A few areas are on the Cumberland Plateau. The native vegetation was mixed hardwoods. Hickory, blackgum, and white, red, and chestnut oaks were common on this soil.

Monongahela silt loam, 2 to 5 percent slopes (MnB).—This moderately well drained soil has a fragipan and is on old stream terraces.

Soil profile:

A_p 0 to 7 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; very friable; very strongly acid.

A_2 7 to 12 inches, pale-brown (10YR 6/3) to light yellowish-brown (10YR 6/4) silt loam; weak, medium, granular structure; friable; very strongly acid.

B_{21} 12 to 17 inches, yellowish-brown (10YR 5/4) to light yellowish-brown (10YR 6/4) silt loam or silty clay loam; weak, fine, subangular blocky structure; friable; very strongly acid.

B_{22} 17 to 26 inches, yellowish-brown (10YR 5/4) to light yellowish-brown (10YR 6/4) silt loam or silty clay loam; moderate, medium, subangular blocky structure; friable; few, fine quartz pebbles; strongly acid.

B_{3m} 26 to 55 inches, yellowish-brown (10YR 5/6) loam; many, coarse mottles of strong brown (7.5YR 5/6) and pale brown (10YR 6/3); massive (structureless); friable to firm; very strongly acid.

C_1 55 to 68 inches, mottled red (2.5YR 4/8), yellowish-brown (10YR 5/6), and light brownish-gray (10YR 6/2) loam; massive (structureless); firm; very strongly acid.

C_2 68 to 95 inches, mottled red (2.5YR 5/8), light-gray (10YR 7/1), and brownish-yellow (10YR 6/6) very fine sandy loam; mottles are many, coarse, and prominent; friable; very strongly acid.

The depth to the fragipan ranges from 18 to 32 inches. The layers of the subsoil vary between silt loam and sandy clay loam in texture.

This soil is very low in natural fertility, low in organic matter, and very strongly acid. Surface runoff is slow to medium. The soil above the fragipan is permeable, but the fragipan layer is slowly permeable and cannot be readily penetrated by plant roots. The soil is easily worked and kept in good tilth. It has a moderately low moisture-supplying capacity.

Most of this soil has been cleared and is in row crops and pasture. The use of this soil, however, is somewhat restricted by the low natural fertility and by the compact subsoil layer, which causes seasonal waterlogging. Most general crops are well suited, but deep-rooted legumes and fruit trees are not. Alfalfa ordinarily lasts only about 2 years, even when it is well fertilized. (Capability unit IIe-3)

Mountview Series

The Mountview series consists of deep to moderately deep, well-drained soils on uplands. These soils formed in thin loess underlain by cherty residuum from limestone or siltstone. They are gently sloping to moderately steep.

Where these soils are not severely eroded, the surface layer is grayish-brown to brown, friable silt loam, and the subsoil is yellowish-brown, friable silty clay loam.

Mountview soils adjoin the Bewleyville, Baxter, Christian, and Dickson soils. They are not so brown as the Bewleyville soils. They do not have the fragipan that is characteristic of the Dickson soils, but they resemble the Dickson soils in color. Mountview soils are similar to Holston silt loam in profile but are underlain by fine-textured residuum instead of old general alluvium.

Mountview soils are very strongly acid and are low in natural fertility. They generally are in good tilth, are easy to work, and respond moderately well to fertilization and other management.

These soils are widely distributed throughout the Highland Rim part of the county. They are in extensive areas and are agriculturally important. Most of these soils have been cleared and are used for general farm crops. The native vegetation was deciduous forest.

Mountview silt loam, 2 to 5 percent slopes (MvB).—This is a well-drained soil on the Highland Rim. It formed in a thin mantle of loess deposited on residuum weathered from cherty limestone.

Soil profile:

A_p 0 to 7 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; friable; very strongly acid.

B_1 7 to 12 inches, yellowish-brown (10YR 5/4) fine silt loam; weak, fine, subangular blocky structure; friable; very strongly acid.

B_2 12 to 26 inches, yellowish-brown (10YR 5/8) silty clay loam; moderate, fine to medium, subangular blocky structure; friable; few, fine fragments of chert; very strongly acid.

B_3 26 to 32 inches, strong-brown (7.5YR 5/6) silty clay loam; common mottles of red (2.5YR 4/8) and yellowish brown (10YR 5/8); moderate, fine, angular blocky structure; firm; few, fine fragments of chert; very strongly acid.

B_{2b} 32 to 42 inches +, red (2.5YR 4/8) silty clay loam or clay; common mottles of yellowish-brown (10YR 5/6) and grayish brown (10YR 5/2); moderate to strong, medium, angular blocky structure; firm; few to common, small fragments of chert; very strongly acid.

This soil varies principally in the B_{2b} horizon. In some places the B_{2b} horizon is silty clay derived from siltstone; in others it is clay loam derived from sandy limestone that has weathered to a soft, fine-grained sandstone. The layer of loess varies between 18 and 34 inches in thickness.

The soil has a moderately high moisture-supplying capacity and is permeable. It is free of stones and generally is in good tilth. Surface runoff is medium to slow. The natural fertility is low, but the soil responds moderately well to fertilization and other good management.

About 90 percent of this soil has been cleared and is in row crops and pasture. It is well suited to all locally grown crops. If well fertilized and otherwise well managed, it produces moderately high yields. (Capability unit IIe–2)

Mountview silt loam, 5 to 12 percent slopes (MvC).—This well-drained soil is on short slopes and rounded ridgetops that adjoin Mountview silt loam, 2 to 5 percent slopes, in slightly dissected parts of the Highland Rim. It is similar to Mountview silt loam, 2 to 5 percent slopes, but formed in a somewhat thinner layer of loess. The thickness of the surface layer and subsoil combined generally is not more than 24 inches.

The soil is low in natural fertility. It generally is in good tilth, is easy to work, and responds moderately well to fertilization and other management.

About 90 percent of this soil has been cleared and is in row crops or pasture. Many kinds of crops can be grown if the soil is well fertilized. Because of the slope, the soil is slightly susceptible to erosion. (Capability unit IIIe–2)

Mountview silt loam, 5 to 12 percent slopes, eroded (MvC2).—This soil has a thinner surface layer than Mountview silt loam, 2 to 5 percent slopes, and is a little shallower to residuum from limestone. This residuum is clayey and is about 2 feet from the surface. The plow layer is yellowish-brown silt loam, 4 to 7 inches thick. The subsoil is yellowish-brown silty clay loam.

Natural fertility is low, but the root zone is fairly thick and friable, and the moisture-supplying capacity is moderate to moderately high. The soil is easy to work and to keep in good tilth.

Yields of crops generally grown are low unless fertilizer is applied at a high rate and other management is good. The supply of available moisture is high enough to justify large additions of fertilizer. (Capability unit IIIe–2)

Mountview silt loam, 5 to 12 percent slopes, severely eroded (MvC3).—This is a deep, well-drained soil that formed in loess underlain by residuum from limestone. The plow layer is yellowish-brown silt loam. This layer is mostly subsoil material because the original surface soil has washed away. The subsoil is yellowish-brown silty clay loam that, on the average, extends 2 feet to residuum of clayey limestone.

This soil is low in natural fertility and is very strongly acid. It contains very little organic matter. Although the plow layer is mostly subsoil material, it is fairly easy to work and generally is in fair tilth. Roots easily penetrate the subsoil to a depth of about 2 feet. The moisture supply is moderately low, but the moisture is sufficient to allow a moderate response to fertilization and other management. This soil produces fair yields of row crops, but it is better suited to small grains, hay, and pasture. Lime and moderately heavy additions of complete fertilizer are required for good yields of crops. (Capability unit IVe–2)

Mountview silt loam, shallow, 2 to 5 percent slopes (MsB).—This soil is shallower than Mountview silt loam, 2 to 5 percent slopes, and contains more chert. The average depth to limestone residuum is 16 inches. Fine, angular fragments of chert are on the surface and throughout the profile.

Soil profile in a forested area:

A_1 0 to ½ inch, very dark brown (10YR 2/2) silt loam; very friable; very strongly acid.

A_2 ½ inch to 6 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; friable; few, fine, angular fragments of chert; very strongly acid.

B_1 6 to 10 inches, light yellowish-brown (10YR 6/4) silt loam; weak to moderate, fine, subangular blocky structure; friable; few, fine, angular fragments of chert; very strongly acid.

B_2 10 to 16 inches, yellowish-brown (10YR 5/8) silty clay loam or fine silt loam; few, fine, faint mottles of light brownish gray (10YR 6/2); moderate, medium, subangular blocky structure; friable; few, fine, angular fragments of chert; very strongly acid.

B_3 16 to 20 inches, yellowish-brown (10YR 5/8) silty clay loam; common mottles of strong brown (7.5YR 5/6) and yellowish red (5YR 4/6); moderate, medium, subangular and angular blocky structure; firm; few, small, angular fragments of chert; very strongly acid.

B_{2b} 20 to 38 inches +, mottled strong-brown, grayish-brown, and yellowish-red cherty silty clay loam or cherty clay; moderate, coarse, angular blocky structure; firm; common, fine and medium, angular fragments of chert; very strongly acid.

The loessal material ranges from 14 to 22 inches in thickness. The substratum (B_{2b} horizon) varies greatly in texture. It is clay loam or sandy clay next to Christian loam, silty clay next to Christian silt loam, and cherty clay or cherty silty clay loam next to Baxter and Bodine soils.

This soil is very strongly acid and is low in natural fertility and in organic matter. Surface runoff and internal drainage are medium. The surface layer and subsoil are moderately permeable, but the substratum is slowly permeable in most areas. The moisture-supplying capacity is moderate. The soil is easy to work, and the risk of erosion is slight to moderate.

Most of this soil is in cutover forest. If cleared, it would be well suited to crops commonly grown in the county. (Capability unit IIe–2)

Mountview silt loam, shallow, 5 to 12 percent slopes (MsC).—The loesslike mantle is thicker in this soil than in Mountview silt loam, shallow, 2 to 5 percent slopes, and the content of chert is greater. Residuum from limestone is at a depth of 12 to 20 inches.

The soil is easily worked. Surface runoff is medium to rapid, and the moisture-supplying capacity is moderately low.

Nearly all of this soil is in cutover forest, mainly oak and hickory. If cleared, it is well suited to most crops commonly grown in the county. It is most productive of small grains, vetch, crimson clover, pasture, and other crops that grow in cool, moist climate. (Capability unit IIIe–2)

Mountview silt loam, shallow, 5 to 12 percent slopes, eroded (MsC2).—The surface layer of this soil is thinner than that of Mountview silt loam, shallow, 2 to 5 percent slopes. Much of the surface soil has been lost through erosion, and the subsoil is exposed in places. The surface layer is yellowish-brown to grayish-brown, friable silt loam, 4 or 5 inches thick. The subsoil is yellowish-brown, friable silty clay loam or fine silt loam. In places small angular fragments of chert are on the surface and in the subsoil.

This soil is suited to pasture and to all of the crops commonly grown in the county. Natural fertility is low, but the soil responds well to good management. The response is great enough to justify moderately heavy fertilization. Unless fertilization is adequate, yields are very low. (Capability unit IIIe–2)

Mountview silt loam, shallow, 5 to 12 percent slopes, severely eroded (MsC3).—The plow layer of this soil is mostly subsoil material. The upper 4 to 6 inches is yellowish-brown silt loam to silty clay loam. It is underlain by yellowish-brown silty clay loam that extends to clayey residuum of limestone, which is 15 to 20 inches from the surface.

This soil is very low in natural fertility. The response to fertilization is fair. Although the surface layer is subsoil material, it is generally in fair tilth and is not difficult to work. The root zone is limited mostly to the upper 15 to 20 inches because most plant roots, especially those of row crops, do not penetrate far into the clayey residuum.

At best, this soil produces only fair yields of row crops. If well fertilized, it produces good yields of small grains, hay, and pasture. (Capability unit IVe–2)

Mountview silt loam, shallow, 12 to 20 percent slopes, eroded (MsD2).—This soil is on the short slopes of low hills. It has thinner layers than Mountview silt loam, shallow, 12 to 20 percent slopes, and contains more chert in places. Included with this soil is a small, uneroded acreage, most of which is in cutover forest consisting of oaks and other hardwoods. Also included is a very small acreage that is severely eroded.

The moisture-supplying capacity is low, and surface runoff is rapid.

Most of this soil has been cleared. It is only fairly well suited to row crops, even under good management. It is best suited to small grains, hay, and pasture, but fertilizer requirements are fairly high. (Capability unit IVe–2)

Muskingum Series

The Muskingum series consists of well-drained to excessively drained soils that are forming in residuum from acid sandstone and shale on the Cumberland Plateau. They generally have a surface layer of brown to grayish-brown, friable sandy loam to silt loam. The subsoil is thin, yellowish-brown, friable clay loam or silty clay loam. These soils are shallow to moderately deep. Sandstone and shale bedrock is 10 to 25 inches from the surface in most places.

The slope of Muskingum soils ranges from 5 to 30 percent or more but averages about 25 percent. These soils are very strongly acid and are low in organic matter and in natural fertility.

Muskingum soils adjoin the Hartsells, Wellston, and Linker soils but are much shallower than those soils.

In Putnam County, Muskingum soils are extensive and are widely distributed in large areas on the Cumberland Plateau. They are better suited to forestry than to agriculture. The native vegetation was mixed pines and hardwoods, but continuous clear-cutting and occasional fires have left these soils with few merchantable trees.

Muskingum silt loam, 5 to 12 percent slopes (MuC).—This shallow soil is forming in residuum from acid shale on the Cumberland Plateau.

Soil profile:

A_1 0 to 1 inch, very dark gray (10YR 3/1) silt loam; weak, fine, granular structure; very friable; very strongly acid.

A_2 1 inch to 6 inches, grayish-brown (10 YR 5/2) to brown (10YR 5/3) silt loam; weak, fine, granular structure; friable; very strongly acid.

BC 6 to 20 inches, yellowish-brown (10YR 5/4) to light yellowish-brown (10YR 6/4) silty clay loam; weak, fine and medium, subangular blocky structure; friable; common fragments of shale; very strongly acid.

C 20 inches +, mottled strong-brown, yellowish-brown, and yellowish-red partly weathered shale.

The fragments of sandstone and shale on the surface and throughout the profile vary in amount, but generally they are not more than 15 percent of the soil mass.

This soil is low in natural fertility and in organic matter. It is very strongly acid throughout the profile. Surface runoff is rapid, internal drainage is moderate, and the moisture-supplying capacity is low. Consequently, the soil is droughty and, when cleared, is susceptible to severe erosion.

This soil is too shallow for most crops. Although it produces small to medium yields of small grains and other close-growing crops, it is better suited to pasture or forestry. (Capability unit VIe–3)

Muskingum silt loam, 12 to 20 percent slopes (MuD).—This soil is shallower than Muskingum silt loam, 5 to 12 percent slopes. The depth to acid shale bedrock ranges from 10 to 20 inches. Fragments of shale are on the surface and throughout the profile.

The soil is fairly extensive in the dissected parts of the Cumberland Plateau. Most of it is in forest of mixed hardwoods and pine. It is poorly suited to row crops and is only fairly well suited to pasture. (Capability unit VIe–3)

Muskingum silt loam, 20 to 30 percent slopes (MuE).—This is a light-colored, excessively drained soil on uplands of the Cumberland Plateau. It is shallow and somewhat shaly. The depth of shaly residuum ranges from 6 to 20 inches. The surface layer is light yellowish-brown, friable silt loam to loam. The subsoil is brownish-yellow to yellowish-brown, friable silty clay loam to clay loam. Shale fragments are scattered on the surface and throughout the profile.

This soil is extensive and is in large areas, particularly on the shaly knobs of the plateau. Nearly all of it is in forest. Because it is steep and shallow, it is poorly suited to crops and pasture and probably should be kept in forest. (Capability unit VIIe–1)

Muskingum sandy loam, 5 to 12 percent slopes (MtC).—This soil is forming mainly in residuum from weathered acid sandstone. It is shallow and excessively drained.

Soil profile on a forested ridgetop:

A_1 0 to 2 inches, grayish-brown (10YR 5/2) sandy loam; weak, fine, granular structure; very friable; stained with organic matter; very strongly acid.

A_2 2 to 8 inches, pale-brown (10YR 6/3) sandy loam; weak, fine and medium, granular structure; loose to very friable; very strongly acid.

BC 8 to 20 inches, light yellowish-brown (10YR 6/4) fine sandy loam or sandy clay loam; weak, medium, subangular blocky structure; very friable; very strongly acid.

D_r 20 inches, sandstone bedrock.

Bedrock generally is less than 2 feet from the surface, and it crops out in many places. In profiles where the A and C horizons are somewhat thicker than those described, a thin B horizon has developed. Occasional small pebbles of quartzite are scattered throughout the soil. Included with this soil are a few severely eroded areas.

This soil is very strongly acid and is low in organic matter and in natural fertility. Surface runoff is rapid, and internal drainage is very rapid. The moisture-supplying capacity is low, and the root zone is too shallow for deep-rooted plants.

Nearly all of this soil is in forest. It is poorly suited to tilled crops and is only fairly well suited to pasture. (Capability unit VIe–3)

Muskingum sandy loam, 12 to 20 percent slopes (MtD).—This soil is shallower than Muskingum sandy loam, 5 to 12 percent slopes. The depth to sandstone bedrock generally is less than 20 inches and averages about 16 inches.

The surface layer is loose, pale-brown to brown sandy loam. The subsoil is yellowish-brown, friable to loose sandy loam. In places sandstone bedrock is exposed. Included with this soil is a small acreage that is severely eroded.

This is the most extensive sandy Muskingum soil in the county. Most of it is in forest that has been cut over several times. Very few merchantable trees are left. The soil is poorly suited to tilled crops and, because of droughtiness, is only fairly well suited to pasture. (Capability unit VIe–3)

Muskingum sandy loam, 20 to 30 percent slopes (MtE).—This excessively drained, sandy soil is forming in residuum from acid sandstone. Most of it is along deep, V-shaped drainageways in the Cumberland Plateau. It is shallower than Muskingum sandy loam, 5 to 12 percent slopes, and has more outcrops of bedrock. In most places it is no more than 14 inches thick.

This soil is mostly in trees, mainly those that can withstand drought. It is unsuited to tilled crops and is poorly suited to pasture. It probably should be kept in forest. (Capability unit VIIe–1)

Muskingum very rocky sandy loam, 12 to 20 percent slopes (MrD).—This moderately steep soil is next to ledges of the Cumberland Plateau escarpment and is in the dissected ravines or gorges of the plateau. More than 15 percent of the soil surface is sandstone bedrock and ledges. The soil profile varies in depth to bedrock as much as 6 to 30 inches within a distance of a few feet.

This soil is very strongly acid and is low in organic matter and in natural fertility. Surface runoff is rapid, and internal drainage is very rapid. The moisture-supplying capacity is very low, and the soil is droughty.

Nearly all of this soil is in forest, mainly oak of poor quality. Most of the smaller woody plants are mountain-laurel.

This soil is best suited to trees, but they grow rather slowly. (Capability unit VIIs–1)

Muskingum very rocky sandy loam, 20 to 30 percent slopes (MrE).—This steep soil has many outcrops of sandstone. The soil between the rocks shows little or no profile development in most places. It is pale-brown, loose sandy loam, generally 6 to 12 inches deep.

The natural fertility and content of organic matter are low; the reaction is very strongly acid. The moisture-supplying capacity is low.

Nearly all of this soil is under native mixed hardwoods and pine. Because it is shallow and steep, it is poorly suited to crops or pasture. Forestry generally is the best use, but the growth of trees is slow. (Capability unit VIIs–1)

Purdy Series

The Purdy series consists of poorly drained, gray soils. These soils are on flats and in depressions on the terraces. They formed in old alluvium that washed chiefly from soils underlain by acid sandstone, shale, and some limestone. The surface layer is commonly dark-gray to grayish-brown, friable silt loam. The subsoil, a silty clay loam or clay loam, is mottled gray and brown but is mostly gray.

Purdy soils adjoin the Holston, Monongahela, Tyler, and Sequatchie soils on terraces and are more poorly drained than those soils. They are similar to Guthrie soils but have formed in alluvium rather than in residuum.

These soils are very strongly acid, low in natural fertility, and low in organic matter. A fluctuating water table is near the surface in winter and spring. Some areas are ponded most of the time.

Only one Purdy soil has been mapped in Putnam County. South of Algood several large areas of this soil extend to the White County line. About half of the total acreage has been cleared for pasture, and half is forested. The trees are mainly willow, oak, sweetgum, red maple, blackgum, and beech. Little of this soil is in row crops.

Purdy silt loam (0 to 2 percent slopes) (Pd).—This gray, poorly drained soil is on stream terraces.

Soil profile:

A_p 0 to 6 inches, dark-gray (10YR 4/1) silt loam; common, medium mottles of light brownish gray (10YR 6/2); weak, fine, granular structure; friable; very strongly acid.

B_{1g} 6 to 9 inches, light brownish-gray (10YR 6/2) silty clay loam; few, fine mottles of yellowish red (5YR 4/8) and yellowish brown (10YR 5/8); weak to moderate, fine, subangular blocky structure; very strongly acid.

B_{2g} 9 to 36 inches, light brownish-gray (10YR 6/2) silty clay loam; many, medium, yellowish-brown (10YR 5/8) mottles; moderate, fine, angular blocky structures; firm and compact; very strongly acid.

The mottled surface layer generally ranges from dark gray to light gray, but it is browner and thicker than normal in places where overwash has accumulated. The compact B_{2g} horizon is a fragipan in some profiles and is weakly developed in others.

Surface runoff is very slow, or is ponded; internal drainage is very slow. Light brownish-gray mottles in the profile indicate that the water table is high much of the time. The surface layer and upper part of the subsoil are permeable, but the firm, compact, lower layer almost stops the movement of water. The moisture-supplying capacity is low, and during dry seasons, the soil is droughty. The soil is easy to work when the moisture content is favorable. Erosion is not a problem.

Most of this soil is wooded or in permanent pasture. A few areas are planted to corn or grain sorghum, but yields are very low and failures are common. This soil is fairly well suited to sorghum, soybeans, and other crops that can be planted late in spring. Pasture generally is of poor quality. Drainage is a problem; suitable outlets are not always available, and tile probably would be ineffective in the compact subsoil (fig. 12). (Capability unit IVw-1)

Rock Land

This land is on escarpments of the Cumberland Plateau and Highland Rim. It consists of ledges of bedrock, other exposed bedrock, soil material in cracks and crevices of the rock, and shallow soils. This land supports sparse stands of trees. Some of the rock is used commercially.

Rock land, limestone (Rk).—This land is on slopes of the Cumberland Plateau and Highland Rim escarpments. It consists mainly of limestone outcrops and very shallow soils. Ledges of clayey and cherty limestone occupy 50 percent of the surface. A thin layer of soil material covers the limestone in places, but generally this material is only in cracks and crevices. It varies in texture but normally is clay or silty clay. Slope ranges from 15 to 45 percent.

In Putnam County on the Cumberland Plateau escarpment, nearly all of this land is in cutover forest (fig. 13). The land cannot produce crops or pasture, but there is enough soil material to support a thin stand of hardwoods, cedar, and pine. Some of the limestone rock is crushed to make gravel, agricultural lime, and other products. (Capability unit VIIs-1)

Figure 12.—**Drainage ditch blasted in Purdy silt loam. Removing excess water reduces the risk of crop failure.**

Figure 13.—**Cedar grove, recently cut over, on Rock land, limestone.**

Rock land, sandstone (Ro).—This land consists almost entirely of sandstone ledges. These ledges are narrow, and the sandstone extends almost vertically downward to form escarpments and benches between the Cumberland Plateau and the lower limestone hills.

This land adjoins the Muskingum soils and Stony colluvial land. It supports hardly any vegetation except mountain-laurel and oak of inferior quality, but a few trees are harvested. It has little agricultural value because more than 50 percent of the surface is bare rock. (Capability unit VIIs-1)

Sango Series

The Sango series consists of moderately well drained soils that have a fragipan. These soils are on broad, nearly level to gently sloping uplands of the Highland Rim. They formed in a thin, nearly chert-free mantle of loess that is underlain by cherty or shaly limestone residuum. Bedrock is 15 to 25 feet or more from the surface.

Sango soils have a surface layer of light yellowish-brown to grayish-brown, friable silt loam. The upper part of the subsoil is faintly mottled, light olive-brown to yellowish-brown, friable silt loam. A fragipan is in the lower part of the subsoil. These soils are very strongly acid and are very low in natural fertility. The slope ranges from 1 to 3 percent.

Sango soils occur with Dickson, Mountview, Lawrence, and Guthrie soils. They generally are between Dickson and Lawrence soils. Sango soils are more poorly drained than the Dickson soils and are shallower to mottling. They are better drained than the Lawrence soils and are not so mottled with grayish brown or gray.

Only one Sango soil has been mapped in Putnam County. It is fairly extensive on the Highland Rim. The native vegetation is mainly hickory, black oak, post oak, sweetgum, and blackgum.

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Sango silt loam (1 to 3 percent slopes) (Sa).—This is a moderately well drained, silty soil on uplands of the Highland Rim.

Soil profile:

A_1 0 to 1 inch, grayish-brown (10YR 5/2) silt loam; weak, fine, granular structure; very friable; very strongly acid.

A_2 1 inch to 8 inches, light yellowish-brown (2.5Y 6/4) silt loam; weak, fine, granular structure; friable; very few, small, dark-brown, round concretions; very strongly acid.

B_1 8 to 14 inches, light yellowish-brown (2.5Y 6/4) to light olive-brown (2.5Y 5/4) fine silt loam; weak, fine, subangular blocky structure; friable; few, small, dark-brown, round concretions; very strongly acid.

B_2 14 to 24 inches, light olive-brown (2.5Y 5/6) to yellowish-brown (10YR 5/6) fine silt loam; few, fine, faint mottles of gray (10YR 6/1) and light yellowish brown (2.5Y 6/4); moderate, fine to medium, subangular blocky structure; friable; few, fine fragments of chert; few, small, brown concretions; very strongly acid.

B_{3m} 24 to 40 inches (fragipan), mottled gray (N 5/0), light brownish-gray (10YR 6/2), pale-yellow (2.5Y 7/4), and strong-brown (7.5YR 5/6) fine silt loam or silty clay loam; moderate, medium, angular blocky structure; firm and compact when moist, brittle when dry; few, brown, round concretions and angular fragments of chert; very strongly acid.

C 40 inches +, mottled light yellowish-brown (2.5Y 6/4), gray (N 5/0), yellowish-brown (10YR 5/6), strong-brown (7.5YR 5/6), and yellowish-red (5YR 5/6) silty clay loam or silty clay; moderate, medium, angular blocky structure; firm; common angular fragments of chert; very strongly acid.

The depth to the fragipan ranges from 18 to 30 inches. In places the fragipan is weakly developed or is absent. The B_2 horizon ranges from pale yellow to light yellowish brown. Some profiles are paler throughout than that described.

Sango silt loam is very strongly acid and is very low in organic matter and in natural fertility. Surface runoff and internal drainage are slow, and the moisture-supplying capacity is moderately low. Permeability is moderate in the upper 18 to 20 inches but is very slow in the fragipan. The soil remains saturated until late in spring and does not dry out soon enough for early planting. In periods of little rainfall, the soil is droughty. It is easy to work and to keep in good tilth.

About half of this soil is in cutover forest. The rest is in corn, soybeans, lespedeza, and pasture. This soil produces moderate yields of most crops, but it requires large additions of fertilizer. Alfalfa and tobacco are not well suited, because the lower subsoil is occasionally waterlogged. (Capability unit IIe-3)

Sequatchie Series

The Sequatchie series consists of deep, well-drained soils on second bottoms and low stream terraces. These soils are nearly level to rolling. They have formed in mixed alluvium washed from soils underlain by limestone, sandstone, and shale.

These soils have a dark-brown, friable loam surface layer. The subsoil is brown to strong-brown, friable clay loam or silty clay loam. Pebbles rounded by water are common below 36 inches. The alluvium is from 5 to 12 feet thick.

The Sequatchie soils adjoin the Holston and Monongahela soils on low stream terraces and the Huntington, Lindside, and Melvin soils on first bottoms. The Sequatchie soils are much browner than the Holston soils.

Sequatchie soils are medium to strongly acid. Because of the high moisture supply and the thick, friable root zone, however, they are among the most productive soils in the county. They are easy to work and generally are in very good tilth.

These soils are mainly in the mountain coves, but some areas are on the low stream terraces. Although inextensive, these soils are agriculturally important because they are suited to a wide variety of crops. The native vegetation was chiefly hardwoods that included hickory, beech, maple, and several kinds of oak.

Sequatchie loam, 2 to 5 percent slopes (SeB).—This nearly level to gently sloping soil is on low stream terraces. It is deep, well drained, and very fertile.

Soil profile:

A_p 0 to 11 inches, dark-brown (10YR 3/3) loam; weak, medium, granular structure; friable; medium acid.

B_1 11 to 18 inches, strong-brown (7.5YR 5/6) silt loam; streaks of dark-brown (7.5YR 4/4) loam in old root channels; weak, fine, subangular blocky structure; friable; medium acid to strongly acid.

B_2 18 to 29 inches, brown (7.5YR 4/4) clay loam; weak to moderate, fine and medium, subangular blocky structure; friable; medium acid to strongly acid.

B_3 29 to 38 inches, brown (7.5YR 4/4) loam or clay loam; weak, medium, subangular blocky structure; friable; few, small, quartzite pebbles; few, fine, rounded, chert pebbles; medium acid to strongly acid.

C 38 to 53 inches +, mottled yellowish-brown and dark-brown loam or sandy loam.

The C horizon is very gravelly in places. Included with this soil are some areas that have a silt loam surface layer and a silty clay loam subsoil.

This soil is naturally fertile and generally is in good tilth. Because it is gently sloping and has slow runoff in most places, the soil is easy to work and to conserve. It is very permeable, is well aerated, and has a high moisture-supplying capacity and a very thick root zone.

All of this soil is planted to crops. It is one of the best soils in the county for row crops, and corn is grown most extensively. Alfalfa, red clover, timothy, and other plants are grown for hay. This soil produces high yields and responds very well to fertilization. (Capability unit I-1)

Sequatchie loam, 5 to 12 percent slopes, eroded (SeC2).—This soil is on short, narrow slopes and escarpments at the edges of low terraces along the major streams, especially in the coves of the Cumberland Plateau. It has a thinner surface layer than has Sequatchie loam, 2 to 5 percent slopes. The surface layer is brown, friable loam, 4 to 8 inches thick. The subsoil generally is brown to strong-brown clay loam. Gravel beds are common at a depth of about 30 inches.

The content of organic matter, the natural fertility, and the moisture-supplying capacity are moderately high. The soil is easy to work and can be tilled within a wide range of moisture content.

The soil is in small and medium-sized areas, nearly all of which are in crops and pasture. It is well suited to most crops commonly grown and responds well to management. (Capability unit IIIe-1)

Stony Colluvial Land

This land is on talus slopes of the Cumberland Plateau escarpment. It is almost entirely in forest.

Stony colluvial land (St).—The talus slopes that make up this land consist of stony and cobbly colluvium. The land extends from immediately below the escarpments of Rock land, sandstone, at an elevation of about 1,900 feet, to the Highland Rim at about 1,000 feet. The many stones and sandstone boulders, some as large as 6 feet in diameter, occupy 15 to 50 percent of the land surface. Much of the colluvium is underlain by limestone bedrock.

This land adjoins Rock land, limestone; Rock land, sandstone; and a few small areas of Talbott soils.

The soil between the stones varies in depth, color, and texture; the average texture is loam. Because the colluvium creeps, a profile has not developed.

Stony colluvial land is in large areas, and most of it is in forest. It is extensive and important to forestry in Putnam County. A few small, scattered, isolated areas have been cleared and are in unimproved pasture or are idle.

This land is best suited to forest. Many kinds of trees grow at rates above average, especially on north- and east-facing slopes. This land is unsuited to crops and is poorly suited to pasture. (Capability unit VIIs–1)

Swaim Series

The Swaim series consists of well-drained, moderately deep, clayey soils on foot slopes and benches. These soils have formed in old local alluvium that washed from Rock land, limestone, and very rocky Talbott soils. The alluvium is from 2 to 4 feet thick.

The surface layer of these soils is brown to dark-brown, friable silt loam to silty clay. The subsoil is yellowish-brown to strong-brown silty clay loam to clay. It ranges from friable in the upper part to plastic in the lower part.

Swaim soils adjoin Jefferson and Allen soils, the very rocky Talbott soils, and Rock land, limestone. They are finer textured, firmer, and browner than the Jefferson soils.

Only one Swaim soil has been mapped in Putnam County. It is in small widely scattered areas, mostly on the benches of the Cumberland Plateau escarpment. Nearly all areas have been cleared of the native mixed hardwoods and are planted to crops. A few small areas have been abandoned and are reverting to forest, mainly oak, hickory, and cedar.

Swaim silt loam, 5 to 12 percent slopes, eroded (SwC2).—This is a fine-textured soil on foot slopes and benches.

Soil profile:

A_p 0 to 6 inches, brown (10YR 5/3) to dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; strongly acid.

B_1 6 to 10 inches, dark-brown (7.5YR 4/4) silty clay loam; weak to moderate, medium, subangular blocky structure; friable; strongly acid.

B_{21} 10 to 18 inches, strong-brown (7.5YR 5/6) silty clay loam; common, medium, faint mottles of yellowish red (5YR 4/6) and black (10YR 2/1); moderate, medium, angular and subangular blocky structure; friable; few, dark-brown, concretions; strongly acid.

B_{22} 18 to 30 inches, yellowish-brown (10YR 5/6) silty clay; many, medium, distinct mottles of reddish brown (5YR 4/4), brown (10YR 5/3), and black (10YR 2/1); moderate to medium, angular blocky structure; firm when moist, plastic when wet; common, round, dark-brown concretions; strongly acid.

C 30 to 60 inches, yellowish-brown (10YR 5/6) clay; common mottles of pale brown (10YR 6/3) and strong brown (7.5YR 5/6); massive (structureless); firm when moist, very plastic when wet; few, dark-brown, round concretions about 5 millimeters in diameter; strongly acid.

In some places the subsoil is firm and compact in the B_{21} horizon.

This soil is strongly acid. It is low in natural fertility, in organic matter, and in moisture-supplying capacity. Surface runoff is medium to rapid. Because the subsoil is firm and fine textured, internal drainage is slow. Permeability is moderate in the surface layer but is moderately slow in the subsoil. The soil can be worked within only a narrow range of moisture content. It puddles if plowed when too wet and clods if plowed when too dry. Good tilth is difficult to maintain.

Most of this soil has been cleared and is in pasture and crops, mainly corn and lespedeza. A small part is in forest.

This soil is fairly well suited to pasture and crops, but surface runoff, especially from mountain slopes, may cause erosion. A low moisture-supplying capacity limits the response to good management. The soil produces good yields of small grains, hay, pasture, and other early maturing crops. Yields of row crops are only fair, even if the soil is well fertilized. (Capability unit IIIe–4)

Talbott Series

The Talbott series consists of well-drained soils that formed on uplands in very clayey residuum from limestone. Uneroded areas of Talbott soils have a surface layer of yellowish-brown to brown silt loam. The subsoil is firm silty clay or clay. It is yellowish red in the upper part and is variegated in the lower part. The depth to bedrock is from 2 to 5 feet, and many rock outcrops occur in most areas. The range in slope is from 5 to 30 percent.

These soils adjoin large areas of Stony colluvial land; Rock land, limestone; and Allen, Hermitage, and Minvale soils. They are similar to Mimosa soils of the Central Basin in texture and consistence, but they are much redder than those soils and are low in phosphorus.

Talbott soils are strongly acid, low in natural fertility, and very low in organic matter. Little of the acreage is suited to crops.

These soils are mostly in small areas on the Cumberland Plateau escarpment. A few small areas are on the Highland Rim. The native vegetation was mainly various kinds of oaks, hickory, maple, and other hardwoods, and there were a few pines and cedars.

Talbott silty clay loam, 5 to 20 percent slopes, eroded (TaD2).—This well-drained, fine-textured soil formed in clayey limestone on uplands.

Soil profile:

A_p 0 to 7 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, medium, subangular blocky structure; friable; strongly acid.

B_2 7 to 18 inches, yellowish-red (5YR 5/8) clay; strong, fine and medium, angular blocky structure; very firm when moist, sticky and very plastic when wet; few, small, round, black concretions; strongly acid.

B_3 18 to 30 inches, mottled yellowish-red (5YR 5/8), strong-brown (7.5YR 5/8), and very pale brown (10YR 7/4) clay; moderate to strong, medium, angular blocky structure; very firm when moist, very sticky and very plastic when wet; strongly acid.

C 30 to 42 inches +, mottled brownish-yellow (10YR 6/6), pale-yellow (2.5Y 7/4), and strong-brown (7.5YR 5/6) clay; firm when moist, very sticky and very plastic when wet; strongly acid.

This soil is eroded to varying degrees. Included with it are many areas that are severely eroded and a few areas that are uneroded. In several places, especially on the strong slopes, the variegated C horizon is at or near the surface. On the upper slopes of the Cumberland escarpment, the soil formed in residuum from reddish shale (Pennington formation).

This soil is strongly acid, low in natural fertility, and very low in organic matter. It is low in moisture-supplying capacity. Surface runoff is rapid to very rapid, and permeability is moderately slow. The very firm clay subsoil retards the penetration of roots. Because of the strong slope, fine texture, and firm consistence, this soil is difficult to till. It clods if plowed when too wet or too dry. The risk of erosion is very high.

Nearly all of this soil has been cleared and planted to crops. Much of it now is idle or is in unimproved pasture, mainly lespedeza and broomsedge mixed with bushy growth. Corn, small grains, and pasture are planted on gentler slopes.

Most of this soil is poorly suited to tilled crops. Permanent pasture grows well if tilth, fertility, and content of organic matter are improved. (Capability unit VIe–2)

Talbott very rocky silty clay loam, 5 to 20 percent slopes (TrD).—This soil is mainly at or near the base of the Cumberland Plateau escarpment. Outcrops of limestone occupy from 15 to 50 percent of the surface, and loose fragments of limestone are on the surface in most places. The soil material ranges from a few inches to 3 feet in thickness.

The spaces between the outcrops are filled with fine-textured soil material that varies greatly in color. It is yellowish red, red, yellowish brown, and, in places, olive and gray. The surface layer is a somewhat firm silty clay loam, and the underlying material is a very firm clay.

Most of this land is in forest consisting of hardwoods and cedar. The forests have been cut over several times, and the trees are now sparse and small.

This very rocky soil is unsuited to tilled crops and is rather poorly suited to pasture, but a few of the less stony areas may provide limited grazing in the spring. (Capability unit VIs–2)

Talbott very rocky silty clay loam, 20 to 30 percent slopes (TrE).—This soil is mainly on the escarpment of the Cumberland Plateau. Steep outcrops of limestone bedrock occupy from 15 to 50 percent of the surface area. In addition, fragments of loose limestone are on the surface in many places.

Yellowish-brown to red clay soil material fills the crevices and cracks between outcrops to a depth ranging from a few inches to 3 feet. This soil material is fine textured and is very sticky and plastic when wet. It has a very low moisture-supplying capacity.

This soil is predominantly in cutover hardwood forest that includes some cedar. It is not suited to crops or pasture. It is better suited to forestry, but access for care and harvesting of the trees is difficult. (Capability unit VIIs–1)

Tyler Series

The soils of the Tyler series are somewhat poorly drained and are in nearly level or depressed areas on old terraces, mainly on the eastern part of the Highland Rim. These soils have formed in old general alluvium that washed from soils derived from sandstone and shale and, to some extent, from limestone. The depth to limestone residuum is 5 to 15 feet.

These soils have a very friable silt loam surface layer that is faintly mottled with dark gray and brown. The subsoil is a friable to firm silty clay loam, mottled with gray and yellow. A firm, compact fragipan is in the lower part of the subsoil.

Tyler soils are next to the poorly drained Purdy soil, the moderately well drained Monongahela soils, and the well drained Waynesboro soils. In profile, the Tyler soils are similar to the Lawrence soil on uplands.

These soils are very strongly acid and are low in organic matter and in natural fertility. Surface runoff is slow, and internal drainage is very slow.

Only one Tyler soil has been mapped in Putnam County. It is in small areas. The native vegetation was scarlet oak, willow oak, sweetgum, red maple, beech, and other water-tolerant trees. Most of this soil is in permanent pasture or is in forest. Corn, hay, and sorghum are grown in a few areas, but yields are low.

Tyler silt loam (0 to 2 percent slopes) (Ty).—This is a somewhat poorly drained soil on nearly level terraces.

Soil profile:

A_p 0 to 5 inches, grayish-brown (10YR 5/2) silt loam; few, fine, faint mottles of dark brown (10YR 4/3); weak, fine, granular structure; very friable; very strongly acid.

B_1 5 to 13 inches, yellowish-brown (10YR 5/6) to brownish-yellow (10YR 6/6) silty clay loam; fine mottles of grayish brown (10YR 5/2); moderate, fine, subangular blocky structure; friable; very strongly acid.

B_2 13 to 30 inches, grayish-brown (10YR 5/2) silty clay loam; common mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8); moderate, medium, subangular and angular blocky structure; friable to firm; very strongly acid.

B_{3m} 30 to 45 inches, grayish-brown (10YR 5/2) silty clay loam or silty clay; common, fine mottles of yellowish brown (10YR 5/8) and light gray (10YR 7/2); firm when dry, plastic when wet; very strongly acid.

The fragipan varies in depth from the surface, in thickness, and in compactness. Overwash has been recently deposited on narrow areas that are between the base of adjacent slopes and large areas of Tyler silt loam. Included with this soil are a few areas that have a loam or fine sandy loam surface soil.

This soil is low in natural fertility and in organic matter and is very strongly acid. It generally is in good tilth and is easy to work when not too wet. The slowly permeable subsoil restricts the movement of water and causes a fluctuating water table. In wet seasons the soil generally is saturated to the surface; it dries out slowly. It is droughty in dry seasons because the subsoil restricts the movement of moisture.

Most of this soil is in pasture, about 10 percent is in crops, and a few areas are in forest. The choice of crops is limited; winter annuals, as well as alfalfa and other deep-rooted crops, are poorly suited. (Capability unit IIIw–2)

Waynesboro Series

The Waynesboro series consists of deep to very deep, well-drained soils on medium and high terraces. These soils have formed in old general alluvium that washed from uplands where the soils were derived from limestone and shale and, to some extent, from sandstone. The alluvium extends to a depth of 4 to 20 feet and overlies residuum from limestone.

Uneroded areas of these soils have a surface layer of dark grayish-brown to brown, friable silt loam. The subsoil is yellowish-red to dark-red, friable silty clay loam or clay loam and is redder in the lower part. A few quartzite pebbles are scattered on the surface and throughout the profile. Slope ranges from 2 to 20 percent but in most places is 2 to 10 percent.

These soils are strongly acid. Their content of organic matter is 1 to 2 percent. The supply of phosphorus is low to very low, but the supply of available potassium is above average.

The Waynesboro soils adjoin Cumberland and Holston soils on the stream terraces and Sequatchie and Hermitage soils on higher slopes. The Waynesboro soils are not so brown in the surface layer as the Cumberland soils and, in places, are sandier. They have a redder subsoil than the Holston soils. They are similar to the Bewleyville soils in profile but formed in alluvium rather than residuum.

The Waynesboro soils are in large areas in the south-central part of the county on the Highland Rim. They are extensive and are important agriculturally.

Waynesboro silt loam, 2 to 5 percent slopes (WaB).—This well-drained soil is on gently sloping parts of stream terraces.

Soil profile:

A_p 0 to 8 inches, brown (10YR 4/3) to dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; strongly acid.

B_1 8 to 13 inches, reddish-brown (5YR 4/4) fine silt loam; moderate, medium, subangular blocky structure; friable; strongly acid.

B_{21} 13 to 21 inches, yellowish-red (5YR 4/8) silty clay loam or clay loam; weak, medium, subangular blocky structure; friable; few 3- to 10-millimeter quartz pebbles; strongly acid.

B_{22} 21 to 27 inches, dark reddish-brown (2.5YR 3/4) to dark-red (2.5YR 3/6) silty clay loam or clay loam; moderate, fine, subangular blocky structure; friable; few 3- to 10-millimeter quartz pebbles; strongly acid.

B_{23} 27 to 37 inches, dark-red (10R 3/6) clay or silty clay; strong, fine, angular blocky structure; friable to firm; few 3- to 10-millimeter quartz pebbles.

C 37 to 50 inches +, dark-red (10R 3/6) clay or silty clay mottled with yellowish red and strong brown; strong, fine and medium, angular blocky structure; common quartz pebbles 3 to 10 millimeters in size.

In some areas the color of the surface soil is dark brown. The lower part of the subsoil ranges from yellowish red to dark red. Included with this soil, especially in the valley of the Calfkiller River, are areas that have a loam surface layer.

This soil is strongly acid, moderate in natural fertility, and moderate in organic matter. Permeability is moderately rapid in the surface layer and moderate in the subsoil. The water-supplying capacity is moderately high. The surface layer generally is in good tilth and can be cultivated within a fairly wide range of moisture content. A few pebbles are scattered over the surface and throughout the profile.

Nearly all of this soil has been cleared and is now in crops and pasture. The main crops are corn, small grains, common lespedeza, alfalfa, red clover, and tobacco.

Although erosion is a hazard, it is easy to control because the soil is gently sloping and absorbs rainfall rapidly. This soil is suited to all common crops and responds well to additions of lime, nitrogen, phosphate, and potash. (Capability unit IIe–1)

Waynesboro silt loam, 5 to 12 percent slopes (WaC).—This soil has a thinner surface layer than has Waynesboro silt loam, 2 to 5 percent slopes. The surface layer is 4 to 6 inches thick. Runoff is medium to slow.

Nearly all areas of this soil are in forest of mixed hardwoods. If the soil were cleared, it would be suited to crops generally grown in the county. (Capability unit IIIe–1)

Waynesboro silt loam, 5 to 12 percent slopes, eroded (WaC2).—This is the most extensive soil in the Waynesboro series. It has slightly thinner layers than Waynesboro silt loam, 2 to 5 percent slopes. In most places the surface layer is yellowish-brown to strong-brown, friable silt loam; it is a mixture of the original surface soil and the upper part of the subsoil. The residuum from limestone is at a depth of 3 to 10 feet.

Nearly all of the acreage has been cultivated, and much of it is planted to corn, small grains, lespedeza, alfalfa, tobacco, and other crops. This soil is well suited to crops commonly grown in the county if the cropping systems are fairly long. (Capability unit IIIe–1)

Waynesboro silt loam, 12 to 20 percent slopes, eroded (WaD2).—This steep soil has formed in old general alluvium. This alluvium varies more in depth than that of Waynesboro silt loam, 2 to 5 percent slopes, but is generally shallower. Except in forests, part of the original surface soil has been removed by erosion and the present surface layer is a yellowish-brown to strong-brown, friable silt loam. The subsoil is yellowish-red to red, friable to firm silty clay loam. The depth of the alluvial material varies between 2 and 10 feet or more. Included with this soil is a very small acreage on slopes of more than 20 percent. About 15 percent of the mapping unit is still in forest and is not eroded.

This soil is fairly difficult to cultivate and conserve because it is strongly sloping and susceptible to erosion. It has rapid surface runoff, moderate natural fertility, and good moisture-supplying capacity.

Most of this soil is in crops and pasture; some is idle. If well fertilized, this soil produces good yields of all crops, but it is not suited to frequent cultivation. (Capability unit IVe–1)

Waynesboro silty clay loam, 5 to 12 percent slopes, severely eroded (WbC3).—This soil has faster surface runoff than Waynesboro silt loam, 2 to 5 percent slopes. The degree of erosion varies within short distances. In most places the plow layer is friable, strong-brown to yellowish-red silty clay loam or clay loam. The subsoil is yellowish-red to dark-red, friable to firm silty clay loam or silty clay. In several areas shallow gullies have formed; a few gullies are too deep to cross with farm machinery.

The soil is strongly acid, low in organic matter, and moderately low in natural fertility. It responds to fertilizer.

All of this soil has been cleared and used for tilled crops or pasture. Some of the acreage is idle. The soil is only fairly well suited to row crops, but it is fair to good for small grains and early maturing hay and pasture. Under a high level of management, good pasture can be established and maintained. (Capability unit IVe-1)

Waynesboro silty clay loam, 12 to 20 percent slopes, severely eroded (WbD3).—The plow layer of this soil is friable to firm, strong-brown to yellowish-red silty clay loam or clay loam. Most of the original surface soil has been lost through erosion and, in places, part of the subsoil. The subsoil is yellowish-red to dark-red, firm silty clay loam or silty clay. In several areas shallow gullies have formed; some gullies are too deep to cross with farm machinery. Some areas between gullies still retain a part of the original surface soil, but it has been mixed with the subsoil by plowing.

The soil is strongly acid and low in organic matter. Surface runoff is rapid, and the moisture-supplying capacity is low. Good tilth is hard to maintain.

This soil is in small areas and is not extensive in Putnam County. Nearly all of the acreage has been cleared and is in unimproved pasture or is idle. A small acreage is in crops, but yields are low. The soil is better suited to permanent pasture. To establish and maintain good pasture, add adequate amounts of lime and fertilizer. (Capability unit VIe-1)

Wellston Series

The Wellston series consists of moderately deep, well-drained soils on broad upland ridges of the Cumberland Plateau. These soils have formed mostly in residuum from acid shale. The surface layer, in uneroded areas, is yellowish-brown, friable silt loam. The subsoil is yellowish-brown, friable to firm silty clay loam that grades to a finer texture with increasing depth. Weathered shale is at a depth of 2 to 4 feet. The slope ranges from 2 to 12 percent.

These soils are on broad ridges at elevations varying between 1,800 and 2,000 feet. They adjoin the Hartsells, Jefferson, and Muskingum soils. Wellston soils are finer textured than the Hartsells soils and have formed from shale rather than sandstone. They developed from the same kind of parent material as the Muskingum soils, but the Wellston soils are on gentler slopes, are deeper to bedrock, and have a well-developed subsoil. They are very strongly acid and are low in organic matter and in natural fertility.

Wellston soils are of limited extent in Putnam County. The native vegetation was post oak, southern red oak, scarlet oak, hickory, shortleaf pine, and Virginia pine. These soils are largely in forest. They are suited to crops because of their depth, good drainage, and desirable texture and structure.

Wellston silt loam, 2 to 5 percent slopes (WeB).—This well-drained, yellowish-brown, silty soil is on uplands and is underlain by shale.

Soil profile in a forested area:

A_1 0 to 2 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; very strongly acid.

A_2 2 to 7 inches, yellowish-brown (10YR 5/6 to 5/4) silt loam; moderate, medium, granular structure; very friable; very strongly acid.

B_1 7 to 12 inches, yellowish-brown (10YR 5/6) fine silt loam; weak, fine, subangular blocky structure; friable; very strongly acid.

B_{21} 12 to 18 inches, yellowish-brown (10YR 5/6) silty clay loam; weak, medium and fine, subangular blocky structure; friable; very strongly acid.

B_{22} 18 to 25 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium mottles of yellowish red (5YR 5/6); moderate, medium, subangular blocky structure; firm; very strongly acid.

B_3 25 to 29 inches, yellowish-brown (10YR 5/6) silty clay loam or silty clay; common, medium mottles of strong brown (7.5YR 5/6) and yellowish red (5YR 5/6); strong, fine, angular blocky structure; very strongly acid.

C_1 29 to 39 inches, yellowish-brown (10YR 5/6) silty clay; common, medium mottles of light yellowish brown (10YR 6/4) and yellowish red (5YR 5/6); moderate, medium, angular blocky and coarse, thick, platy structure; firm; few fragments of shale; very strongly acid.

C_2 39 to 45 inches, light-gray (2.5Y 7/2) shaly silty clay; many, coarse mottles of yellow (10YR 7/6) and red (2.5YR 4/8); moderate, coarse, thick, platy structure that breaks to moderate, medium, angular blocky; common fragments of shale.

D_r 45 inches +, level-bedded acid shale.

In some places the subsoil is silty clay. It ranges from 10 to 30 inches in thickness, and in some areas it is strong brown. Most cultivated fields are slightly eroded.

Wellston silt loam, 2 to 5 percent slopes, has good moisture-supplying capacity, medium internal drainage, and medium surface runoff. It is free of stones except for a few fragments of shale scattered on the surface and throughout the profile. It is low in fertility and is very strongly acid, but it responds well to fertilization and other good management. Areas that have a thin subsoil are droughty.

This soil is largely in forest of cutover oak and hickory. If it were cleared, it would be suited to most of the crops grown locally. (Capability unit IIe-2)

Wellston silt loam, 5 to 12 percent slopes (WeC).—This soil has a thinner surface layer and subsoil than Wellston silt loam, 2 to 5 percent slopes, and is less uniform in depth. It is 20 to 26 inches deep to the shaly, silty clay residuum.

This soil is moderate in moisture-supplying capacity. It is very strongly acid and low in fertility, but it responds well to fertilization. It is easy to work and to keep in good tilth.

Most of the acreage is cutover woodland. This soil is fairly well suited to all common crops but requires large amounts of fertilizer to produce good yields. (Capability unit IIIe-2)

Wellston silt loam, 5 to 12 percent slopes, eroded (WeC2).—This soil has thinner layers than Wellston silt loam, 2 to 5 percent slopes, and is shallower to bedrock. It is on ridgetops and long slopes. The plow layer is 3 to 5 inches thick and consists of yellowish-brown silt loam. The subsoil is about the same color as the plow layer but contains a little more clay. A few fragments of shale are on the surface and in the profile. The depth to shale bedrock is about 24 inches.

This soil is very strongly acid and low in fertility. It has moderate moisture-supplying capacity and is permeable. It generally is in good tilth and is easy to work.

This soil is susceptible to erosion and is not so well suited to intensive use as Wellston silt loam, 2 to 5 percent slopes. If adequately limed and fertilized, it produces fair yields of most of the commonly grown crops. (Capability unit IIIe-2)

Use and Management of Soils

This section discusses the use and management of soils in Putnam County for crops and pasture, as woodland, in engineering work, and for wildlife food and cover.

Crops and Pasture

In this subsection are a discussion on maintenance of lime and plant nutrients, an explanation of capability grouping, a description of each capability unit in Putnam County, and a table providing estimated yields at two levels of management.

Maintaining lime and plant nutrients

Plants need many nutrients, but probably the most important are nitrogen, phosphorus, and potassium. Lime also is needed to neutralize a soil that is too acid for selected crops. This subsection discusses general practices of applying lime, nitrogen, potash, and phosphate. Soil tests should be made to determine the actual rates of liming and fertilizing for specified crops.

Lime: Although plants vary widely in their tolerance for acidity, a pH range of 6.0 to 6.5 is suitable for most crops grown in Putnam County. The amount of lime needed to reduce acidity to that pH range depends on the natural acidity of the soil, the soil texture, past liming, and the type, purity, and fineness of the liming material to be used. Consequently, exact amounts of lime that will neutralize a specified soil under all conditions cannot be recommended. Soil tests for lime requirements are accurate and inexpensive and should be made to find out how much lime a soil needs initially.

After the initial application of lime brings the reaction within the pH range of 6.0 to 6.5, about one-fourth of a ton of lime per acre each year will maintain most soils of the county at a pH within that range. The lime may be applied at a rate of 1 ton per acre every 4 years or of 1½ tons per acre every 6 years.

It is not efficient to apply more than 4 tons of lime per acre in any one year or to spread more than 2 tons on the surface. If a soil needs more than 2 tons of lime per acre, apply the amount needed by one of the following methods, which are listed in order of preference: (1) Plow part of the lime down and then spread 1 to 2 tons on the surface after plowing; (2) apply 2 tons to the surface of plowed land, harrow or disc it into the top 3 inches of the soil, and then spread the rest on the surface; (3) apply as much as 4 tons per acre and plow all of it down.

More important than the time of year that the lime is applied are the moisture content of the soil, the cropping system planned, and other factors. During the extent of the cropping system, lime generally is applied only once, and then at the time when it will benefit the crop that most needs lime. If a legume is in the crop sequence, lime should be applied at least 2 to 4 months before the legume is seeded. Legumes need lime more than most other crops, and in 2 to 4 months the lime will have had time to reduce the acidity of the soil.

The preferred method of liming is to spread the lime on plowed land and, when the seedbed is prepared, to mix the lime with the soil. The lime then has maximum contact with the soil particles and more quickly corrects the acid condition. Except on permanent pasture and meadow, topdressing with lime is seldom recommended. If a soil is topdressed with lime, apply the lime late in fall or in winter so that the lime will be distributed better through the soil when it freezes and thaws.

Nitrogen: The nitrogen required by plants depends on the kind of plant, the season, past management, and past cropping. Because the organic matter in a soil holds almost all of the nitrogen that is available to plants, the content of organic matter indicates how much available nitrogen the soil contains.

In Putnam County most crops need commercial nitrogen to help start their initial growth because the soils stay cold until about the middle of May. In the spring even the well-drained soils do not release enough nitrogen for winter wheat and some other crops. Nitrogen applied at planting will increase the growth of corn on almost all soils in Putnam County. Nitrogen fertilizer is especially needed to get a crop started on poorly drained soils because they stay cold and wet much longer in spring than well-drained soils.

Management that keeps organic matter at a high level is important to the supply of nitrogen in the soil. Organic matter can be kept high by turning under crop residue or green manure, or by adding barnyard manure.

If corn, or another nonlegume, follows a legume in a cropping system, the corn will need smaller additions of nitrogen than it would if it followed a nonlegume. Inoculated legumes may not need any commercial nitrogen.

Some soils hold nitrogen better than others, but almost all of the nitrogen fertilizer applied is either rapidly taken up by plants or is soon washed or leached away. Consequently, enough nitrogen must be supplied each year to meet the needs of the crop grown.

Phosphorus: Except for the Armour, Mimosa, and Dellrose soils, and the phosphatic phases of Huntington soils, the soils of Putnam County generally are very low to low in phosphorus and need additions of phosphate.

Potassium: The soils of Putnam County are generally low in potassium and require additions of potash. The potash should be applied in small or moderate amounts. If large additions are applied at long intervals, much potassium may be leached or plants may take in more than they need. Rainwater during a warm winter may leach away much potassium, but a cover crop reduces this loss. On the other hand, the continued removal of hay, especially legumes, severely depletes the soil of potassium, which ought to be replaced by adding potash. If acid soils that are to be seeded to legumes are limed, more potassium is needed by the legumes because the lime makes them grow better. The increased growth, however, reduces the leaching of the potassium.

By not removing the residue of small grains and corn, about three-fourths of the potassium in the crop is returned to the soil. A much greater proportion of potassium is lost, however, in the harvested parts of tobacco and vegetables. Much of the potassium in the leaves of deciduous trees returns to the soil in available form.

The amount of available potassium in the soils on a farm can be determined best from soil tests.

Capability grouping of soils

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

In this system soils are grouped at three levels, the capability class, subclass, and unit. Eight capability classes are in the broadest grouping and are designated by Roman numerals I through VIII. In class I are the soils that have fewest limitations, the widest range of use, and the least risk of damage when they are cultivated. 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 three 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 the risk of erosion; "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 shallow, droughty, or stony; and "c," which is not used in Putnam County, indicates that the chief limitation is climate that is too cold or too dry.

In class I there is no subclass, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses w, s, and c, because the soils in it have little or no susceptibility to 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-2.

Soils are classified in capability classes, subclasses, and units according to the degree and kind of their permanent limitations. Not considered in this classification are major projects of landforming or reclamation that would change the slopes, depth, or other characteristics of the soil.

The eight classes in the capability system, and the subclasses and units in Putnam County, are described in the following list:

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

Capability unit I-1.—Deep, well drained to moderately well drained soils on nearly level to gently sloping flood plains 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.—Deep, well-drained, gently sloping soils on stream terraces and old colluvial slopes; moderate to high natural fertility.

Capability unit IIe-2.—Moderately deep to deep, gently sloping soils on uplands and old colluvial slopes; low natural fertility.

Capability unit IIe-3.—Moderately well drained, gently sloping soils that have a compact fragipan layer.

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, well-drained, moderately sloping soils; moderate to high in natural fertility.

Capability unit IIIe-2.—Moderately deep to deep, well-drained, moderately sloping soils that have a friable surface layer and subsoil; low natural fertility.

Capability unit IIIe-3.—Moderately well drained, moderately sloping soils that have a compact fragipan layer.

Capability unit IIIe-4.—Well-drained, gently sloping to moderately sloping soils that have a slowly permeable subsoil.

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

Capability unit IIIs-1.—Very sandy soils on level to gently sloping bottom land.

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

Capability unit IIIw-1.—Poorly drained soils on first bottoms.

Capability unit IIIw-2.—Somewhat poorly drained soils that have a fragipan.

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-1.—Deep or very deep soils that are well drained and are sloping to moderately steep.

Capability unit IVe-2.—Deep, moderately sloping to steep soils that are mostly friable in the subsoil.

Capability unit IVe-3.—Moderately deep to shallow soils that are sloping to moderately steep and have a fine-textured, mostly firm subsoil.

Capability unit IVe-4.—Deep, well-drained old colluvial soils that are cherty and friable.

Subclass IVs. Soils that have severe limitations of stoniness, low moisture-supplying capacity, or other soil features.

Capability unit IVs-1.—Deep, well-drained, cherty and cobbly soils on moderate to strong slopes.

Subclass IVw. Soils that have very severe limitations for cultivation because of excess water.

Capability unit IVw-1.—Poorly drained soils on uplands and stream terraces.

Class V. Soils not likely to erode that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover.

(Class V soils are not present in Putnam County.)

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

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

Capability unit VIe-1.—Moderately steep to steep soils that are free of stones, mostly friable to firm, and severely eroded.

Capability unit VIe-2.—Moderately sloping to steep soils that have a clayey subsoil.

Capability unit VIe-3.—Shallow, well-drained to excessively drained soils on uplands formed from sandstone and shale.

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

Capability unit VIs-1.—Sloping to moderately steep, well-drained, cherty and cobbly soils.

Capability unit VIs-2.—Very rocky, shallow to deep soils that have many outcrops of limestone bedrock.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation, and that restrict their use largely to grazing, woodland, or wildlife food and cover.

Subclass VIIe. Soils and land types that are very severely limited, mainly by risk of erosion, if protective cover is not maintained.

Capability unit VIIe-1.—Shallow or severely eroded, steep, cherty soils and areas of land that are gullied.

Subclass VIIs. Soils very severely limited by moisture-supplying capacity, stoniness, or other soil features.

Capability unit VIIs-1.—Very cherty, rocky, or stony soils and land types on steep slopes.

Class VIII. Soils and landforms that have limitations that preclude their use, without major reclamation, for commercial production of plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes.

(Class VIII soils and landforms are not present in Putnam County.)

Capability units

This subsection describes the soils of each of the capability units, lists the soils in the units, and tells of their use and suitability for crops, pasture, and forest. Cropping systems and management practices are suggested.

Statements suggesting specific amounts of fertilizer, varieties of crops, and seeding mixtures for pastures are not given, because recommendations for them change as new discoveries are made and as prices vary. Up-to-date recommendations are published from time to time by the Tennessee Agricultural Experiment Station and the Agricultural Extension Service. This subsection will help you select good uses and practices for each kind of soil. You can obtain technical assistance from the local Extension Service and the Soil Conservation Service in planning the management of your farm.

CAPABILITY UNIT I-1

This capability unit consists of deep, well drained to moderately well drained soils that are nearly level to gently sloping. These soils are on first bottoms, on low terraces, along intermittent drainageways, and at the bottom of foot slopes. Some of the bottom land is likely to be flooded for short periods, probably no longer than a day. The surface layer of most of these soils is friable to very friable silt loam. The subsoil is friable silt loam, silty clay loam, or clay loam. These soils are:

Ennis silt loam, local alluvium.
Huntington silt loam.
Huntington silt loam, phosphatic.
Huntington silt loam, local alluvium.
Huntington cherty silt loam.
Huntington cherty silt loam, phosphatic.
Huntington fine sandy loam.
Lindside silt loam.
Sequatchie loam, 2 to 5 percent slopes.

These soils produce high yields of pasture and tilled crops. They are moderate to high in natural fertility and can supply much moisture to plants. They are slightly acid to medium acid. Tilth is generally good, and the soils can be tilled within a wide range of moisture content. The cherty soils contain enough chert and gravel to interfere with cultivation and are not so productive as the other soils.

The soils of this unit occupy about 4.4 percent of the county. Practically all of the acreage is cultivated, much of it to corn and hay. The corn is grown for grain or silage every year in many areas. Tobacco is important, but it is grown in a smaller acreage than other crops.

These soils can be used intensively. Because crop yields are high, the soils generally are not used for pasture, although their high moisture-supplying capacity makes them especially valuable for supplemental summer pasture. All of the common crops can be grown, although there is some risk in planting tobacco in areas that are flooded occasionally. All of these soils except Lindside silt loam are suited to alfalfa. The alfalfa, however, ordinarily does not live so long on these soils as it does on the red soils of the uplands.

Row crops can be grown continuously, but it may be desirable on some farms to follow a system that alternates row crops with a green-manure crop. If crop residues are left on the ground and green-manure crops are turned under, organic matter will be added to the soil and good tilth maintained.

Some varieties of small grain often lodge on these soils, and some varieties mature later than they do on uplands. These soils are suited to a cropping system of corn followed by a legume such as red clover or lespedeza, or to a system consisting of small grain followed by soybeans.

Even without fertilizer these soils produce high yields, but fertilizer is needed to maintain high yields under intensive use. The response to fertilization is excellent, but weeds are difficult to control if the fertilizer added is high in nitrogen. The phosphatic Huntington soils do not respond to applied phosphate, but they generally respond to nitrogen and potash. Nitrogen fertilizer is needed for continuous cropping.

Special management generally is not needed to maintain good tilth or to control water. These soils ordinarily do not erode, except in a few places where streambanks are scoured and in the more sloping parts of the Sequatchie soil. In some places diversion ditches are needed for protection against surface runoff and against overwash from adjacent soils upslope.

CAPABILITY UNIT IIe-1

This capability unit consists of deep, well-drained, gently sloping soils on stream terraces and old colluvial slopes. These soils are permeable and friable. The surface layer is 4 to 8 inches thick. The subsoil is friable silty clay loam. The soils are:

Armour silt loam, 2 to 5 percent slopes.
Cumberland silt loam, 2 to 5 percent slopes.
Hermitage silt loam, 2 to 5 percent slopes.
Waynesboro silt loam, 2 to 5 percent slopes.

These soils are moderate to high in natural fertility and are medium acid to strongly acid. Their capacity to supply moisture to plants is high to moderately high. They are easy to work and to keep in good tilth. The Armour and Hermitage soils are generally lower than the surrounding soils and receive runoff that increases or maintains the moisture content. The control of runoff and erosion is only a slight to moderate problem.

The area of these soils amounts to about 1.3 percent of the county. The soils are used for all the common crops and for pasture. Corn, small grains, and hay are most extensive. Little acreage is in forest.

These soils are suitable for moderately intensive use. They are especially well suited to tobacco. Oats, wheat, barley, and other small grains as well as corn, soybeans, and other row crops, grow well under good management. These soils produce good yields of alfalfa, ladino clover, crimson clover, vetch, orchardgrass, and tall fescue (fig. 14). They are well suited to supplemental summer pasture but are not so well suited as the soils in capability unit I-1.

Figure 14.—Alfalfa on Waynesboro silt loam, 2 to 5 percent slopes.

Under good management, a suitable cropping system is 2 years of corn followed by 2 years of grasses and legumes. Also suitable is corn followed by a small grain that is overseeded with red clover or lespedeza. In selecting the crops and planning the crop sequence, keep in mind that these soils are very well suited to alfalfa, red clover, and other exacting, deep-rooted legumes. A crop sequence well suited to dairy farming is corn followed by a small grain, periods tillage is often delayed in the less sloping areas of alfalfa.

Except for the Armour soil, these soils are generally slightly to moderately deficient in lime, phosphorus, nitrogen, and possibly potassium. Because their physical properties are favorable and their moisture-supplying capacity is high, these soils respond well enough to justify a high rate of fertilization. Nitrogen fertilizer is required for high yields of nearly all crops except legumes, but the crops immediately following legumes need less nitrogen.

If these soils are well managed, controlling water is not difficult and the risk of erosion is slight. Cultivating on the contour and sodding natural waterways help to control erosion and to increase the amount of water that enters the soil.

CAPABILITY UNIT IIe-2

This capability unit consists of gently sloping well-drained soils on uplands and old colluvial slopes. These soils generally have a friable surface layer, about 4 to 8 inches thick. The subsoil is friable, yellowish-red to yellowish-brown silty clay loam or clay loam. The depth to bedrock is moderately deep to deep. The soils are:

Allen loam, 2 to 5 percent slopes.
Bewleyville silt loam, 2 to 5 percent slopes.
Christian loam, 2 to 5 percent slopes.
Hartsells loam, 2 to 5 percent slopes.
Holston loam, 2 to 5 percent slopes.
Holston silt loam, 2 to 5 percent slopes.
Jefferson loam, 2 to 5 percent slopes.
Minvale silt loam, 2 to 5 percent slopes.
Mountview silt loam, 2 to 5 percent slopes.
Mountview silt loam, shallow, 2 to 5 percent slopes.
Wellston silt loam, 2 to 5 percent slopes.

These soils are low in natural fertility and are strongly acid to very strongly acid. They are permeable to moisture and plant roots and are moderately high to high in moisture-supplying capacity. They are easy to work, easy to keep in good tilth, and can be worked within a wide range of moisture content.

The soils of this unit occupy about 10.2 percent of the county. Much of their total acreage is in forest, and nearly all of the Hartsells soil is in forest. The cleared areas are used for a wide variety of crops and pasture plants, and the yields are good to very good. Most commonly grown are corn, tobacco, small grains, soybeans, alfalfa, and red clover.

If these soils are managed well, they are suited to a cropping system that provides 2 years of corn followed by 2 years of grasses and legumes. A less intensive system consists of corn followed by a small grain overseeded with red clover or another legume that is allowed to grow for 2 years. In a shorter cropping system, annual lespedeza may be substituted for red clover. Any other row crop commonly grown can be substituted for corn in these cropping systems. A longer cropping system consists of a row crop followed by pasture or alfalfa that is allowed to grow for several years.

These soils are very low in lime, phosphorus, potassium, and nitrogen. They require larger quantities of amendments than do the soils in capability unit IIe-1. Alfalfa, especially, requires lime and heavy fertilization if good stands are to be maintained. Inoculated legumes generally supply the succeeding crop with enough nitrogen for moderate yields, but corn, tobacco, and other crops need additional nitrogen. Nitrogen fertilizer can be applied as a topdressing to small grains and as a sidedressing to corn. Manure is a good source of nitrogen, potassium, and organic matter, but it should be supplemented with phosphate fertilizer to obtain a balance of plant nutrients.

Although these soils are well suited to pasture, lime and a complete fertilizer are needed to establish the pasture, and potash and phosphate may be needed to maintain it. Orchardgrass or tall fescue mixed with ladino clover or white clover provides good yields.

Even though these soils are slightly susceptible to erosion, the problem is not serious if the soils are managed well. All cultivation should be on the contour (fig. 15). Terracing may be desirable in places.

CAPABILITY UNIT IIe-3

In this capability unit are moderately well drained, gently sloping soils that have a fragipan at a depth of 22 to 30 inches. The fragipan, or compact layer, restricts the movement of water and air and the growth of plant roots. These soils have a friable silt loam surface layer. Their subsoil is yellowish-brown or light yellowish-brown silt loam or silty clay loam. It is underlain by a mottled compact layer. The soils are:

Dickson silt loam.
Landisburg silt loam, 2 to 5 percent slopes.
Monongahela silt loam, 2 to 5 percent slopes.
Sango silt loam.

These soils are very low in natural fertility. They are strongly acid to very strongly acid and are low in organic matter. Their moisture-supplying capacity ranges from moderately low to moderately high, depending on the depth to the fragipan. Tilth generally is good, and the soils can be worked within a fairly wide range of moisture content. Because these soils warm up slowly in spring, seedbed preparation and planting are sometimes delayed. Corn is often planted on these soils 2 weeks later than on the better drained, red soils on uplands. The soils of this unit are permeable in the upper 1½ to 2 feet, but below this depth they are slowly permeable. Because the fragipan restricts the movement of moisture, the soils are very dry during extended periods of dry weather. In very wet periods tillage is often delayed in the less sloping areas of Sango silt loam by excess surface water.

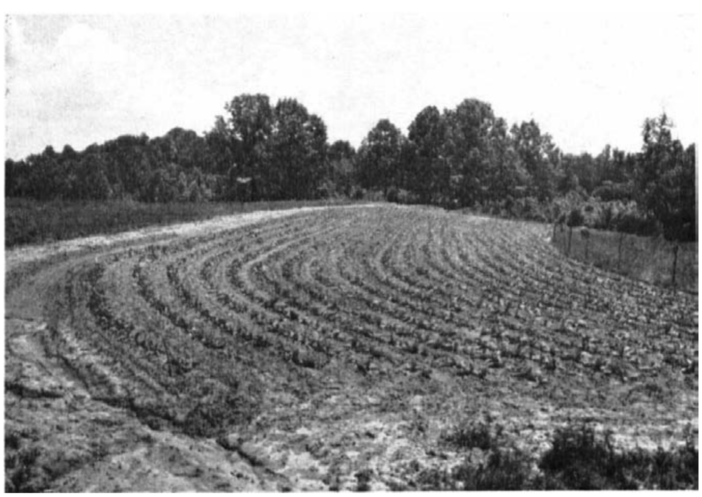

Figure 15.—**Tobacco cultivated on the contour on Mountview silt loam, 2 to 5 percent slopes.**

These soils occupy about 4.3 percent of the county. They are mainly in tilled crops, hay, and pasture. A small acreage is in forest. The main crops are tobacco, corn, small grains, soybeans, grain sorghum, lespedeza, crimson clover, vetch, orchardgrass, fescue, and white clover. Tobacco is the main cash crop.

These soils are suitable for fairly intensive use. They produce fair to good yields of all the common crops except alfalfa, which does not last long because drainage is restricted. Heavily fertilized alfalfa may grow well for about 2 years. Part of the tobacco crop may be lost in wet years.

If a row crop is grown, it is best to plant the crop only once in 3 or 4 years, but it can be planted once in 2 years. A suitable cropping system is corn or another row crop followed by 2 years of a fall-seeded small grain that is overseeded each spring with annual lespedeza. Some farmers prefer a longer cropping system that consists of a row crop followed by pasture for 3 to 5 years. A suitable short cropping system consists of a fall-seeded small grain, overseeded in spring with annual lespedeza, which is followed by another crop of small grain in fall.

The soils of this unit need nitrogen, phosphate, potash, and lime. Lime generally should be applied every 4 to 6 years at the rate and frequency indicated by soil tests. As these soils are naturally low in fertility, a balanced fertilizing program is essential for good yields. These soils generally respond moderately well to fertilization and in the best seasons respond very well. If fertilization is not adequate, yields are very low.

These soils should be tilled on the contour and protected by diversion ditches against runoff from adjoining upland slopes.

CAPABILITY UNIT IIIe-1

The soils in this capability unit are deep, well drained, and productive. Except for the Cookeville soil, which formed in limestone residuum, these soils are on stream terraces or foot slopes. The surface layer is mostly brown to reddish-brown, friable loam, silt loam, or cherty silt loam and is about 4 to 8 inches thick. The subsoil is friable clay loam, silty clay loam, or clay. The soils are:

Armour silt loam, 5 to 12 percent slopes, eroded.
Cookeville silt loam, 5 to 12 percent slopes, eroded.
Cumberland silt loam, 5 to 12 percent slopes, eroded.
Hermitage silt loam, 5 to 12 percent slopes.
Hermitage cherty silt loam, 5 to 12 percent slopes.
Sequatchie loam, 5 to 12 percent slopes, eroded.
Waynesboro silt loam, 5 to 12 percent slopes.
Waynesboro silt loam, 5 to 12 percent slopes, eroded.

These soils are medium acid to strongly acid. Their natural fertility is moderate to moderately high, depending, to a great extent, on the past cropping system. Because they have a deep, friable root zone and a moderately high to high moisture-supplying capacity, these soils respond well to fertilization and other management. Except for the cherty Hermitage soil, they are easy to work and to maintain in good tilth. They can be tilled within a fairly wide range of moisture content. The cherty areas are not so high in moisture-supplying capacity as the chert-free areas and are not so productive.

These soils occupy slightly more than 3 percent of the county. They are farmed rather intensively. Nearly all of the acreage is cultivated. A few scattered, small patches are in native hardwoods, and a very small acreage is idle. All of the common crops are grown, chiefly corn, hay, small grains, and pasture. Lespedeza, alfalfa, and red clover are generally grown for hay. Tobacco is an important crop, but the total acreage is small.

These soils are well suited to corn, tobacco, small grains, alfalfa, red clover, ladino clover, lespedeza, crimson clover, fescue, and orchardgrass. They are a little more limited in use than the soils of capability unit IIe–1, mainly because of their stronger slope.

A well-suited cropping system consists of corn or another row crop followed by a small grain, and then 2 years of mixed legumes and grasses grown for hay or pasture. Instead of the small grain, mixed legumes and grasses consisting of 3 to 5 years of alfalfa or of orchardgrass and ladino clover can be substituted. These soils, especially the Cookeville, Cumberland, and Waynesboro soils, are among the best soils in the county for alfalfa. If they are adequately fertilized and otherwise well managed, good stands can be maintained for 4 to 6 years.

The soils of this unit need moderately heavy applications of lime and potash. All except the Armour soil need phosphate. Unless legumes are grown, these soils need nitrogen. Apply the nitrogen as a topdressing for small grains and as a sidedressing for corn. Potash is especially required for alfalfa, which also needs boron. Large additions of a complete fertilizer are generally required to establish pasture of high quality.

Cultivating on the contour, terracing, and stripcropping are effective in reducing runoff and in increasing the moisture supply. If the fields are terraced or cropped in strips, the rate of fertilization and planting should be increased to take advantage of the increased moisture supply.

CAPABILITY UNIT IIIe–2

This unit consists of moderately deep to deep, well-drained soils on uplands, colluvial slopes, and stream terraces. These soils generally range in slope from 5 to 12 percent. The surface layer in most places is brown, friable silt loam or loam, about 6 to 8 inches thick. It is underlain by yellowish-brown to yellowish-red, friable silt loam, silty clay loam, or clay loam. The depth to bedrock is from 2½ to 10 feet or more. The soils are:

Allen loam, 5 to 12 percent slopes.
Bewleyville silt loam, 5 to 12 percent slopes.
Bewleyville silt loam, 5 to 12 percent slopes, eroded.
Christian loam, 5 to 12 percent slopes.
Christian loam, 5 to 12 percent slopes, eroded.
Hartsells loam, 5 to 12 percent slopes.
Hartsells loam, 5 to 12 percent slopes, eroded.
Holston loam, 5 to 12 percent slopes, eroded.
Holston silt loam, 5 to 12 percent slopes.
Holston silt loam, 5 to 12 percent slopes, eroded.
Jefferson loam, 5 to 12 percent slopes.
Linker loam, 5 to 12 percent slopes.
Linker loam, 5 to 12 percent slopes, eroded.
Minvale silt loam, 5 to 12 percent slopes.
Minvale cherty silt loam, 2 to 12 percent slopes.
Mountview silt loam, 5 to 12 percent slopes.
Mountview silt loam, 5 to 12 percent slopes, eroded.
Mountview silt loam, shallow, 5 to 12 percent slopes.
Mountview silt loam, shallow, 5 to 12 percent slopes, eroded.
Wellston silt loam, 5 to 12 percent slopes.
Wellston silt loam, 5 to 12 percent slopes, eroded.

These soils are low in natural fertility and are strongly acid to very strongly acid. They are permeable to water and air, and they are easily penetrated by plant roots. They have a moderately high moisture-supplying capacity and respond well to management. Tilth generally is good, and the soils can be tilled within a wide range of moisture content. Except for Minvale cherty silt loam, 2 to 12 percent slopes, the soils are relatively free of stones and chert.

These soils occupy about 12.8 percent of the county. They are used for a variety of crops and for pasture. A considerable acreage remains in forest, including nearly all of Hartsells loam, 5 to 12 percent slopes. Corn, small grains, and annual hay are the main crops. These soils are well suited to all common crops, but they require large additions of fertilizer.

These soils respond well to good management. Cropping systems of 3 years or longer are suitable if grasses and legumes are kept on the soil about two-thirds of the time. Do not plant a row crop more than once every 3 or 4 years. Follow each row crop with a winter cover crop, and as often as possible, seed a green-manure crop and turn it under. A suitable cropping system is corn, a small grain, and then grasses and legumes grown for hay or pasture for 2 or 3 years. On some farms it may be desirable to omit the row crop.

These soils are low in lime, phosphorus, nitrogen, and potassium, but they respond well to fertilization. Row crops require heavy applications of a complete fertilizer. Legumes require lime, phosphate, potash, and a moderate addition of nitrogen to get started. To establish grasses, apply a complete fertilizer. A grass-legume mixture needs little additional nitrogen if the legume has been properly inoculated. To increase the yield of small grains, add nitrogen as a topdressing. If rainfall is adequate, sidedress corn and tobacco.

These soils are suited to row crops but are probably better suited to close-growing crops because the close-growing crops grow in seasons when plenty of moisture is available.

Because they are permeable, these soils are not so erosive as the finer textured, clayey soils. But some soil material will be lost unless runoff is controlled. Protect the soils and conserve moisture by cultivating on the contour and maintaining natural waterways in permanent sod. Terracing may be suitable on slopes of less than 10 percent. Stripcropping is effective on the longer slopes (fig. 16).

CAPABILITY UNIT IIIe–3

The only soil in this unit—Landisburg silt loam, 5 to 12 percent slopes—is on colluvial foot slopes and is moderately well drained. Its surface layer is pale-brown, friable silt loam. The subsoil is yellowish-brown, friable silty clay loam that contains a mottled, compact fragipan. The thickness of the colluvium ranges from 2 to 6 feet.

This soil is strongly acid. It contains little organic matter and is low in natural fertility. Surface runoff is medium, and the moisture-supplying capacity is moderately low. The soil is permeable in the upper 20 inches but is slowly permeable in the firm, compact fragipan.

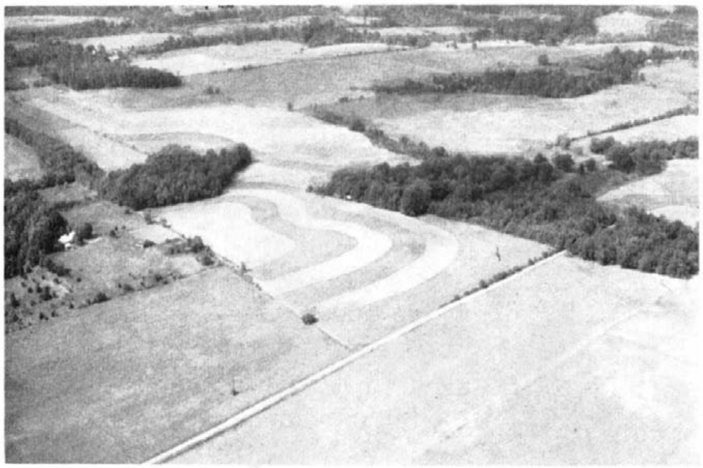

Figure 16.—**This 2-unit system of stripcropping has even-width strips. The crop sequence is 1 year of corn followed by 1 year of small grain and 2 years of red clover.**

The soil is easy to work and to keep in good tilth. Although it can be worked within a fairly wide range of moisture content, tillage is frequently delayed in wet periods. Because the soil warms slowly in spring, seedbed preparation and planting are sometimes delayed. During an extended drought, the fragipan prevents water from moving upward and the soil becomes very dry.

This soil occupies less than 1 percent of the county. It is used for corn, small grains, and pasture, and for hay, which is generally lespedeza. Some areas are idle. This soil is fair to good for crops and is good for pasture. It is suited to the crops commonly grown, but alfalfa generally does not grow well for more than 2 years.

This soil is not suited to intensive use. If it is used for tilled crops, close-growing crops should be grown about 3 years in 4. A suitable cropping system consists of a row crop, a small grain, and 2 or 3 years of grass-legume hay or pasture. In some areas it may be more profitable to omit the row crop because yields are only moderate.

This soil produces very low yields unless it is fertilized, but it responds well enough to justify moderately heavy applications of a complete fertilizer and lime. The response to fertilization varies greatly, depending on rainfall. The root zone above the pan has moderately low moisture-supplying capacity and is only 18 to 24 inches thick. The response to fertilizer is therefore best in wet seasons. Small grains, cool-season grasses, and legumes that grow best when moisture is plentiful respond to fertilization better than do row crops.

Special practices are not needed to control erosion. Cultivate on the contour, keep natural waterways in sod, and where needed, dig diversion drains to control runoff and overwash from adjoining slopes.

CAPABILITY UNIT IIIe-4

The soils in this unit are moderately deep to deep and are well drained, but they have a clayey subsoil. They are mostly on uplands, but a few areas are on old colluvial slopes. Their surface layer is brown to yellowish-brown, friable silt loam, 4 to 8 inches thick. The subsoil is yellowish-red, firm silty clay that is underlain by siltstone or limestone. Generally the depth to bedrock is about 3 feet, but the range is from 1½ to 6 feet or more. The soils are:

Baxter cherty silt loam, 5 to 12 percent slopes, eroded.
Christian silt loam, 2 to 5 percent slopes, eroded.
Christian silt loam, 5 to 12 percent slopes.
Christian silt loam, 5 to 12 percent slopes, eroded.
Swaim silt loam, 5 to 12 percent slopes, eroded.

These soils are low in natural fertility and in organic matter and are strongly acid. Permeability is slow to moderately slow, but plant roots can penetrate the subsoil. The moisture-supplying capacity is low to moderately low. These soils can be tilled without clodding or puddling only within a narrow range of moisture content. The Baxter soil has many chert fragments on the surface and throughout the profile, but its subsoil contains less clay than that of the other soils and is a little more permeable.

These soils occupy about 3 percent of the county. About 90 percent of the acreage is in crops and pasture, and most of the rest is in hardwood forest. Generally grown are corn and oats, wheat, and other small grains, as well as hay and pasture.

These soils are not well suited to truck crops, especially root crops. Because of their low moisture-supplying capacity, these soils are suited to early-maturing crops such as small grains, grasses, and legumes, including alfalfa. They produce only moderate to low yields of corn and other row crops that mature late in summer or in fall.

Row crops should not be grown more than 1 year in 4. A suitable cropping system consists of a row crop, a small grain, and then 2 or 3 years of grass-legume hay or pasture. Omitting the row crop from this cropping system may be advisable in some places.

If fairly large amounts of fertilizer and lime are added, these soils produce good yields of grass-legume permanent pasture and moderate to low yields of row crops.

Cultivate on the contour to control runoff and sheet erosion and to increase the moisture supply. If the fields are terraced or planted in strips, increase the rate of fertilization and seeding to get better yields by taking advantage of increased moisture supply.

CAPABILITY UNIT IIIs-1

The only soil in this capability unit—Bruno loamy sand—is droughty and occurs on level to gently sloping first bottoms. It varies in thickness but is normally more than 18 inches thick.

This soil is medium acid. It is low in organic matter, low in natural fertility, and very low in moisture-supplying capacity. It is rapid to very rapid in permeability and is loose and very friable. The soil is difficult to conserve because most areas are along streams and are likely to be overwashed and scoured by floodwaters.

Bruno loamy sand occupies less than 1 percent of the county. It is used mainly in the same way as adjoining soils on first bottoms. Corn and pasture are the main crops.

This soil produces high yields of the common crops only if it is irrigated. But most areas are too small for irrigation to be practical, and they are next to large areas of soils that produce high yields without irrigation. Bruno loamy sand is best suited to early-maturing crops, vegetables, and melons. Because the moisture supply is low, heavy fertilization is not practical.

CAPABILITY UNIT IIIw-1

This capability unit consists of poorly drained soils on first bottoms that are generally level but are slightly depressed in some areas. The surface layer of these soils is friable to very friable, grayish-brown to dark-brown silt loam. It is underlain by layers of friable, gray or dark-gray silt loam. Surface runoff and internal drainage are slow, and a fluctuating water table is near the surface much of the time. Consequently, these soils are often saturated. Many areas are likely to be flooded for short periods, and a few areas are ponded at times. The soils are:

Atkins silt loam.
Elkins silt loam.
Melvin silt loam.

The Melvin soil is moderately high in natural fertility and is slightly acid to medium acid. The Atkins and Elkins soils are low in natural fertility and strongly acid. The Elkins soil contains a considerable amount of organic matter. During much of the year, all of these soils are too wet to be tilled. Row crops are often weedy because tillage has been delayed. The high water table restricts the movement of air and the growth of plant roots. Poor drainage and the hazard of flooding or ponding greatly limit the use of these soils.

The soils occupy slightly more than 1 percent of the county. Nearly all the acreage in Atkins and Elkins soils remains in water-tolerant hardwoods. Almost all of the Melvin soil has been cleared, and much of it is in pasture. Only a very few areas have been drained. A small part is used for corn and hay. A few areas of Melvin soil produce high yields of whiteclover and fescue.

Unless they are drained, these soils are poorly suited to many crops. They are best suited to fescue, white clover, ladino clover, and alsike clover. They produce good yields of corn, but the risk of flooding and crop failure is high. Yields of soybeans and sorghum are also good, but these crops may also fail because of flooding.

Improved drainage is the main requirement of these soils. Pasture can be improved, to some extent, by applying fertilizer and seeding water-tolerant plants, but the pasture could be grazed only during short periods in summer when the water table is lowest. These soils would produce pasture of a high carrying capacity if they were adequately drained, fertilized, and seeded to suitable grasses and legumes. Corn, soybeans, and other row crops would also be suited to these soils if they were drained.

However, the improved drainage may not be practical unless (1) suitable outlets are available, (2) drainage costs are justified by increased crop production, and (3) additional acreage is needed for cultivation. These soils may be drained by open ditches, bedding, or tiling. Diversion ditches may be needed to intercept runoff from adjacent slopes. Grazing should be controlled during wet periods to prevent compaction.

CAPABILITY UNIT IIIw-2

The soils in this capability unit are somewhat poorly drained and have a fragipan or a dense, compact lower subsoil. They are on upland flats and in depressions, mostly on the Highland Rim. Their slope generally is less than 2 percent. The surface layer is highly leached, friable silt loam, about 8 inches thick. The subsoil is mottled brown and gray silty clay loam that is underlain by a fragipan at a depth of about 2 feet. The soils are:

Lawrence silt loam.
Tyler silt loam.

These soils are low in natural fertility and are very strongly acid. The strong mottling and the gray color indicate that the subsoil is sometimes saturated. During much of the winter and spring the water table is near the surface, and for short periods depressed areas are ponded by runoff from surrounding slopes. Planting may be delayed in spring because of wetness. In summer and fall the water table may drop several feet below the surface. Because roots generally do not penetrate these soils below a depth of 18 inches, plants lack sufficient moisture in summer when the water table is below the limit of rooting.

These soils are poorly suited to alfalfa, tobacco, vegetables, and other crops that cannot tolerate wetness. They are best suited to soybeans, grain sorghum, white clover, alsike clover, fescue, and redtop. Small grains can grow in the higher areas but not in the depressed areas that are occasionally ponded. Meadows overseeded with lespedeza produce fair to good yields of either hay or pasture.

Large additions of fertilizer are needed for good yields of all crops, but yields of corn and other row crops vary, depending on the erratic moisture supply. Yields of hay and pasture are moderately high on these soils if they are adequately limed and fertilized.

If these soils were drained, they could be used intensively for crops, but drainage is not feasible in some areas, because outlets are lacking. These soils cost more to drain than do soils on bottom lands because water moves laterally more slowly, and more drains are needed.

CAPABILITY UNIT IVe-1

This capability unit consists of well-drained, sloping to moderately steep soils on uplands, stream terraces, and old colluvial slopes. These soils generally are deep or very deep. Erosion is severe on the sloping soils and is moderate on the moderately steep soils. On the severely eroded slopes, the plow layer is friable to firm, yellowish-red to dark-red silty clay loam. The plow layer of the moderately eroded soils is mostly friable, brown to dark-brown silt loam. The soils are:

Armour silt loam, 12 to 20 percent slopes, eroded.
Cookeville silty clay loam, 5 to 12 percent slopes, severely eroded.
Cumberland silty clay loam, 5 to 12 percent slopes, severely eroded.
Hermitage silt loam, 12 to 20 percent slopes, eroded.
Waynesboro silt loam, 12 to 20 percent slopes, eroded.
Waynesboro silty clay loam, 5 to 12 percent slopes, severely eroded.

These soils are moderately low to moderately high in natural fertility and are medium acid to strongly acid. Because they are deep and porous, they absorb large amounts of water. But much of the water, especially in the Cumberland and Cookeville soils, is held tightly by the clay particles and is not available to plants. All of the soils have a deep, well-aerated root zone, but that of the Armour and Hermitage soils is more friable than the rest and is easier for roots to penetrate. The severely eroded areas generally are in fair to poor tilth, but the less eroded areas are easy to work and to keep in good tilth. Surface runoff is rapid on all of these soils, and they are highly susceptible to sheet erosion.

These soils occupy slightly more than 1 percent of the county. About 85 to 90 percent of the acreage has been cultivated. All of the common crops are grown to some extent, but a large part of the total acreage is in hay and pasture. Alfalfa and lespedeza are important hay crops. A small acreage is in corn, and small grains are also grown.

These soils are suited to the crops commonly grown, and to alfalfa, red clover, and other deep-rooted legumes. They are particularly well suited to alfalfa. Because of the low moisture-supplying capacity, the severely eroded soils do not produce high yields of row crops. The moderately eroded soils produce fair to good yields of row crops, but the slope is too strong for frequent cultivation.

Well suited to these soils is a cropping system that provides a row crop, a small grain, and then legume-grass hay or pasture for about 4 years. To make better use of the available water, it may be desirable to omit the row crop and to follow the small grain with a legume-grass mixture.

Fairly large amounts of fertilizer are required for high yields of all crops. The Armour soil is naturally well supplied with phosphorus but is moderately low in the other plant nutrients. The other soils in this unit are medium to low in nitrogen, phosphorus, and potassium. They need a complete fertilizer, as well as lime, but they respond to fertilization enough to justify heavy applications. In the severely eroded areas, the response is greater for cool-season crops, such as small grains, than it is for late-maturing row crops such as corn.

Contouring, terracing, and stripcropping are effective in controlling water. Terracing is suitable on slopes of less than 10 per cent.

CAPABILITY UNIT IVe-2

This capability unit consists mainly of severely eroded soils on moderate slopes and eroded soils on moderately steep slopes. The soils are deep and well drained. They have a friable, medium-textured plow layer and a yellowish-brown to yellowish-red, friable, medium-textured subsoil. The soils are:

- Allen clay loam, 5 to 12 percent slopes, severely eroded.
- Allen loam, 12 to 20 percent slopes.
- Bewleyville silty clay loam, 5 to 12 percent slopes, severely eroded.
- Bewleyville silt loam, 12 to 20 percent slopes, eroded.
- Christian loam, 12 to 20 percent slopes, eroded.
- Jefferson loam, 12 to 20 percent slopes, eroded.
- Minvale cherty silt loam, 12 to 20 percent slopes, eroded.
- Mountview silt loam, 5 to 12 percent slopes, severely eroded.
- Mountview silt loam, shallow, 5 to 12 percent slopes, severely eroded.
- Mountview silt loam, shallow, 12 to 20 percent slopes, eroded.

These soils are low in natural fertility and in organic matter. They are strongly acid to very strongly acid. Their moisture-supplying capacity is low or moderately low. The soils are permeable to water and air and are easily penetrated by plant roots, but the severely eroded soils absorb water rather slowly. Because of the strong slopes or the severe erosion, most of the soils are a little difficult to work and to conserve.

These soils occupy about 2 percent of the county and are mostly in crops and pasture. About one-third of the acreage is idle.

Strong slopes or severe erosion limits these soils. Yields are fair to good when rainfall is above average. These soils are best suited to small grains, pasture, and other close-growing crops that mature early when moisture conditions are favorable. If they are well fertilized, these soils produce good yields of alfalfa.

The cropping system should last at least 5 years if it includes row crops. A suitable sequence would be a row crop, a small grain, and then 3 or 4 years of a grass-legume mixture for hay or pasture. If row crops are not grown, the cropping system can be shorter and may be more profitable. A small grain, followed by a pasture of whiteclover and tall fescue, or of orchardgrass and whiteclover, is suitable.

To establish good pasture, add a complete fertilizer and lime and control grazing. Maintain the pasture by adding phosphate and potash. Apply barnyard manure frequently and turn under green-manure crops and crop residue to improve tilth and to increase the moisture-supplying capacity, organic matter, and fertility.

Till and plant these soils on the contour. When reseeding an old pasture it may be desirable to work the soil and reseed in alternate strips. This will leave some undisturbed strips that will protect the pasture from erosion. Because most slopes are steep, terraces are not generally suitable. All natural waterways should remain in permanent sod.

CAPABILITY UNIT IVe-3

In this capability unit are moderately deep to shallow soils that have a clayey subsoil. They are on sloping to moderately steep uplands. These soils formed in residuum from clayey, shaly, and cherty limestone. The sloping soils are mostly severely eroded, and the moderately steep soils are uneroded to moderately eroded. The plow layer consists of a thin layer of firm to friable silt loam to silty clay loam and some of the clayey subsoil. The soils are:

- Baxter cherty silt loam, 12 to 20 percent slopes.
- Baxter cherty silt loam, 12 to 20 percent slopes, eroded.
- Christian silty clay loam, 5 to 12 percent slopes, severely eroded.
- Christian silt loam, 12 to 20 percent slopes.
- Christian silt loam, 12 to 20 percent slopes, eroded.

These soils are strongly acid, low in organic matter, and low in natural fertility. Because they are strongly sloping and absorb water at a moderately slow rate, runoff is rapid and the moisture-supplying capacity is low. Generally, tilth in the cherty or severely eroded soils is rather poor.

This group of soils occupies about 3.2 percent of the county. Most of the acreage has been cleared and is in unimproved pasture.

These soils produce rather low yields of cultivated crops. They are better suited to small grains, hay, and pasture. A suggested cropping system consists of a small grain followed by about 4 years of legume-grass hay or pasture. Tall fescue or orchardgrass mixed with ladino clover or white clover is a suitable pasture mixture.

Because the soils are clayey, preparing a good seedbed is important. To produce good pasture, these soils require a complete fertilizer and lime. Because moisture is scarce, however, the response to fertilizer is only moderate, especially in periods of low rainfall. Turning under green-manure crops, crop residue, and barnyard manure will improve tilth, moisture-supplying capacity, and fertility.

Even if kept in pasture or close-growing crops, these soils need special care to protect them from runoff and erosion. All farming operations should be on the contour. Keep natural waterways in thick sod. On the longer and steeper slopes, improve old sod and control erosion by establishing pasture and by seeding permanent hay in strips.

CAPABILITY UNIT IVe-4

The soils in this capability unit are deep and well drained. They have formed in old colluvium or local alluvium on moderately steep slopes. The surface layer is friable cherty silt loam, and the subsoil is friable cherty silty clay loam to silt loam. The soils are:

Dellrose cherty silt loam, 12 to 20 percent slopes.
Hermitage cherty silt loam, 12 to 20 percent slopes.

These soils are moderate in organic matter, moderately high in natural fertility, and medium to strongly acid. They are permeable to water and air and are easily penetrated by plant roots. Although these soils can be tilled early in spring, tillage is difficult because of the strong slopes and high content of chert. The moisture-supplying capacity is moderately high to high. The moisture supply is best where the soils receive seepage from higher slopes. To the Dellrose soil, this seepage probably brings additional phosphate from adjoining geologic formations.

The soils of this unit are cherty in most places and are very cherty in a few spots. Probably because rain is absorbed rapidly, the steep slopes are not so eroded as might be expected.

These soils occupy less than 1 percent of the county. Most of the acreage is in crops and pasture. Corn is grown widely, and a few of the steeper areas are in forest.

These soils can produce moderate to high yields of tilled crops, but the strong slopes restrict cultivation. The soils are better suited to small grains, hay, and pasture. A suitable cropping system in the less steep areas is a small grain followed by 4 or 5 years of pasture. Lespedeza, tall fescue, orchardgrass, and whiteclover are well suited. If fertility is kept at a high level, alfalfa grows well.

These soils generally need additions of potash and nitrogen. Some phosphate may also be needed, especially on the Hermitage soil, but the Dellrose soil responds very little to phosphatic fertilizer.

To conserve these soils, till and plant them on the contour. When reseeding an old pasture, it may be desirable to work and reseed alternate strips rather than the whole pasture. Keep all natural waterways in permanent sod.

CAPABILITY UNIT IVs-1

The soils in this capability unit have moderate to large amounts of angular chert fragments or angular cobbles throughout their profile. These soils are well drained and highly leached in the upper part. They have formed in residuum from cherty limestone and in old coarse-textured colluvium or local alluvium. Generally, the cherty soils are on hilltops and the cobbly soils are on side slopes. The slope ranges from 5 to 20 percent. These soils vary in depth but are normally more than 3 feet deep. The surface layer is light-colored cherty silt loam, cobbly loam, or cobbly sandy loam, about 5 to 8 inches thick. The soils are:

Allen cobbly loam, 5 to 20 percent slopes.
Bodine cherty silt loam, 5 to 12 percent slopes.
Jefferson cobbly sandy loam, 5 to 12 percent slopes.

These soils are low in natural fertility and are strongly acid to very strongly acid. They contain very little organic matter. Although they are friable and permeable, they contain so much chert that their moisture-supplying capacity is low. Because these soils absorb water rapidly, they do not erode so readily as other soils on comparable slopes. They can be tilled within a wide range of moisture content, and they are not likely to clod or puddle. Nevertheless, these soils are difficult to work because the chert and cobbles interfere.

The soils in this unit occupy 1.5 percent of the county. Almost half of the acreage is in hardwood forest. The remainder is mostly in pasture, but small patches of row crops are grown.

These soils are better suited to crops that mature early, and to those that resist drought, than they are to the late-maturing crops. The late-maturing crops do not get enough moisture in the latter part of the growing season. Suitable crops are small grains, red clover, crimson clover, vetch, early vegetables, and pasture. Corn, tobacco, and other late-maturing crops are likely to be injured during long dry periods.

If these soils are cultivated, they are likely to erode, but they are less likely to erode than are soils that contain more clay and are free of chert and cobbles. These soils are not suited to intensive use. Unless fields are strip-cropped, do not grow a row crop more than once in 4 or 5 years. A suitable cropping system consists of a row crop followed by a fall-seeded small grain, and then a grass-legume mixture for 4 years. Also suitable is a row crop followed by 4 to 6 years of pasture consisting of fescue or orchardgrass mixed with ladino clover. On some farms it may be better to omit the row crop. If fields are strip-cropped, a safe cropping system is a row crop followed by a grass-legume mixture for only 2 years.

All crops need additions of lime and fertilizer for even moderate yields. Small grains, hay, and pasture are more productive than row crops if amendments are added, but heavy fertilization does not increase yields enough to justify the cost.

These soils should be cultivated on the contour wherever possible. Terraces may be suitable on the more uniform, milder slopes. Stripcrop steep, long slopes where terraces are impractical. Keep natural waterways in sod, and dig diversion ditches where needed to control runoff from the higher slopes.

CAPABILITY UNIT IVw-1

This capability unit consists of poorly drained, gray soils on uplands and stream terraces. These soils generally occupy flats, and many areas are in depressions. The slope is generally less than 2 percent. The surface soil is highly leached, friable silt loam, about 8 to 10 inches thick. The subsoil is dense, compact silty clay loam to clay. In some places the subsoil is distinctly mottled, and in others it is almost uniformly gray. The soils are:

Guthrie silt loam.
Purdy silt loam.

These soils are very strongly acid, are very low in organic matter, and are generally low in natural fertility. Their strong mottling and the gray color indicate that the subsoil is sometimes saturated with water. The moisture supply is erratic, but a considerable amount of water is retained for a long time after rainy periods. In dry periods these soils dry, crack, and retain very little moisture for plants. Because the subsoil is dense and slowly permeable, roots do not penetrate deeply. Rainfall and water that flows from upland slopes drain away very slowly, and the surface is extremely wet in winter and spring.

The soils of this unit amount to about 1 percent of the county. A large part of the acreage is in forest, and most of the large, cleared areas are in pasture.

These soils are too wet for corn, tobacco, small grains, and alfalfa. They are better suited to pasture and summer hay. The better drained areas are fairly well suited to grain sorghum, soybeans, and lespedeza. Tall fescue, ladino clover, white clover, and bermudagrass are suitable for pasture.

The main problems of management are selecting plants, supplying fertilizer and lime, and improving drainage. If the soils are adequately limed or fertilized, fescue mixed with white clover or ladino clover is probably best for pasture. Because the moisture available to plants varies, the response to fertilization is not consistently high. These soils are more difficult to drain than are soils on bottom lands. Open ditches, tile, and beds have been used but have been largely ineffective. Where suitable outlets are available, drainage by open ditches is possible, but costs should be carefully considered. Because the lateral movement of water in these soils is slow, tile is not always effective.

CAPABILITY UNIT VIe-1

The soils in this capability unit are well drained and are deep to moderately deep over bedrock. In areas not severely eroded, the surface layer is loam, silt loam, or cherty silt loam and is about 4 to 6 inches thick. The severely eroded areas have a clay loam or silty clay loam plow layer. The subsoil ranges from silty clay loam to clay loam. In most places it is yellowish red to red and is friable to firm. The soils are:

- Allen clay loam, 12 to 30 percent slopes, severely eroded.
- Allen loam, 20 to 30 percent slopes.
- Bewleyville silty clay loam, 12 to 20 percent slopes, severely eroded.
- Christian loam, 20 to 30 percent slopes.
- Cookeville silty clay loam, 12 to 20 percent slopes, severely eroded.
- Dellrose cherty silt loam, 20 to 30 percent slopes.
- Dellrose cherty silt loam, 30 to 45 percent slopes.
- Hermitage cherty silt loam, 20 to 30 percent slopes, eroded.
- Waynesboro silty clay loam, 12 to 20 percent slopes, severely eroded.

These soils are strongly acid to very strongly acid. They are low to moderately high in natural fertility and in organic matter. Their root zone is friable and fairly thick. The severely eroded areas generally are rather poor in tilth, but the less eroded areas can be kept in good tilth. The response to fertilization and other management is moderate to high.

These soils occupy 4.4 percent of the county. Nearly all of the acreage has been cleared and was cultivated until low yields and erosion made cultivation impractical. Now most of the acreage is in unimproved pasture. Many areas are idle and sparsely vegetated, and a few areas are used for crops along with adjacent soils that are less steep or less eroded. Lespedeza is generally grown for hay and pasture. The uncleared acreage is in forest of hardwoods and a few pines and cedars.

Because these soils are droughty, steep, and erosive, they are best suited to pasture and forest. They should be plowed only to reseed pasture. Good stands of pasture can be established and maintained on the Dellrose and Hermitage soils, which are the most productive in this unit but are rather steep for cultivation. Suitable pasture plants are orchardgrass, tall fescue, bermudagrass, sericea lespedeza, and whiteclover.

These soils need additions of lime, and all except the Dellrose soils need a complete fertilizer. The Dellrose soils are well supplied with phosphorus. On the long slopes, seeding pasture in successive contour strips for a few years will help control erosion until stands are established. The severely eroded areas may require heavy seeding and heavy fertilization, including barnyard manure. Control grazing after the pasture is established.

CAPABILITY UNIT VIe-2

In this capability unit are well-drained, steep soils that are deep to moderately deep over bedrock and are clayey in the subsoil. The surface layer generally is not more than 6 inches thick. In severely eroded areas, the plow layer is mostly subsoil material. The slope of these soils ranges from 5 to 35 percent but averages between 15 and 20 percent. The soils are:

- Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded.
- Baxter cherty silt loam, 20 to 30 percent slopes.
- Christian silty clay loam, 12 to 20 percent slopes, severely eroded.
- Christian silty clay loam, 20 to 30 percent slopes, severely eroded.
- Mimosa silt loam, 12 to 20 percent slopes, eroded.
- Mimosa silt loam, 20 to 35 percent slopes, eroded.
- Talbott silty clay loam, 5 to 20 percent slopes, eroded.

These soils are low in natural fertility and are medium acid to strongly acid. They are slowly permeable and fairly difficult for roots to penetrate. Because runoff is generally rapid, severe erosion is likely. These soils are generally dry in summer. Tilth is rather poor in most areas because the surface soil is clayey or cherty. Because only a small amount of moisture is available to plants, the response to management is not good.

The soils in this capability unit occupy almost 3 percent of the county. Nearly all of the acreage is in pasture or is idle. Most of the pasture is unimproved.

These soils are poorly suited to tilled crops and are best suited to pasture or forest. Under good management, pasture is fair to good. Suitable plants are orchardgrass, fescue, whiteclover, annual lespedeza, and bermudagrass. These soils should be plowed or disked only when a seedbed is prepared to reestablish pasture. Seed long slopes in alternate strips. Divert runoff from critical areas by diversion ditches.

All except the Mimosa soils respond fairly well to lime and a complete fertilizer, but the Mimosa soils are phosphatic and do not need additions of phosphate.

Forestry is the best use for much of the acreage, especially the steepest, severely eroded areas. Loblolly and shortleaf pines are suitable for planting in areas that need revegetating.

CAPABILITY UNIT VIe-3

This capability unit consists of shallow soils that formed on the Cumberland Plateau in residuum from sandstone and shale. These soils are well drained to excessively drained. Their surface layer is brown, friable silt loam or sandy loam. The subsoil is generally yellowish-brown loam, silty clay loam, or clay loam. Most of the acreage is uneroded, but a small acreage is severely eroded. The slope ranges from 5 to 20 percent but is 12 to 20 percent in most places. The soils are:

Muskingum sandy loam, 5 to 12 percent slopes.
Muskingum sandy loam, 12 to 20 percent slopes.
Muskingum silt loam, 5 to 12 percent slopes.
Muskingum silt loam, 12 to 20 percent slopes.

These soils are low in organic matter, low in natural fertility, and are very strongly acid. They have a low moisture-supplying capacity. The root zone is limited by the bedrock, which ordinarily is less than 24 inches from the surface. A few fragments of sandstone and shale are on the surface and throughout the profile.

The soils in this unit occupy about 3.2 percent of the county. They are mostly in cutover forest of mixed hardwoods and pine. A few areas have been cleared and are in pasture. Some areas are idle, and a few patches or small fields are used for corn, hay, and small grains. Lespedeza is the most common plant for pasture and hay.

Because these shallow soils are sloping to moderately steep and are very likely to erode, they are poorly suited to clean-tilled crops. They produce fair to medium yields of pasture plants commonly grown. Although low to medium yields of small grains can be grown in the less steep areas, these soils are best suited to pasture and forestry. They need moderate additions of lime and fertilizer but do not respond enough to justify heavy additions.

These soils should be plowed only before reseeding pasture and then only on the contour. Long, steep slopes should not be plowed their full length, as runoff builds up rapidly and sometimes destroys new stands of pasture. Generally, pasture should be seeded in successive contour strips for a few years, but strips are not necessary on short slopes. Plant trees in cleared areas that are not needed for pasture. Loblolly and shortleaf pines generally grow best.

CAPABILITY UNIT VIs-1

This capability unit consists of well-drained, cherty, and cobbly soils that are sloping to moderately steep. The slope generally ranges from 12 to 20 percent. Chert or cobbles are on the surface and throughout the profile. The amount of chert increases with increasing depth, but the cobbles are evenly distributed throughout the profile. The surface layer is friable, the subsoil is friable to firm, and both are medium to coarse in texture. The soils are:

Allen cobbly loam, 20 to 30 percent slopes.
Bodine cherty silt loam, 12 to 20 percent slopes.
Jefferson cobbly sandy loam, 12 to 20 percent slopes.
Jefferson cobbly sandy loam, 20 to 30 percent slopes.

These soils are strongly acid to very strongly acid. They are low in natural fertility, in organic matter, and in moisture-supplying capacity. These soils can be cultivated, but they contain so much chert and cobbles that they are difficult to work. The chert and cobbles on the surface slow runoff so that more water is absorbed, but those in the profile lessen the moisture-supplying capacity and make the soils dry out quickly.

This capability unit occupies about 1.6 percent of the county. About 40 percent of the acreage is in cutover forest of hardwoods intermingled with a few pines and cedars. Most of the cleared acreage is in pasture, mainly lespedeza.

These soils are fairly well suited to pasture, but they are droughty and poorly suited to crops. Even pasture grows little in summer. Fescue grows well, and orchardgrass and whiteclover can be grown under good management. Fair yields of small grains and other crops that mature early can be grown in the less steep areas.

These soils are low in nitrogen, phosphorus, potassium, and lime. Yields of pasture are very low unless the soils are well fertilized, and even then the response is only moderate. The response is best in spring and early in summer, when there is sufficient moisture to allow full use of fertilizer.

To maintain yields of crops and to reduce loss of soil, till these soils on the contour. On the long slopes, establish pasture in strips for a few years, and thereby reduce the risk of losing pasture seedlings during heavy rains. Control grazing carefully to prevent compaction.

CAPABILITY UNIT VIs-2

The soils in this group are studded with outcrops of limestone bedrock. Between the rocks the soil is fine textured and ranges in depth from a few inches to 3 or 4 feet. The surface layer is silty clay loam, 4 to 6 inches thick, and the subsoil is clay. The soils are:

Mimosa very rocky silty clay loam, 5 to 20 percent slopes, eroded.
Talbott very rocky silty clay loam, 5 to 20 percent slopes.

Much of the acreage of these soils is in mixed hardwoods and cedar. The cleared areas are in pasture.

Because of the rock outcrops, the strong slope, and the clayey soil material, these soils are suited only to pasture or forest. They are probably best suited to forest, but a small to medium amount of pasture can be grown.

The Mimosa soil has a natural supply of phosphorus but needs small additions of lime, nitrogen, and potash. The Talbott soil requires lime and a complete fertilizer. Both soils, however, are not responsive enough to justify more than light fertilization. Where the stand of native grasses is fairly good, adding nitrogen early in spring increases the yield. These native stands generally are in volunteer lespedeza, bluegrass, whiteclover, and weeds. The pasture grows little in summer and fall.

Carefully regulate grazing at all times so that a good cover is maintained and erosion is controlled. It is particularly important to guard against overgrazing because the pasture grows slowly on these soils. If a good cover is not maintained, the rapid runoff washes away the surface soil and exposes bare rock and unproductive subsoil material.

CAPABILITY UNIT VIIe-1

This unit consists of shallow, steep, cherty soils and areas of land that are gullied. They are:

Baxter cherty silty clay loam, 20 to 30 percent slopes, severely eroded

Gullied land.
Muskingum sandy loam, 20 to 30 percent slopes.
Muskingum silt loam, 20 to 30 percent slopes.

The Muskingum soils, which make up most of the acreage of this unit, are in forest. The Baxter soil and Gullied land support little vegetation, although a few areas have been recently planted to pines.

Because they are steep, erosive, and not responsive to mangement, these soils are not suited to pasture. The Baxter soil probably is better suited to pasture than the Muskingum soils or Gullied land, but yields on the Baxter soil would be low because of poor tilth and a low moisture supply. The cleared areas should be reforested, preferably to pine trees.

CAPABILITY UNIT VIIs-1

This capability unit consists of the following very cherty, rocky, or stony soils and land types:

Bodine cherty silt loam, 20 to 40 percent slopes.
Mimosa very rocky silty clay loam, 20 to 30 percent slopes, eroded.
Muskingum very rocky sandy loam, 12 to 20 percent slopes.
Muskingum very rocky sandy loam, 20 to 30 percent slopes.
Rock land, limestone.
Rock land, sandstone.
Stony colluvial land.
Talbott very rocky silty clay loam, 20 to 30 percent slopes.

These soils and land types are almost entirely in forest, and their forested acreage constitutes much of the woodland in the county. On the Talbott and Mimosa soils and on Rock land, limestone, the forest is mixed hardwoods and cedar. On the others, it is mixed hardwoods and pine.

All of these soils and land types are too steep, rocky, or cherty for good pasture. A few of the less steep areas of the Bodine, Mimosa, and Talbott soils are used for pasture, but because they are droughty, their response to management is poor and yields are very low. Forest is the best use. Except for areas of Rock land, limestone, and Rock land, sandstone, all of the soils and land types are well suited as woodland.

Estimated yields

Table 2 lists estimated yields of the principal crops grown on the soils in Putnam County under two levels of management. Yields in columns A are expected under prevailing or common management. Yields in columns B are expected under improved management defined later in this subsection. Under the prevailing management, yields generally are 20 to 35 percent less than they are under the improved management.

The estimates in columns B are based on (1) yields obtained in long-term experiments, (2) yields harvested on farms in a cooperative study of soil productivity and management, and (3) estimates by agronomists and soil scientists who have had much experience with the crops and soils in Putnam County.

The yield data from the long-term experiments were adjusted to reflect the combined effects of slope, weather, and level of management. For soils on which long-term experiments were not conducted, estimates were made from experiments on similar soils. For all estimates it was assumed that rainfall was the average for a long period and that the soils were not irrigated. The overflow hazard of soils on bottom lands was disregarded because the effects of flooding must be considered locally by those familiar with the habits of the various streams.

Estimates are not listed for a crop if the soil ordinarily is not planted to the crop or is not suited to it.

To obtain the yields listed in columns B of table 2, follow these practices:

1. Fertilize at planting time according to needs indicated by soil tests and by past cropping and fertilizing practices. This refers especially to needs for phosphorus, potassium, calcium, and minor elements.
2. Select high-yielding varieties of crops suited to the soil.
3. Prepare seedbeds adequately.
4. Plant or seed by suitable methods, at appropriate rates, and at the right times.
5. Inoculate legumes.
6. Use shallow cultivation for row crops.
7. Control weeds, insects, and diseases.
8. Use cropping systems that conserve soil like those suggested in the subsection "Capability Units" or similar systems.
9. Where needed, conserve soil and water by sodding waterways, cultivating on the contour, terracing, or contour stripcropping.
10. Protect pasture from overgrazing.

Although soil tests should determine rates of fertilization, specified rates of fertilization and of planting were assumed in estimating yields in columns B. By fertilizing and planting at about the rates assumed, which are those suggested in the following paragraphs, you can expect to obtain the yields in columns B.

Corn: Soils that produce 85 bushels or more of corn per acre, as indicated in column B of table 2, require 100 to 125 pounds of nitrogen and 12,000 to 16,000 plants per acre. Soils that show yields of 60 to 85 bushels ordinarily require 75 to 100 pounds of nitrogen and 8,000 to 12,000 plants. Soils that yield 40 to 60 bushels ordinarily require 50 to 75 pounds of nitrogen and about 8,000 plants. If the estimated yield is less than 40 bushels of corn per acre, the soil is poorly suited to corn and may be better suited to some other crop.

Nitrogen may be supplied by commercial fertilizer, by barnyard manure, by the residue of legumes, or by any combination of these.

The rates of fertilization of corn grown for silage are the same as those of corn grown for grain. For silage, however, the plant population normally is greater and sorghum can be planted with the corn. To determine the approximate yield of corn silage, divide the number of bushels of corn by 5. The result is the approximate number of tons of silage.

Burley tobacco: To obtain the yields of burley tobacco listed in column B, select soils that meet these requirements: (1) thick (7 to 8 inches), friable surface soil of loam or silt loam texture; (2) friable subsoil that roots can penetrate easily; (3) areas that will not be flooded or waterlogged during the crop season. Apply 100 to 130 pounds of nitrogen at, or shortly before, planting time, and use 8,500 to 10,000 plants per acre. The nitrogen may be supplied by commercial fertilizer, by barnyard manure, or by a combination of these.

TABLE 2.—*Estimated average acre yields of principal crops under two levels of management*

[Rainfall is assumed to be the average of a long period, and soils are not irrigated. Dashed lines indicate that crop is not suited to soil or ordinarily is not grown on it]

Soil	Corn		Burley tobacco		Alfalfa		Wheat		Oats		Lespedeza seeded alone		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Lb.*	*Lb.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Allen clay loam, 5 to 12 percent slopes, severely eroded	24	36	----	----	1.6	2.1	17	24	25	42	0.5	0.7	65	105
Allen clay loam, 12 to 30 percent slopes, severely eroded	----	----	----	----	----	----	13	18	20	33	.3	.5	45	75
Allen cobbly loam, 5 to 20 percent slopes	25	36	975	1,300	1.5	2.3	13	22	21	37	.5	.9	65	105
Allen cobbly loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	45	80
Allen loam, 2 to 5 percent slopes	45	65	1,600	2,000	2.0	2.7	22	30	35	55	.8	1.5	85	150
Allen loam, 5 to 12 percent slopes	40	60	1,525	1,900	1.9	2.5	22	29	32	52	.7	1.4	85	140
Allen loam, 12 to 20 percent slopes	34	50	1,300	1,500	1.7	2.3	18	25	27	44	.6	1.2	75	130
Allen loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	65	110
Armour silt loam, 2 to 5 percent slopes	55	80	1,700	2,300	2.7	3.4	24	32	42	60	1.3	1.8	105	165
Armour silt loam, 5 to 12 percent slopes, eroded	49	68	1,550	1,950	2.5	3.2	24	30	37	55	1.0	1.5	100	155
Armour silt loam, 12 to 20 percent slopes, eroded	40	56	1,300	1,600	2.3	3.0	21	26	32	48	.9	1.3	80	130
Atkins silt loam	----	[2] 50	----	----	----	----	----	----	----	----	.7	[2] 1.5	80	[2] 135
Baxter cherty silt loam, 5 to 12 percent slopes, eroded	30	45	1,100	1,600	1.6	2.3	18	25	34	50	.6	1.1	75	120
Baxter cherty silt loam, 12 to 20 percent slopes	28	40	1,000	1,350	1.5	2.2	16	23	30	44	.5	.9	70	115
Baxter cherty silt loam, 12 to 20 percent slopes, eroded	25	38	900	1,200	1.4	2.0	15	22	28	42	.5	.8	65	110
Baxter cherty silt loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	60	90
Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded	18	27	----	----	1.2	1.5	10	15	18	78	.3	.5	40	65
Baxter cherty silty clay loam, 20 to 30 percent slopes, severely eroded	----	----	----	----	----	----	----	----	----	----	----	----	30	50
Bewleyville silt loam, 2 to 5 percent slopes	45	75	1,550	2,100	2.6	3.3	21	32	37	57	1.0	1.6	90	150
Bewleyville silt loam, 5 to 12 percent slopes	40	68	1,450	1,900	2.5	3.2	20	30	33	54	.9	1.4	85	140
Bewleyville silt loam, 5 to 12 percent slopes, eroded	38	62	1,300	1,800	2.5	3.1	20	29	32	54	.7	1.2	80	135
Bewleyville silt loam, 12 to 20 percent slopes, eroded	34	53	1,050	1,400	2.1	2.8	17	24	28	45	.6	1.0	70	125
Bewleyville silty clay loam, 5 to 12 percent slopes, severely eroded	28	40	900	1,100	1.5	2.6	17	24	28	45	.5	.8	65	105
Bewleyville silty clay loam, 12 to 20 percent slopes, severely eroded	21	30	----	----	1.4	2.0	13	18	23	35	.4	.7	60	80
Bodine cherty silt loam, 5 to 12 percent slopes	25	35	----	----	----	----	11	17	16	25	.4	.7	40	70
Bodine cherty silt loam, 12 to 20 percent slopes	20	30	----	----	----	----	8	13	14	22	.4	.6	35	60
Bodine cherty silt loam, 20 to 40 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Bruno loamy sand	15	25	----	----	----	----	8	11	17	25	.3	.4	30	50
Christian loam, 2 to 5 percent slopes	38	60	1,200	1,750	2.4	3.2	22	30	35	58	.7	1.4	80	135
Christian loam, 5 to 12 percent slopes	35	55	1,100	1,500	2.4	3.1	21	29	31	52	.6	1.2	80	135
Christian loam, 5 to 12 percent slopes, eroded	34	50	900	1,300	2.4	3.0	21	28	29	49	.6	1.1	75	125
Christian loam, 12 to 20 percent slopes, eroded	30	42	----	----	2.1	2.5	17	23	23	43	.5	.9	65	110
Christian loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	55	95
Christian silt loam, 2 to 5 percent slopes, eroded	34	50	1,150	1,700	2.2	2.9	20	28	35	55	.7	1.2	80	135
Christian silt loam, 5 to 12 percent slopes	33	47	1,050	1,450	2.1	2.7	19	27	30	47	.7	1.1	75	135
Christian silt loam, 5 to 12 percent slopes, eroded	30	43	900	1,250	2.0	2.6	18	26	27	44	.6	.9	75	125
Christian silt loam, 12 to 20 percent slopes	26	38	----	----	1.7	2.4	16	22	26	42	.5	.8	70	120
Christian silt loam, 12 to 20 percent slopes, eroded	22	34	----	----	1.6	2.1	16	21	23	38	.5	.7	65	110
Christian silty clay loam, 5 to 12 percent slopes, severely eroded	17	28	----	----	1.2	1.7	10	15	20	30	.3	.5	50	80
Christian silty clay loam, 12 to 20 percent slopes, severely eroded	----	----	----	----	1.0	1.4	9	13	20	27	.2	.4	40	65
Christian silty clay loam, 20 to 30 percent slopes, severely eroded	----	----	----	----	----	----	----	----	----	----	----	----	35	45
Cookeville silt loam, 5 to 12 percent slopes, eroded	35	55	1,200	1,650	2.4	3.3	21	30	38	55	.7	1.3	90	130
Cookeville silty clay loam, 5 to 12 percent slopes, severely eroded	22	35	800	1,000	1.5	2.4	14	22	27	38	.5	.7	70	105
Cookeville silty clay loam, 12 to 20 percent slopes, severely eroded	20	28	----	----	1.4	2.0	12	18	23	30	.4	.6	50	75
Cumberland silt loam, 2 to 5 percent slopes	48	70	1,550	1,950	2.8	3.7	22	34	39	60	1.1	1.6	105	150

See footnotes at end of table.

TABLE 2.—*Estimated average acre yields of principal crops under two levels of management*—Continued

[Rainfall is assumed to be the average of a long period, and soils are not irrigated. Dashed lines indicate that crop is not suited to soil or ordinarily is not grown on it]

Soil	Corn		Burley tobacco		Alfalfa		Wheat		Oats		Lespedeza seeded alone		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Lb.*	*Lb.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Cumberland silt loam, 5 to 12 percent slopes, eroded	36	56	1,350	1,700	2.6	3.5	20	30	35	55	0.8	1.3	100	145
Cumberland silty clay loam, 5 to 12 percent slopes, severely eroded	25	40	950	1,150	2.2	2.9	13	22	23	36	.5	.7	85	120
Dellrose cherty silt loam, 12 to 20 percent slopes	39	58	1,375	1,725	2.2	2.8	18	27	38	50	.8	1.3	90	135
Dellrose cherty silt loam, 20 to 30 percent slopes	32	45	----	----	----	----	----	----	----	----	----	----	70	110
Dellrose cherty silt loam, 30 to 45 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Dickson silt loam	40	60	1,350	1,800	1.4	2.0	17	26	36	54	.7	1.4	85	135
Elkins silt loam	----	[2] 45	----	----	----	----	----	----	----	----	.6	[2] 1.3	80	[2] 125
Ennis silt loam, local alluvium	55	90	1,650	2,200	1.8	2.5	20	26	38	50	1.4	2.0	145	190
Gullied land	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Guthrie silt loam	----	[2] 42	----	----	----	----	----	----	----	----	.6	[2] 1.2	70	[2] 105
Hartsells loam, 2 to 5 percent slopes	44	80	1,450	2,100	1.6	2.8	17	28	34	58	.8	1.5	75	145
Hartsells loam, 5 to 12 percent slopes	43	68	1,300	1,900	1.5	2.5	16	25	31	55	.7	1.3	70	135
Hartsells loam, 5 to 12 percent slopes, eroded	38	62	1,200	1,800	1.4	2.3	16	25	30	53	.7	1.2	70	130
Hermitage cherty silt loam, 5 to 12 percent slopes	40	58	1,500	1,900	2.4	3.0	19	28	34	48	.8	1.4	110	145
Hermitage cherty silt loam, 12 to 20 percent slopes	37	49	1,250	1,600	1.5	2.7	18	27	32	44	.8	1.3	95	130
Hermitage cherty silt loam, 20 to 30 percent slopes, eroded	----	----	----	----	----	----	----	----	----	----	----	----	75	100
Hermitage silt loam, 2 to 5 percent slopes	55	80	1,850	2,300	2.5	3.2	22	32	42	60	1.3	1.8	120	160
Hermitage silt loam, 5 to 12 percent slopes	50	72	1,700	2,100	2.5	3.2	22	30	38	55	1.1	1.6	110	150
Hermitage silt loam, 12 to 20 percent slopes, eroded	42	56	1,450	1,700	2.2	2.7	20	28	34	48	.8	1.4	100	130
Holston loam, 2 to 5 percent slopes	45	75	1,600	2,100	1.8	2.5	18	28	34	58	.8	1.5	85	150
Holston loam, 5 to 12 percent slopes, eroded	38	60	1,350	1,700	1.6	2.4	17	26	30	55	.7	1.2	80	140
Holston silt loam, 2 to 5 percent slopes	45	75	1,600	2,100	1.8	2.5	18	28	35	58	.8	1.5	85	150
Holston silt loam, 5 to 12 percent slopes	40	68	1,525	1,900	1.6	2.4	17	26	30	55	.7	1.3	80	140
Holston silt loam, 5 to 12 percent slopes, eroded	38	60	1,350	1,700	1.6	2.4	17	26	30	55	.7	1.2	80	140
Huntington cherty silt loam	55	80	1,600	2,000	1.8	2.6	19	24	37	50	1.3	1.8	110	180
Huntington cherty silt loam, phosphatic	55	80	1,600	2,000	1.8	2.6	19	24	37	50	1.3	1.8	110	180
Huntington fine sandy loam	60	85	1,600	2,100	2.0	2.7	19	24	37	52	1.4	2.0	110	180
Huntington silt loam	65	100	1,850	2,300	2.2	2.9	20	26	40	55	1.4	2.0	120	190
Huntington silt loam, local alluvium	65	95	1,850	2,300	2.2	2.9	20	26	40	55	1.4	2.0	120	190
Huntington silt loam, phosphatic	65	100	1,850	2,300	2.3	3.0	20	26	40	55	1.4	2.0	120	190
Jefferson cobbly sandy loam, 5 to 12 percent slopes	26	37	975	1,300	1.5	2.2	10	15	27	45	.6	1.1	65	115
Jefferson cobbly sandy loam, 12 to 20 percent slopes	22	31	----	----	----	----	8	12	25	40	.5	.8	55	95
Jefferson cobbly sandy loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	45	80
Jefferson loam, 2 to 5 percent slopes	40	70	1,600	2,100	1.7	2.6	18	29	34	58	.8	1.6	80	150
Jefferson loam, 5 to 12 percent slopes	38	63	1,525	1,900	1.6	2.5	17	27	32	55	.7	1.4	75	140
Jefferson loam, 12 to 20 percent slopes, eroded	34	53	1,150	1,450	1.3	2.2	17	26	32	55	.7	1.1	65	125
Landisburg silt loam, 2 to 5 percent slopes	39	60	1,400	1,850	1.4	2.0	16	24	32	48	1.0	1.5	90	135
Landisburg silt loam, 5 to 12 percent slopes	35	55	1,300	1,750	1.4	2.0	15	23	30	46	.8	1.3	85	130
Lawrence silt loam	30	[2] 45	----	----	----	----	11	[2] 18	23	[2] 35	.6	1.2	70	125
Lindside silt loam	50	75	1,150	[2] 1,650	----	----	18	22	38	47	1.4	2.0	115	175
Linker loam, 5 to 12 percent	40	68	1,500	1,800	2.0	2.9	18	28	34	56	.7	1.4	85	140
Linker loam, 5 to 12 percent slopes, eroded	38	60	1,250	1,600	1.9	2.9	17	27	34	56	.7	1.3	80	135
Melvin silt loam	27	[2] 55	----	----	----	----	----	----	----	----	.8	[2] 1.7	90	135
Mimosa silt loam, 12 to 20 percent slopes, eroded	21	31	----	----	1.5	2.2	11	16	18	30	.6	.9	70	90
Mimosa silt loam, 20 to 35 percent slopes, eroded	----	----	----	----	----	----	----	----	----	----	----	----	60	75
Mimosa very rocky silty clay loam, 5 to 20 percent slopes, eroded	----	----	----	----	----	----	----	----	----	----	----	----	40	60
Mimosa very rocky silty clay loam, 20 to 30 percent slopes, eroded	----	----	----	----	----	----	----	----	----	----	----	----	30	40
Minvale silt loam, 2 to 5 percent slopes	43	70	1,600	2,100	2.4	3.2	23	33	38	60	1.0	1.8	105	160
Minvale silt loam, 5 to 12 percent slopes	38	63	1,400	1,850	2.3	3.1	22	31	36	57	.8	1.6	100	150
Minvale cherty silt loam, 2 to 12 percent slopes	35	53	1,200	1,500	1.6	2.6	15	27	32	50	.8	1.4	80	125
Minvale cherty silt loam, 12 to 20 percent slopes, eroded	30	44	----	----	1.4	2.1	14	25	30	45	.7	1.2	65	105
Mine pits and dumps	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Monongahela silt loam, 2 to 5 percent slopes	35	55	1,250	1,750	1.3	1.8	14	17	30	50	.7	1.4	80	130
Mountview silt loam, 2 to 5 percent slopes	42	68	1,500	2,000	1.9	2.6	18	29	35	58	.8	1.5	85	145
Mountview silt loam, 5 to 12 percent slopes	39	63	1,450	1,800	1.9	2.6	17	27	32	55	.8	1.3	80	135

See footnotes at end of table.

TABLE 2.—*Estimated average acre yields of principal crops under two levels of management*—Continued

[Rainfall is assumed to be the average of a long period, and soils are not irrigated. Dashed lines indicate that crop is not suited to soil or ordinarily is not grown on it]

Soil	Corn		Burley tobacco		Alfalfa		Wheat		Oats		Lespedeza seeded alone		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Lb.*	*Lb.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Mountview silt loam, 5 to 12 percent slopes, eroded	37	57	1,250	1,550	1.9	2.6	17	26	32	55	0.7	1.2	75	125
Mountview silt loam, 5 to 12 percent slopes, severely eroded	27	40	850	1,050	1.6	2.1	14	22	27	45	.6	.8	60	100
Mountview silt loam, shallow, 2 to 5 percent slopes	34	54	1,200	1,750	1.8	2.4	18	27	33	53	.8	1.3	70	120
Mountview silt loam, shallow, 5 to 12 percent slopes	29	50	1,100	1,550	1.7	2.3	16	25	30	50	.7	1.1	65	115
Mountview silt loam, shallow, 5 to 12 percent slopes, eroded	27	46	1,000	1,400	1.6	2.2	15	23	30	48	.6	1.0	60	105
Mountview silt loam, shallow, 5 to 12 percent slopes, severely eroded	21	30	850	950	1.2	1.8	10	17	20	30	.4	.6	50	80
Mountview silt loam, shallow, 12 to 20 percent slopes, eroded	23	34	----	----	1.2	1.8	12	19	26	40	.5	.8	55	90
Muskingum sandy loam, 5 to 12 percent slopes	18	27	----	----	----	----	9	16	18	32	.6	.8	25	65
Muskingum sandy loam, 12 to 20 percent slopes	----	----	----	----	----	----	9	15	16	30	----	----	25	65
Muskingum sandy loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Muskingum silt loam, 5 to 12 percent slopes	18	30	----	----	----	----	9	16	18	32	.6	.9	35	70
Muskingum silt loam, 12 to 20 percent slopes	----	----	----	----	----	----	9	15	16	30	----	----	35	70
Muskingum silt loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Muskingum very rocky sandy loam, 12 to 20 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Muskingum very rocky sandy loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Purdy silt loam	----	[2] 42	----	----	----	----	----	----	----	----	.6	[2] 1.1	45	[2] 105
Rock land, limestone	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Rock land, sandstone	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Sango silt loam	32	56	1,100	1,500	1.2	1.7	12	22	28	46	.7	1.2	75	130
Sequatchie loam, 2 to 5 percent slopes	55	85	1,800	2,300	2.3	2.9	22	30	46	62	1.3	1.8	110	165
Sequatchie loam, 5 to 12 percent slopes, eroded	50	78	1,650	2,050	2.2	2.8	22	30	42	58	1.1	1.6	95	150
Stony colluvial land	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Swaim silt loam, 5 to 12 percent slopes, eroded	25	38	850	1,000	1.6	2.5	16	24	25	40	.6	.9	60	95
Talbott silty clay loam, 5 to 20 percent slopes, eroded	21	32	850	950	1.5	2.3	11	17	22	36	.6	.9	55	90
Talbott very rocky silty clay loam, 5 to 20 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	40	55
Talbott very rocky silty clay loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----	35	50
Tyler silt loam	23	[3] 46	----	----	----	----	11	[3] 17	22	[3] 35	.6	1.2	65	120
Waynesboro silt loam, 2 to 5 percent slopes	45	72	1,650	2,000	2.4	3.5	21	33	38	60	1.1	1.6	100	150
Waynesboro silt loam, 5 to 12 percent slopes	40	63	1,500	1,850	2.3	3.4	20	30	35	54	1.0	1.5	95	140
Waynesboro silt loam, 5 to 12 percent slopes, eroded	39	56	1,350	1,650	2.3	3.3	18	28	33	52	.9	1.4	90	130
Waynesboro silt loam, 12 to 20 percent slopes, eroded	34	49	1,150	1,400	2.1	2.8	16	24	28	48	.8	1.2	80	120
Waynesboro silty clay loam, 5 to 12 percent slopes, severely eroded	27	38	950	1,100	1.7	2.5	14	24	23	37	.7	1.0	70	100
Waynesboro silty clay loam, 12 to 20 percent slopes, severely eroded	21	32	----	----	1.6	2.2	12	18	20	30	.5	.7	55	75
Wellston silt loam, 2 to 5 percent slopes	40	68	1,400	1,900	1.8	2.7	17	28	32	56	.7	1.4	70	140
Wellston silt loam, 5 to 12 percent slopes	38	60	1,300	1,700	1.8	2.4	15	26	28	52	.7	1.2	65	130
Wellston silt loam, 5 to 12 percent slopes, eroded	37	54	1,200	1,550	1.3	1.9	14	23	27	50	.7	1.1	65	125

[1] Number of days 1 acre will support 1 animal unit (1 cow, steer, or horse; 5 hogs; or 7 sheep or goats) without injury to the pasture. To get the tons of air-dry forage per acre, divide the cow-acre-days by 53.

[2] Yields are for areas from which excess surface water is removed by ditches or drains.

Alfalfa: Apply as much as 15 pounds of borax per acre when alfalfa is seeded. After the first year, apply the amounts indicated by soil tests, or apply per acre 30 pounds of phosphate, 20 pounds of borax, and at least 120 pounds of potash. Mow the alfalfa, control grazing, and do not cut hay between about September 10 and the date of the first killing frost. You can obtain the yields estimated for alfalfa only if the soils are not ponded or flooded.

Small grain: To obtain the yields of wheat and oats listed in columns B, apply 30 pounds of nitrogen per acre in fall at seeding time. You can determine the approximate yield of the oats harvested for hay by dividing the bushels of oats listed in columns A or B by 31. The result is the approximate yield of hay in tons.

Lespedeza: To obtain the yields of lespedeza listed in column B, seed Kobe lespedeza alone in spring on a prepared seedbed or allow it to volunteer, and fertilize according to soil tests. Kobe lespedeza is a variety of common lespedeza. Annual yields of lespedeza overseeded on small grain harvested for grain are about 50 to 60 percent less than annual yields of lespedeza seeded alone. Overseeding generally results in nearly complete failure of the lespedeza crop once every 2 years. If the small grain is harvested for hay, the estimated yields of the lespedeza are generally about 80 percent of those of lespedeza seeded alone.

Pasture: To obtain the yields of pasture listed in column B of table 2, apply fertilizer at seeding time according to the results of soil tests, and if the clover in a mixture is sparse, topdress late in February each year with 30 pounds of nitrogen per acre.

Pasture plants suited to the soils of Putnam County are too numerous to list in table 2. The estimated yields on the poorly drained soils (Atkins, Elkins, Guthrie, Melvin, and Purdy) are yields of tall fescue and of whiteclover and plants that are water tolerant. The estimated yields for the rest of the soils in the county are those of the common pasture plants. The more common mixtures for improved pastures are orchardgrass and whiteclover, and tall fescue and whiteclover. For information about suitability of specified soils for specified pasture plants, see the section "Descriptions of Soils" and the subsection "Capability Units."

Woodland [1]

Putnam County, Tennessee, is in the Central Forest Region of eastern North America (*8*).[2] Originally most of the county was covered by forest of the oak-hickory and oak-pine type groups. No areas of virgin forest were found, however, during this soil survey.

Approximately 51 percent of the county is woodland, consisting of 10 forest types, as recognized by the Society of American Foresters. These types are: Post oak-black oak (SAF 40); Eastern redcedar-hardwoods (SAF 48); Black locust (SAF 50); White oak-red oak-hickory (SAF 52); White oak (SAF 53); Yellow-poplar (SAF 57); Shortleaf pine (SAF 75); Shortleaf pine-oak (SAF 76); Shortleaf pine-Virginia pine (SAF 77); and Virginia pine (SAF 79).

[1] This section was written by C. M. HENNINGER, woodland conservationist, Soil Conservation Service.

[2] Italic numbers in parentheses refer to Literature Cited, p. 112.

Cutting of timber, mainly to clear land for agriculture, began soon after the first settlers arrived. After the Civil War a great part of the remaining original forest was cut in extensive logging. Between 1900 and 1940, a large amount of timber was used in coal mines in the eastern part of the county. A part of woodland management is control of fire. Since 1946, a fire-control system has operated in the county. Before that time, it was customary to burn over the woodland to improve grazing. This practice was especially prevalent on the Cumberland Plateau.

Rough lumber from portable sawmills in this county and in adjoining counties is shipped to several concentration yards. A woodyard in Cookeville handles pine pulpwood. Mills in the county manufacture oak flooring, handles, barrel staves, sash and door facings, and finished lumber. Some mills specialize in processing black walnut, eastern redcedar, and cherry. Large quantities of rough lumber are shipped out of the county by truck and train.

Because the woodland in Putnam County is extensive, it is important to manage the soils used so that production of desirable trees is increased. In the following pages, the grouping of soils according to suitability for woodland is discussed and some suggestions for management are given.

Woodland suitability grouping of soils

Management of woodland can be planned more effectively if soils are grouped according to those characteristics that affect growth of trees and management of the stands. For this reason, the soils of Putnam County have been placed in 15 woodland suitability groups. Each group consists of soils that have about the same suitability for wood crops, require about the same management, and have about the same potential productivity.

Listed in table 3, and described in the text, are the 15 woodland suitability groups in this county. For each suitability group, table 3 gives the site index of important trees, the approximate priority of the tree species, and a rating for the degree of hazards or limitations that affect management. The terms used in this table require explanation.

The potential productivity of a soil for a specified kind of tree is expressed as a *site index*. A site index for a given soil is the height, in feet, that a specified kind of tree growing on that soil will reach in 50 years. The site index of a soil is determined mainly by the capacity of the soil to provide moisture and growing space for tree roots. A site index in table 3 is an average for all the soils in the suitability group. The site index for any one soil in the group may be somewhat different from the average.

The site indexes listed in table 3 were calculated from measurements of trees taken in site-index plots. In a cooperative project sponsored by the Tennessee Valley Authority in 1960, State, industrial, and consulting foresters gathered the data at approximately 70 plots. Soil scientists of the Soil Conservation Service supplied information about soils in these plots. Other data were gathered from plots by members of the Soil Conservation Service from 1955 through 1960. All these data were combined to provide the basis for the estimates of the site indexes listed in table 3.

TABLE 3.—*Woodland suitability*

Woodland suitability group	Approximate species priority	Site index [1]	
		Yellow-poplar [2]	Shortleaf pine [3]
Group 1: Deep, well-drained, stony and cobbly soil on steep talus slopes.	Yellow-poplar, northern red oak, white oak, shortleaf pine, and Virginia pine.	84 (1)	58
Group 2: Steep soils that are generally shallow to sandstone and shale bedrock.	Virginia pine, shortleaf pine, and chestnut oak	84 (1)	59±10 (9)
Group 3: Steep soils that have many outcrops of sandstone.	Virginia pine and shortleaf pine	(6)	60
Group 4: Moderately deep to moderately shallow, medium- and coarse-textured soils that formed in residuum from sandstone and shale; gently sloping to moderately steep.	Virginia pine, shortleaf pine, southern red oak, and black oak.	83 (2)	62±6 (58)
Group 5: Moderately steep to steep soils that have many limestone outcrops.	Eastern redcedar, shortleaf pine, and Virginia pine	(6)	80 (2)
Group 6: Deep, well-drained, steep, medium-textured soils.	Yellow-poplar, northern red oak, southern red oak, black oak, white oak, Virginia pine, shortleaf pine, and loblolly pine.	91±8 (15)	56±3 (4)
Group 7: Gently sloping to moderately steep, well-drained soils that are medium textured and friable.	Yellow-poplar, northern red oak, southern red oak, black oak, white oak, Virginia pine, shortleaf pine, and loblolly pine.	91±10 (31)	66±8 (27)
Group 8: Eroded, sloping to steep, deep and moderately deep soils that have a slowly permeable, fine-textured subsoil.	Eastern redcedar, Virginia pine, and shortleaf pine.	90	65 (1)
Group 9: Eroded, gently sloping to moderately steep soils that are deep, well drained, and mainly medium textured and friable.	Virginia pine, shortleaf pine, and loblolly pine	90	66 (2)
Group 10: Nearly level, poorly drained to somewhat poorly drained soils that are slowly permeable, have slow surface runoff, and are occasionally ponded.	Yellow-poplar, white oak, southern red oak, willow oak, red maple, and loblolly pine.	97 (3)	(6)
Group 11: Nearly level, poorly drained to moderately well drained, permeable soils on bottom lands; subject to flooding.	Yellow-poplar, white oak, southern red oak, and loblolly pine.	102 (1)	79 (2)
Group 12: Deep, well-drained, fertile soils on bottom lands and colluvial slopes; friable and permeable.	Yellow-poplar, northern red oak, southern red oak, white oak, black walnut, black oak, loblolly pine, shortleaf pine, Virginia pine, eastern white pine, white ash, and black cherry.	94±9 (12)	76 (2)
Group 13: Gently sloping, moderately well drained soils that have a fragipan at a depth of about 2 feet.	Yellow-poplar, white oak, southern red oak, loblolly pine, shortleaf pine, and Virginia pine.	91±11 (8)	71±7 (9)
Group 14: Excessively drained, very sandy soil on bottom lands; very rapidly permeable and droughty.	Eastern cottonwood, American sycamore, and black willow.	(6)	(6)
Group 15: Land in gullied areas and in mine pits and dumps.	Virginia pine, shortleaf pine, and black locust	(6)	55

[1] Site index is average total height of the tallest trees in well-stocked stands at 50 years of age. Standard deviations, plus or minus, are shown where the site index was calculated from measurements made in 4 or more plots. The number in parentheses is the number of plots in which measurements were made. Absence of parentheses indicates plot measurements were not made and that site index was estimated from observations made on soils similar to those in the woodland group.

[3] Site indexes computed from curves developed in 1957 by W. T. Doolittle, U.S. Forest Service.

As shown in table 3, each woodland suitability group has, in varying degree, limitations that affect its management. Some of these limitations are expressed in the relative terms, *slight*, *moderate*, or *severe*. The relative term expresses the degree of limitation, as explained in the following:

Plant competition: When a woodland is disturbed by fire, cutting, grazing, or some other means, it is likely to be invaded by undesirable brush, trees, and plants. The invading growth competes with the desirable trees and hinders their establishment and growth.

Competition is *slight* if unwanted plants are no special problem. It is *moderate* if the invaders delay but do not prevent the establishment of a normal, fully stocked stand. Where plant competition is moderate, seedbed preparation is generally not needed, and simple methods can be *grouping of soils*

Site index [1]—Continued: Mixed upland oaks [4]	Site index [1]—Continued: Virginia pine [5]	Plant competition	Equipment limitation	Seedling mortality	Windthrow hazard	Erosion hazard
65 (1)	65	Slight	Severe	Slight	Slight	Moderate.
70 (2)	69±9 (8)	Slight	Moderate	Slight	Severe	Moderate.
66 (3)	65	Slight	Severe	Slight	Severe	Severe.
59±5 (5)	70±7 (26)	Slight to moderate	Slight	Slight	Moderate	Slight.
(6)	76 (1)	Moderate	Severe	Moderate	Moderate	Moderate.
70±6 (6)	66 (1)	Moderate	Moderate	Slight	Slight	Moderate to severe.
67±7 (22)	69±8 (24)	Moderate	Slight to moderate	Slight	Slight	Slight to moderate.
60	66	Moderate	Slight to moderate	Moderate	Slight	Severe.
66±5 (4)	70 (3)	Moderate	Slight	Slight	Slight	Moderate.
60 (2)	(6)	Moderate	Severe	Slight	Moderate	Slight.
65	85	Moderate	Severe	Slight	Moderate	Slight.
72 (3)	77 (1)	Severe	Slight to moderate	Slight	Slight	Slight.
70±8 (6)	70 (3)	Moderate	Moderate	Slight	Moderate	Slight.
(6)	(6)	Moderate	Severe	Severe	Slight	Slight to severe.
(6)	69 (1)	Slight to moderate	Severe	Severe	Moderate to severe.	Slight to severe.

[3] Site indexes computed by methods described in Journal of Forestry, June 1953 (*15*).
[4] Site indexes computed by method described in USDA Technical Bulletin 560 (7)
[5] Site indexes computed by method described in Research Note 135, Southeast Forest Service Experiment Station, November 1959 (*13*).
[6] Tree generally not on soils of group.

used to prevent undesirable plants from invading. Competition is *severe* if trees cannot regenerate naturally. Where competition is severe, good management includes site preparation, controlled burning, spraying with chemicals, and girdling.

Equipment limitation: Drainage, slope, stoniness, soil texture, or other soil characteristics may restrict or prohibit the use of ordinary equipment in pruning, thinning, harvesting, or other woodland management. Different soils may require different kinds of equipment and methods of operation, or may have different seasonal limitations on use of equipment.

Limitation is *slight* if there are no restrictions on the type of equipment or on the time of year that the equipment can be used. It is *moderate* if slopes are moderately steep, if heavy equipment is restricted by wetness in win-

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ter and early in spring, or if the use of equipment damages the tree roots to some extent. Equipment limitation is *severe* if many types of equipment cannot be used, if the equipment cannot be used more than 3 months a year, and if the use of equipment severely damages the roots of trees and the structure and stability of the soil. Limitation is severe on moderately steep and steep soils that are stony and have rock outcrops. In winter or early in spring, it is also severe on wet bottom lands and low terraces.

Seedling mortality: Even when healthy seedlings of a suitable tree are correctly planted or occur naturally in adequate numbers, some of them will not survive if characteristics of the soil are unfavorable.

Mortality is *slight* if not more than 25 percent of the planted seedlings die, or if trees ordinarily regenerate naturally in places where there are enough seeds. It is *moderate* if 25 to 50 percent of the seedlings die, or if trees do not regenerate naturally in numbers needed for adequate restocking. In some places replanting to fill open spaces will be necessary. Mortality is *severe* if more than 50 percent of the planted seedlings die, or if trees do not ordinarily reseed naturally in places where there are enough seeds. If mortality is *severe*, plant seedlings where the seeds do not grow. Prepare special seedbeds, and use good methods of planting to insure a full stand of trees.

Windthrow hazard: Soil characteristics affect the development of tree roots and the firmness with which the roots anchor the tree in the soil so that it resists the force of wind. Root development may be prevented by a high water table or by an impermeable soil layer. The protection of surrounding trees also affects windthrow hazard. Knowing the degree of this hazard is important when choosing trees for planting and when planning release cuttings or harvest cuttings.

The windthrow hazard is *slight* if roots hold the tree firmly against a normal wind. Individual trees are likely to remain standing if protective trees on all sides are removed. The hazard is *moderate* if the roots develop enough to hold the tree firmly except when the soil is excessively wet and the wind velocity is very high. It is *severe* if rooting is not deep enough to give adequate stability against normal wind. Individual trees are likely to be blown over if they are released on all sides.

Erosion hazard: Woodland can be protected from erosion by choosing the kinds of trees, by adjusting the rotation age and cutting cycles, by using special techniques in management, and by carefully constructing and maintaining roads, trails, and landings.

Erosion hazard is rated according to the risk of erosion on well-managed woodland that is not protected by special practices. It is *slight* where a small loss of soil is expected. Generally, erosion is slight if slopes range from 0 to 2 percent and runoff is slow or very slow. The erosion hazard is *moderate* where loss of soil will be moderate if runoff is not controlled and the vegetative cover is not adequate for protection. It is *severe* where steep slopes, rapid runoff, slow infiltration and permeability, and past erosion make the soil susceptible to severe erosion.

WOODLAND SUITABILITY GROUP 1

Stony colluvial land is the only mapping unit in this group. This land is deep, well drained, stony, and cobbly. It can supply a moderate amount of moisture to trees because it receives seepage water and has a thick and permeable root zone. It consists of talus, or rock debris, on steep slopes of the Cumberland Plateau escarpment.

Nearly all of this land is covered with mixed upland hardwoods. It is suited to many kinds of trees. At 50 years of age a fully stocked, unmanaged stand may be expected to yield in board feet per acre about as follows: Yellow-poplar, 20,000; shortleaf pine, 11,000; mixed upland oaks, 8,000; and Virginia pine, 22,800.

Equipment limitations are severe on this land because of steepness, stones, and large rocks. These limitations must be considered in planning the use of equipment and the construction of access roads and trails. During logging the erosion hazard is moderate, particularly on roads and trails and in disturbed areas.

This land should be managed to assist the growth of existing trees that are preferred and are listed in table 3. Planting is not often required.

WOODLAND SUITABILITY GROUP 2

The soils in this group are steep and generally shallow, but they vary in depth and, therefore, in moisture supply and thickness of root zone. They are forming in residuum from sandstone and shale on the Cumberland Plateau. They are:

Muskingum silt loam, 20 to 30 percent slopes.
Muskingum sandy loam, 20 to 30 percent slopes.

The existing vegetation on these soils is a mixture of pines and oaks. At 50 years of age a fully stocked, unmanaged stand may be expected to yield in board feet per acre about as follows: Yellow-poplar, 20,000; shortleaf pine, 11,700; mixed upland oaks, 9,700; and Virginia pine, 24,000.

Equipment limitations are moderate, mainly because these soils are steep. Because the soils are shallow, the windthrow hazard is severe. Individual trees blow over if they are released on all sides. Erosion is moderate on these steep, shallow soils, especially on roads and trails and in disturbed areas.

The trees suited to these soils are somewhat drought resistant. These trees are listed in table 3 and should be preferred in management. Planting is not often required.

WOODLAND SUITABILITY GROUP 3

In this group are steep, very rocky soils and land made up of sandstone ledges of the Cumberland Plateau. The soils were derived from sandstone. The soils and the land type have a thin root zone and a low moisture-supplying capacity. They are:

Muskingum very rocky sandy loam, 12 to 20 percent slopes.
Muskingum very rocky sandy loam, 20 to 30 percent slopes.
Rock land, sandstone.

Mixed stands of pines and oaks make up most of the existing vegetation. These stands are open or are only spotted with trees because much of the land will not support trees.

Soil covers as much as half an acre in some places, and in these spots potential productivity is about the same as on the soils in woodland suitability groups 1 and 2. Yields per acre are not listed, because few acres are fully stocked.

Steep slopes, stones, and rocky obstructions severely limit the use of equipment on these soils. Because the rock on the surface concentrates runoff, the hazard of erosion is severe. Locate access roads and trails and plan logging operations to allow for the equipment limitations and to avoid disturbing the soil unnecessarily.

Seedling mortality is slight on the Muskingum soils and in areas of Rock land, sandstone, that have enough soil to support tree growth. Virginia and shortleaf pines regenerate without difficulty. Windthrow is a severe hazard because rooting in these shallow soils is insufficient to hold the trees against wind. Individual trees blow over if they are released on all sides.

Mainly because they are tolerant of drought, Virginia and shortleaf pines are preferred on these soils. Hardwoods are not well suited. Planting is not generally required.

WOODLAND SUITABILITY GROUP 4

In this group are moderately deep to moderately shallow soils that are medium and coarse in texture and gently sloping to moderately steep. They are:

Hartsells loam, 2 to 5 percent slopes.
Hartsells loam, 5 to 12 percent slopes.
Hartsells loam, 5 to 12 percent slopes, eroded.
Linker loam, 5 to 12 percent slopes.
Linker loam, 5 to 12 percent slopes, eroded.
Muskingum silt loam, 5 to 12 percent slopes.
Muskingum silt loam, 12 to 20 percent slopes.
Muskingum sandy loam, 5 to 12 percent slopes.
Muskingum sandy loam, 12 to 20 percent slopes.
Wellston silt loam, 2 to 5 percent slopes.
Wellston silt loam, 5 to 12 percent slopes.
Wellston silt loam, 5 to 12 percent slopes, eroded.

More different kinds of trees grow on these soils than on soils in groups 2 and 3. Pure and mixed stands of pines and hardwoods are common, but they generally are of low quality, and the stands are poorly stocked as a result of fires and of indiscriminate cutting and grazing. Yellow-poplar is seldom found.

At 50 years of age fully stocked, unmanaged stands can be expected to produce the following yields in board feet per acre: Yellow-poplar, 19,600; shortleaf pine, 14,200; mixed upland oaks, 6,000; and Virginia pine, 24,600.

Plant competition is slight on the Muskingum soils because fewer kinds of trees grow on these soils than on the other soils of the group. The other soils have moderate plant competition. Some seedlings are lost, and stands do not always adequately restock naturally. Because the depth to bedrock is generally between 20 and 30 inches, the windthrow hazard is moderate if trees are released on all sides.

The trees that should be favored in naturally occurring stands are listed in table 3. Although yellow-poplar appears to be productive, that tree is not listed, because most of the soils in this group have been damaged by poor management and may not support such a demanding tree. Virginia pine and shortleaf pine (fig. 17) are suitable for planting in old fields and openings.

WOODLAND SUITABILITY GROUP 5

This group consists of soils and land types that have many limestone outcrops and, generally, shallow soil material between the outcrops. Runoff is rapid. The soils are fine textured, slowly permeable, and low in moisture-supplying capacity. They are:

Mimosa very rocky silty clay loam, 5 to 20 percent slopes, eroded.
Mimosa very rocky silty clay loam, 20 to 30 percent slopes, eroded.

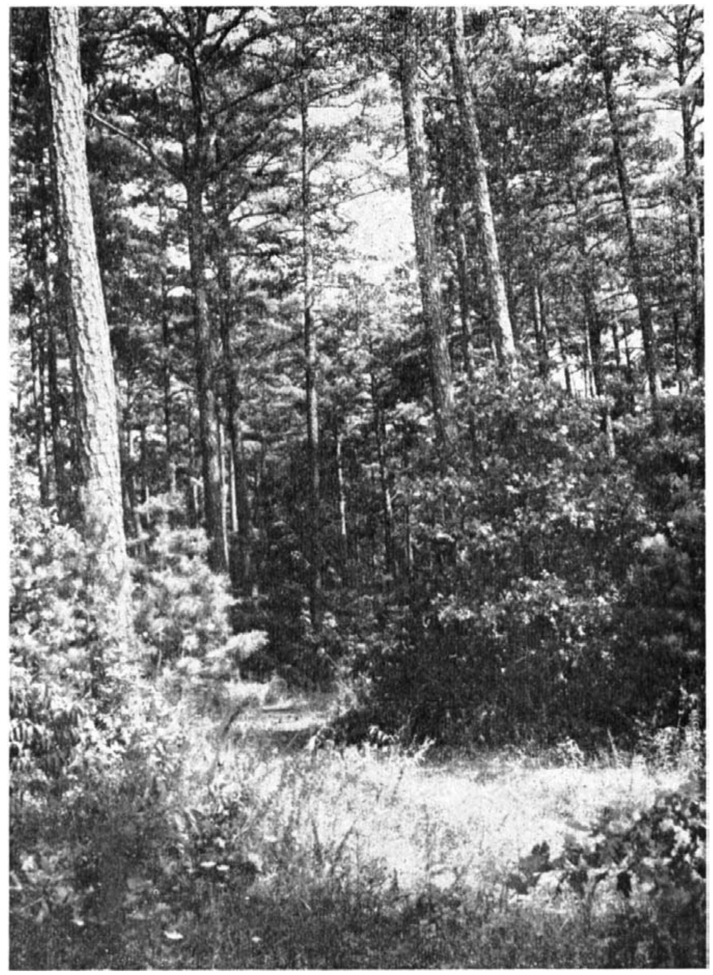

Figure 17.—**Shortleaf pine on Hartsells loam, 2 to 5 percent slopes.**

Rock land, limestone.
Talbott very rocky silty clay loam, 5 to 20 percent slopes.
Talbott very rocky silty clay loam, 20 to 30 percent slopes.

Except for a considerable acreage in crops and pasture, these soils have been cut over and the valuable trees removed. The existing trees make up pure stands of eastern redcedar and mixed stands of redcedar and hardwoods such as elm, hickory, ash, hackberry, Osage-orange, honeylocust, and black locust. All of these trees readily restock naturally, but except for the eastern redcedar, they generally are not valuable for wood crops. The composition of the stands probably should be improved by planting more desirable trees.

These soils are well suited to pines and eastern redcedar but are not suited to yellow-poplar and mixed upland oaks. At 50 years of age fully stocked, unmanaged stands can be expected to produce about 31,200 board feet of shortleaf pine and about 26,300 board feet of Virginia pine per acre.

Plant competition is moderate in areas that have low-grade or undesirable trees. The conversion to more desirable trees may require planting and a moderate amount of seedbed preparation and weeding. Seedling mortality is moderate because the soils are droughty. Planting may be necessary to fill in places where seeds do not grow.

Steep slopes, limestone outcrops, and clayey soil material limit the use of equipment, especially when the soils are wet. Because of the concentrated runoff, erosion is a moderate hazard. Roads and trails should be located so that equipment can operate without damaging the soil and so that excessive loss of soil is prevented. Avoid disturbing the soil unnecessarily. Windthrow is a moderate hazard, especially when the soil is wet. Individual trees should not be left open or exposed to wind on all sides.

Listed in table 3 are trees to be favored in naturally occurring stands. Black walnut, chinkapin oak, and white oak may occur and can be favored in an occasional large area where the soil between the rocks is deeper than normal. If plantings are desired in old fields and openings, consider planting eastern redcedar, shortleaf pine, and Virginia pine.

WOODLAND SUITABILITY GROUP 6

In this group are deep, well-drained, friable soils that are permeable throughout the profile. Most of these soils are medium textured. They are:

- Allen cobbly loam, 20 to 30 percent slopes.
- Allen loam, 20 to 30 percent slopes.
- Baxter cherty silt loam, 20 to 30 percent slopes.
- Baxter cherty silty clay loam, 20 to 30 percent slopes, severely eroded.
- Bodine cherty silt loam, 20 to 40 percent slopes.
- Christian loam, 20 to 30 percent slopes.
- Jefferson cobbly sandy loam, 20 to 30 percent slopes.

Many kinds of pines and hardwoods grow naturally in mixed and pure stands. However, a considerable acreage of these soils is in pasture.

At 50 years of age fully stocked, unmanaged stands can be expected to produce the following yields in board feet per acre: Yellow-poplar, 25,200; shortleaf pine, 9,700; mixed upland oaks, 9,700; and Virginia pine, 23,100.

Competition is moderate from brush and undesirable trees if the overstory is removed or openings are made in the canopy. Ordinarily, this competition does not prevent establishing favored trees, but it may slow initial growth and delay adequate restocking. Site preparation is not essential for natural regeneration, although it may make planting easier.

The steep slopes moderately limit the use of equipment on these soils. Erosion is a severe hazard on Baxter cherty silty clay loams with slopes of 20 to 30 percent and is a moderate hazard on the other soils. Because of these limitations, special care should be taken in locating roads and trails and in logging.

The trees in existing stands that should be preferred in management are listed in table 3. Virginia, shortleaf, and loblolly pines are preferred for planting in areas that need reforesting.

WOODLAND SUITABILITY GROUP 7

The soils in this group are deep, well drained, and gently sloping to moderately steep. They are friable and permeable to moderately permeable throughout the profile. These soils have formed in old alluvium, in colluvium, and in residuum from cherty limestone. They are:

- Allen loam, 2 to 5 percent slopes.
- Allen loam, 5 to 12 percent slopes.
- Allen loam, 12 to 20 percent slopes.
- Allen cobbly loam, 5 to 20 percent slopes.
- Baxter cherty silt loam, 5 to 12 percent slopes, eroded.
- Baxter cherty silt loam, 12 to 20 percent slopes.
- Baxter cherty silt loam, 12 to 20 percent slopes, eroded.
- Bewleyville silt loam, 2 to 5 percent slopes.
- Bewleyville silt loam, 5 to 12 percent slopes.
- Bewleyville silt loam, 5 to 12 percent slopes, eroded.
- Bewleyville silt loam, 12 to 20 percent slopes, eroded.
- Bodine cherty silt loam, 5 to 12 percent slopes.
- Bodine cherty silt loam, 12 to 20 percent slopes.
- Christian loam, 2 to 5 percent slopes.
- Christian loam, 5 to 12 percent slopes.
- Christian loam, 5 to 12 percent slopes, eroded.
- Christian loam, 12 to 20 percent slopes, eroded.
- Cookeville silt loam, 5 to 12 percent slopes, eroded.
- Cumberland silt loam, 2 to 5 percent slopes.
- Cumberland silt loam, 5 to 12 percent slopes, eroded.
- Holston loam, 2 to 5 percent slopes.
- Holston loam, 5 to 12 percent slopes, eroded.
- Holston silt loam, 2 to 5 percent slopes.
- Holston silt loam, 5 to 12 percent slopes.
- Holston silt loam, 5 to 12 percent slopes, eroded.
- Jefferson loam, 2 to 5 percent slopes.
- Jefferson loam, 5 to 12 percent slopes.
- Jefferson loam, 12 to 20 percent slopes, eroded.
- Jefferson cobbly sandy loam, 5 to 12 percent slopes.
- Jefferson cobbly sandy loam, 12 to 20 percent slopes.
- Minvale silt loam, 2 to 5 percent slopes.
- Minvale silt loam, 5 to 12 percent slopes.
- Minvale cherty silt loam, 2 to 12 percent slopes.
- Minvale cherty silt loam, 12 to 20 percent slopes, eroded.
- Mountview silt loam, 2 to 5 percent slopes.
- Mountview silt loam, 5 to 12 percent slopes.
- Mountview silt loam, 5 to 12 percent slopes, eroded.
- Mountview silt loam, 5 to 12 percent slopes, severely eroded.
- Mountview silt loam, shallow, 2 to 5 percent slopes.
- Mountview silt loam, shallow, 5 to 12 percent slopes.
- Mountview silt loam, shallow, 5 to 12 percent slopes, eroded.
- Mountview silt loam, shallow, 5 to 12 percent slopes, severely eroded.
- Mountview silt loam, shallow, 12 to 20 percent slopes, eroded.
- Waynesboro silt loam, 2 to 5 percent slopes.
- Waynesboro silt loam, 5 to 12 percent slopes.
- Waynesboro silt loam, 5 to 12 percent slopes, eroded.
- Waynesboro silt loam, 12 to 20 percent slopes, eroded.

Although a large acreage of these soils is in crops or pasture, many kinds of pines and hardwoods occur naturally in pure and mixed stands. Much of the abandoned land has grown up in pure stands of pines and yellow-poplar.

At 50 years of age fully stocked, unmanaged stands may be expected to produce the following yields in board feet per acre: Yellow-poplar, 25,000; shortleaf pine, 17,700; mixed upland oaks, 8,700; and Virginia pine, 24,200.

Plant competition is moderate on these deep soils if the overstory is removed or if openings are made in the canopy. Competition, however, does not prevent establishment of preferred species, but it may slow initial growth and delay adequate restocking. Site preparation generally is not essential for natural regeneration, but it may make planting easier.

In seepy areas of the Allen, Jefferson, and Minvale soils, the use of equipment is moderately limited. Erosion is a moderate hazard on the Bewleyville, Cookeville, Cumberland, and Waynesboro soils.

In managing existing stands on these soils, the suitable species listed in table 3 are preferred. Where planting is needed, pines are preferred.

WOODLAND SUITABILITY GROUP 8

The soils in this group are deep to moderately deep and have a slowly permeable, fine-textured subsoil. These soils formed in residuum from noncherty limestone. They are:

Christian silty clay loam, 5 to 12 percent slopes, severely eroded.
Christian silty clay loam, 12 to 20 percent slopes, severely eroded.
Christian silty clay loam, 20 to 30 percent slopes, severely eroded.
Cookeville silty clay loam, 5 to 12 percent slopes, severely eroded.
Cookeville silty clay loam, 12 to 20 percent slopes, severely eroded.
Mimosa silt loam, 12 to 20 percent slopes, eroded.
Mimosa silt loam, 20 to 35 percent slopes, eroded.
Talbott silty clay loam, 5 to 20 percent slopes, eroded.

Nearly all of the acreage has been cleared and used for crops and pasture. The existing pure and mixed stands consist of pines, oaks, eastern redcedar, hickory, elms, and other less desirable trees. It may be best to improve the composition of the stands by planting more valuable trees.

At 50 years of age fully stocked, unmanaged stands can be expected to produce in board feet per acre: Yellow-poplar, 24,400; shortleaf pine, 16,800; mixed upland oaks, 6,300; and Virginia pine, 23,200.

Plant competition is moderate in stands of inferior or undesirable trees. The conversion to more desirable species may require planting and a moderate amount of weeding or seedbed preparation.

Seedling mortality is moderate because the soils are droughty. Planting may be required to fill in openings and to restock areas that have failed.

The equipment limitation is moderate on the steeper soils in this group. All soils in the group are subject to severe erosion. These limitations must be considered in planning and constructing access roads and trails. During logging operations the soil should be disturbed as little as possible.

Table 3 lists suitable species that are to be favored in the management of naturally occurring stands. In old fields and in openings, plant eastern redcedar, Virginia pine, and shortleaf pine. Although yellow-poplar once grew well, and mixed upland oaks grew moderately well, the soils in this group now are so eroded that they are not suited to those trees.

WOODLAND SUITABILITY GROUP 9

In this group are deep, well-drained, gently sloping to moderately steep soils that are friable and medium textured. They are:

Allen clay loam, 5 to 12 percent slopes, severely eroded.
Allen clay loam, 12 to 30 percent slopes, severely eroded.
Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded.
Bewleyville silty clay loam, 5 to 12 percent slopes, severely eroded.
Bewleyville silty clay loam, 12 to 20 percent slopes, severely eroded.
Christian silt loam, 2 to 5 percent slopes, eroded.
Christian silt loam, 5 to 12 percent slopes.
Christian silt loam, 5 to 12 percent slopes, eroded.
Christian silt loam, 12 to 20 percent slopes.
Christian silt loam, 12 to 20 percent slopes, eroded.
Cumberland silty clay loam, 5 to 12 percent slopes, severely eroded.
Swaim silt loam, 5 to 12 percent slopes, eroded.
Waynesboro silty clay loam, 5 to 12 percent slopes, severely eroded.
Waynesboro silty clay loam, 12 to 20 percent slopes, severely eroded.

Many kinds of pines and hardwoods grow naturally on these soils in mixed and pure stands, but a considerable acreage is in other agricultural uses. At 50 years of age fully stocked, unmanaged stands can be expected to produce in board feet per acre: Yellow-poplar, 24,400; shortleaf pine, 17,700; mixed upland oaks, 8,400; and Virginia pine, 24,600.

If the overstory is removed or if openings are made in the canopy, the competition from brush and undesirable trees is moderate. Converting to more desirable species may require planting and a moderate amount of weeding or seedbed preparation.

Erosion is a moderate hazard because of the slope and the moderately slow permeability. In some areas there are a few gullies. Use special care in locating roads and trails and in logging so that the soil is not disturbed unnecessarily.

The trees to favor in the management of existing stands are listed in table 3. Eastern redcedar is especially suited to Swaim silt loam. Although yellow-poplar apparently is highly productive, and mixed upland oaks are moderately productive, past treatment has damaged most areas so that those species are not suitable for management. Plant pines to fill in old fields and openings.

WOODLAND SUITABILITY GROUP 10

The soils in this group are nearly level, poorly drained to somewhat poorly drained, and slowly permeable. They have slow surface runoff and may be ponded occasionally. The soils are:

Guthrie silt loam.
Lawrence silt loam.
Purdy silt loam.
Tyler silt loam.

Wooded areas are in pure and mixed stands of water-tolerant hardwoods. Shortleaf pine and Virginia pine seldom occur on soils of this group. A considerable acreage has been cleared for crops and pasture.

At 50 years of age fully stocked, unmanaged stands of yellow-poplar may be expected to produce 29,800 board feet per acre, and mixed upland oaks, 6,300 board feet per acre.

Competition from brush or undesirable trees is moderate if the overstory is removed or if openings are made in the canopy. Converting to more desirable trees may require a moderate amount of weeding. Equipment limitations are severe because the water table is high 3 to 6 months each year. The high water table also retards root growth and causes a moderate windthrow hazard if trees are released on all sides.

The trees to favor in the management of naturally occurring stands are listed in table 3. In old fields and openings, plant loblolly pine.

WOODLAND SUITABILITY GROUP 11

The soils in this group are nearly level, poorly drained to moderately well drained, and permeable. They have formed in recent alluvium on first bottoms and are likely to be flooded occasionally. The soils are:

Atkins silt loam.
Elkins silt loam.
Lindside silt loam.
Melvin silt loam.

The woodland consists of pure and mixed stands of water-tolerant hardwoods and a few shortleaf pines and Virginia pines. A large acreage is used for crops and pasture.

These soils are productive of several commercially important trees. At 50 years of age fully stocked, unmanaged stands can be expected to produce the following yields in board feet per acre: Yellow-poplar, 33,800; shortleaf pine, 30,200; mixed upland oaks, 8,000; and Virginia pine, 28,800.

If the overstory is removed or openings are made in the canopy, the competition from brush and less desirable trees is moderate. Converting to more desirable species may require moderate weeding.

Because the water table is high 3 to 6 months a year, equipment limitations are severe and the windthrow hazard is moderate if trees are released on all sides. Occasional flooding is also a hazard.

In naturally occurring stands trees to be favored in management are listed in table 3. Shortleaf pine and Virginia pine occur so infrequently that they are not listed. Loblolly pine is well suited for planting in old fields and openings.

WOODLAND SUITABILITY GROUP 12

The soils in this group are deep, well drained, and moderately fertile to fertile. They occur on bottom lands and colluvial slopes. The soils are:

- Armour silt loam, 2 to 5 percent slopes.
- Armour silt loam, 5 to 12 percent slopes, eroded.
- Armour silt loam, 12 to 20 percent slopes, eroded.
- Dellrose cherty silt loam, 12 to 20 percent slopes.
- Dellrose cherty silt loam, 20 to 30 percent slopes.
- Dellrose cherty silt loam, 30 to 45 percent slopes.
- Ennis silt loam, local alluvium.
- Hermitage cherty silt loam, 5 to 12 percent slopes.
- Hermitage cherty silt loam, 12 to 20 percent slopes.
- Hermitage cherty silt loam, 20 to 30 percent slopes, eroded.
- Hermitage silt loam, 2 to 5 percent slopes.
- Hermitage silt loam, 5 to 12 percent slopes.
- Hermitage silt loam, 12 to 20 percent slopes, eroded.
- Huntington fine sandy loam.
- Huntington silt loam.
- Huntington silt loam, local alluvium.
- Huntington silt loam, phosphatic.
- Huntington cherty silt loam.
- Huntington cherty silt loam, phosphatic.
- Sequatchie loam, 2 to 5 percent slopes.
- Sequatchie loam, 5 to 12 percent slopes, eroded.

Nearly all of the acreage of these soils has been cleared and used for crops and pasture. The existing woodland is mostly pure and mixed stands of hardwoods. Where seed sources are available, some areas have reseeded to shortleaf pine and Virginia pine. These soils are well suited to many kinds of trees.

At 50 years of age fully stocked, unmanaged stands can be expected to produce in board feet per acre: Yellow-poplar, 27,000; shortleaf pine, 27,200; mixed upland oaks, 10,600; and Virginia pine, 26,600.

Because of the generally high fertility and the good moisture supply, plant competition is severe. Natural regeneration does not always adequately restock desired trees. In natural stands, repeated weeding and planting and other special management may be required. Old fields and openings that require planting may need site preparation, cultivation, weeding, and repeated planting.

The soils in this group on first bottoms and terraces have moderate equipment limitation because the water table is high during periods of prolonged rainfall. On the steep Dellrose soils and cherty Hermitage soils, the equipment limitation is moderate because of the slope. Locate roads and trails so that the soils will not be disturbed unnecessarily.

Manage existing stands to favor the trees listed in table 3. Plant loblolly pine and yellow-poplar seedlings in old fields and openings. Black walnut may be planted to increase the proportion of this desirable tree in old fields or wooded areas.

WOODLAND SUITABILITY GROUP 13

This group consists of gently sloping, moderately well drained soils that are medium textured and have a slowly permeable fragipan at a depth of 22 to 30 inches. The fragipan restricts the movement of air and water and the growth of plant roots. The soils are:

- Dickson silt loam.
- Landisburg silt loam, 2 to 5 percent slopes.
- Landisburg silt loam, 5 to 12 percent slopes.
- Monongahela silt loam, 2 to 5 percent slopes.
- Sango silt loam.

Most of the acreage has been cleared and is used for crops and pasture, but many kinds of hardwoods and pines grow naturally in pure and mixed stands (fig. 18).

At 50 years of age fully stocked, unmanaged stands may be expected to produce in board feet per acre: Yellow-poplar, 25,200; shortleaf pine, 22,200; mixed upland oaks, 9,800; and Virginia pine, 24,600.

Competition from brush and undesirable trees is moderate if tree overstory is removed or openings are made in the canopy. Ordinarily, this competition does not prevent desirable species from establishing themselves, but it may delay adequate restocking and slow the initial growth.

Because the water table is high during wet periods, equipment limitations are considered moderate. The high water table also causes a moderate windthrow hazard if trees are released on all sides.

Table 3 lists the trees that should be favored in management of naturally occurring stands. If old fields or openings in stands are to be planted, plant pine.

WOODLAND SUITABILITY GROUP 14

Bruno loamy sand is the only soil in this group. This soil is on bottom lands and is sandy and excessively drained.

The existing trees on this soil are many kinds of hardwoods, including black willow, American sycamore, river birch, alder, elm, eastern cottonwood, and white ash. A considerable acreage, however, is used for crops and pasture.

The site index of preferred trees is not given because those trees seldom, if ever, occur on this soil.

In areas that have grown up in inferior or undesirable trees, plant competition is moderate. Planting and a moderate amount of weeding and cultivation may be needed to convert to more desirable and productive trees.

The deep sandy material, a high water table, and flooding severely limit the use of equipment. There is also a severe erosion hazard, and the flooding may cause scouring and deposition.

Table 3 lists the trees that should be favored in management of naturally occurring stands. Eastern cottonwood

Figure 18.—**Mixed upland hardwoods on Sango silt loam.**

is preferred for planting in old fields and in openings of stands.

WOODLAND SUITABILITY GROUP 15

This group consists of severely gullied land and of areas that have been strip mined. The mapping units are:

Gullied land.
Mine pits and dumps.

These land types are bare or are covered with many kinds of trees and lesser vegetation. The trees are generally tolerant of drought. Within relatively short distances, the sites on these land types range from good to very poor. Hardwoods are too demanding for the poor sites.

Limitations and hazards vary, depending on the land and the extent to which it has been disturbed or has been neglected. Plant competition is slight to moderate. Equipment limitation is severe. Seedling mortality is severe, and repeated planting may be necessary. Windthrow is a moderate to severe hazard if trees are released on all sides. The hazard of erosion is slight to severe.

Table 3 lists the trees that should be favored in the management of existing stands. Plant shortleaf pine, Virginia pine, or black locust in open areas.

Engineering [3]

This subsection was written so that the soil survey information contained in this report can be used for engineering purposes.

The information in this subsection does not eliminate the need for sampling and testing soils before specific engineering structures are designed and constructed. The information, however, can be used to—

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

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some words—for example, *soil*, *clay*, *silt*, *sand*, *topsoil*, *aggregate*, and *granular*—may have special meaning in soil science. These terms are defined in the Glossary.

To make the best use of the soil map and the soil survey report, the engineer should know the physical properties of the soil materials and the in-place condition of the soil. After testing the soil materials and observing the behavior of each soil when used in engineering structures and foundations, the engineer can develop design recommendations for each soil unit delineated on the map.

Soil test data

Samples from the principal soil types in seven extensive soil series were tested according to standard procedures so that the soils could be evaluated for engineering purposes. The test data are given in table 4.

In the moisture-density (compaction) test, soil material is compacted into a mold several times with a constant compactive effort, each time at a successively higher moisture content. The density (unit weight) of the soil material increases as the moisture content increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest density obtained in the compaction test is termed "maximum density." Moisture-density data are important in earthwork because, as a rule, the soil will be most stable if it is compacted to the maximum density when it is at the optimum moisture content.

The results of the mechanical analyses tell the relative proportions of the different size particles. These data, however, should not be used in naming soil textural classes, because the clay content was obtained by the hydrometer method. The liquid limit and the plasticity index indicate the effect of water on the consistence of the soil material.

Table 4 gives two engineering classifications for each soil sample. These classifications are based upon the

[3] This section was written by NORMAN YOUNG, soils engineer, Materials and Test Division, Tennessee State Highway Department, and GEORGE T. JACKSON, soil scientist, Soil Conservation Service.

TABLE 4.—*Engineering*

Soil name and location	Parent material	Tennessee report number	Depth	Horizon	Moisture-density [2] Maximum dry density	Moisture-density [2] Optimum moisture
					Lb. per cu. ft.	*Percent*
Christian loam: 270 yards W. of Neal's store on State Highway 42 along gravel road. (Sandy type)	Sandy shale and siltstone.	72	0 to 6 in	A_p	100	15
		73	14 to 29 in	B_2	98	20
		74	34 to 62 in	C_1	102	18
		75	7 to 10 ft		106	16
		76	18 to 20 ft		107	16
		77	28 to 30 ft		104	18
Christian silt loam: 1 mile NW. of Neal's store on State Highway 42 and 20 feet N. of private road. (Representative)	Shaly limestone and siltstone.	67	½ to 5 in	A_2	99	14
		68	8 to 18 in	B_2	101	20
		69	18 to 30 in	C	94	25
		70	7 to 11 ft		91	26
		71	13 to 17 ft		106	16
Christian silt loam: ½ mile NW. of Shipley Church. (Cherty variation)	Shaly and cherty limestone.	78	0 to 6 in	A_p	103	14
		79	6 to 17 in	B_2	92	23
		80	33 to 48 in	C_2	98	20
		81	33 to 48 in	C_2	89	20
Dellrose cherty silt loam: 0.7 mile S. of Gentry School on road to Buffalo Valley. (Representative)	Old colluvium from cherty limestone.	36	0 to 16 in	A_p and A_2	98	16
		37	20 to 36 in	B_2	102	16
		38	3 to 5 ft		104	17
		39	9 to 13 ft		106	16
		40	18 to 23 ft		107	15
0.7 mile NW. of Gentry School. (D horizon at 28 inches)	Old colluvium from cherty limestone.	41	0 to 10 in	A_p	94	21
		42	15 to 28 in	B_2	100	18
		43	28 to 48 in	D	92	26
2.9 miles W. and 100 yards NE. of Bloomington Springs Post Office. (Lighter colored and chertier than common)	Old alluvium from cherty limestone.	44	0 to 7 in	A_p	94	20
		45	14 to 30 in	B_2	96	16
		46	5 to 9 ft		104	19
		47	9 to 12 ft		100	20
Dickson silt loam: ¾ mile E. of Double Springs and 100 yards S. of U.S. Highway 70N. (Representative)	Loess over shaly and cherty limestone.	48	0 to 7 in	A_p	107	19
		49	10 to 24 in	B_2	110	14
		50	28 to 38 in	B_{32m}	103	16
		51	4 to 7 ft	D_{u1}	90	25
		52	9 to 13 ft	D_{u2}	90	25
		53	18 to 22 ft	D_{u3}	100	20
		54	26 to 30 ft	D_{u4}	97	18
⅝ mile NE. of Bloomington Springs on Gainesboro Road. (Intergrade to Sango soil)	Loess over shaly and cherty limestone.	55	½ to 5 in	A_2	104	12
		56	8 to 24 in	B_2	112	10
		57	24 to 38 in	B_{3m}	114	12
		58	13 to 18 ft	D_{u1}	95	22
		59	18 to 22 ft	D_{u2}	92	19
⅝ mile NE. of Thomas; 100 yards E. of farmhouse. (Loess over shaly residuum)	Loess over shaly and cherty limestone.	60	0 to 7 in	A_p	106	12
		61	10 to 24 in	B_2	114	12
		62	26 to 36 in	B_{32m}	109	14
		63	4 to 10 ft	D_{u1}	96	21
		64	10 to 14 ft	D_{u2}	98	21
		65	14 to 24 ft	D_{u3}	100	17
		66	24 to 30 ft	D_{u4}	98	20

See footnotes at end of table.

test data [1]

Mechanical analysis [3]											Liquid limit	Plasticity index	Classification	
Discarded in field sampling (estimate)	Percentage passing sieve [4]						Percentage smaller than [4]—						AASHO [5]	Unified [6]
3 in. to 1 in.	3 in.	¾ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
0	------	100	99	99	96	54	48	39	21	12	30	(7)	A-4(4)	ML.
0	------	------	------	100	99	60	57	54	48	42	48	14	A-7-5(8)	ML.
0	------	------	------	------	100	45	44	40	38	33	43	9	A-5(2)	SM.
0	------	------	------	100	98	49	46	40	34	28	40	8	A-4(3)	SM.
0	------	100	98	96	95	50	44	39	29	18	40	9	A-4(3)	SM.
0	------	------	100	99	98	74	65	58	45	31	48	18	A-7-5(13)	ML.
0	------	100	95	93	90	74	67	54	28	15	28	(7)	A-4(8)	ML.
0	------	100	87	86	85	78	77	68	49	38	44	18	A-7-6(12)	ML-CL.
0	------	100	98	97	97	96	94	86	72	62	67	32	A-7-5(20)	MH.
0	100	99	97	96	93	83	82	77	66	59	69	37	A-7-5(20)	MH-CH.
0	------	------	100	99	93	91	88	76	52	36	47	21	A-7-6(14)	ML-CL.
0	100	98	72	68	65	48	44	35	16	9	26	4	A-4(3)	GM-GC.
0	100	98	90	88	86	72	71	69	56	51	67	31	A-7-5(19)	MH.
40	100	98	89	88	87	73	69	62	49	43	58	21	A-7-5(6)	GM.
40	100	93	82	80	79	65	63	59	45	43	55	17	A-7-5(3)	GM.
20	[8] 97	88	74	68	60	56	54	43	27	17	46	18	A-7-6(5)	GM-GC.
30	------	97	91	90	84	81	80	73	38	28	36	12	A-6(5)	ML-CL.
0	------	91	62	55	49	45	44	39	23	18	35	11	A-6(2)	GM-GC.
0	------	97	66	58	50	44	43	38	24	18	35	12	A-6(3)	GM-GC.
0	------	97	76	68	58	50	48	42	26	20	34	11	A-6(3)	SM-SC.
20	100	91	82	78	71	68	66	58	26	15	40	10	A-4(4)	ML.
30	100	91	83	80	74	71	70	61	31	21	36	10	A-4(3)	GM-GC.
0	100	96	93	92	90	88	87	83	68	58	63	29	A-7-5(20)	MH.
[9] 15	100	95	74	70	61	57	55	47	28	19	37	7	A-4(3)	GM.
[9] 35	100	91	60	56	47	44	42	36	18	12	32	5	A-2-4(0)	GM.
0	100	99	64	58	51	46	45	37	19	13	30	5	A-4(2)	GM.
0	------	100	91	89	84	81	79	73	50	39	49	21	A-7-6(14)	ML-CL.
0	------	100	98	96	92	76	68	47	14	8	23	(7)	A-4(8)	ML.
0	------	100	99	97	95	86	79	66	33	26	34	13	A-6(9)	CL.
0	------	100	96	95	92	83	78	65	37	27	40	13	A-6(9)	ML-CL.
0	------	100	89	98	96	91	88	84	70	60	73	36	A-7-5(20)	MH.
0	100	99	99	98	96	86	82	73	62	52	65	28	A-7-5(20)	MH.
0	------	100	98	97	94	88	71	60	44	36	52	20	A-7-5(14)	MH.
0	100	99	94	92	88	76	71	57	38	26	47	14	A-7-5(11)	ML.
0	------	100	99	97	92	74	70	44	14	9	23	(7)	A-4(8)	ML.
0	------	100	99	97	95	80	74	56	23	17	26	5	A-4(8)	ML-CL.
0	------	100	99	97	96	83	74	60	28	20	30	10	A-4(8)	CL.
0	100	99	76	71	65	58	56	53	38	29	58	28	A-7-5(14)	MH-CH.
0	------	100	93	89	82	75	73	63	38	25	43	11	A-7-5(9)	ML.
0	------	------	100	98	95	82	75	57	24	17	25	(7)	A-4(8)	ML.
0	------	100	99	98	96	86	78	62	28	18	29	8	A-4(8)	ML-CL.
0	------	100	99	98	96	88	83	66	31	23	33	9	A-4(8)	ML-CL.
0	------	------	------	100	98	84	83	74	54	43	62	29	A-7-5(20)	MH-CH.
0	------	------	------	100	96	78	72	63	51	43	60	27	A-7-5(19)	MH.
0	------	------	100	99	90	78	72	61	45	38	55	25	A-7-5(17)	CH.
0	100	99	83	77	71	58	56	47	33	24	48	18	A-7-5(9)	ML.

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TABLE 4.—*Engineering*

Soil name and location	Parent material	Tennessee report number	Depth	Horizon	Moisture-density [2] Maximum dry density	Moisture-density [2] Optimum moisture
					Lb. per cu. ft.	*Percent*
Hartsells loam:						
8.0 miles E. of Monterey on County Highway 4244. (Representative)	Acid sandstone.	1	1 to 12 in.	A_2	106	13
		2	18 to 28 in.	B_2	115	10
		3	32 to 54 in.	C_1	111	14
0.2 mile W. of Walnut Grove School and 50 feet N. of U.S. Highway 70N. (Sandier than common)	Pennsylvanian sandstone.	4	1 to 10 in.	A_2	108	10
		5	14 to 42 in.	B_2	114	9
		6	42 to 60 in. +	C	116	11
4.7 miles E. of Monterey High School on Clarkrange Road. (Finer textured than common)	Acid sandstone and siltstone.	7	1 to 14 in.	A_2	106	13
		8	14 to 27 in.	B_2	108	11
		9	30 to 48 in.	C_1	106	16
		10	48 to 60 in.	C_2	92	22
Mountview silt loam:						
At Lilys Chapel, S. of Baxter. (Representative)	Loess over shaly and cherty limestone.	11	0 to 7 in.	A_p	94	13
		12	12 to 26 in.	B_2	106	14
		13	32 to 42 in.	D	96	18
1.5 miles S. of Bangham School and 100 yards E. of Hilham Road. (Sandier than common)	Loess over cherty and sandy limestone.	14	0 to 7 in.	A_p	111	14
		15	10 to 20 in.	B_2	116	8
		16	24 to 36 in.	D	104	16
		17	4 to 7½ ft.		108	14
		18	14 to 18 ft.		111	12
		19	22 to 30 ft.		106	14
Mountview silt loam:						
¾ mile NE. of Twin Oak School. (Weathered shale D horizon)	Loess over shaly limestone.	20	0 to 6 in.	A_p	115	10
		21	9 to 24 in.	B_2	112	11
		22	32 to 50 in.	D	92	20
		23	6½ to 10 ft.		96	17
		24	14½ to 18 ft.		92	18
		25	18 to 25 ft.		98	20
Purdy silt loam:						
0.8 mile N. of Winona Motel on U.S. Highway 70. (Representative)	Alluvial terrace over cherty limestone and shale.	82	0 to 6 in.	A_p	100	15
		83	9 to 36 in.	B_{22g}	116	10
		84	7½ to 11 ft.		100	20
		85	11 to 16 ft.		108	18
		86	18 to 20 ft.		99	20
1.3 miles E. of Neal's store. (Younger alluvium than common)	Alluvial terrace over cherty limestone and shale.	87	0 to 10 in.	A_p	111	10
		88	10 to 18 in.	B_{21g}	118	9
		89	18 to 40 in.	B_{22g}	115	10
		90	5 to 7 ft.		111	14
		91	7 to 9 ft.		116	12
3/4 mile S. of Algood. (Level phase)	Alluvial terrace over cherty limestone and shale.	92	1 to 12 in.	A_2	99	14
		93	16 to 36 in.	B_{22g}	110	12
		94	9 to 11 ft.		107	13
		95	17 to 20 ft.		98	21
Waynesboro silt loam:						
100 yards N. and 100 ft. E. of Mt. Herman Church. (Representative)	Old alluvium.	26	1 to 7 in.	A_2	106	13
		27	18 to 36 in.	B_{22}	99	18
		28	4 to 28 ft.	C_2	106	18

See footnotes at end of table.

test data [1]—Continued

Mechanical analysis [3]											Liquid limit	Plasticity index	Classification	
Discarded in field sampling (estimate)	Percentage passing sieve [4]						Percentage smaller than [4]—						AASHO [5]	Unified [6]
3 in. to 1 in.	3 in.	¾-in.	Nol 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
0	------	------	------	100	92	58	58	50	24	18	25	6	A-4(5)	ML-CL.
0	------	------	------	100	90	53	52	44	26	19	28	11	A-6(4)	CL.
0	------	------	------	100	90	48	48	44	31	28	30	7	A-4(3)	SM-SC.
0	100	99	98	96	90	26	25	22	13	12	18	(7)	A-2-4(0)	SM.
0	------	------	------	100	96	39	38	34	22	17	17	2	A-4(1)	SM.
0	------	------	------	100	91	29	28	23	22	19	23	(7)	A-2-4(0)	SM.
0	------	------	100	99	97	84	82	68	32	23	29	9	A-4(8)	CL.
0	------	100	96	93	91	78	76	61	29	29	30	8	A-4(8)	ML-CL.
0	------	100	96	94	93	76	73	64	38	29	39	14	A-6(10)	ML-CL.
0	------	100	98	97	96	88	87	78	52	42	59	27	A-7-5(19)	MH-CH.
0	------	------	------	100	97	86	82	62	20	10	26	(7)	A-4(8)	ML.
0	------	100	99	98	96	84	82	68	32	23	32	10	A-4(8)	ML-CL.
0	------	------	------	100	98	88	84	74	49	42	48	14	A-7-5(11)	ML.
0	------	100	99	98	95	56	51	40	15	9	21	(7)	A-4(4)	ML.
0	------	100	99	99	97	67	64	54	27	20	24	7	A-4(6)	ML-CL.
0	------	100	93	92	91	63	62	55	35	29	35	13	A-6(7)	ML-CL.
0	------	------	------	100	99	57	55	50	43	42	40	11	A-6(5)	ML.
0	------	------	100	98	95	73	70	66	49	42	59	31	A-7-6(19)	CH.
0	------	100	99	97	96	82	81	76	53	43	49	28	A-7-6(17)	CL.
0	------	100	99	98	94	83	76	57	23	17	26	6	A-4(8)	ML-CL.
0	------	100	94	93	91	83	80	63	32	23	35	13	A-6(9)	ML-CL.
0	------	100	98	97	93	86	81	67	50	42	56	23	A-7-5(16)	MH.
0	------	100	94	92	87	78	74	58	42	33	47	17	A-7-5(12)	ML.
0	------	100	94	93	88	81	79	66	43	32	48	10	A-5(10)	ML.
0	100	92	76	72	67	60	57	49	38	30	58	26	A-7-5(14)	MH-CH.
0	------	------	------	100	98	66	60	47	17	10	30	(7)	A-4(6)	ML.
0	------	------	------	100	99	68	61	49	19	14	22	4	A-4(7)	ML-CL.
0	------	------	100	99	97	92	90	88	69	54	63	37	A-7-6(20)	CH.
0	100	97	90	86	81	62	58	54	34	30	43	23	A-7-6(11)	CL.
0	------	100	96	94	90	81	80	76	58	47	57	30	A-7-6(19)	CH.
0	------	100	99	98	96	57	48	36	13	8	23	(7)	A-4(4)	ML.
0	------	100	80	79	76	45	41	31	14	8	20	2	A-4(2)	SM.
0	------	------	100	99	96	55	49	38	14	9	20	(7)	A-4(4)	ML.
0	100	98	76	74	70	43	38	31	19	15	28	8	A-4(2)	SC.
0	------	100	98	98	96	63	57	48	29	23	29	12	A-6(6)	CL.
0	------	100	99	99	98	67	58	45	15	10	30	3	A-4(6)	ML.
0	------	100	97	96	92	70	65	55	28	20	31	9	A-4(7)	ML-CL.
0	------	100	97	96	93	79	76	69	47	40	53	29	A-7-6(18)	CH.
0	------	100	93	93	91	84	82	79	60	49	58	33	A-7-6(20)	CH.
0	------	96	96	95	91	66	50	42	28	15	24	3	A-4(6)	ML.
0	------	------	------	100	98	81	78	74	53	46	43	12	A-7-5(9)	ML.
0	------	------	------	100	98	63	59	51	44	41	41	8	A-5(6)	MI

TABLE 4.—*Engineering*

Soil name and location	Parent material	Tennessee report number	Depth	Horizon	Moisture-density [2] Maximum dry density	Moisture-density [2] Optimum moisture
					Lb. per cu. ft.	*Percent*
Waynesboro silt loam—Continued						
1 mile S. and 160 yards W. of Mt. Herman Church. (Sandy variant)	Old alluvium.	29	0 to 6 in	A_p	122	8
		30	9 to 26 in	B_2	112	13
		31	26 to 38 in	C	106	16
0.1 mile NE. of Taylor Seminary. (Intergrades to Holston soil)	Old alluvium.	32	0 to 9 in	A_p	112	10
		33	14 to 25 in	B_2	112	12
		34	29 to 38 in	C_1	108	14
		35	38 to 50 in. +	C_2	107	15

[1] Tests performed by Tennessee Department of Highways and Public Works in accordance with standard procedures of the American Association of State Highway Officials (AASHO).

[2] Based on the Moisture-density Relations of Soils, using a 5.5-lb. Rammer and 12-inch Drop, AASHO Designation T 99-57, Method A.

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

liquid limit, the plasticity index, and the data obtained by mechanical analyses. They are briefly described in the subsection "Engineering Classification of Soils."

Engineering classification of soils

Most highway engineers classify soil materials according to the system of the American Association of State Highway Officials (*1*). In this system there are seven principal groups. These groups range from A–1, consisting of gravelly soils having a high bearing capacity, to A–7, consisting of clay soils having low strength when wet. Within each group the relative engineering value of the soil material can be indicated by a group index number. Group indexes range from 0 for the best material to *test data* [1]—Continued

Mechanical analysis [3]											Liquid limit	Plasticity index	Classification	
Discarded in field sampling (estimate)	Percentage passing sieve [4]						Percentage smaller than [4]—						AASHO [5]	Unified [6]
3 in. to 1 in.	3 in.	¾-in.	Nol 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
0	------	100	96	93	87	43	40	33	22	19	19	3	A-4(2)	SM.
0	------	100	98	95	81	45	43	39	33	28	35	14	A-6(3)	SC.
0	------	100	99	95	83	46	46	44	40	38	43	15	A-7-6(4)	SM-SC.
0	------	------	------	100	94	69	64	54	26	17	23	4	A-4(7)	ML-CL.
0	------	100	99	98	94	75	70	61	31	24	31	9	A-4(8)	ML-CL.
0	------	100	99	99	94	72	69	62	40	33	37	10	A-4(8)	ML.
0	------	100	99	98	93	68	64	57	40	35	41	9	A-5(7)	ML.

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

[4] Based on sample as received in laboratory. Laboratory test data not corrected for amount discarded in field sampling.

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

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

[7] Nonplastic.

[8] Material larger than 3 inches received in laboratory.

[9] Some of material between ½ and 1 inch was also discarded in field sampling.

20 for the poorest. In table 4 the group index is shown in parentheses following the soil-group symbol.

Some engineers prefer the Unified soil classification (*16*). In this classification soil materials are identified as coarse grained (8 classes), fine grained (6 classes), or highly organic.

The classification of a soil material by either the AASHO or the Unified system identifies that soil material with regard to gradation and plasticity characteristics. The classification permits the engineer to appraise the soil material rapidly by comparing it with more familiar soils that have the same classification. Table 5 lists two engineering classifications and the USDA textural class for each soil in the county.

TABLE 5.—*Brief description of soils*

Map symbol	Soil	Brief description of site and soil	Depth to seasonally high water table	Depth to bedrock	Depth from surface (typical profile)
			Feet	*Feet*	*Inches*
AaC3	Allen clay loam, 5 to 12 percent slopes, severely eroded.	Well-drained soils formed in old local alluvium or colluvium on foot slopes and benches; parent material from limestone and sandstone; limestone bedrock; upper 4 to 6 inches of soil profile has washed away.	20+	2½–20	0–46
AaE3	Allen clay loam, 12 to 30 percent slopes, severely eroded.				46–60
AcD	Allen cobbly loam, 5 to 20 percent slopes.	Well-drained soils formed in colluvium on foot slopes and benches; parent material from limestone and sandstone; 3- to 10-inch cobbles on surface and in soil profile.	20+	3–25	0–13 13–40
AcE	Allen cobbly loam, 20 to 30 percent slopes.				40–50
AmB	Allen loam, 2 to 5 percent slopes.	Well-drained soils formed in old local alluvium or colluvium on foot slopes and benches; parent material from limestone and sandstone; limestone bedrock.	20+	3–25	0–10
AmC	Allen loam, 5 to 12 percent slopes.				10–46
AmD	Allen loam, 12 to 20 percent slopes.				46–60
AmE	Allen loam, 20 to 30 percent slopes.				
ArB	Armour silt loam, 2 to 5 percent slopes.	Soils on colluvial slopes and on terraces; developed in old colluvium washed from phosphatic limestone.	20	2–12	0–10 10–48
ArC2	Armour silt loam, 5 to 12 percent slopes, eroded.				48–60
ArD2	Armour silt loam, 12 to 20 percent slopes, eroded.				
At	Atkins silt loam	Poorly drained soil on bottom land; subject to flooding; bedrock of sandstone or shale.	0	2–5	0–30
BaC2	Baxter cherty silt loam, 5 to 12 percent slopes, eroded.	Well-drained, cherty soils formed in residuum from cherty limestone in uplands; angular chert fragments as much as 5 inches in diameter on the surface and in profile.	20+	5–30	0–7
BaD	Baxter cherty silt loam, 12 to 20 percent slopes.				7–22
BaD2	Baxter cherty silt loam, 12 to 20 percent slopes, eroded.				22–70
BaE	Baxter cherty silt loam, 20 to 30 percent slopes.				
BcD3	Baxter cherty silty clay loam, 12 to 20 percent slopes, severely eroded.	Well-drained, cherty soils formed in residuum from cherty limestone in uplands; angular chert fragments as much as 5 inches in diameter on the surface and in profile; upper 4 to 6 inches has washed away.	20+	5–30	0–22 22–77
BcE3	Baxter cherty silty clay loam, 20 to 30 percent slopes, severely eroded.				
BeB	Bewleyville silt loam, 2 to 5 percent slopes.	Well-drained soils on uplands; formed in 2 to 3 feet of loess over limestone residuum; limestone bedrock.	20+	10–30	0–9 9–36
BeC	Bewleyville silt loam, 5 to 12 percent slopes.				36–48
BeC2	Bewleyville silt loam, 5 to 12 percent slopes, eroded.				
BeD2	Bewleyville silt loam, 12 to 20 percent slopes, eroded.				
BmC3	Bewleyville silty clay loam, 5 to 12 percent slopes, severely eroded.	Well-drained soils on uplands; formed in 2 to 3 feet of loess over limestone residuum; limestone bedrock; upper 4 to 6 inches has washed away.	20+	10–30	0–36 36–48
BmD3	Bewleyville silty clay loam, 12 to 20 percent slopes, severely eroded.				
BoC	Bodine cherty silt loam, 5 to 12 percent slopes.	Excessively drained, cherty soils on uplands formed in very cherty limestone residuum.	20+	2–10	0–8
BoD	Bodine cherty silt loam, 12 to 20 percent slopes.				8–20
BoE	Bodine cherty silt loam, 20 to 40 percent slopes.				
Br	Bruno loamy sand	Excessively drained, sandy soil on first bottoms	0	6–12	0–50

and their estimated physical properties

Classification			Percentage passing sieve—			Selected characteristics significant to engineering				
USDA textural class	Unified	AASHO	No. 4	No. 10	No. 200	Permeability	Structure	Available water	Reaction [1]	Shrink-swell potential
						Inches per hour		*Inches per inch*	*pH*	
Clay loam	ML or CL	A-6 or A-7.	95-100	85-100	55-75	0. 8-2. 5	Blocky	0. 15-. 20	4. 5-5. 5	Moderate.
Clay loam to clay.	CL	A-7	95-100	85-100	55-80	. 8-2. 5	Blocky	. 15-. 20	4. 5-5. 5	Moderate.
Cobbly loam	SM or SC	A-4	70-85	60-85	40-50	2. 5-5. 0	Granular	. 10-. 15	4. 5-5. 5	Low.
Cobbly clay loam.	ML or CL	A-6 or A-7.	70-85	65-85	50-60	. 8-2. 5	Blocky	. 10-. 15	4. 5-5. 5	Moderate.
Cobbly clay loam.	ML or CL	A-6 or A-7	70-85	65-85	50-60	. 8-2. 5	Blocky	. 10-. 15	4. 5-5. 5	Moderate.
Loam	ML or CL	A-4	95-100	85-100	55-85	2. 5-5. 0	Granular	. 15-. 20	4. 5-5. 5	Low.
Clay loam	ML or CL	A-6 or A-7.	95-100	85-100	55-80	. 8-2. 5	Blocky	. 15-. 20	4. 5-5. 5	Moderate.
Clay loam to clay.	CL	A-7	95-100	85-100	55-80	. 8-2. 5	Blocky	. 15-. 20	4. 5-5. 5	Moderate.
Silt loam	ML or CL	A-6	85-95	85-95	75-90	. 8-2. 5	Granular	. 20-. 25	5. 6-6. 0	Low.
Silty clay loam	CL	A-6	85-95	85-95	75-90	. 8-2. 5	Blocky	. 15-. 20	5. 6-6. 0	Moderate.
Silty clay	MH or CH	A-7	85-95	85-95	75-90	. 2- . 8	Blocky	. 10-. 15	5. 6-6. 0	High.
Silt loam	ML	A-6	95-100	90-100	80-95	. 8-2. 5	Granular	. 15-. 20	5. 1-5. 5	Moderate.
Cherty silt loam.	CL or ML	A-4	70-90	65-85	55-70	2. 5-5. 0	Granular	. 10-. 15	5. 1-5. 5	Low.
Cherty silty clay loam.	MH or CH	A-7	70-85	65-80	60-75	. 8-2. 5	Blocky	. 10-. 15	5. 1-5. 5	High.
Cherty clay	CH	A-7	60-80	55-75	50-75	. 8-2. 5	Blocky	. 05-. 15	4. 5- 5. 0	High.
Cherty silty clay loam.	MH or CH	A-7	70-85	65-80	60-75	. 8-2. 5	Blocky	. 10-. 15	5. 1-5. 5	High.
Cherty clay	CH	A-7	60-80	55-75	50-75	. 8-2. 5	Blocky	. 05-. 15	4. 5-5. 0	High.
Silt loam	ML or CL	A-4	95-100	95-100	85-95	2. 5-5. 0	Granular	. 15-. 20	5. 1-5. 5	Low.
Silty clay loam.	ML or CL	A-6 or A-7.	95-100	95-100	85-95	. 8-2. 5	Blocky	. 15-. 20	5. 1-5. 5	Moderate.
Clay	MH or CH	A-7	95-100	90-100	80-95	. 8-2. 5	Blocky	. 10-. 15	5. 1-5. 5	High.
Silty clay loam	ML or CL	A-6 or A-7.	95-100	95-100	85-95	. 8-2. 5	Blocky	. 15-. 20	5. 1-5. 5	Moderate.
Clay	MH or CH	A-7	95-100	90-100	80-95	. 8-2. 5	Blocky	. 10-. 15	5. 1-5. 5	High.
Cherty silt loam.	ML or GM	A-4	55-75	45-65	40-55	2. 5-5. 0	Granular	. 05-. 15	5. 1-5. 5	Low.
Cherty silt loam.	GM	A-2 or A-4.	35-50	30-45	25-40	2. 5-5. 0	Massive	. 05-. 15	4. 5-5. 0	Low.
Loamy sand	SM	A-2	80-95	75-90	25-35	5. 0-10. 0	Single grain	. 05-. 10	5. 6-6. 0	Very low.

TABLE 5.—*Brief description of soils and their*

Map symbol	Soil	Brief description of site and soil	Depth to seasonally high water table	Depth to bedrock	Depth from surface (typical profile)
			Feet	*Feet*	*Inches*
CcC3 CcD3 CcE3	Christian silty clay loam, 5 to 12 percent slopes, severely eroded. Christian silty clay loam, 12 to 20 percent slopes, severely eroded. Christian silty clay loam, 20 to 30 percent slopes, severely eroded.	Well-drained soils on rolling to hilly uplands; formed in residuum from interbedded shaly limestone and siltstone; upper 4 to 6 inches washed away.	20+	2–6	0–36 36–56
ChB ChC ChC2 ChD2 ChE	Christian loam, 2 to 5 percent slopes. Christian loam, 5 to 12 percent slopes. Christian loam, 5 to 12 percent slopes, eroded. Christian loam, 12 to 20 percent slopes, eroded. Christian loam, 20 to 30 percent slopes.	Well-drained soils on rolling to steep uplands; formed in residuum from interbedded sandy limestone and siltstone.	20+	2½–6	0–8 8–26 26–42
CkC2	Cookeville silt loam, 5 to 12 percent slopes, eroded.	Well-drained soil on rolling to hilly uplands; formed in residuum from noncherty limestone.	20+	5–20	0–7 7–38 38–48
CoC3 CoD3	Cookeville silty clay loam, 5 to 12 percent slopes, severely eroded. Cookeville silty clay loam, 12 to 20 percent slopes, severely eroded.	Well-drained soils on rolling to hilly uplands; formed in residuum from noncherty limestone; upper 4 to 6 inches washed away.	20+	5–20	0–38 38–48
CrB2 CrC CrC2 CrD CrD2	Christian silt loam, 2 to 5 percent slopes, eroded. Christian silt loam, 5 to 12 percent slopes. Christian silt loam, 5 to 12 percent slopes, eroded. Christian silt loam, 12 to 20 percent slopes Christian silt loam, 12 to 20 percent slopes, eroded.	Well-drained soils on rolling to hilly uplands; formed in residuum from interbedded shaly limestone and siltstone.	20+	2½–6	0–8 8–36 36–56
CsB CsC2	Cumberland silt loam, 2 to 5 percent slopes. Cumberland silt loam, 5 to 12 percent slopes, eroded.	Well-drained soils on high stream terraces; generally sloping to rolling; formed in old general alluvium; bedrock mainly limestone.	20+	5–20	0–10 10–30 30–70
CuC3	Cumberland silty clay loam, 5 to 12 percent slope, severely eroded.	Well-drained soil on high stream terraces; generally sloping to rolling; formed in old general alluvium; bedrock mainly limestone; upper 4 to 6 inches washed away.	20+	5–20	0–30 30–70
DeD DeE DeF	Dellrose cherty silt loam, 12 to 20 percent slopes. Dellrose cherty silt loam, 20 to 30 percent slopes. Dellrose cherty silt loam, 30 to 45 percent slopes.	Cherty colluvial soils on long steep slopes of the Highland Rim escarpment.	20+	2–30	0–20 20–60
Dk	Dickson silt loam	Soil on uplands formed in a thin silt mantle; contains a fragipan; underlain at about 36 inches by cherty residuum from limestone.	2–3	6–20	0–6 6–25 25–38 38–50

estimated physical properties—Continued

Classification			Percentage passing sieve—			Selected characteristics significant to engineering				
USDA textural class	Unified	AASHO	No. 4	No. 10	No. 200	Permeability	Structure	Available water	Reaction [1]	Shrink-swell potential
						Inches per hour		*Inches per inch*	*pH*	
Silty clay	MH or CH	A-7	90–100	90–100	80–95	.2 – .8	Blocky	.10–.15	5.1–5.5	High.
Clay	MH or CH	A-7	90–100	90–100	80–95	.2 – .8	Blocky	.10–.15	5.1–5.5	High.
Loam	ML or CL	A-4	95–100	95–100	65–75	2.50– 5.0	Granular	.15–.20	5.1–5.5	Low.
Clay loam	CH or CL	A-6 or A-7.	95–100	95–100	60–85	.8 – 2.5	Blocky	.15–.20	5.1–5.5	Moderate to high.
Sandy clay loam.	CL	A-4 or A-6.	95–100	95–100	50–75	.8 – 2.5	Blocky	.10–.15	5.1–5.5	Moderate.
Silt loam	ML or CL	A-4	90–100	90–100	75–90	.8 – 2.5	Granular	.15–.20	5.1–5.5	Low.
Silty clay	MH or CH	A-7	90–100	90–100	85–95	.8 – 2.5	Blocky	.10–.15	5.1–5.5	High.
Clay	MH or CH	A-7	90–100	90–100	85–95	.8 – 2.5	Blocky	.10–.15	5.1–5.5	High.
Silty clay	MH or CH	A-7	90–100	90–100	85–95	.8 – 2.5	Blocky	.10–.15	5.1–5.5	High.
Clay	MH or CH	A-7	90–100	90–100	85–95	.8 – 2.5	Blocky	.10–.15	5.1–5.5	High.
Silt loam	ML or CL	A-4	90–100	90–100	65–80	.8 – 2.5	Granular	.15–.20	5.1–5.5	Moderate.
Silty clay	MH or CH	A-7	90–100	90–100	80–95	.2 – .8	Blocky	.10–.15	5.1–5.5	High.
Clay	MH or CH	A-7	90–100	90–100	80–95	.2 – .8	Blocky	.10–.15	5.1–5.5	High.
Silt loam	ML or CL	A-4 or A-6	95–100	90–100	70–90	.8 – 2.5	Granular	.15–.20	5.1–6.0	Moderate.
Silty clay loam.	CL	A-6 or A-7.	95–100	90–100	65–75	.8 – 2.5	Blocky	.15–.20	5.1–5.5	Moderate.
Silty clay or clay.	MH or CH	A-7	95–100	90–100	75–90	.8 – 2.5	Blocky	.10–.15	5.1–5.5	High.
Silty clay loam.	CL	A-6 or A-7.	95–100	90–100	65–75	.8 – 2.5	Blocky	.15–.20	5.6–6.0	Moderate.
Silty clay or clay.	MH or CH	A-7	95–100	90–100	75–90	.8 – 2.5	Blocky	.10–.15	5.1–5.5	High.
Cherty silt loam.	GM or ML	A-4 or A-7.	65–80	60–75	45–60	2.5 – 5.0	Granular	.10–.20	5.1–6.0	Low to moderate.
Cherty silty clay loam.	GM, GM-GC, or ML.	A-4 or A-6.	65–80	60–75	45–60	2.5 – 5.0	Blocky	.10–.15	5.1–6.0	Moderate.
Silt loam	ML	A-4	95–100	90–100	85–95	.8 – 2.5	Granular	.15–.20	4.5–5.0	Moderate.
Silt loam	ML or CL	A-4	95–100	90–100	85–95	.8 – 2.5	Blocky	.15–.20	4.5–5.0	Moderate.
Silt loam	ML or CL	A-6	95–100	90–100	85–95	.2 – .8	Massive	.10–.15	4.5–5.0	Moderate.
Silty clay loam.	ML or CL	A-7	95–100	90–100	80–90	.2 – .8	Blocky	.10–.15	4.5–5.0	High.

TABLE 5.—*Brief description of soils and their*

Map symbol	Soil	Brief description of site and soil	Depth to seasonally high water table	Depth to bedrock	Depth from surface (typical profile)
			Feet	*Feet*	*Inches*
Ek	Elkins silt loam	Nearly black, very poorly drained soil along small drains of the Cumberland Plateau.	0	2–4	0–36
En	Ennis silt loam, local alluvium	Well-drained soil forming in recent alluvium along small intermittent drains; alluvium formed from cherty limestone residuum.	2–3	3–10	0–48
Gs	Guthrie silt loam	Poorly drained, fine-textured soil in upland flats and depressions on the Highland Rim.	0	10–20	0–35 35–50 50–60
Gu	Gullied land	Land consisting of a network of shallow and deep gullies; soil material between gullies formed from limestone and is fine textured.	20+	0–30	-------
HaB HaC HaC2	Hartsells loam, 2 to 5 percent slopes. Hartsells loam, 5 to 12 percent slopes. Hartsells loam, 5 to 12 percent slopes, eroded.	Well-drained, medium-textured soils on uplands; formed in residuum from sandstone and sandy shale on the Cumberland Pleateau.	20+	2–4	0–12 12–36
HcC HcD HcE2	Hermitage cherty silt loam, 5 to 12 percent slopes. Hermitage cherty silt loam, 12 to 20 percent slopes. Hermitage cherty silt loam, 20 to 30 percent slopes, eroded.	Well-drained, cherty soils formed in colluvium derived from limestone; most chert fragments are less than 3 inches across.	10–20	5–12	0–16 16–42
HeB HeC HeD2	Hermitage silt loam, 2 to 5 percent slopes. Hermitage silt loam, 5 to 12 percent slopes. Hermitage silt loam, 12 to 20 percent slopes, eroded.	Well-drained soils formed in colluvium derived from limestone; limestone bedrock.	10–20	5–12	0–14 14–50
HnB HnC2	Holston loam, 2 to 5 percent slopes. Holston loam, 5 to 12 percent slopes, eroded.	Well-drained soils formed in old general alluvium derived from sandstone and some limestone.	10–20	8–25	0–12 12–40 40–58
HoB HoC HoC2	Holston silt loam, 2 to 5 percent slopes. Holston silt loam, 5 to 12 percent slopes. Holston silt loam, 5 to 12 percent slopes, eroded.	Soils formed in a loess cap 18 to 30 inches deep over old general alluvium; on high terraces and benches.	20+	10–20	0–10 10–40 40–54
Hr	Huntington cherty silt loam	Well-drained, cherty soil on first bottoms; forming in young alluvium derived principally from cherty limestone of the Highland Rim.	2–3	5–15	0–40
Hs	Huntington cherty silt loam, phosphatic.	Well-drained, cherty soil on first bottoms; forming in young alluvium derived from cherty limestone of the Highland Rim and phosphatic limestone of the Central Basin.	2–3	5–15	0–40
Ht	Huntington fine sandy loam	Well-drained soil on first bottoms; forming in young alluvium derived principally from limestone and sandstone.	2–3	5–15	0–18 18–36
Hu	Huntington silt loam	Well-drained soil on first bottoms; formed in alluvium washed principally from soils derived from limestone on the Highland Rim.	2–3	5–15	0–40
Hv	Huntington silt loam, local alluvium.	Well-drained soil forming in depressions, on foot slopes, and in sinkholes from material washed principally from soils derived from limestone on the Highland Rim.	2–3	5–15	0–40
Hw	Huntington silt loam, phosphatic.	Well-drained soil on first bottoms, forming in young alluvium derived principally from phosphatic limestone of the Central Basin.	2–3	5–15	0–40

estimated physical properties—Continued

Classification			Percentage passing sieve—			Selected characteristics significant to engineering				
USDA textural class	Unified	AASHO	No. 4	No. 10	No. 200	Permeability	Structure	Available water	Reaction [1]	Shrink-swell potential
						Inches per hour		*Inches per inch*	*pH*	
Silt loam or loam.	ML or CL	A-4	95-100	90-100	80-90	.8-2.5	Massive	.20-.25	5.1-5.5	Low.
Silt loam or loam.	ML or CL	A-4	95-100	90-100	80-95	.8-2.5	Granular	.15-.20	5.6-6.0	Moderate.
Silt loam	ML or CL	A-4	95-100	90-100	80-95	.2-.8	Granular	.15-.20	4.5-5.0	Moderate.
Silty clay loam	CL	A-6	95-100	90-100	85-95	.2-.8	Massive	.10-.15	4.5-5.0	Moderate.
Silty clay	CH	A-7	95-100	90-100	80-90	.2-.8	Massive	.10-.15	4.5-5.0	High.
Clay or cherty clay.	CH	A-7	70-100	65-100	60-100	<.2	Blocky to massive.	.05-.10	4.5-5.5	High.
Loam	ML or CL	A-4	95-100	90-100	55-75	.8-2.5	Granular	.15-.20	4.5-5.0	Low.
Clay loam or loam.	ML or CL	A-4 or A-6.	95-100	90-100	55-75	.8-2.5	Blocky	.15-.20	4.5-5.0	Low to moderate.
Cherty silt loam.	ML or CL	A-4	70-95	70-90	60-75	1.5-5.0	Granular	.10-.15	5.6-6.0	Moderate.
Cherty silty clay loam.	CL	A-6	70-90	70-90	60-75	2.5-5.0	Blocky	.10-.15	5.1-5.5	Moderate.
Silt loam	ML or CL	A-4	90-100	85-95	70-85	.8-2.5	Granular	.20-.25	5.6-6.0	Moderate.
Silty clay loam	CL	A-6	90-100	85-95	70-85	.8-2.5	Blocky	.15-.20	5.1-5.5	Moderate.
Loam	ML	A-4	95-100	90-100	55-75	.8-2.5	Crumb	.15-.20	5.1-5.5	Low.
Clay loam	CL	A-6	95-100	90-100	60-80	.8-2.5	Blocky	.15-.20	5.1-5.5	Moderate.
Loam	ML or CL	A-6	95-100	90-100	60-75	.8-2.5	Blocky	.15-.20	5.1-5.5	Moderate.
Silt loam	ML or CL	A-4 or A-6.	95-100	90-100	60-95	.8-2.5	Granular	.15-.20	5.1-5.5	Moderate.
Silty clay loam	ML or CL	A-4 or A-6.	95-100	90-100	60-95	.8-2.5	Blocky	.15-.20	5.1-5.5	Moderate.
Silty clay loam or clay loam.	MH or CL	A-7	95-100	90-100	60-90	.8-2.5	Blocky	.15-.20	5.1-5.5	Moderate.
Cherty silt loam.	ML or CL	A-4	70-90	60-80	50-70	.8-2.5	Granular	.10-.15	5.6-6.5	Low.
Cherty silt loam.	ML or CL	A-4	70-90	60-80	50-70	.8-2.5	Granular	.10-.15	5.6-6.5	Low.
Fine sandy loam.	SM, SC, or ML.	A-4	95-100	90-100	45-60	.8-2.5	Granular	.15-.20	5.6-6.5	Low.
Loam	ML or CL	A-4	95-100	90-100	65-75	----------	Granular	.15-.20	5.6-6.5	Low.
Silt loam	ML or CL	A-4 or A-6.	95-100	90-100	60-95	.8-2.5	Granular	.20-.25	5.6-6.5	Moderate.
Silt loam	ML or CL	A-4 or A-6.	95-100	90-100	60-95	.8-2.5	Granular	.20-.25	5.6-6.5	Moderate.
Silt loam	ML or CL	A-4 or A-6.	95-100	90-100	80-95	.8-2.5	Granular	.20-.25	5.6-6.5	Moderate.

TABLE 5.—*Brief description of soils and their*

Map symbol	Soil	Brief description of site and soil	Depth to seasonally high water table	Depth to bedrock	Depth from surface (typical profile)
			Feet	*Feet*	*Inches*
JcC	Jefferson cobbly sandy loam, 5 to 12 percent slopes.	Well-drained, cobbly soils on foot slopes and benches; formed in colluvium derived from sandstone, shale, and limestone; 3- to 10-inch cobbles on the surface and in the profile.	20+	3-8	0-8
JcD	Jefferson cobbly sandy loam, 12 to 20 percent slopes.				8-22
JcE	Jefferson cobbly sandy loam, 20 to 30 percent slopes.				22-50
JeB	Jefferson loam, 2 to 5 percent slopes.	Well-drained soils on foot slopes and benches; formed in local alluvium and colluvium derived from sandstone, shale, and limestone; bedrock is limestone or sandstone.	20+	3-12	0-16 16-36
JeC	Jefferson loam, 5 to 12 percent slopes.				
JeD2	Jefferson loam, 12 to 20 percent slopes, eroded.				
LaB	Landisburg silt loam, 2 to 5 percent slopes.	Moderately well drained soils on foot slopes; formed in old local alluvium derived from cherty limestone; fragipan at about 2 feet; underlain by limestone; seasonally perched water table.	1. 5-2. 5	10-15	0-12 12-26
LaC	Landisburg silt loam, 5 to 12 percent slopes.				26-38 38-50
Lm	Lawrence silt loam	Somewhat poorly drained soil on uplands; formed in a thin silt mantle over a firm fragipan about 10 to 25 inches thick; bedrock is cherty limestone; soil remains saturated long after wet periods.	0	15-25	0-14 14-20 20-50 50-72
Ln	Lindside silt loam	Moderately well to somewhat poorly drained soil on first bottoms; recent alluvium derived mainly from limestone; subject to flooding; underlain by limestone.	0	5-15	0-32 32-48
LrC	Linker loam, 5 to 12 percent slopes.	Well-drained soils on uplands of the Cumberland Plateau; formed in residuum from acid sandstone; bedrock is sandstone.	20+	2. 5-5	0-5 5-34
LrC2	Linker loam, 5 to 12 percent slopes, eroded.				34-48
Ma	Melvin silt loam	Poorly drained soil on first bottoms; alluvium derived mainly from limestone; subject to flooding; underlain by limestone.	0	5-15	0-27 27-48
McC	Minvale cherty silt loam, 2 to 12 percent slopes.	Well-drained, cherty soils formed in local alluvium and colluvium derived from cherty limestone; on foot slopes and benches; underlain by limestone; chert fragments as large as 3 inches across.	10+	5-15	0-12
McD2	Minvale cherty silt loam, 12 to 20 percent slopes, eroded.				12-35 35-50
MeB	Minvale silt loam, 2 to 5 percent slopes.	Well-drained soils formed in local alluvium and colluvium derived from cherty limestone; on foot slopes and benches; underlain by limestone.	10+	5-15	0-12 12-33
MeC	Minvale silt loam, 5 to 12 percent slopes.				33-50
MmD2	Mimosa very rocky silty clay loam, 5 to 20 percent slopes, eroded.	Soils on uplands, 15 to 50 percent of the surface covered with limestone outcrops and loose fragments.	20+	0-3	0-5
MmE2	Mimosa very rocky silty clay loam, 20 to 30 percent slopes, eroded.				5-20

estimated physical properties—Continued

Classification			Percentage passing sieve—			Selected characteristics significant to engineering				
USDA textural class	Unified	AASHO	No. 4	No. 10	No. 200	Permeability	Structure	Available water	Reaction [1]	Shrink-swell potential
						Inches per hour		*Inches per inch*	*pH*	
Cobbly sandy loam.	SM, ML, or SC.	A-4	65–85	65–85	40–55	.8–2.5	Crumb	.10–.15	4.5–5.5	Low.
Cobbly clay loam.	ML or CL	A-6 or A-7.	55–85	50–70	50–70	.8–2.5	Blocky	.10–.15	4.5–5.5	Moderate.
Cobbly sandy clay loam.	ML or CL	A-6 or A-7.	55–85	50–70	50–70	.8–2.5	Blocky	.10–.15	4.5–5.5	Moderate.
Loam	ML or CL	A-4	95–100	90–100	55–75	.8–2.5	Granular	.15–.20	4.5–5.5	Low.
Clay loam	ML or CL	A-4 or A-6.	95–100	90–100	70–80	.8–2.5	Blocky	.15–.20	4.5–5.5	Moderate.
Silt loam	ML or CL	A-4	85–95	80–95	60–75	.8–2.5	Granular	.15–.20	5.1–5.5	Low.
Silty clay loam	CL	A-6	90–100	80–95	70–85	.8–2.5	Blocky	.15–.20	5.1–5.5	Moderate.
Silty clay loam	CL	A-6	90–100	80–100	65–95	.2–.8	Massive	.10–.15	4.5–5.0	Moderate.
Silty clay loam	CL	A-6	85–100	75–100	65–95	.2–.8	Blocky	.10–.15	4.5–5.0	Moderate.
Silt loam	ML or CL	A-4	95–100	90–100	80–95	.8–2.5	Granular	.15–.20	4.5–5.0	Low.
Silt loam or silty clay loam.	CL	A-4 or A-6.	95–100	90–100	75–95	.2–.8	Blocky	.15–.20	4.5–5.0	Moderate.
Silty clay loam	CL	A-6	95–100	85–100	75–95	.2–.8	Massive	.10–.15	4.5–5.0	Moderate.
Silty clay	CL	A-6 or A-7.	95–100	85–100	70–90	.2–.8	Massive	.10–.15	4.5–5.0	Moderate to high.
Silt loam	ML or CL	A-6	95–100	90–100	70–95	.8–2.5	Granular	.15–.20	5.6–6.5	Moderate.
Silt loam to silty clay loam.	ML or CL	A-6	95–100	90–100	70–95	.2–.8	Massive	.15–.20	5.6–6.5	Moderate.
Loam	ML or CL	A-4	95–100	90–100	60–70	.8–2.5	Granular	.15–.20	4.5–5.0	Low.
Clay loam	ML or CL	A-6 or A-7.	95–100	90–100	60–75	.8–2.5	Blocky	.10–.15	4.5–5.0	Moderate.
Sandy clay loam.	ML or CL	A-4 or A-6.	95–100	90–100	50–75	.8–2.5	Massive	.10–.15	4.5–5.0	Moderate.
Silt loam	ML or CL	A-6	95–100	95–100	90–100	.8–2.5	Granular	.15–.20	5.6–6.5	Moderate.
Silt loam or silty clay loam.	CL	A-6	95–100	95–100	85–100	.2–.8	Massive	.15–.20	5.6–6.5	Moderate.
Cherty silt loam.	ML or CL	A-4	70–90	65–85	55–75	.8–2.5	Granular	.10–.15	5.1–5.5	Low.
Cherty silty clay loam.	CL	A-6	70–85	55–80	60–75	.8–2.5	Blocky	.10–.15	5.1–5.5	Moderate.
Cherty silty clay loam to cherty silty clay.	CL	A-6 or A-7.	70–85	65–80	60–75	.8–2.5	Blocky	.10–.15	5.1–5.5	Moderate to high.
Silt loam	ML or CL	A-4	80–100	70–95	55–75	.8–2.5	Granular	.15–.20	5.1–5.5	Low.
Silty clay loam	CL	A-6	85–100	85–100	70–90	.8–2.5	Blocky	.15–.20	5.1–5.5	Moderate to high.
Silty clay	CL	A-6 or A-7.	85–100	80–100	65–95	.8–2.5	Blocky	.10–.15	5.1–5.5	High.
Very rocky silty clay loam.	ML or CL	A-7	85–95	60–95	50–85	.2–.8	Granular	.05–.10	5.1–5.5	Moderate to high.
Clay or silty clay.	MH or CH	A-7	85–95	85–95	85–95	.2	Massive	.05–.10	5.1–5.5	High.

TABLE 5.—*Brief description of soils and their*

Map symbol	Soil	Brief description of site and soil	Depth to seasonally high water table	Depth to bedrock	Depth from surface (typical profile)
			Feet	*Feet*	*Inches*
MoD2	Mimosa silt loam, 12 to 20 percent slopes, eroded.	Soils on uplands of the Central Basin; formed in residuum from phosphatic, clayey limestone; bedrock is limestone.	20+	3–8	0–9
MoE2	Mimosa silt loam, 20 to 35 percent slopes, eroded.				9–18
					18–41
MnB	Monongahela silt loam, 2 to 5 percent slopes.	Moderately well drained soil on terraces and benches; derived from sandstone, shale, and limestone; a fragipan 10 to 30 or more inches thick is at a depth of about 2 feet; bedrock is limestone or sandstone.	2	5–25	0–12
					12–26
					26–68
Mp	Mine pits and dumps	These are areas of soil or trash deposits and excavations	20+	0–20	
MsB	Mountview silt loam, shallow, 2 to 5 percent slopes.	Well-drained soils on uplands; formed in a mantle of loess less than 18 inches thick that overlies residuum from cherty, shaly, or clayey limestone.	20+	6–20	0–10
MsC	Mountview silt loam, shallow, 5 to 12 percent slopes.				10–20
MsC2	Mountview silt loam, shallow, 5 to 12 percent slopes, eroded.				20–38
MsC3	Mountview silt loam, shallow, 5 to 12 percent slopes, severely eroded.				
MsD2	Mountview silt loam, shallow, 12 to 20 percent slopes, eroded.				
MvB	Mountview silt loam, 2 to 5 percent slopes.	Well-drained soils on uplands, formed in a mantle of loess, 18 to 30 inches thick, that overlies residuum from cherty, shaly, or clayey limestone.	20+	6–20	0–12
MvC	Mountview silt loam, 5 to 12 percent slopes.				12–32
MvC2	Mountview silt loam, 5 to 12 percent slopes, eroded.				32–40
MvC3	Mountview silt loam, 5 to 12 percent slopes, severely eroded.				
MrD	Muskingum very rocky sandy loam, 12 to 20 percent slopes.	Droughty soils on uplands; 15 to 50 percent of the surface covered with sandstone outcrops, large fragments, and boulders.	20+	0–3	0–6
MrE	Muskingum very rocky sandy loam, 20 to 30 percent slopes.				6–20
MtC	Muskingum sandy loam, 5 to 12 percent slopes.	Excessively drained soils on uplands; formed in residuum from acid sandstone on the Cumberland Plateau.	20+	1–3	0–8
MtD	Muskingum sandy loam, 12 to 20 percent slopes.				8–20
MtE	Muskingum sandy loam, 20 to 30 percent slopes.				
MuC	Muskingum silt loam, 5 to 12 percent slopes.	Well-drained soils on uplands; formed in residuum from acid shale and sandstone on the Cumberland Plateau.	20+	1–3	0–6
MuD	Muskingum silt loam, 12 to 20 percent slopes.				6–20
MuE	Muskingum silt loam, 20 to 30 percent slopes.				
Pd	Purdy silt loam	Poorly drained soil on terraces or benches; formed in old general alluvium from limestone, sandstone, and shale; nearly level to slightly depressed; subject to ponding.	0	6-20+	0–6
					6–36
					36–59
Rk	Rock land, limestone	More than 50 percent of surface covered by limestone	20+	0	
Ro	Rock land, sandstone	More than 50 percent of surface covered by sandstone	20+	0	
Sa	Sango silt loam	Moderately well drained soil on uplands; formed in a loess mantle over limestone residuum; a fragipan is at a depth of 18 to 36 inches.	2	15-25	0-8
					8-24
					24-40
					40-60

estimated physical properties—Continued

Classification			Percentage passing sieve—			Selected characteristics significant to engineering				
USDA textural class	Unified	AASHO	No. 4	No. 10	No. 200	Permeability	Structure	Available water	Reaction [1]	Shrink-swell potential
						Inches per hour		*Inches per inch*	*pH*	
Silt loam	ML or CL	A–4 or A–6.	95–100	95–100	90–95	.2–.8	Granular	.15–.20	5.1–6.0	Moderate.
Silty clay loam	MH or CH	A–6 or A–7.	95–100	95–100	90–100	.2–.8	Blocky	.15–.20	5.1–5.5	High.
Clay or silty clay.	MH or CH	A–6 or A–7.	95–100	95–100	95–100	.2	Massive	.10–.15	5.1–5.5	High.
Silt loam	CL or ML	A–4	95–100	90–100	85–95	.8–2.5	Granular	.15–.20	4.5–5.0	Low.
Silty clay loam	CL or ML	A–4 or A–6.	90–100	90–100	85–95	.8–2.5	Blocky	.15–.20	4.5–5.0	Moderate.
Loam	CL or ML	A–4 or A–6.	95–100	90–100	80–90	.2–.8	Massive	.10–.15	4.5–5.0	Moderate.
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Silt loam	ML or CL	A–4	85–95	80–95	80–90	.8–2.5	Granular	.15–.20	4.5–5.0	Low.
Silt loam to silty clay loam.	CL	A–4 or A–6.	85–95	80–95	75–85	.8–2.5	Blocky	.15–.20	4.5–5.0	Moderate.
Silty clay loam to silty clay.	CL, CH, or MH.	A–6 or A–7.	70–85	65–80	60–75	.8–2.5	Blocky	.10–.15	4.5–5.0	Moderate to high.
Silt loam	ML or CL	A–4	95–100	90–100	85–95	.8–2.5	Granular	.15–.20	4.5–5.0	Low.
Silt loam to silty clay loam.	ML or CL	A–4 or A–6.	95–100	90–100	85–95	.8–2.5	Blocky	.15–.20	4.5–5.0	Moderate.
Silty clay loam to silty clay.	CL, ML, or MH.	A–6 or A–7.	95–100	90–100	80–95	.8–2.5	Blocky	.10–.15	4.5–5.0	Moderate to high.
Very rocky sandy loam.	ML	A–4	70–90	60–80	50–60	2.5–5.0	Granular	.05–.15	4.5–5.0	Low.
Fine sandy loam.	ML or CL	A–4 or A–6.	70–90	60–80	50–60	2.5–5.0	Blocky	.05–.15	4.5–5.0	Low.
Sandy loam	ML	A–4	70–90	60–80	50–60	2.5–5.0	Granular	.10–.15	4.5–5.5	Low.
Fine sandy loam or sandy clay loam.	ML or CL	A–4 or A–6.	70–90	60–80	50–60	2.5–5.0	Blocky	.10–.15	4.5–5.0	Moderate.
Silt loam	ML or CL	A–4	90–95	85–90	80–90	.8–2.5	Granular	.15–.20	4.5–5.0	Low.
Silty clay loam.	ML or CL	A–4 or A–6.	80–85	75–85	70–85	.8–2.5	Blocky	.10–.15	4.5–5.0	Moderate.
Silt loam	ML or CL	A–4	95–100	90–100	60–70	.2–.8	Granular	.15–.20	4.5–5.0	Low.
Silty clay loam.	ML or CL	A–4	95–100	90–100	50–70	.2–.8	Massive	.10–.15	4.5–5.0	Low.
Silty clay or clay.	CH or MH	A–6 or A–7.	95–100	90–100	80–90	.2–.8	Massive	.10–.15	4.5–5.0	High.
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Silt loam	ML or CL	A–4	95–100	90–100	80–90	.8–2.5	Granular	.15–.20	4–5–5.0	Low.
Silt loam	ML or CL	A–4	95–100	90–100	80–90	.8–2.5	Blocky	.15–.20	4.5–5.0	Low.
Silty clay loam	ML or CL	A–4 or A–6.	90–100	85–100	75–90	.2–.8	Massive	.10–.15	4.5–5.0	Moderate.
Silty clay	CH or MH	A–6 or A–7.	90–100	80–100	70–90	.2–.8	Blocky	.10–.15	4.5–5.0	Moderate to high.

TABLE 5.—*Brief description of soils and their*

Map symbol	Soil	Brief description of site and soil	Depth to seasonally high water table	Depth to bedrock	Depth from surface (typical profile)
			Feet	*Feet*	*Inches*
SeB	Sequatchie loam, 2 to 5 percent slopes.	Well-drained soils on low second bottoms or terraces; formed in mixed alluvium; underlain by limestone.	2–5	5–12	0–18
SeC2	Sequatchie loam, 5 to 12 percent slopes, eroded.				18–38
St	Stony colluvial land	Stony and cobbly colluvium on steep, talus slopes of Cumberland Plateau escarpment; stones, cobbles, and some boulders occupy 15 to 50 percent of the land surface.	20+	2–20	[2]
SwC2	Swaim silt loam, 5 to 12 percent slopes, eroded.	Well-drained, clayey soil in old colluvium or local alluvium on foot slopes and benches; parent materials were washed from Rock land, limestone, and from Talbott soils.	10–20	3–10	0–6
					6–18
					18–60
TaD2	Talbott silty clay loam, 5 to 20 percent slopes, eroded.	Well-drained, fine-textured soil on rolling uplands; formed in residuum from clayey limestone; few bedrock outcrops.	20+	2–5	0–7
					7–48
TrD	Talbott very rocky silty clay loam, 5 to 20 percent slopes.	Well-drained, fine-textured soil material on uplands; bedrock outcrops occupy 15 to 50 percent of the land surface.	20+	0–2	0–5
TrE	Talbott very rocky silty clay loam, 20 to 30 percent slopes.				5–20
Ty	Tyler silt loam	Somewhat poorly drained soil on nearly level old terraces; formed in fine-textured alluvial deposits that washed from soils derived from sandstone, shale, and limestone; bedrock is predominantly limestone.	0	8–25	0–5
					5–30
					30–45
WaB	Waynesboro silt loam, 2 to 5 percent slopes.	Well-drained soils on high terraces; formed in old general alluvium; bedrock is mainly limestone.	20+	4–30	0–13
WaC	Waynesboro silt loam, 5 to 12 percent slopes.				13–27
WaC2	Waynesboro silt loam, 5 to 12 percent slopes, eroded.				27–50
WaD2	Waynesboro silt loam, 12 to 20 percent slopes, eroded.				
WbC3	Waynesboro silty clay loam, 5 to 12 percent slopes, severely eroded.	Well-drained soils on high terraces; formed in old general alluvium; bedrock is mainly limestone; upper 4 to 6 inches washed away.	20+	4–30	0–27
WbD3	Waynesboro silty clay loam, 12 to 20 percent slopes, severely eroded				27–50
WeB	Wellston silt loam, 2 to 5 percent slopes.	Well-drained soils on uplands; formed in residuum from acid shale on the Cumberland Plateau; bedrock is mostly shale.	20+	2–4	0–12
					12–25
WeC	Wellston silt loam, 5 to 12 percent slopes.				25–39
WeC2	Wellston silt loam, 5 to 12 percent slopes, eroded.				

[1] pH before liming. [2] Variable.

Engineering descriptions

A brief description of each soil in the county, and the depths to the water table and to bedrock, are given in table 5. This table also lists, for the principal horizons, the agricultural and engineering classifications of soil material, the percentage of material passing sieves of various sizes, and some characteristics of the soil material significant to engineering.

The depth to the seasonally high water table is based on field observations. Comparisons of the depth to bedrock and the depth to the water table show that for some soils the water table lies within the bedrock. This is possible in pervious, sedimentary deposits and in cavernous limestone.

Permeability is the estimated rate at which water is transmitted in uncompacted soil material. The estimates in table 5 are based on a consideration of the structure and consistence of the soil and on field observations. Only a small amount of laboratory data was available.

Available water, in inches per inch of depth, is the approximate amount of capillary water in the soil when the soil is wet to field capacity. It is the amount of water held in the soil between 1/3 and 15 atmospheres of tension. If the soil is at permanent wilting point, the amount of water listed in inches will wet the soil to a depth of 1 inch.

estimated physical properties—Continued

Classification			Percentage passing sieve—			Selected characteristics significant to engineering				
USDA textural class	Unified	AASHO	No. 4	No. 10	No. 200	Permeability	Structure	Available water	Reaction [1]	Shrink-swell potential
						Inches per hour		*Inches per inch*	*pH*	
Loam	ML or CL	A-4 or A-6.	95-100	90-100	60-75	.8-2.5	Granular	.15-.20	5.0-6.0	Moderate.
Clay loam	ML or CL	A-6	95-100	90-100	65-80	.8-2.5	Blocky	.15-.20	5.0-6.0	Moderate.
(2)	(2)	(2)				2.5-5.0	(2)	.10-.20	(2)	
Silt loam	ML or CL	A-4 or A-6.	85-100	75-90	65-75	.8-2.5	Granular	.15-.20	5.1-5.5	Moderate.
Silty clay loam	CL or CH	A-6 or A-7.	95-100	90-100	80-90	.2-.8	Blocky	.10-.15	5.1-5.5	High.
Silty clay or clay.	CH	A-7	95-100	90-100	80-100	.2-.8	Blocky	.10-.15	5.1-5.5	High.
Silty clay loam	ML or CL	A-6 or A-7.	100	95-100	90-100	.2-.8	Blocky	.10-.15	5.1-5.5	Moderate to high.
Clay	MH or CH	A-7	100	95-100	95-100	.2-.8	Blocky	.10-.15	5.1-5.5	High.
Very rocky silty clay loam.	ML or CL	A-7	85-95	70-90	50-85	.2-.8	Blocky	.05-.10	5.1-5.5	Moderate to high.
Clay	MH or CH	A-7	85-95	85-95	85-95	.2-.8	Blocky	.05-.10	5.1-5.5	High.
Silt loam	ML or CL	A-4	95-100	95-100	85-95	.2-.8	Granular	.15-.20	4.5-5.0	Low.
Silty clay loam	CL	A-6	95-100	95-100	95-100	.2-.8	Blocky	.10-.15	4.5-5.0	Moderate.
Silty clay loam to silty clay.	CL	A-7	95-100	95-100	95-100	.2	Massive	.10-.15	4.5-5.0	Moderate to high.
Silt loam	ML	A-4	85-100	80-95	50-65	.8-2.5	Granular and blocky.	.15-.20	5.1-5.5	Low.
Silty clay loam or clay loam.	ML or CL	A-6 or A-7.	85-100	80-95	50-75	.8-2.5	Blocky	.12-.20	5.1-5.5	Moderate to high.
Silty clay or clay.	ML	A-5 or A-7.	90-100	85-95	50-75	.8-2.5	Blocky	.10-.15	5.5-5.5	Moderate.
Silty clay loam or clay loam.	ML or CL	A-6 or A-7	85-100	80-95	50-75	.8-2.5	Granular and blocky.	.15-.20	5-1.5.5	High.
Silty clay or clay.	MH or CH	A-7	90-100	85-95	50-75	.8-2.5	Blocky	.10-.15	5.1-5.5	High.
Silt loam	ML or CL	A-4	95-100	95-100	90-95	.8-2.5	Granular	.15-.20	4.5-5.0	Low.
Silty clay loam	ML or CL	A-4 or A-6.	95-100	95-100	90-100	.2-.8	Blocky	.15-.20	4.5-5.0	Moderate.
Silty clay	MH or CH	A-7	90-95	85-95	80-90	.2-.8	Blocky	.10-.15	4.5-5.0	High.

Laboratory data suitable for estimating available water were compiled for only a few soils in Putnam County; for the other soils, the estimates are from data for similar soils.

The soil reaction, or pH, is estimated on the basis of field observations and laboratory tests.

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

Features affecting engineering work

In table 6 the soils of the county are rated according to their adaptability to winter grading, their suitability for road subgrade and road fill, and their suitability as a source of topsoil and of sand and gravel. Also, table 6 lists soil features that affect highway construction and conservation engineering. These features generally are not apparent to the engineer unless he has access to the results of field investigations. They are, however, significant enough to influence construction.

TABLE 6.—*Engineering*

Soil series [1] and map symbols	Adaptability to winter grading	Suitability of soil material for—		Suitability as source of—		Soil features affecting—
		Road subgrade	Road fill	Topsoil	Sand and gravel	Vertical alinement for highways
Allen (AaC3, AaE3, AcD, AcE, AmB, AmC, AmD, AmE).	Poor	Fair	Fair	Fair	Unsuitable	Subject to sliding; cobbles in places; bedrock may be within 3 feet of surface.
Armour (ArB, ArC2, ArD2)	Poor to fair	Poor to fair	Fair	Good	Unsuitable	Subject to sliding; seepage likely.
Atkins (At)	Poor	Poor	Poor	Poor	Unsuitable	Poorly drained; water table high and flooding likely.
Baxter (BaC2, BaD, BaD2, BaE, BcD3, BcE3).	Poor	Poor to fair	Fair	Poor	Unsuitable	No unfavorable features
Bewleyville (BeB, BeC, BeC2, BeD2, BmC3, BmD3).	Poor to fair	Poor to fair	Fair	Fair	Unsuitable	No unfavorable features
Bodine (BoC, BoD, BoE)	Fair to good	Fair to good	Good	Poor	Fair	Limestone bedrock and chert beds.
Bruno (Br)	Good	Good	Good	Poor	Good	Occasional flooding
Christian (CcC3, CcD3, CcE3, ChB, ChC, ChC2, ChD2, ChE, CrB2, CrC, CrC2, CrD, CrD2)	Poor	Poor	Poor to fair	Poor	Unsuitable	Shale and siltstone bedrock.
Cookeville (CkC2, CoC3, CoD3)	Poor to fair	Poor to fair	Fair	Poor	Unsuitable	No unfavorable features
Cumberland (CsB, CsC2, CuC3)	Poor	Poor	Poor	Fair	Unsuitable	No unfavorable features
Dellrose (DeD, DeE, DeF)	Fair	Poor to fair	Poor to fair	Good to fair	Unsuitable	Subject to sliding; variable depth to bedrock.
Dickson(Dk)	Poor	Poor	Poor	Fair	Unsuitable	Seasonal perched water table.
Elkins(Ek)	Poor	Poor	Poor	Poor	Unsuitable	High water table; occasional flooding.
Ennis(En)	Poor	Poor to fair	Poor to fair	Good	Unsuitable	Occasional flooding
Gullied land(Gu)	Poor	Poor	Poor	Poor	Unsuitable	Limestone bedrock; subject to sliding.
Guthrie(Gs)	Poor	Poor	Poor	Poor	Unsuitable	Occasional ponding; slow surface drainage.

See footnotes at end of table.

interpretations of soils

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions
Reservoir area	Embankment			
Excess seepage likely; bedrock is cavernous limestone.	Good strength and stability.	Well drained	Generally moderate water-holding capacity; cobbly areas have low water-holding capacity.	Some areas have many stones.
Excess seepage likely; bedrock is cavernous limestone.	Mostly silt and clay; fair stability.	Well drained	High water-holding capacity; soil is productive.	May receive overwash from adjoining steep slopes.
Seepage not likely; bedrock is sandstone and tight-bedded shale.	Good strength and stability.	High water table; moderate permeability.	Poorly drained soil; moderately high water-holding capacity.	Nearly level; poor drainage.
Excess seepage likely; bedrock is cavernous limestone.	Good strength and stability.	Well drained	Moderate to low water-holding capacity; moderate to low productivity.	Favorable.
Underlain by residuum from cherty limestone through which seepage is moderate.	Silt in upper 2 feet; fair strength and stability.	Well drained	Moderately high water-holding capacity; potentially productive.	Favorable.
Excess seepage unless compacted; high permeability.	Good strength and stability; chert beds near surface.	Good	Very low water-holding capacity and low productivity.	Mostly too steep; shallow to chert beds.
High risk of seepage; very permeable; can be compacted.	Moderate strength and stability; rapid permeability.	Good	Very low water-holding capacity.	Nearly level and very sandy.
Shaly and sandy substratum; low risk of seepage.	Good to fair strength and stability.	Good	Low to moderate water-holding capacity.	Favorable.
Strong structure; high risk of seepage.	Fair strength and stability.	Good	Moderate water-holding capacity; potentially productive.	Favorable.
Permeable; excess seepage	Poor to fair stability	Good	Moderately high water-holding capacity; potentially productive.	Favorable.
Permeable; excess seepage	Poor stability	Good	Moderate to high water-holding capacity.	Mostly too steep.
Easy to compact; low risk of seepage if pond is built above pan.	Fair stability	Moderately good to good; pan at about 2 feet.	Pan at about 2 feet; moderate response.	Favorable.
Low risk of seepage; underlain by sandstone and shale.	Fair stability	Very poor; seasonally high water table; often ponded or flooded; moderately permeable.	Poorly drained soil with a high water-holding capacity.	Nearly level, poorly drained soil on bottom land.
Moderate to high risk of seepage; rapid permeability.	Fair stability	Good	High water-holding capacity; very productive.	Nearly level, well-drained soil on bottom land.
Site very poor because of excess silting.	Fair stability; limited soil material.	Good	Not suitable; many gullies	Not suitable; many gullies.
Subsoil is slowly permeable; best suited to shallow reservoirs.	Fair to poor stability	Poor; very slowly permeable subsoil.	Poorly drained; slowly permeable subsoil.	Nearly level soil; poorly drained.

TABLE 6.—*Engineering*

Soil series [1] and map symbols	Adaptability to winter grading	Suitability of soil material for—		Suitability as source of—		Soil features affecting—
		Road subgrade	Road fill	Topsoil	Sand and gravel	Vertical alinement for highways
Hartsells(HaB, HaC, HaC2)	Poor	Poor to fair	Fair	Poor to fair	Unsuitable	Sandstone bedrock
Hermitage (HcC, HcD, HcE2, HeB, HeC, HeD2).	Poor	Poor to fair	Poor to fair	Good	Unsuitable	No unfavorable features
Holston (HnB, HnC2, HoB, HoC, HoC2).	Poor	Poor	Poor to fair	Good to fair	Unsuitable	No unfavorable features
Huntington (Hr, Hs, Ht, Hu, Hv, Hw).	Poor	Poor to fair	Poor to fair	Good	Unsuitable; fair in cherty and sandy soils.	Subject to flooding
Jefferson (JcC, JcD, JcE, JeB, JeC, JeD2).	Poor	Fair to poor	Fair	Fair	Unsuitable	Limestone or sandstone bedrock; cobbles in places; subject to sliding.
Landisburg (LaB, LaC)	Poor	Poor	Poor to fair	Poor to fair	Unsuitable	Seasonal perched water table.
Lawrence (Lm)	Poor	Poor	Poor	Poor	Unsuitable	Subject to ponding
Lindside (Ln)	Poor	Poor	Poor to fair	Fair to good	Unsuitable	Occasional flooding; high water table.
Linker (LrC, LrC2)	Fair to good	Fair	Fair	Poor to fair	Fair; some areas underlain by sand.	Sandstone bedrock
Melvin (Ma)	Poor	Poor to fair	Poor	Poor to fair	Unsuitable	Occasional flooding; high water table.
Mimosa (MmD2, MmE2, MoD2, MoE2).	Poor	Poor	Poor	Poor	Unsuitable	Limestone bedrock
Minvale (McC, McD2, MeB, MeC).	Poor	Poor to fair	Fair	Fair	Unsuitable	No unfavorable features
Monongahela (MnB)	Poor	Poor	Poor	Fair to poor	Unsuitable	Seasonal perched water table.
Mountview (MsB, MsC, MsC2, MsC3, MsD2, MvB, MvC, MvC2, MvC3).	Poor	Poor to fair	Poor to fair	Fair	Unsuitable	Limestone bedrock
Muskingum (MrD, MrE, MtC, MtD, MtE, MuC, MuD, MuE).	Fair to good	Good to fair	Good to fair	Poor	Unsuitable	Sandstone and shale bedrock.
Purdy (Pd)	Poor	Poor	Poor	Poor	Unsuitable	Poorly drained; subject to ponding.
Sango (Sa)	Poor	Poor	Poor	Poor to fair	Unsuitable	Seasonal perched water table; some ponding.

See footnotes at end of table.

interpretations of soils—Continued

Soil features affecting—Continued				
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions
Reservoir area	Embankment			
Low risk of seepage; underlain by level-bedded sandstone and shale.	Good stability; limited soil material.	Good	Moderate water-holding capacity.	Favorable.
Permeable; high risk of seepage.	Good stability	Good	Moderate to high water-holding capacity.	Favorable.
Low risk of seepage if compacted.	Good stability	Good	Moderate water-holding capacity.	Favorable.
Soil generally borders a stream; high risk of seepage.	Good stability	Good	High water-holding capacity; productive.	Nearly level.
Cobbles in places; low risk of seepage if compacted.	Fair to good stability	Good	Moderate water-holding capacity.	Many cobbles in some areas.
Easy to compact; low risk of seepage if pond is built above pan layer.	Good stability	Moderately good; pan at about 2 feet.	Pan at about 2 feet; moderate response.	Favorable.
Subsoil is slowly permeable; low risk of seepage.	Poor to fair stability	Somewhat poor; very slowly permeable subsoil.	Poorly drained; slowly permeable subsoil.	Nearly level, poorly dra ined.
Soil is permeable, and bedrock is generally broken where underlain by limestone; high risk of seepage.	Fair to good stability	Seasonally high water table; permeable soil.	High water-holding capacity.	Nearly level.
Well suited to ponds; low risk of seepage.	Good stability; limited soil material.	Good	Moderate water-holding capacity.	Favorable.
Moderate risk of seepage	Good stability	Somewhat poor to moderately good; seasonally high water table; permeable soil.	Poorly drained; seasonally high water table.	Nearly level; poorly drained.
Broken limestone rock; high risk of seepage; shallow to bedrock.	Poor to fair stability; soil shallow in places; limited soil material.	Good	Low water-holding capacity.	Shallow to bedrock; rock outcrops.
Permeable; high risk of seepage.	Fair to good stability	Good	Moderate to high water-holding capacity.	Favorable.
Easy to compact; low risk of seepage if pond is built above pan.	Fair stability	Moderately good; pan at about 2 or 3 feet.	Pan at about 2 or 3 feet; moderate response.	Favorable.
Moderate risk of seepage; bedrock is cavernous limestone.	Silty in upper 2 or 3 feet; fair strength and stability.	Good	Moderate water-holding capacity.	Favorable.
Shallow to bedrock	Good strength and stability.	Good	Low water-holding capacity	Shallow to bedrock; rock outcrops.
Subsoil is slowly permeable; low risk of seepage.	Fair stability	Poor; very slowly permeable subsoil.	Poorly drained; slowly permeable subsoil.	Nearly level; poorly drained.
Low risk of seepage if pond is built above pan.	Fair stability	Moderately good; pan at about 2 feet.	Pan at about 2 feet	Favorable.

TABLE 6.—*Engineering*

Soil series [1] and map symbols	Adaptability to winter grading	Suitability of soil material for—		Suitability as source of—		Soil features affecting—
		Road subgrade	Road fill	Topsoil	Sand and gravel	Vertical alinement for highways
Sequatchie (SeB, SeC2)	Fair	Fair	Fair	Good	Unsuitable	Most areas are occasionally flooded.
Stony colluvial land (St)	Fair to good	Good to fair	Good to fair	Poor	Poor	Limestone or sandstone bedrock; stones and cobbles; subject to sliding.
Swaim (SwC2)	Poor	Poor	Poor	Poor	Unsuitable	Limestone bedrock
Talbott (TaD2, TrD, TrE)	Poor	Poor	Poor	Poor	Unsuitable	Limestone bedrock
Tyler (Ty)	Poor	Poor	Poor	Poor to fair	Unsuitable	Subject to ponding; slow surface drainage.
Waynesboro (WaB, WaC, WaC2, WaD2, WbC3, WbD3).	Poor	Poor to fair	Fair to poor	Fair	Unsuitable	No unfavorable features
Wellston (WeB, WeC, WeC2)	Poor	Poor to fair	Poor to fair	Fair	Unsuitable	Shale bedrock

[1] Miscellaneous land types not rated.

Table 6 shows that almost all soils in the county are poorly suited to winter grading. The better drained, coarse soil materials can be excavated, hauled, and compacted in winter, but the silty and clayey materials absorb so much water that they cannot be dried to a moisture content favorable for compaction.

For a subgrade and a fill, very coarse grained, easily drained materials are best, but soils of this kind are few in Putnam County. Bodine and Baxter soils are the most suitable.

Chert gravel is economical for secondary and county roads, but normally it is not strong enough to be used in concrete structures or as base material for primary roads. Crushed limestone is much more satisfactory, but on a poor soil a layer of chert can be used to reduce the amount of limestone required.

In Putnam County, limestone is taken from several quarries, mostly in areas of Rock land, limestone, and very rocky Talbott soils. Sand is found in deposits of decomposed sandstone that commonly underlie the Linker soils. Several sand pits are worked in the county.

Because the original surface layer of most soils in the county is thin or is absent, the rating for suitability as a source of topsoil refers to the subsoil material. For the Huntington, Lindside, Ennis, and a few other young soils that do not have distinct layers, the rating applies to the entire soil profile. Most of the soils in the county are unsuitable as a source of sand or gravel.

The vertical alinement for highways is affected by drainage and by the depth of the soil to bedrock. The Atkins, Guthrie, Landisburg, and other soils in the county are flooded occasionally or have a seasonally high water table. Roads in these soils should be raised above high water by an embankment. Ditches or underdrains may be needed to intercept water that might seep to the surface, as is common at the base of slopes in deposits of local alluvium. Seepage in the back slopes of cuts may cause overlying material to slump or slide.

The location of secondary roads in areas where the soils are sloping or steep may be influenced by the depth to bedrock and the kind of bedrock. The engineer ascertains the type of rock so that he can tell how difficult it will be to excavate. For all highways, he investigates the likelihood of slides, of other soil movements, and of water seeping along or through the bedrock strata. He considers whether or not the material within or slightly below the subgrade is poor. A layer of highly plastic clay impedes internal drainage and provides a poor foundation. In some places the clay layer should be cut out before the pavement is constructed. In low, flat, or poorly drained areas where it is not feasible to cut out a clay layer, the roadway should be built well above the layer by using an embankment section. Cobbles and stones are likely to cause grading problems.

Farm ponds and their construction are adversely affected by permeable substrata, by bedrock of cavernous limestone, and by inadequate or insufficient material for embankments. The water in ponds may be lost through excess seepage if the substrata near the surface are permeable. If there are caves in the limestone bedrock, the water may be lost when it seeps through the permeable soil layer and into the cavernous rock. In table 6 the soils *interpretations of soils*—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions
Reservoir area	Embankment			
Very permeable; high risk of excess seepage; sand and gravel below 38 inches.	Fair stability	Good	High water-holding capacity; productive.	Some areas subject to flooding.
Shallow to bedrock in places; soil material very pervious; generally too steep.	Generally too stony	Good	Normally too stony for irrigation.	Too stony; bedrock outcrops.
Broken limestone rock; high risk of seepage.	Poor to fair stability	Good	Medium to low water-holding capacity.	Highly erodible.
Broken limestone rock; high risk of seepage; shallow to bedrock.	Poor to fair stability; soil shallow in places; limited soil material.	Good	Medium to low water-holding capacity.	Bedrock outcrops.
Slowly permeable subsoil; low risk of seepage.	Fair stability	Slowly permeable subsoil.	Slow drainage and slow permeability.	Nearly level; slowly drained.
Soil is permeable but can be compacted; moderate risk of seepage.	Fair stability	Good	Moderate water-holding capacity.	Favorable.
Seepage not likely; bedrock is tight-bedded shale.	Fair strength and stability	Good	Moderate water-holding capacity.	Favorable.

of the county are rated according to the risk of seepage in the reservoir area and according to their stability in embankments.

Wildlife [4]

Game and fish were once important sources of food for the settlers of Putnam County, but agriculture has long met the people's need for food. Hunting and fishing continue, but the emphasis is now on recreation.

Soil, plants, and water can be managed to increase wildlife and fish by providing adequate food, shelter, and water. These essentials for wildlife generally have not been intentionally provided by agriculture. If an area had ample food, cover, and water to meet the needs of the animal, it survived; otherwise it perished or moved elsewhere.

Many kinds of wildlife are found in Putnam County, but those hunted most are deer, rabbit, squirrel, bobwhite, mourning dove, wild duck, wild geese, grouse, and wild turkey. Many kinds of nongame birds are important because most of them eat harmful insects. Both the game birds and nongame birds depend on farmland for food, nesting, and shelter.

Wild animals need different kinds of food and cover. Some animals spend all their time in the woods, others prefer open fields, and many prefer a combination of woods and open fields. Ducks and other fowl require a water habitat. Following is a brief summary of the food and cover that should be provided for the more important wildlife in Putnam County:

Deer: In Tennessee deer stay in large wooded areas. The browse in woods can be supplemented by seeding nutritious plants in open grazing areas. Deer drink water frequently, and watering places must be provided.

Rabbit: Because they are the primary food of many predators, rabbits need the cover of brush for protection. Clover, wheat, and other green winter foliage growing near this cover will provide food and increase the number of rabbits.

Squirrel: Choice foods of this game animal are acorns, black cherry, corn, mulberry, pecans, walnuts, and other nuts and fruits. Squirrels nest in trees, preferably in den holes. Any hardwood area producing choice foods will support them.

Bobwhite: Choice foods are acorns, lespedeza (bicolor, common, Korean, and japonica), partridgepeas, soybeans, tickclover, and the seeds of other legumes, grasses, and weeds. The bobwhite also eats insects. The food must be close to sheltering vegetation so that, while feeding, the birds are protected from predators, the sun, and bad weather.

Dove: This bird prefers to pick its food off ground that is not covered by excessive vegetation. It does not eat insects. Choice foods are browntop millet, corn, cowpeas, oats, pokeberry seeds, wheat, and a few other grass and weed seeds.

Wild duck: Ducks prefer to feed in water. Choice foods are acorns, browntop millet, corn, Japanese millet,

[4] This subsection was written by FLOYD R. FESSLER, biologist, Soil Conservation Service.

and smartweed. The food may be grown in fields or in woods, which are flooded in fall. This is practical only on land that slopes less than 2 percent. The soil should be slowly permeable or should have a water table that is naturally or artificially high from October to March. In Putnam County, Elkins and Atkins soils on the Cumberland Plateau are suited to this use, as are the Guthrie, Lawrence, Melvin, Purdy, and Tyler soils on the Highland Rim.

Wild geese: These migratory birds feed in winter on growing clover, rye, ryegrass, and wheat. They also need corn and other grain, as well as water, from the time they arrive from the north until they return.

Grouse: This bird stays in the wooded mountain areas of Tennessee. Ways of increasing the number of grouse are not well known. However, grouse are benefited by planting whiteclover in logging roads, clearings, and old fields. Keeping apple trees in clearings is also beneficial.

Wild turkey: These birds require areas of woodland that are 1,000 acres or larger. They eat insects, acorns, grass seeds, grapes, pine seeds, and green forage. Turkeys need surface water for daily drinking.

Many parts of Putnam County can be managed to increase wildlife. Manage parts of the following physiographic areas to increase the kinds of game listed—

Physiographic area	*Game*
Cumberland Plateau and its escarpment.	Bobwhite, duck, geese, grouse, turkey, deer, rabbit, and squirrel.
Highland Rim and areas of red soils.	Bobwhite, dove, duck, geese, rabbit, and squirrel.
Central Basin	Bobwhite, dove, geese, rabbit, and squirrel.

Fish: Fish that can be increased in Putnam County are largemouth bass, bluegill, red ear sunfish, channel catfish, buffalo fish, and bait minnows. This increase depends on the amount of food available, which is determined largely by the fertility of the water. Supplementary feeding is possible and worthwhile. Ponds, lakes, and reservoirs can be built throughout the county.

In the cold waters of the Cumberland Plateau and its escarpment, and in the Central Basin, the number of trout can be increased by management. Ponds supplied with cold spring water can be built and stocked with trout. These fish do best in water with a temperature ranging from 55° to 68° F. Because very little food is produced in cold water, supplementary feeding will be necessary.

The Putnam County Soil Conservation District and the Tennessee Game and Fish Commission will furnish plans for managing fish and wildlife so as to increase production.

Formation and Classification of Soils

This section discusses the five factors of soil formation and the formation of soils in the four physiographic areas of the county. Also in the section is a classification of soils by higher categories.

Factors of Soil Formation

The soils of this county were formed as the result of combinations of factors and processes that affect the formation of soil in some way throughout the world. The nature of a soil at any given point depends upon the effects of climate, living organisms, parent materials, topography, and time. Some combination of these five factors determines the characteristics of every soil. The importance of each factor varies from place to place. In some places one factor is more important, and in other places another is important. In some places all five factors may affect the development of a soil about equally. For example, no one factor has dominated in the formation of the well-drained, well-developed Waynesboro soils. Topography, however, has dominated in the development of the poorly drained Guthrie soil. Because water has been removed slowly from that level soil, the soil has been saturated and poorly aerated for long periods. Consequently, a gray soil profile has formed. Because of the steep topography, geologic erosion has removed much soil material from the Muskingum soils and has left a thin profile.

Nearly all soils in Putman County have some characteristics in common. They are highly leached, strongly acid, and low in plant nutrients. These characteristics reflect the effects of the warm, temperate climate and the fairly high rainfall. Soluble materials are leached out of the soil almost continuously because the winters are mild and the soil is seldom frozen deeper than 3 inches. In addition, freezing generally lasts for only a day or two.

Formation of Soils in Physiographic Areas

As one crosses the county, he can see striking differences in soils. These differences result mainly from the effects of the parent material, the topography, and the time during which the soils have been forming. These factors can be described best by discussing their effects in each of the four physiographic areas in the county. From east to west these areas are (1) the Cumberland Plateau and escarpment, (2) the red soil area, (3) the Highland Rim, and (4) the outer Central Basin.

CUMBERLAND PLATEAU AND ESCARPMENT

This area occupies the eastern third of the county. The plateau ranges from 1,800 to 2,000 feet above sea level and is 800 to 1,000 feet higher than the Highland Rim, which joins it on the west. It is mostly rolling but ranges from undulating to hilly. Narrow sandstone ledges are at the top of the escarpment, and steep slopes of talus are below. Narrow, disconnected benches on the escarpment lead from the plateau down to the Highland Rim and somewhat resemble a stairway.

In the distant past, the Cumberland Plateau extended farther out on the Highland Rim and, at one time, probably covered all of Putnam County. This is indicated by remnants of outlying hills that have the same rock formations as the formations of the plateau escarpment. Geologic erosion ate, or cut, into the plateau and made it smaller. Gorges, cut deeply into the face of the escarpment, have widened in some places to form small valleys within the plateau. These gorges and valleys formed when the underground soluble limestone decayed and washed away. Nearer the center of the plateau the drains are not deeply entrenched.

Nearly all of the soils of the Cumberland Plateau have formed in residuum from hard sandstone and shale. They have formed under a mixed hardwood and pine forest in a climate that is slightly more moist and slightly cooler than the climate of the rest of the county. Because of the acid parent materials, high rainfall, and forest vegetation, all of the soils in this area are strongly acid, highly leached, and very low in elements that plants need. The soils have a thin surface layer and a thin to moderately thick subsoil. Probably because the parent material is coarse textured, the soil horizons, or layers, are weakly developed. In most places, the surface layer and the subsoil differ so little that they are hard to distinguish. Few profiles have more than 30 percent clay in the subsoil, and many are loam in texture from the surface to the bedrock.

The main soils in this physiographic area are in the Hartsells, Muskingum, Wellston, and Linker series. Because climate and vegetation are uniform in this area, the differences among soils are caused mostly by differences in topography, parent materials, and the amount of time the parent materials have been in place.

The depth to bedrock is related to the slope. For example, soils with slopes of less than 15 percent generally are from 2 to 4 feet deep. Soils with slopes more than 15 percent generally are shallow and weakly developed. From the steep soils, geologic erosion has removed soil materials almost as fast as the soils formed. The Hartsells, Wellston, and Linker soils are on the milder slopes and average 2 to 3 feet in depth to bedrock. The differences in those soils are mainly caused by parent materials. On the other hand, the Muskingum soils have thinner profiles than have other soils in the area, mainly because they are steeper and younger than the other soils.

RED SOIL AREA

This physiographic area adjoins the Cumberland Plateau escarpment on the east and, at its widest part, extends westward about 7 miles to the Highland Rim. It is about 1,000 to 1,200 feet above sea level and is about 800 to 1,000 feet lower than the top of the Cumberland Plateau. The red soil area is a sea of low, rolling hills. In places the surface is pitted by sinks and depressions.

The soils in this area probably formed in old local alluvium that was deposited at the base of the Cumberland escarpment. As geologic erosion ate into the escarpment, it receded eastward to its present position. In this process deposits of parent material were left, and the present soils formed in the deposits. Some sediments came from the top of the plateau, where the parent material was dominantly residuum from sandstone. As these materials were washed down the steep escarpment, they were mixed with other soil materials that weathered from limestone and shale. The sediments were further mixed and redeposited by existing small streams as they changed their course and formed new channels. The local alluvium ranges from 30 feet to only a few inches in thickness and is absent on some of the steeper slopes. The underlying material is residuum from limestone and is several feet thick. In a few of the more level areas there appears to be a foot or two of loess.

Because of the warm, temperate climate, the forest vegetation, and the kind of parent materials, most of the soils formed in this area are highly leached and strongly acid. The soils are low in organic matter and moderate to low in elements that plants need. The surface layer generally is 8 or 9 inches thick, and the subsoil is as much as 6 feet thick in some places. Much fine material has leached out of the surface layer and has accumulated in the subsoil. In the more highly developed profiles, the clay content of the subsoil ranges from 35 to 65 percent. The red colors common to many soils in this area are caused by the relatively high content of free iron oxides.

The main soils in this area are in the Waynesboro, Holston, Monongahela, Tyler, Purdy, Huntington, Lindside, Sequatchie, and Hermitage series. Climate and vegetation have had a strong but fairly equal impact on soil development. Differences between the Waynesboro soils and the Holston soils are believed to be the result of slight differences in parent material. The parent material of the Waynesboro soils probably contained more limestone than the parent material of the Holston soils. The Monongahela, Tyler, and Purdy soils have parent material similar to that of the Waynesboro and Holston soils but were influenced mainly by their nearly level topography. Their subsoil ranges from mottled gray and brown to uniform gray. The gray color indicates slow removal of water and poor aeration. The Hermitage, Sequatchie, Huntington, and Lindside soils are young and do not have well-developed soil profiles. Their surface layer and subsoil differ from each other only slightly in texture and color.

HIGHLAND RIM

This physiographic area is roughly in the center of the county and joins the red soil area on the east and the outer Central Basin on the west. It is 950 to 1,100 feet above sea level. The area is dominantly undulating and rolling, but some parts, which are cut deeply by drainageways, are hilly to steep. This area is underlain mostly by limestone, but lenses of siltstone are in some places. A thick mantle of clay or cherty clay has weathered from these rocks. Most of the Highland Rim is covered by a mantle of loess, which is underlain by the clay or cherty clay residuum. This mantle is a thin film in some places and is about 30 inches thick in others. At one time the silty mantle probably covered the entire Highland Rim, but it has been removed or worn thin on the steeper slopes by geologic and accelerated erosion. It is believed that the loess originated near the Mississippi River during the glacial ages. Little, if any, of the loess extends farther east in Putnam County than the Cumberland Plateau escarpment.

The soils in this area have formed under a hardwood forest in a warm, temperate climate. Free carbonates and soluble salts have been washed completely out of the profile. These soils are strongly acid, highly leached, and low in organic matter. They are slightly more acid in the lower part than in the upper part.

Soils with fragipans (*17*) occupy a large part of this area. Most of these soils formed in a loess mantle. The fragipan layer appears to be near the boundary between the loess mantle and the underlying residuum from limestone. Fragments or clods from fragipan layers are commonly hard when dry but crush suddenly and completely under severe pressure. They are friable when moist, mainly silt loam in texture, and of high bulk density, but they seldom contrast sharply with adjacent horizons.

The fragipans exist in all degrees of development. They range from faint and barely evident under favorable moisture content to prominent and hard when dry. Except on very level topography, fragipans commonly lie 20 to 30 inches below the surface of the soil. In very level

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areas, the top of the pan may be within 15 inches of the surface. Generally, the more distinct pans are near the surface, and the less distinct ones are deeper in the profile. It has been noted that a lump of soil from a fragipan horizon will crumble if it is placed in water after it is air dried. This slaking and crumbling indicates that the pans are not permanently cemented.

The loess and the underlying limestone residuum in which these soils formed exist in varying proportions. Where the layer of loess has been removed or thinned by erosion, the proportions of loess and of limestone residuum depend on the amount of mixing that occurred as the loess eroded. In general, the presence of the residuum can be estimated from the higher clay content and red color. If untreated, soils formed in residuum from limestone are low in exchangeable bases, and hydrogen and aluminum dominate the exchange sites in the clay. The minerals of the silt and sand fractions are nearly all nonweatherable and low in essential elements. These soils have a much higher content of free iron oxide than soils formed in loess and probably have a greater phosphate-fixing capacity. However, the clay mineral from loess is dominantly vermiculite, which has a high potassium-fixing capacity. But the effect of this property may be somewhat offset because the silt fraction contains feldspar, which releases potassium upon weathering.

The main soils on the Highland Rim are in the Bewleyville, Mountview, Dickson, Sango, Lawrence, and Guthrie series. These soils have formed in loess that overlies residuum from limestone. They range in drainage and topography from the well-drained Bewleyville soils in rolling areas to the poorly drained Guthrie soils on flats. The Dickson, Sango, Lawrence, and Guthrie soils have a fragipan. The differences among the Baxter, Bodine, and Christian soils are mainly the result of differences in parent materials. The parent materials of the Bodine soils are very cherty, those of the Baxter are moderately cherty, and those of the Christian soils are mixed sandstone and siltstone.

OUTER CENTRAL BASIN

Only a small part of the Central Basin extends into Putnam County, and it is in the extreme western part of the county. It is dominantly hilly and steep and is cut deeply by Indian Creek, Martin Creek, and their tributaries. The soils are mainly on the steep slopes below the escarpment of the Highland Rim. The area is 500 to 900 feet above sea level, which is much lower than the Highland Rim. At one time the Highland Rim extended over what is now the Central Basin. The Central Basin was formed when the Highland Rim eroded and the escarpment receded to its present position.

Many of the soils in this area are weakly to moderately developed. They formed in colluvium on steep hillsides of the escarpment and on isolated outlying knobs. Very cherty soils formed from the Fort Payne chert formation, which caps the ridges of the escarpment and is resistant to geologic erosion. This formation is underlain by soluble phosphatic limestone. As the limestone weathers away, the higher lying chert drifts or washes down the long slopes and forms the steep, cherty colluvial soils. These accumulations are as much as 30 feet deep in places. They are most common at the head of steep coves or valleys and on north- and east-facing slopes.

In this area soils on north- and east-facing slopes are generally deeper and darker colored than are soils on south- and west-facing slopes, for they have not been affected so much by alternate freezing and thawing. On north slopes the top inch or two of the soils does not always thaw during the daytime, but on south slopes the warmth from the sun thaws the soils after each freeze. Consequently, the soils on south slopes become loose, pulverized, and more susceptible to erosion and soil drifting.

Drifting, or creep, is accelerated when a soil is saturated. The water lubricates the individual particles and enables them to slip over each other and over the bedrock more easily. Also, water replaces air in the pore spaces and adds materially both to the weight and ease of movement of the mass. When the water freezes in the open spaces, it swells and lifts up part of the surface of the soil mass at right angles to the slope. When the ice melts, each particle drops vertically downward from the place to which it has been elevated and therefore comes to rest downslope, or a little below its position before the freezing occurred. Repeated freezing and thawing for many years extending from the geologic past to the present may account for the generally thinner accumulation of colluvial soil material and for much of the limestone rockland on the south-facing slopes. In contrast, on the cool north-facing slopes the accumulations of colluvium are deeper, the soils contain more organic matter, and less limestone bedrock is exposed.

The soils in the outer Central Basin have formed in parent materials that were rich in plant nutrients. They have been in place a shorter time than have the other soils in the county and are, therefore, less leached than those soils. They contain more calcium and other elements and are generally rich in phosphorus. These soils are browner than the other soils and contain more organic matter.

The main soils in the outer Central Basin are in the Dellrose, Armour, Huntington, and Mimosa series. All of these soils have formed under hardwood forest in a warm, temperate climate. The Dellrose, Armour, and Huntington soils are young and have weakly to moderately developed soil layers. The Dellrose soils have formed in thick, colluvial deposits on long, steep slopes. The Armour soils are on benches. They have a redder subsoil than the Dellrose soils and are slightly higher in clay. The Huntington soils are forming in recent alluvium and have little or no development of soil layers. The Mimosa soils have formed in residuum from phosphatic limestone and have a more strongly developed profile than the other soils of the area.

Classification of Soils

Soils are classified in categories that are progressively more inclusive. The lowest categories commonly used in the field are the phase, type, and series. These categories are defined in the Glossary and in the section "How Soils Are Named, Mapped, and Classified."

Higher categories of classification are the great soil groups and the soil orders. In table 7 the soil series in Putnam County have been placed in their respective great soil groups and soil orders. Distinguishing characteristics of each soil series are given, as well as the soil-forming factors that account for most of these differences.

Above the great soil group is the soil order. Each great soil group is in one of the three classes of soil orders, which are zonal, intrazonal, and azonal (*14*).

Soils in the zonal order have evident, genetically related horizons that reflect the dominant influence of climate and living organisms in their formation. Soils in the intrazonal order, however, have evident, genetically related horizons that show the dominant influence of topography and parent material over the normal influence of the climate and vegetation. Soils in the azonal order lack distinct, genetically related horizons, generally because of youth, resistant parent material, or steep topography.

Nine great soil groups are represented in Putnam County. They are the Red-Yellow Podzolic, Reddish-Brown Lateritic, Gray-Brown Podzolic, Planosol, Humic Gley, Low-Humic Gley, Regosol, Lithosol, and Alluvial soils. These great soil groups are defined in the Glossary (*12*, *14*).

TABLE 7.—*Soil series classified by higher categories, and factors of soil formation that have contributed to their differences*

ZONAL SOILS

Great soil group and series	Profile [1]	Drainage	Parent material	Slope range	Degree of development [2]
Red-Yellow Podzolic soils:				*Percent*	
Allen	Brown, very friable loam over friable, yellowish-red clay loam.	Good	Old colluvium or local alluvium from soils on sandstone, shale, and limestone.	2 to 30	Strong.
Armour [3]	Dark-brown, friable silt loam over strong-brown to dark-brown, friable silty clay loam.	Good	Colluvium or alluvium from soils on phosphatic limestone.	2 to 20	Moderate.
Baxter	Yellowish-brown or brown, friable cherty silt loam over yellowish-red, firm cherty silty clay loam to cherty clay.	Good	Residuum from cherty limestone.	5 to 30	Strong.
Bewleyville	Yellowish-brown to brown, friable silt loam over strong-brown to yellowish-red, friable silty clay loam.	Good	Thin mantle of loess over residuum from limestone.	2 to 20	Strong.
Christian	Yellowish-brown, friable silt loam over yellowish-red, firm silty clay.	Good	Residuum from interbedded siltstone and shaly limestone and, in places, sandy limestone.	2 to 30	Strong.
Cookeville	Brown, friable silt loam over red, firm clay.	Good	Residuum from nearly chert-free limestone.	5 to 20	Strong.
Dickson [4]	Yellowish-brown to pale-brown, friable silt loam over yellowish-brown silty clay loam or silt loam; fragipan at about 24 inches.	Moderately good to good.	Thin mantle of loess over residuum from cherty limestone.	0 to 2	Strong.
Hartsells	Yellowish-brown, friable loam over yellowish-brown, friable clay loam or loam.	Good	Residuum from acid sandstone and some shale.	2 to 12	Moderate.
Hermitage [3]	Dark-brown, friable silt loam over reddish-brown to yellowish-red, friable silty clay loam.	Good	Colluvium or local alluvium from soils on limestone.	2 to 30	Moderate to weak.
Holston	Brown to yellowish-brown, friable loam or silt loam over yellowish-brown clay loam or silty clay loam.	Good	Alluvium from soils on sandstone and limestone covered by a thin mantle of loess.	2 to 12	Strong.
Jefferson	Brown to yellowish-brown, friable loam over yellowish-brown, friable clay loam or silty clay loam.	Good	Colluvium or local alluvium from soils on sandstone, shale, and limestone.	2 to 30	Moderate.
Landisburg [4]	Dark grayish-brown to brown, friable silt loam over yellowish-brown silty clay loam that is cherty in places; fragipan at about 26 inches.	Moderately good.	Colluvium or local alluvium from soils on relatively cherty limestone.	2 to 12	Moderate.
Linker	Dark yellowish-brown, friable loam over yellowish-red to red, friable clay loam.	Good	Residuum, chiefly from acid, medium-grained sandstone.	5 to 12	Strong.
Minvale	Brown, friable silt loam over yellowish-red, friable silty clay loam; cherty in places.	Good	Colluvium or local alluvium from soils on limestone with some chert in places.	2 to 20	Moderate.
Monongahela [4]	Brown, friable silt loam over yellowish-brown to light yellowish-brown, friable silt loam or silty clay loam; fragipan at about 26 inches.	Moderately good.	Old general alluvium from soils on sandstone and shale and, to some extent, limestone.	2 to 5	Strong.
Mountview	Grayish-brown to brown, friable silt loam over yellowish-brown, friable silty clay loam.	Good	Thin mantle of loess over residuum of cherty limestone or siltstone.	2 to 20	Strong.

See footnotes at end of table.

TABLE 7.—*Soil series classified by higher categories, and factors of soil formation that have contributed to their differences*—Continued

ZONAL SOILS—Continued

Great soil group and series	Profile [1]	Drainage	Parent material	Slope range	Degree of development [2]
				Percent	
Sango [4]	Light yellowish-brown to grayish-brown, friable silt loam over mottled, light olive-brown to yellowish-brown, friable silt loam; fragipan at a depth of about 24 inches.	Good	Thin mantle of loess over residuum from cherty or shaly limestone.	1 to 3	Strong.
Sequatchie	Brown, friable loam over brown to strong-brown, friable clay loam or silty clay loam.	Good	Young general alluvium from soils formed on limestone, sandstone, and shale.	2 to 12	Weak to moderate.
Swaim	Brown to dark-brown, friable silt loam over yellowish-brown to strong-brown, firm silty clay loam to clay.	Good	Colluvium or local alluvium from clayey soils on limestone.	5 to 12	Moderate to strong.
Talbott	Yellowish-brown to brown, friable silt loam over firm, yellowish-red silty clay or clay.	Good	Residuum from clayey limestone.	5 to 30	Very strong.
Waynesboro [3]	Dark grayish-brown to brown, friable silt loam over yellowish-red to dark-red, friable silty clay loam or clay loam.	Good	Alluvium from soils on limestone, shale, and, to some extent, sandstone.	2 to 20	Strong.
Wellston [5]	Yellowish-brown, friable silt loam over yellowish-brown, friable to firm silty clay loam.	Good	Residuum from acid shale	2 to 12	Strong.
Reddish-Brown Lateritic soils:					
Cumberland	Dark-brown to dark reddish-brown, friable silt loam over red, friable to firm silty clay loam to clay.	Good	Old alluvium, mainly from soils on limestone.	2 to 12	Strong.
Gray-Brown Podzolic soils:					
Dellrose [6]	Dark-brown, friable cherty silt loam over brown to strong-brown, friable cherty silty clay loam or silt loam.	Good	Old colluvium from cherty soils on limestone, and generally overlying clayey residuum from phosphatic limestone.	12 to 45	Weak to moderate
Mimosa	Dark-brown, friable silt loam over variegated yellowish-brown and strong-brown, firm or plastic silty clay loam or clay.	Good	Clayey residuum from phosphatic limestone.	5 to 35	Strong.

INTRAZONAL SOILS

Great soil group and series	Profile [1]	Drainage	Parent material	Slope range	Degree of development [2]
Planosols:					
Guthrie	Gray, friable silt loam over friable or firm, mottled silty clay loam or silt loam mottled with gray; discontinuous fragipan.	Poor	Thin mantle of loess over cherty residuum from limestone; colluvial deposits in places.	0 to 2	Strong.
Lawrence	Grayish-brown, mottled silt loam over mottled, light yellowish-brown, friable silt loam.	Somewhat poor	Thin mantle of loess over cherty and shaly residuum from limestone.	1 to 3	Strong.
Purdy	Dark-gray to grayish-brown, friable silt loam over mottled, gray and brown silty clay loam or clay loam.	Poor	Old alluvium in flats and depressions from soils on sandstone, shale, and limestone.	0 to 2	Strong to moderate.
Tyler	Grayish-brown, mottled silt loam over friable to firm silty clay loam mottled with gray and yellow.	Somewhat poor	Old general alluvium from soils on sandstone and shale and, to some extent, limestone.	0 to 2	Strong.

See footnotes at end of table.

TABLE 7.—*Soil series classified by higher categories, and factors of soil formation that have contributed to their differences*—Continued

INTRAZONAL SOILS—Continued

Great soil group and series	Profile [1]	Drainage	Parent material	Slope range	Degree of development [2]
Low-Humic Gley soils:				*Percent*	
Atkins	Gray, friable silt loam over mottled, gray to light brownish-gray, friable silt loam.	Poor	Recent alluvium from soils on sandstone and shale; shale soils dominate.	0 to 2	Weak.
Melvin	Mottled, grayish-brown, friable silt loam over distinctly mottled, light brownish-gray or gray silt loam.	Poor	Recent alluvium from soils on uplands and terraces; formed mainly from limestone.	0 to 2	Weak.
Humic Gley soils:					
Elkins	Very dark gray, friable silt loam over dark-gray, friable silt loam to loam.	Very poor	Recent alluvium from soils on shale and sandstone.	0 to 2	Weak.

AZONAL SOILS

Great soil group and series	Profile [1]	Drainage	Parent material	Slope range	Degree of development [2]
Alluvial soils:					
Bruno	Pale-brown, loose loamy sand over light yellowish-brown, loose fine sand or loamy fine sand.	Excessive	Mixed recent alluvium from soils on sandy limestone and sandstone.	0 to 3	Weak.
Ennis	Brown to grayish-brown, friable silt loam over brown or dark yellowish-brown, friable silt loam.	Good	Mixed local alluvium from soils on cherty limestone mixed with loess.	0 to 3	Weak.
Huntington	Dark-brown, friable silt loam, generally deep over stratified layers of variable texture.	Good	Mixed recent alluvium, mostly from soils on limestone.	0 to 3	Weak.
Lindside	Brown to dark-brown, friable silt loam over mottled, grayish-brown, friable silt loam.	Moderately good to somewhat poor.	Mixed recent alluvium, mostly from soils on limestone.	0 to 2	Weak.
Lithosols:					
Muskingum	Grayish-brown to brown, friable sandy loam or silt loam over a thin horizon of yellowish-brown, friable clay loam, silty clay loam, or loam.	Good to excessive.	Residuum from acid sandstone and shale.	5 to 30	Weak.
Regosols:					
Bodine	Pale-brown to brown cherty silt loam over mottled cherty silty clay loam or cherty silt loam.	Somewhat excessive.	Residuum from very cherty limestone.	5 to 40	Weak.

[1] Soil profiles not materially affected by erosion.
[2] As measured by the number of genetic horizons and the degree of contrast between them.
[3] Red-Yellow Podzolic soils grading toward Reddish-Brown Lateritic soils.
[4] Red-Yellow Podzolic soils grading toward Planosols.
[5] Red-Yellow Podzolic soil grading toward Gray-Brown Podzolic soils.
[6] Gray-Brown Podzolic soil grading toward Red-Yellow Podzolic soils.

Chemical and Physical Properties of Soils

Table 8 lists laboratory data from chemical and mechanical analyses of some of the more important soils in Putnam County. Some of the samples analyzed were taken in Coffee County, which is about 50 miles from Putnam County, but these samples are representative of similar soils in Putnam County.

644-010—63——8

TABLE 8.—*Chemical and physical characteristics*

Soil type and sample location	Horizon	Depth	Chemical characteristics						
			Exchangeable cations (milliequivalents per 100 grams of soil)						Base saturation
			Ca	Mg	K	Na	H	Sum	
		Inches							*Percent*
Armour silt loam:									
Site 1	A_p	0–9	3.8	0.8	0.2	<0.1	9.2	14.0	34
	B_1	9–15	4.9	.4	.2	<.1	6.8	12.3	45
	B_2	15–32	5.7	.4	.2	.1	6.3	12.7	50
	C	32+	5.1	.8	.2	.1	6.6	12.8	48
Site 2	A_p	0–9	10.9	2.0	.5	<.1	6.0	19.4	69
	B_1	9–14	5.4	.4	.2	.2	7.9	14.1	44
	B_2	14–32	5.9	1.8	.2	.1	8.4	16.4	49
	C	32+	4.6	1.7	.2	.2	9.2	15.9	42
Baxter cherty silt loam:									
Site 1	A_p	0–7	7.4	.8	.4	<.1	3.4	12.0	72
	B_1	7–10	3.6	.4	.1	<.1	2.4	6.5	63
	B_2	10–32	2.9	1.2	.1	.1	5.6	9.9	43
	C	32+	6.3	2.6	.3	.1	8.0	17.3	54
Site 2	A_p	0–7	3.1	.3	.1	.2	4.5	8.2	45
	B_1	7–10	.6	.3	<.1	.1	6.2	7.2	14
	B_3	10–32	.1	.2	.1	.1	7.5	8.0	6
	C	32+	4.4	.3	.1	<.1	10.4	15.2	32
Bodine cherty silt loam:									
Site 1	A_2	1–9	.4	.2	.2	.1	7.2	8.1	11
	C_1	9–20	.3	.3	.2	<.1	2.8	3.6	22
	C_2	20–60+	1.3	1.1	.2	<.1	5.9	8.5	30
Site 2	A_2	1–9	.6	.8	.3	<.1	8.5	10.2	17
	C_1	9–20	1.0	.9	.2	<.1	3.7	5.8	36
	C_2	20–60+	.8	1.3	.2	<.1	3.7	6.0	38
Cookeville silt loam:									
Site 1	A_1	0–2	3.0	1.0	.4	<.1	6.5	10.9	40
	A_2	2–8	.8	.2	.2	<.1	6.1	7.3	16
	B_2	13–32	.3	1.1	.2	<.1	11.9	13.5	12
	C	32+	.7	1.3	.2	<.1	16.5	18.7	12
Site 2	A_1	0–2	7.4	2.5	.5	.1	16.5	27.0	39
	A_2	2–8	1.5	.3	.1	.1	7.0	9.0	22
	B_2	14–34	.3	.9	.2	<.1	10.6	12.0	12
	C	34+	.2	.2	.1	<.1	11.3	11.8	4
Cumberland silt loam:									
Site 1	A_p	0–8	7.7	.5	.2	.1	4.9	13.4	63
	A_3	8–16	5.8	.2	.2	.1	5.1	11.4	55
	B_1	16–23	2.7	.7	.2	.1	8.2	11.9	31
	B_{21}	23–27	1.6	.8	.2	.1	9.1	11.8	23
	B_{22}	27–38	1.0	.9	.2	<.1	9.1	11.2	19
	B_{23}	38–45	1.3	.9	.3	<.1	8.8	11.3	22
	B_{24}	45–52	2.1	.9	.3	<.1	8.2	11.5	29
	B_{25}	52–61	3.0	1.4	.3	.1	8.5	13.3	36
	B_{31}	61–75	3.0	1.3	.3	.1	9.3	14.0	34
	B_{32}	75–87	2.9	.5	.3	.1	8.9	12.7	30
Site 2	A_p	0–7	3.6	.8	.3	.1	6.6	11.4	42
	A_3	7–13	3.4	.4	.2	<.1	5.9	9.9	40
	B_1	13–21	3.4	1.2	.2	<.1	6.4	11.2	43
	B_{21}	21–29	1.6	1.5	.2	<.1	7.0	10.3	32
	B_{22}	29–40	.4	1.6	.2	.1	8.2	10.5	22
	B_{23}	40–52	.3	.2	.2	.1	9.3	10.1	8
	B_{24}	52–61	.1	1.8	.2	.1	10.1	12.3	18
	B_{31}	61–73	.1	.8	.2	.1	9.9	11.1	11
	B_{32}	73–85+	.1	.8	.2	.1	9.9	11.1	11

See footnotes at end of table.

of some representative soils [1]

Chemical characteristics—Continued		Physical characteristics							
		Size class and diameter of particles in millimeters							Textural class [2]
pH 1:1	Organic carbon	Very coarse sand (2.0–1.0)	Coarse sand (1.0–0.5)	Medium sand (0.5–0.25)	Fine sand (0.25–0.1)	Very fine sand (0.1–0.05)	Silt (0.05–0.002)	Clay (<0.002)	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	
5. 5	1. 04	2. 2	2. 8	1. 4	1. 6	2. 3	68. 0	21. 7	Silt loam.
5. 7	. 42	1. 2	1. 9	1. 1	1. 2	1. 7	66. 1	26. 8	Silt loam or silty clay loam.
5. 8	. 34	1. 8	2. 2	1. 1	1. 2	2. 0	63. 5	28. 2	Silty clay loam.
5. 5	. 10	3. 9	3. 4	1. 5	1. 7	2. 7	52. 7	34. 1	Silty clay loam.
6. 5	2. 46	5. 3	4. 6	1. 9	2. 0	2. 2	63. 2	20. 8	Silt loam.
5. 3	. 29	9. 5	4. 5	1. 7	1. 7	2. 1	50. 5	30. 0	Silty clay loam or clay loam.
5. 1	. 20	4. 9	3. 9	1. 7	1. 7	2. 7	47. 1	38. 0	Silty clay loam.
5. 0	. 15	7. 0	5. 8	2. 6	2. 8	3. 9	42. 0	35. 9	Clay loam.
6. 6	1. 88	4. 2	3. 0	2. 2	4. 6	3. 8	67. 1	15. 1	Silt loam.
5. 7	. 20	5. 0	4. 5	3. 1	6. 3	6. 4	53. 8	20. 9	Silt loam.
4. 7	. 09	2. 2	3. 7	2. 6	4. 1	4. 1	51. 0	32. 2	Silty clay loam.
5. 0	. 04	. 6	1. 0	. 7	1. 3	1. 7	38. 4	56. 3	Clay
5. 5	1. 40	1. 0	1. 0	1. 0	12. 4	14. 9	60. 3	9. 4	Silt loam.
4. 6	. 24	. 8	. 9	. 7	9. 1	12. 2	56. 7	19. 6	Silt loam.
4. 4	. 15	. 8	1. 0	. 8	10. 4	13. 4	52. 1	21. 5	Silt loam.
4. 7	. 28	1. 8	1. 9	1. 2	6. 4	8. 6	35. 3	44. 8	Clay.
5. 0	1. 37	4. 8	3. 4	1. 8	3. 1	5. 0	68. 5	13. 4	Silt loam.
4. 8	. 31	8. 6	6. 1	2. 6	4. 4	6. 2	60. 9	11. 2	Silt loam.
4. 6	. 28	5. 4	4. 3	1. 9	3. 5	5. 0	50. 6	29. 3	Silty clay loam or clay loam.
5. 1	1. 42	5. 2	3. 2	1. 4	2. 6	4. 9	68. 2	14. 5	Silt loam.
5. 2	. 35	6. 9	4. 9	1. 9	3. 3	5. 8	63. 3	13. 9	Silt loam.
5. 0	. 19	7. 2	5. 0	2. 1	3. 9	7. 1	59. 3	15. 4	Silt loam.
5. 6	1. 99	2. 0	2. 2	1. 2	4. 5	8. 2	70. 5	11. 4	Silt loam.
5. 0	1. 00	2. 0	1. 9	1. 0	3. 8	7. 4	70. 0	13. 9	Silt loam.
4. 7	. 13	. 5	. 5	. 4	2. 5	6. 6	47. 4	42. 1	Silty clay.
4. 8	. 06	. 2	. 5	. 3	3. 0	7. 0	31. 2	57. 8	Clay.
4. 7	7. 7	2. 5	4. 0	2. 8	11. 8	12. 4	58. 3	8. 2	Silt loam.
4. 5	1. 73	2. 7	2. 0	. 9	7. 1	11. 0	65. 4	10. 9	Silt loam.
4. 7	. 37	. 7	. 5	. 3	2. 7	4. 8	50. 7	40. 3	Silty clay or silty clay loam.
4. 8	. 07	1. 8	1. 7	1. 0	4. 2	6. 9	29. 5	54. 9	Clay.
6. 6	1. 17	. 8	2. 0	3. 2	6. 9	5. 6	58. 7	22. 8	Silt loam.
6. 3	. 74	. 8	1. 6	2. 0	4. 5	4. 4	55. 1	31. 6	Silty clay loam.
5. 0	. 28	1. 0	1. 9	2. 1	4. 8	5. 0	50. 8	34. 4	Silty clay loam.
4. 8	. 27	. 6	1. 2	2. 2	5. 2	5. 0	44. 0	41. 8	Silty clay.
4. 8	. 25	. 6	1. 0	2. 2	5. 2	5. 3	41. 6	44. 1	Silty clay.
4. 8	. 26	. 4	1. 0	2. 2	5. 2	5. 4	39. 5	46. 3	Clay or silty clay.
4. 8	. 26	. 3	. 9	2. 3	5. 5	5. 8	35. 7	49. 5	Clay.
4. 8	. 26	. 3	1. 0	2. 2	5. 4	5. 8	32. 4	52. 9	Clay.
4. 7	. 26	. 4	. 8	2. 0	5. 1	5. 7	26. 7	59. 3	Clay.
4. 8	. 25	. 2	. 8	2. 1	5. 2	5. 8	27. 3	58. 6	Clay.
5. 8	1. 20	. 3	1. 7	5. 3	13. 5	8. 8	52. 6	17. 8	Silty loam.
5. 5	. 58	. 1	. 8	3. 1	8. 4	6. 2	54. 0	27. 4	Silty clay loam or silt loam.
5. 2	. 36	. 3	1. 0	3. 0	8. 0	5. 9	51. 2	30. 6	Silty clay loam.
5. 0	. 34	. 3	. 9	3. 0	8. 6	6. 5	43. 1	37. 6	Silty clay loam or clay loam.
4. 9	. 27	. 4	. 8	3. 2	8. 8	6. 6	38. 7	41. 5	Clay.
4. 7	. 24	. 1	. 8	3. 4	9. 9	7. 4	36. 2	42. 2	Clay.
4. 7	. 24	. 3	. 8	3. 6	10. 2	8. 3	32. 8	44. 0	Clay.
4. 6	. 25	. 2	. 8	3. 7	10. 8	8. 5	31. 7	44. 3	Clay.
4. 6	. 25	. 2	. 9	4. 1	11. 9	9. 9	28. 8	44. 2	Clay.

TABLE 8.—*Chemical and physical characteristics*

Soil type and sample location	Horizon	Depth	Chemical characteristics: Exchangeable cations (milliequivalents per 100 grams of soil) Ca	Mg	K	Na	H	Sum	Base saturation
		Inches							*Percent*
Dellrose cherty silt loam: Site 1	A_p	0–9	2.3	.2	.2	.1	11.7	14.5	19
	A_3	9–16	2.6	.3	.1	.1	6.6	9.7	32
	B_1	16–25	3.4	.3	.2	.1	7.4	11.4	35
	B_{21}	25–35	1.4	.6	.2	.1	8.8	11.1	21
	B_{22}	35–44	.8	.4	.2	<.1	9.4	10.8	13
	B_{23}	44–55	.4	.6	.2	<.1	10.7	11.9	10
	B_{24}	55–62	.3	.5	.2	<.1	10.7	11.7	8
	B_3	62–74	.3	.3	.2	<.1	10.5	11.3	7
Site 2	A_p	0–8	1.8	.6	.2	.1	12.1	14.8	18
	A_3	8–14	2.5	.4	.2	.1	6.8	10.0	32
	B_1	14–22	3.0	.4	.2	.1	5.5	9.2	40
	B_{21}	22–33	2.7	.7	.2	.1	5.3	9.0	41
	B_{22}	33–44	.4	.6	.2	<.1	6.4	7.6	16
	B_{23}	44–57	.2	.2	.2	<.1	5.8	6.4	9
	B_{24}	57–65	.1	.1	.2	<.1	5.6	6.0	7
	B_3	65–77	.7	.4	.2	<.1	7.3	8.6	15
Dickson silt loam: Site 1	A_1	0–1	1.0	.9	.3	.1	14.1	16.4	14
	A_2	1–6	.2	.3	.1	<.1	7.6	8.2	7
	B_2	11–23	.1	.2	.1	.1	8.8	9.3	5
	B_m	27–48	.2	.1	.1	.1	8.8	9.3	5
	D	48+	.2	.2	.1	<.1	11.0	11.5	4
Site 2	A_1	0–1	2.2	.7	.3	<.1	13.7	16.9	19
	A_2	1–6	.3	.2	.2	.1	7.4	8.2	10
	B	11–24	.2	.2	.2	.1	9.1	9.8	7
	B_m	28–46	.2	<.1	.1	.1	7.7	8.1	5
	D	46+	.1	.5	.1	<.1	14.2	14.9	5
Guthrie silt loam: Site 1	A_1	0–1	6.6	1.2	.2	.2	10.8	19.0	43
	A_2	1–5	3.5	.8	.1	.1	6.7	11.2	40
	B_g	5–28	1.8	.2	.1	.1	7.5	9.7	23
	C	28–60+	5.1	.4	.1	.1	4.6	10.3	55
Site 2	A_1	0–1	.2	.2	.2	.1	27.4	28.1	2
	A_2	1–5	.2	.1	.1	.1	10.8	11.3	4
	B_g	5–28	.5	.4	.1	.1	10.5	11.6	9
	C	28–60+	.1	.2	.1	.1	11.1	11.6	4
Huntington silt loam: Site 1	A_p	0–12	9.7	.7	.1	.2	5.4	16.1	66
	C_1	12–30	10.9	1.0	.1	.1	5.0	17.1	71
	C_2	30–36+	15.5	1.2	.2	.1	6.0	23.0	74
Site 2	A_p	0–11	4.8	.4	.1	.1	9.1	14.5	37
	C_1	11–30	2.8	.4	.1	.1	13.5	16.9	20
	C_2	30–36	2.5	<.1	.1	<.1	15.4	18.0	14
Site 3	A_p	0–12	9.8	.7	.1	<.1	3.9	14.5	73
	C_1	12–25	5.1	.2	.1	<.1	4.4	9.8	55
	C_2	25–43	2.5	.3	.1	<.1	2.7	5.6	52
Site 4	A_p	0–12	7.3	.2	.1	<.1	3.6	11.2	68
	C_1	12–25	2.2	.3	<.1	<.1	5.8	8.3	30
	C_2	25–35	1.8	.1	<.1	<.1	3.4	4.9	24
Lawrence silt loam: Site 1	A_1	0–1	.2	.4	.2	<.1	8.3	9.1	9
	A_2	1–7	.2	.3	.1	<.1	7.1	7.7	8
	B_1	7–15	<.1	.2	.1	<.1	9.1	9.4	3
	B_2	15–24	.2	.2	.1	<.1	7.5	8.0	6
	B_{3m1}	24–35	.2	.2	.1	.1	7.1	7.7	8
	B_{3m2}	35–47	<.1	.4	.1	.1	9.3	9.9	6
	C_{m1}	47–59	.1	.7	.1	<.1	10.4	11.3	8
	C_{m2}	59–71	.1	.4	.1	.1	8.5	9.2	8

See footnotes at end of table.

of some representative soils [1]—Continued

Chemical characteristics—Continued		Physical characteristics							Textural class [2]
		Size class and diameter of particles in millimeters							
pH 1:1	Organic carbon	Very coarse sand (2.0–1.0)	Coarse sand (1.0–0.5)	Medium sand (0.5–0.25)	Fine sand (0.25–0.1)	Very fine sand (0.1–0.05)	Silt (0.05–0.002)	Clay (<0.002)	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	
5.3	1.38	5.1	3.9	1.8	2.0	1.8	66.2	19.2	Silt loam.
5.5	.96	5.2	3.5	1.6	1.7	1.6	65.4	21.0	Silt loam.
5.2	.18	5.9	4.4	1.9	2.2	2.4	57.1	26.1	Silt loam or silty clay loam.
4.9	.14	4.2	4.2	2.2	2.6	2.5	54.5	29.8	Silty clay loam.
4.8	.12	4.3	4.3	2.0	2.4	2.5	54.4	30.1	Silty clay loam.
4.7	.09	4.2	4.2	1.9	2.2	2.4	53.3	31.8	Silty clay loam.
4.6	.12	5.5	4.5	1.8	2.2	2.4	52.0	31.6	Silty clay loam.
4.6	.09	4.3	4.0	1.9	2.8	3.4	52.0	31.5	Silty clay loam.
5.3	1.96	5.2	3.9	1.8	2.2	1.6	67.9	17.4	Silt loam.
5.5	.48	4.0	3.4	1.6	2.0	1.5	67.6	19.9	Silt loam.
5.5	.24	5.6	4.6	2.0	2.3	2.1	63.8	19.6	Silt loam.
5.4	.15	6.4	5.3	2.5	2.9	2.6	60.8	19.5	Silt loam.
4.9	.08	7.9	6.0	2.9	3.9	4.0	57.4	17.9	Silt loam.
4.8	.09	7.2	5.3	2.6	3.9	4.5	59.5	17.0	Silt loam.
4.9	.09	5.4	3.8	1.9	2.7	3.9	63.0	19.3	Silt loam.
		4.7	4.0	1.9	2.4	3.3	57.3	26.4	Silt loam or silty clay loam.
4.0	5.0	[3]1.3	2.2	1.6	6.0	5.9	72.1	10.9	Silt loam.
4.3	1.03	.7	1.0	.8	4.8	6.0	73.8	12.9	Silt loam.
4.5	.16	1.2	.8	.6	3.0	4.4	69.6	20.4	Silt loam.
4.6	.08	.8	.7	.5	3.2	5.0	68.0	21.8	Silt loam.
4.7	.05	1.7	1.0	.7	3.9	5.7	54.1	32.9	Silty clay loam.
4.4	5.0	[3]2.1	[3]2.5	[3]1.5	4.7	8.9	71.7	8.6	Silt loam.
4.6	1.53	1.3	1.1	.7	2.2	7.4	75.2	12.1	Silt loam.
4.4	.23	1.6	.9	.5	1.4	6.3	66.9	22.4	Silt loam.
4.4	.13	1.3	.9	.5	1.7	7.5	71.1	17.0	Silt loam.
4.5	.11	1.2	1.1	.7	2.0	8.2	49.9	36.9	Silty clay loam.
5.0	4.06	[3].2	[3].9	1.4	7.7	8.2	65.8	15.8	Silt loam.
5.2	1.84	.2	.6	1.4	7.8	8.8	65.1	16.1	Silt loam.
4.7	.36	.3	.6	1.3	7.1	8.7	60.4	21.6	Silt loam.
4.9	.13	.8	1.0	1.3	4.7	6.3	60.8	25.1	Silt loam.
3.8	6.7	7.4	1.9	1.5	7.4	8.0	57.7	16.1	Silt loam.
4.1	2.16	.8	.9	1.3	7.9	9.1	65.7	14.3	Silt loam.
4.3	.38	.2	.9	1.0	5.1	7.5	61.8	23.5	Silt loam.
4.3	.10	.2	.8	1.2	6.0	8.7	55.1	28.0	Silty clay loam.
6.3	1.31	.2	.3	.3	1.5	5.2	70.2	22.3	Silt loam.
6.4	.95	.6	.7	.8	2.0	4.4	67.0	24.5	Silt loam.
6.4	.96	1.0	1.2	1.1	2.7	5.1	53.2	35.7	Silty clay loam.
5.3	1.18	.1	.4	.6	4.6	11.8	63.1	19.4	Silt loam.
4.8	.52	.2	.5	.5	2.3	9.7	61.0	25.8	Silt loam.
4.6	.61	0	.1	.2	1.6	7.8	61.2	28.7	Silty clay loam.
6.9	.80	[4].5	.7	1.6	8.9	11.8	54.6	22.5	Silt loam.
5.9	.32	[4].2	1.2	3.3	17.4	15.9	41.9	20.1	Silt loam.
5.4	.13	.8	5.0	12.6	34.9	14.6	20.2	11.9	Fine sandy loam.
6.7	1.08	.2	.9	2.0	11.3	11.5	56.7	17.4	Silt loam.
5.8	.71	[4].1	1.7	4.7	28.4	17.3	37.7	10.1	Sandy loam or loam.
5.7	.29	.1	.7	4.0	36.3	21.4	29.4	8.1	Fine sandy loam.
4.2	2.08	.2	.7	1.0	6.4	6.2	75.5	10.0	Silt loam.
4.4	.50	.1	.3	.8	4.8	5.1	72.9	16.0	Silt loam.
4.3	.23	.2	.3	.8	4.1	4.8	67.6	22.2	Silt loam.
4.4	.14	.1	.5	1.0	4.1	4.7	71.0	18.6	Silt loam.
4.5	.10	.2	.5	1.2	4.6	5.3	70.3	17.9	Silt loam.
4.6	.06	.1	.5	.9	3.8	4.7	65.0	25.0	Silt loam.
4.4	.06	.5	.7	1.2	4.7	5.4	59.6	27.9	Silty clay loam or silt loam.
4.4	.02	2.6	2.8	3.5	10.1	8.2	45.7	27.1	Clay loam or loam.

TABLE 8.—*Chemical and physical characteristics*

Soil type and sample location	Horizon	Depth	Chemical characteristics: Exchangeable cations (milliequivalents per 100 grams of soil): Ca	Mg	K	Na	H	Sum	Base saturation
		Inches							*Percent*
Site 2	A_1	0–2	<.1	.1	.1	<.1	10.3	10.6	3
	A_2	2–10	.1	.2	<.1	<.1	6.8	7.1	4
	B_1	10–15	.1	.2	<.1	.1	6.9	7.3	5
	B_2	15–23	.1	.2	.1	.1	7.9	8.4	6
	B_{3m1}	23–37	.1	.2	<.1	.1	7.3	7.7	5
	B_{3m2}	37–51	.2	.2	<.1	.1	9.1	9.6	5
	B_{2b}	51–59	.1	.1	<.1	.1	11.1	11.4	3
	B_{3b}	69–81	.1	.1	<.1	.2	11.5	11.9	3
Linker loam: Site 1	A_1	0–5	.2	.3	.2	.1	12.1	12.9	6
	A_2	5–10	.1	.6	.2	.1	13.6	14.6	7
	B_1	10–15	.1	.8	.2	<.1	13.9	15.0	7
	B_{21}	15–20	<.1	.5	.2	<.1	13.4	14.1	5
	B_{22}	20–34	<.1	.4	.1	<.1	10.7	11.2	4
	C	34–48	<.1	.3	.1	<.1	9.0	9.4	4
Site 2	A_1	0–5	.2	.2	.1	<.1	12.6	13.1	4
	A_2	5–10	.1	.5	.2	<.1	12.4	13.2	6
	B_1	10–15	.2	.7	.2	.1	14.3	15.5	8
	B_{21}	15–25	.1	.7	.2	.1	13.5	14.6	8
	B_{22}	25–43	.1	.2	.1	<.1	10.0	10.4	4
	C_1	43–58	.1	.1	.1	.1	6.8	7.2	6
	C_2	58–69	<.1	.1	.1	<.1	6.8	7.0	3
Mimosa silt loam: Site 1	A_p	0–9	10.6	.8	.2	<.1	8.7	20.3	57
	B_{21}	9–18	19.3	1.0	.2	.1	11.9	32.5	63
	B_{22}	18–24	21.0	1.4	.2	.1	14.8	37.5	60
	B_{23}	24–27	24.5	1.4	.2	.1	11.2	37.4	70
	B_{24}	27–41	31.2	1.3	.2	.1	4.6	37.4	88
Site 2	A_p	0–7	5.3	.4	.3	<.1	9.2	15.2	39
	B_{21}	7–15	12.6	.8	.2	<.1	9.4	23.0	59
	B_{22}	15–24	10.3	.9	.2	<.1	11.3	22.7	50
	B_{23}	24–28	8.4	.6	.2	<.1	10.8	20.0	46
	B_{24}	28–42	6.9	.6	.2	<.1	10.8	18.5	42
Monongahela silt loam: Site 1	A_p	0–7	.4	.2	.1	<.1	5.8	6.5	11
	A_2	7–11	.3	.2	.1	<.1	3.6	4.2	14
	B_{21}	11–15	.2	.2	.1	<.1	4.4	4.9	10
	B_{22}	15–26	.3	.3	.1	<.1	6.3	7.0	10
	B_{23}	26–31	<.1	.2	.1	<.1	7.0	7.3	4
	B_{24}	31–39	<.1	.2	.1	<.1	7.3	7.6	4
	B_3	39–48	.1	.4	.1	<.1	8.5	9.1	6
	C_1	48–54	<.1	.2	.1	.1	8.0	8.4	5
	C_2	54–60	<.1	.2	.1	<.1	8.8	9.1	3
Site 2	A_p	0–7	4.2	.5	.1	<.1	2.2	7.0	68
	A_2	7–12	3.8	.4	.1	<.1	3.4	7.7	56
	B_{21}	12–17	1.4	.2	.1	<.1	6.3	8.0	21
	B_{22}	17–26	1.0	.1	.1	<.1	7.8	9.0	13
	B_{23}	26–30	.2	.5	.1	<.1	7.5	8.3	10
	B_{24}	30–42	<.1	.2	.1	<.1	7.3	7.6	4
	B_3	42–53	<.1	.4	.1	<.1	7.3	7.8	6
	C_1	53–68	<.1	.2	.1	<.1	8.3	8.8	3
	C_2	68–95	<.1	.4	<.1	<.1	4.4	4.8	8
Mountview silt loam: Site 1	A_1	0–1	2.9	1.1	.5	.1	10.0	14.6	32
	A_2	1–8	.5	.5	.2	.1	7.9	9.2	14
	A_3	8–10	.9	1.1	.2	<.1	6.4	8.6	26
	B_2	10–29	.8	.7	.2	<.1	8.4	10.1	17
	B_3	29–34	.3	.7	.2	<.1	10.0	11.2	11
	D	34+	.2	.5	.2	<.1	13.3	14.2	6

See footnotes at end of table.

of some representative soils [1]—Continued

Chemical characteristics—Continued		Physical characteristics							Textural class [2]
		Size class and diameter of particles in millimeters							
pH 1:1	Organic carbon	Very coarse sand (2.0–1.0)	Coarse sand (1.0–0.5)	Medium sand (0.5–0.25)	Fine sand (0.25–0.1)	Very fine sand (0.1–0.05)	Silt (0.05–0.002)	Clay (<0.002)	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	
4.2	2.18	.2	.5	.7	8.2	11.5	69.1	9.8	Silt loam.
4.3	.42	.2	.3	.5	6.6	10.0	67.9	14.5	Silt loam.
4.4	.20	.1	.3	.5	6.2	9.9	67.1	15.9	Silt loam.
4.6	.09	.1	.2	.4	5.2	8.3	62.8	23.0	Silt loam.
4.4	.09	.1	.2	.4	5.4	9.5	66.5	17.9	Silt loam.
4.4	.12	0	.2	.4	4.2	7.7	63.9	23.6	Silt loam.
4.5	.06	.1	.5	.9	6.3	11.0	45.8	35.4	Silty clay loam.
4.6	.06	1.6	1.5	.9	5.8	9.8	43.1	37.3	Silty clay loam or clay loam.
4.6	1.76	1.6	8.3	13.6	18.9	3.8	30.5	23.3	Loam.
4.7	.85	1.4	8.4	12.7	16.7	3.1	25.8	31.9	Clay loam.
4.8	.53	1.9	8.5	11.3	14.0	2.5	25.0	36.8	Clay loam.
4.9	.40	1.7	9.2	12.0	14.8	2.6	22.9	36.8	Clay loam.
5.1	.14	2.4	11.2	14.2	18.8	3.0	16.4	34.0	Sandy clay loam.
5.1	.09	4.4	13.6	17.1	26.8	3.8	9.7	24.6	Sandy clay loam.
4.6	1.15	1.0	5.7	13.4	20.3	4.2	30.9	24.5	Loam.
4.8	.79	.8	6.0	13.1	18.1	3.6	28.3	30.1	Clay loam.
4.9	.60	1.4	6.7	12.8	17.0	3.2	25.5	33.4	Clay loam.
4.9	.40	.6	6.1	13.0	18.8	3.3	19.4	38.8	Clay loam.
5.0	.09	1.6	9.0	17.6	24.2	3.2	14.5	29.9	Sandy clay loam.
4.8	.07	2.6	11.4	22.3	30.0	3.5	11.0	19.2	Fine sandy loam or sandy loam.
5.0	.06	3.2	14.6	22.4	26.1	3.3	7.4	23.0	Sandy clay loam.
5.6	1.39	[4] 3.4	[4] 2.6	[4] 1.2	1.4	2.3	61.6	27.5	Silty clay loam or silt loam.
5.5	.33	1.5	[4] 1.2	[4] .5	[4] .8	[4] 1.0	34.2	60.8	Clay.
5.1	.22	.8	[4] .8	[4] .5	[4] 1.0	[4] 1.1	34.4	61.4	Clay.
5.5	.20	.6	[4] 1.2	[4] .8	[4] 1.7	[4] 1.7	35.7	58.3	Clay.
6.9	.17	[4] 1.0	[4] 1.1	[4] .5	[4] .9	[4] 1.2	36.1	59.2	Clay.
5.3	1.08	[4] 5.8	[4] 3.1	[4] 1.3	1.7	2.5	61.2	24.4	Silt loam.
5.5	.33	[4] .4	[4] .5	[4] .4	[4] 1.0	[4] 2.2	37.1	58.4	Clay.
5.1	.24	[4] .4	[4] .8	[4] .6	[4] 1.4	[4] 2.4	36.2	58.2	Clay.
5.0	.21	[4] 1.4	[4] 1.5	[4] .8	1.4	2.2	39.5	53.2	Clay.
4.9	.16	[4] 2.4	[4] 1.8	.8	1.2	1.8	42.3	49.7	Silty clay.
5.0	.91	[4] .5	1.4	1.1	18.2	15.4	55.8	7.5	Silt loam.
4.8	.29	[4] .3	1.2	.9	15.9	13.8	58.5	9.4	Silt loam.
4.8	.20	[4] .6	1.2	.9	15.9	13.5	56.6	11.3	Silt loam.
4.9	.16	[4] .5	1.0	.8	14.3	12.6	55.4	15.4	Silt loam.
4.9	.09	.3	.9	.8	13.6	12.8	52.4	19.2	Silt loam.
4.9	.07	.3	1.0	.8	14.0	12.7	51.2	20.0	Silt loam.
4.9	.07	.3	1.3	.9	14.0	12.5	47.0	24.0	Loam.
4.8	.06	.2	1.1	.9	14.1	12.6	48.0	23.1	Loam.
4.9	.06	[4] .3	[4] 1.5	1.2	17.3	14.5	38.1	27.1	Clay loam or loam.
6.6	.60	[4] .4	[4] 1.1	1.6	18.7	14.8	51.1	12.3	Silt loam.
6.3	.29	[4] .4	[4] .9	1.0	12.0	8.9	60.4	16.4	Silt loam.
4.9	.18	[4] .5	[4] .9	1.1	14.5	11.2	53.9	17.9	Silt loam.
4.8	.13	[4] .6	[4] .7	1.2	16.5	13.1	48.8	19.1	Loam.
4.8	.07	[4] .5	[4] .9	1.2	18.6	14.8	45.9	18.1	Loam.
4.8	.06	[4] .5	[4] .8	1.3	19.2	15.6	45.2	17.4	Loam.
4.6	.06	.5	.9	1.4	19.9	16.3	43.3	17.4	Loam.
4.6	.08	.2	1.2	1.7	23.9	18.9	33.2	21.8	Loam.
4.6	.04	.6	2.0	2.7	36.3	23.8	22.8	11.8	Fine sandy loam.
5.2	3.92	1.4	1.9	.9	2.4	4.9	74.2	14.3	Silt loam.
4.7	1.32	1.6	1.6	.7	1.5	4.0	76.6	14.0	Silt loam.
4.9	.43	1.0	1.3	.6	1.2	3.8	70.9	21.2	Silt loam.
4.7	.13	1.6	1.4	.5	.9	3.2	65.6	26.8	Silt loam or silty clay loam.
4.7	.08	1.2	.7	.4	.9	3.6	60.1	33.1	Silty clay loam.
4.8	0	.8	.7	.4	1.0	4.5	45.0	47.6	Silty clay.

TABLE 8.—*Chemical and physical characteristics*

Soil type and sample location	Horizon	Depth	Chemical characteristics: Exchangeable cations (milliequivalents per 100 grams of soil) Ca	Mg	K	Na	H	Sum	Base saturation
		Inches							*Percent*
Site 2	A_1	0–1	1.2	.3	.3	.1	14.1	16.0	12
	A_2	1–8	.4	.1	.1	.1	4.8	5.0	13
	A_3	8–11	.1	<.1	.2	.1	5.8	6.5	6
	B_2	11–28	.1	<.1	.1	<.1	8.7	9.2	3
	B_3	28–32	.1	.4	.2	<.1	11.3	12.0	6
	D	32+	.2	1.0	.1	<.1	13.6	14.9	9
Muskingum silt loam: Site 1	A_1	0–2	.8	1.0	.3	<.1	10.1	12.2	10
	A_2	2–8	.1	.2	.1	<.1	12.2	12.6	3
	BC	8–17	.3	.2	.2	<.1	9.7	10.4	7
	C	17–25	.2	.2	.1	<.1	6.3	6.8	7
Site 2	A_1	0–2	.2	.2	.2	<.1	15.8	16.4	4
	A_2	2–9	<.1	<.1	.1	<.1	6.1	6.2	2
	BC	9–19	.1	.2	.1	<.1	7.3	7.7	5
	C	19–30	<.1	.4	.2	<.1	12.7	13.3	4
Sango silt loam: Site 1	A_1	0–3	.3	.2	.1	<.1	8.0	8.6	7
	A_2	3–10	.1	<.1	.1	<.1	5.0	5.1	2
	A_3	10–14	.1	.3	.1	<.1	5.8	6.3	8
	B_1	14–23	.3	.2	.1	<.1	6.8	7.4	8
	B_2	23–30	<.1	.1	.1	<.1	6.8	7.0	3
	B_{3m1}	30–36	.1	.2	.1	<.1	7.2	7.6	5
	B_{3m2}	36–43	.3	<.1	.1	<.1	7.0	7.4	5
	C_m	43–50	.3	.2	.1	<.1	5.6	6.2	10
Site 2	A_1	0–2	.4	.4	.2	<.1	13.3	14.3	7
	A_{21}	2–6	.1	.4	.1	<.1	6.8	7.4	8
	A_{22}	6–12	<.1	.2	.1	<.1	6.6	6.9	4
	A_3	12–18	<.1	<.1	.1	<.1	6.2	6.3	2
	B_2	18–25	<.1	.2	.1	<.1	6.2	6.5	5
	B_{3m1}	25–34	<.1	.2	.1	<.1	6.8	7.1	4
	B_{3m2}	34–54	<.1	.1	.1	<.1	6.8	7.0	3
	B_{1b}	54–65	<.1	.7	.1	<.1	14.6	15.4	5
	B_{2b}	65–76	<.1	.4	.1	.1	13.6	14.2	4
Sequatchie loam: Site 1	A_1	0–4	2.3	.2	.1	<.1	7.8	10.4	25
	B_1	4–12	3.6	.7	.1	<.1	8.3	12.7	35
	B_{21}	12–26	3.2	.5	.1	<.1	7.8	11.6	33
	B_{22}	26–35	2.7	.6	.1	<.1	5.8	9.2	37
	B_3	35–43	1.2	.3	.1	<.1	2.7	4.2	37
	C	43–55	1.6	.2	.1	<.1	2.2	4.1	46
Site 2	A_p	0–11	5.8	.2	.1	<.1	2.7	8.8	69
	B_1	11–18	4.8	.3	.1	<.1	2.9	8.1	64
	B_{21}	18–29	3.9	.3	.1	<.1	4.6	8.9	48
	B_{22}	29–32	1.3	.1	.1	<.1	6.3	7.8	19
	C	38–53	1.1	.1	.1	<.1	4.8	6.1	21
Wellston silt loam: Site 1	A_1	0–2	--------	--------	--------	--------	27.5	--------	--------
	A_2	2–7	<.1	.3	.1	<.1	8.8	9.2	4
	B_1	7–11	<.1	.4	.2	<.1	11.2	11.8	5
	B_{21}	11–23	<.1	.4	.3	<.1	13.9	14.6	5
	B_{22}	23–27	<.1	.4	.3	<.1	26.0	26.7	3
	B_{23}	27–34	<.1	.2	.3	<.1	23.7	24.2	2
	C	34–48+	1.6	.3	.3	.1	14.8	17.1	13
Site 2	A_1	0–2	.6	.4	.2	<.1	16.0	17.2	7
	A_2	2–7	.2	.1	.1	<.1	9.7	10.2	5
	B_1	7–12	.2	.2	.1	.1	13.4	14.0	4
	B_{21}	12–18	<.1	.1	.1	<.1	17.2	17.4	1
	B_{22}	18–25	<.1	.2	.1	.1	21.0	21.4	2
	B_{23}	25–29	.1	.2	.2	.1	21.0	21.6	3
	B_{24}	29–39	.1	.1	.1	.1	20.4	20.8	2
	C	39–45	<.1	.1	.2	.1	20.0	20.4	2

[1] Data obtained by Soil Survey Laboratory, Soil Conservation Service, Beltsville, Md.
[2] As determined by mechanical analysis.

of some representative soils [1]—Continued

Chemical characteristics—Continued		Physical characteristics							
		Size class and diameter of particles in millimeters							Textural class [2]
pH 1:1	Organic carbon	Very coarse sand (2.0–1.0)	Coarse sand (1.0–0.5)	Medium sand (0.5–0.25)	Fine sand (0.25–0.1)	Very fine sand (0.1–0.05)	Silt (0.05–0.002)	Clay (<0.002)	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	
4.2	4.9	[3] 1.1	[3] 2.2	3.5	8.4	6.5	69.0	9.3	Silt loam.
4.5	.82	2.4	2.0	3.2	9.2	7.5	65.6	10.1	Silt loam.
4.5	.37	2.0	2.1	2.4	6.7	5.8	62.9	18.1	Silt loam.
4.5	.22	2.1	1.8	1.9	5.4	5.1	56.8	26.9	Silt loam or silty clay loam.
4.6	.24	1.5	2.0	1.8	5.2	4.7	46.8	38.0	Silty clay loam.
4.6	.16	.5	1.1	1.6	4.3	4.6	35.3	52.6	Clay.
5.0	4.88	.9	.8	.9	13.4	15.7	48.6	19.7	Loam.
5.0	1.06	[4] 1.0	[4] .9	1.1	14.4	16.1	46.8	19.7	Loam.
4.9	.29	[4] 2.5	[4] 1.4	1.2	14.3	15.0	43.9	21.7	Loam.
4.8	.13	[4] 1.5	[4] 1.7	2.1	23.6	23.6	35.9	11.9	Very fine sandy loam.
4.7	3.94	[4] 1.4	[4] 1.6	3.2	7.3	19.4	51.8	15.3	Silt loam.
4.9	.56	[4] 2.1	[4] 1.5	2.9	7.3	18.8	50.4	17.0	Silt loam or loam.
5.0	.22	[4] 2.7	[4] 1.8	2.8	6.8	18.1	44.5	23.3	Loam.
4.9	.17	[4] 3.2	[4] 2.0	1.5	3.9	11.5	40.3	37.6	Clay loam.
4.4	1.86	.6	.6	.7	6.0	7.7	77.3	7.1	Silt loam.
4.7	.44	.3	.4	.4	4.9	6.6	78.3	9.1	Silt loam.
4.7	.19	.2	.2	.4	4.4	6.5	74.5	13.8	Silt loam.
4.6	.12	.4	.4	.5	4.1	5.7	74.2	14.7	Silt loam.
4.6	.05	.6	.5	.6	3.8	5.4	73.9	15.2	Silt loam.
4.7	.04	1.1	.6	.8	3.6	5.8	71.9	16.2	Silt loam.
4.8	.04	2.4	1.1	.9	3.4	5.5	71.1	15.6	Silt loam.
4.8	.02	1.6	.8	.8	3.7	5.9	74.0	13.2	Silt loam.
4.4	2.83	.7	.6	.9	4.9	4.3	76.4	12.2	Silt loam.
4.6	.67	.6	.4	.7	4.6	4.6	76.1	13.0	Silt loam.
4.6	.31	.6	.5	.7	4.3	4.1	74.5	15.3	Silt loam.
4.7	.24	.7	.8	.9	5.3	5.3	72.8	14.2	Silt loam.
4.8	.14	.6	.7	.9	5.3	5.0	72.0	15.5	Silt loam.
4.9	.09	.9	1.0	1.0	4.5	4.7	71.6	16.3	Silt loam.
4.8	.08	.8	.8	.9	4.0	4.3	72.4	16.8	Silt loam.
4.8	.12	.9	.7	.9	3.6	3.9	58.2	31.8	Silty clay loam.
5.0	.08	.9	1.2	1.4	5.0	5.0	51.9	34.6	Silty clay loam.
5.2	.72	.1	2.8	10.9	26.6	13.1	32.9	13.6	Fine sandy loam.
5.1	.53	.1	2.4	9.1	22.8	11.5	33.6	20.5	Loam.
5.0	.33	.1	1.8	6.4	19.3	13.1	35.5	23.8	Loam.
5.1	.21	[4] 5.9	[4] 13.5	17.1	19.1	6.4	21.3	16.7	Sandy loam.
5.2	.09	[4] 8.9	[4] 44.6	24.8	8.8	1.4	4.5	7.0	Loamy coarse sand or coarse sand.
5.4	.09	[4] 17.2	[4] 33.1	23.3	10.3	2.0	6.8	7.3	Loamy coarse sand.
7.1	.64	1.6	4.8	4.8	23.8	15.6	33.7	10.7	Loam.
6.9	.28	1.2	3.8	3.5	17.2	11.5	44.5	18.3	Loam.
5.6	.18	1.4	3.9	4.0	17.0	10.9	42.8	20.0	Loam.
4.8	.11	[4] 6.0	[4] 6.5	5.3	19.4	12.3	33.7	16.8	Loam.
4.9	.09	[4] 9.5	[4] 8.2	4.6	16.3	13.0	34.8	13.6	Loam or fine sandy loam.
4.2	7.80	----	----	----	----	----	----	----	
4.8	.76	[4] .4	[4] .4	.7	8.9	26.2	44.5	18.9	Loam.
4.8	.39	[4] .6	[4] .4	.6	8.2	21.5	40.3	28.4	Clay loam.
4.7	.25	[4] .1	[4] .2	.3	5.5	13.9	31.0	49.0	Clay.
4.5	.32	<.1	<.1	.1	1.8	4.7	29.1	64.3	Clay.
4.5	.28	[4] .3	[4] .4	.1	.7	1.9	43.3	53.3	Silty clay.
4.5	.25	<.1	<.1	<.1	<.1	1.9	62.0	36.0	Silty clay loam.
4.6	3.90	[4] 2.1	[4] .8	[4] 1.8	8.6	8.1	64.7	14.5	Silt loam.
4.8	.90	[4] 1.4	[4] .6	.9	6.5	6.4	61.5	22.7	Silt loam.
4.7	.53	[4] 1.3	[4] .5	.6	4.4	5.0	54.2	34.0	Silty clay loam.
4.8	.30	[4] 1.0	[4] .2	.4	3.0	3.4	45.3	46.7	Silty clay.
5.0	.23	[4] .3	[4] .2	.3	2.0	2.3	40.5	54.4	Silty clay or clay.
5.0	.18	[4] .8	[4] .8	.2	1.5	2.0	41.1	54.2	Silty clay.
5.0	.17	[4] .9	[4] .8	[4] .2	1.4	2.1	45.2	50.0	Silty clay.
4.9	.21	[4] 4.0	[4] .5	[4] .3	.9	1.8	45.8	46.7	Silty clay.

[3] Contains undispersed humus aggregates.
[4] Contains aggregates with iron and magnesium.

General Nature of the Area

This section tells briefly the history of Putnam County; describes the physiography, geology, drainage, and climate; and gives some general facts about the agriculture.

History of the County

Putnam County was settled by Revolutionary War soldiers and their descendents. Most of the settlers came from Virginia and North Carolina and were of English and Scotch-Irish descent. The county was established in 1842 from parts of White, Overton, Jackson, Smith, and DeKalb Counties. It was named in honor of Gen. Israel Putnam of the Revolutionary War. In 1844 an injunction restrained the county and circuit court officers from performing their duties. In 1854, however, Putnam County was reestablished, largely through the efforts of Maj. Richard F. Cooke, for whom Cookeville, the county seat, was named (*5*).

The population of the county in 1920 was 22,231. By 1960 it had increased to 29,236. The population of Cookeville in 1920 was 2,395; by 1960 it had increased to 7,805. In 1960 the population of Algood was 886; Baxter, 853; and Monterey, 2,069.

Physiography, Geology, and Drainage

Putnam County lies within two major physiographic divisions—the Appalachian Plateau Province and the Interior Low Plateau Province. The Cumberland Plateau is in the Appalachian Plateau Province, and the Highland Rim and the Central Basin are in the Interior Low Plateau Province. The Central Basin is also called the Nashville Basin (*4*).

The entire county is underlain by sedimentary rocks that were formed in the geologic periods that extended from the Pennsylvanian to the Upper Ordovician (*6*).

The Cumberland Plateau and its escarpment in the eastern part of the county are about 1,800 to 2,000 feet above sea level. This is about 800 to 1,000 feet higher than the neighboring Highland Rim. The surface of the plateau is a true peneplain, which is undulating and dissected by young valleys (*4*).

Sewanee conglomerate and the Gizzard formation cap the Cumberland Plateau. The conglomerate consists of fine- to coarse-grained, quartzose sandstone. It generally contains many milky white quartz pebbles as large as 1 inch in diameter. The Gizzard formation consists largely of fine-grained, hard sandstone (*9*). In Putnam County the conglomerate and the sandstone form the steep bluffs and sandstone precipices of the Cumberland Plateau. Where the cap of conglomerate and sandstone has been removed, great sinks have formed in the underlying soluble limestone. One of these sinks is Icy Cove, 5 miles south of Monterey.

On the Cumberland Plateau escarpment at an elevation of about 1,400 feet, Cypress sandstone forms benches or shoulders as much as a mile in width. This sandstone is coarse grained, massive, and firmly cemented (*2*). It is resistant to geologic erosion and is mostly covered with old colluvium or local alluvium.

The Highland Rim and its escarpment occupy about half of the county. On the east the Highland Rim is bounded by the red soil area. On the west the rim is bounded by its escarpment, which descends into the Central Basin about 150 feet below.

The East Fork of Obey River and other tributaries of the Cumberland River drain most of the Cumberland Plateau in Putnam County.

The Highland Rim in Putnam County has an average elevation of about 1,100 feet. The relief is mostly undulating to hilly. Except for an area around Baxter that is slightly dissected, the drainage system is well developed. In several places east of Cookeville the rim is gently sloping and has sinkholes.

St. Louis limestone and Warsaw limestone underlie the soils on much of the Highland Rim. The St. Louis limestone is gray, fine grained to compact, and generally thick bedded. It weathers to a clay or cherty clay and is generally covered by a thick mantle of residual material. The Warsaw limestone is generally grayish and thick bedded like the St. Louis limestone. It is somewhat cherty and is sandy in the upper part. Both limestone formations are very soluble and have well-developed underground drainage (*10*).

The Cookeville and Talbott soils have formed mainly from St. Louis limestone. They contain little chert. The Baxter and Christian soils have formed from Warsaw limestone; they have more sinkholes or karsts than soils that developed on other geologic formations.

Fort Payne chert forms a large part of the Highland Rim escarpment and also the tops of outlying hills and ridges in the deeply dissected Central Basin. Fort Payne chert weathers to heavy beds of blocky, brittle chert from which the Bodine and Baxter soils were derived.

Chattanooga shale underlies the Fort Payne chert and is easy to distinguish from other formations by its black fissile shale. The base of the shale formation is generally accepted as the separation line between the Highland Rim and the outer Central Basin. The Chattanooga shale averages only about 15 feet in thickness and is not important in the formation of soils in this county.

The outer Central Basin is in two major areas in the western part of the county. One area is north of U.S. Highway No. 70N and is deeply dissected by Martin Creek and its tributaries. The other area is south of U.S. Highway No. 70N and is dissected by Big Indian Creek and its tributaries. Drainage is well defined and dendritic, and stream dissection is well advanced. The Leipers formation underlies the Chattanooga shale and is the youngest geologic formation of the Ordovician system. Beneath the Leipers formation are the Catheys, Cannon, and Hermitage formations, in that order. The oldest rocks in the county, those in the Hermitage formation, are barely exposed in the extreme northwestern corner, on a bluff along Martin Creek. All formations in the outer Central Basin in Putnam County have weathered from phosphatic, clayey limestone. The Mimosa soils formed in this residual material.

Climate [5]

In Putnam County, rainfall is generally abundant, winter is relatively mild, and summer is warm. The weather,

[5] This section was written by R. R. DICKSON, State climatologist, U.S. Weather Bureau, Nashville, Tenn.

however, is frequently affected by transitory storm centers and their associated incursions of warm and cold air.

The diverse topography of the county affects the local climate. The county extends eastward from the outer fringes of the Great Basin in the central part of the State, through a part of the Highland Rim, and terminates on the Cumberland Plateau. Elevations range from about 500 feet in the western part of the county to about 2,000 feet in the eastern part. Because of this diverse topography, the data summarized in table 9 for Cookeville are not strictly representative of all parts of the county.

Average annual precipitation in the county increases from west to east as elevation increases, and it reaches a maximum of 59 inches near Monterey. Average temperature decreases from west to east. It is about 1° F. warmer in the extreme western part of the county than in Cookeville and is 3° colder in the extreme eastern part.

More precipitation falls in winter and spring than at other times. Precipitation is lightest in fall because slow-moving, high-pressure areas frequently occur and suppress rain. In 1 year out of 10, less than 1 inch of rain can be expected in May, June, September, and October.

For a period ending in 1950, the maximum precipitation recorded in the county was 2.01 inches in 1 hour (Carthage); 3.5 inches in 2 hours (Carthage); 3.63 inches in 3 hours (Carthage); and 3.65 inches in 6 hours (Carthage); 5.13 inches in 12 hours (Cookeville); and 10.31 inches in 24 hours (Rock Island). For a period ending in 1960, annual precipitation at Cookeville was as much as 66.79 inches (1915) and as little as 38.53 inches (1930).

Severe storms have been infrequent in Putnam County. Between 1916 and 1959, only three tornadoes have been reported in the county. Destruction from tropical storms is rare. In a 40-year period recently studied, blizzards were nonexistent. Hailstorms occur mostly in spring and are observed in one place about twice a year.

The following estimates of weather conditions in Putnam County are based on data from full-time offices of the U.S. Weather Bureau in Tennessee and surrounding States. During the year there is an average of 125 days with precipitation of 0.01 inch or more. Thunderstorms occur on an average of 54 days a year. Relative humidity averages about 70 percent annually. The maximum monthly humidity average is 75 percent and is in January; the minimum monthly average is 63 percent and is in April.

Prevailing winds are generally from the south, and the average annual windspeed is 8 miles per hour. The average hourly windspeed ranges from a maximum of about 9 miles per hour in March to a minimum of about 6 miles per hour in August. Generally, the lightest winds occur just before sunrise, and the strongest, late in the afternoon. The average daily windspeed is about 4 miles per hour. Skies are cloudy on an average of 219 days

TABLE 9.—*Temperature and precipitation, Cookeville, Putnam County, Tenn.*

[Elevation 1,117 feet; latitude 36°11′ N., longitude 85°30′ W.]

Month	Temperature [1]				Precipitation [2]			
	Average daily maximum [3]	Average daily minimum [3]	Two years in 10 will have at least 4 days with [4]—		Average monthly total	One year in 10 will have—		Average snowfall [5]
			Maximum temperature equal to or higher than	Minimum temperature equal to or lower than		Less than	More than	
	° F.	° F.	° F.	° F.	Inches	Inches	Inches	Inches
January	49.8	30.9	68	8	4.56	1.2	7.6	1.9
February	51.6	31.9	66	14	5.09	1.6	10.6	2.1
March	60.4	39.1	74	22	5.70	2.4	8.9	1.6
April	69.2	47.0	81	32	4.04	2.2	6.1	([6])
May	78.0	55.4	88	42	4.10	.9	7.1	0
June	85.9	63.5	95	52	4.14	.9	7.2	0
July	88.3	66.9	95	59	4.57	1.9	9.2	0
August	87.5	65.6	96	58	4.57	2.3	7.9	0
September	84.0	59.5	93	47	3.13	.7	6.0	0
October	73.4	47.4	85	35	2.46	.6	5.5	([6])
November	60.0	38.5	74	20	3.99	1.2	8.2	.6
December	50.7	32.8	66	15	5.09	2.0	10.1	1.8
Year	69.9	48.2	[7] 98	[7] 1	51.44	[8] 41.7	[9] 61.5	8.0

[1] Temperature listed in this summary was measured in standard instrument shelters of the U.S. Weather Bureau. The thermometer was 4.5 feet above the ground. Temperature recorded at that height on clear, calm nights usually is about 5° F. warmer than the air temperature near the ground, but this difference may be as much as 12°.

[2] In the 17 years that records were available between 1931 and 1952.

[3] 1931–45.

[4] 1931–40.

[5] In the 15 years that records were available between 1931 and 1952.

[6] Trace.

[7] Average of annual extremes 1931–45.

[8] In 1 year in 10 total precipitation will be less than 41.7 inches.

[9] In 1 year in 10 total precipitation will be more than 61.5 inches.

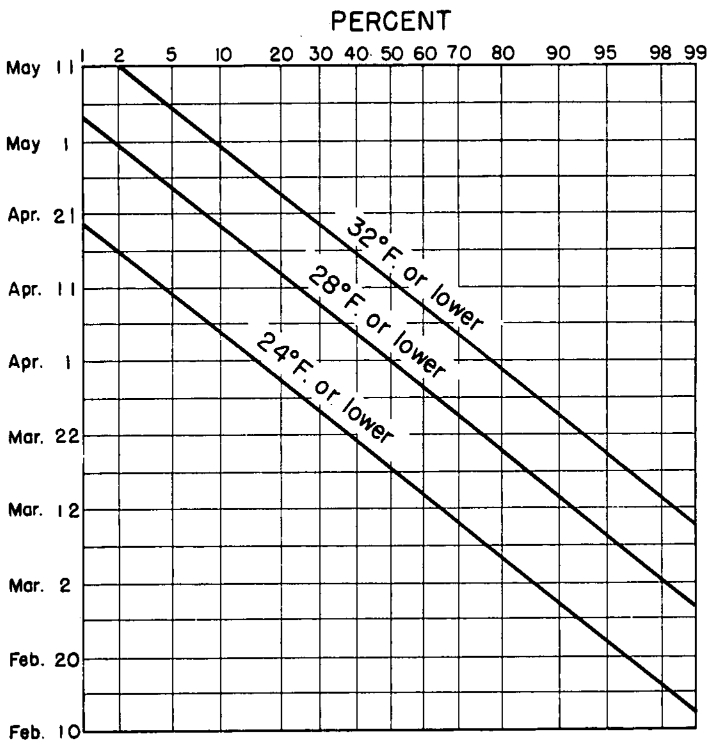

Figure 19.—**Probability that the temperature at Cookeville will be 24° F. or lower, 28° or lower, or 32° or lower after any date in spring.**

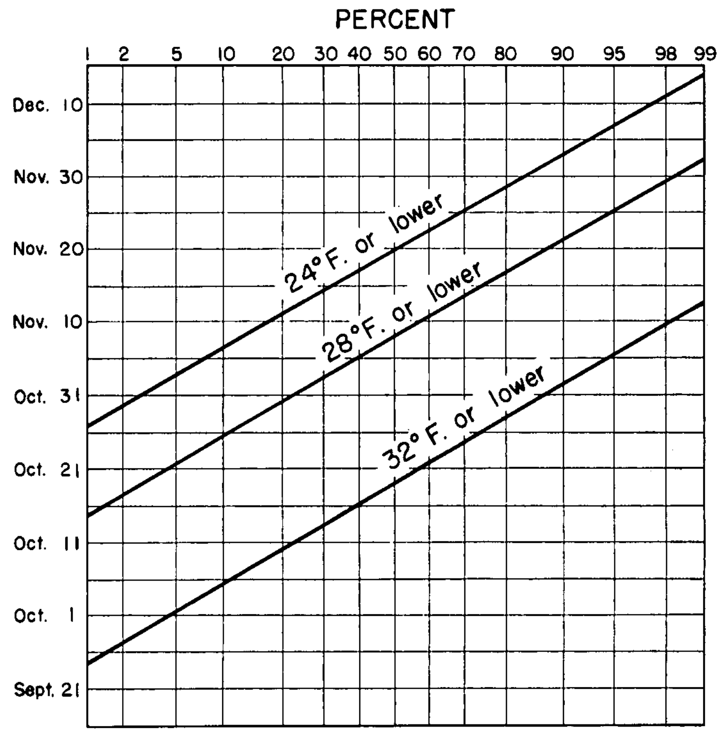

Figure 20.—**Probability that the temperature at Cookeville will be 24° F. or lower, 28° or lower, or 32° or lower before any date in fall.**

a year. The range is from about 12 cloudy days in October to 22 cloudy days in January.

Growing season and freezing temperature

The growing season, or the interval between the last temperature of 32° or lower in spring and the first in fall, ranges from about 200 days in the western part of the county to about 175 days on the Cumberland Plateau in the eastern part. At Cookeville the average date of the last freezing temperature in spring is April 12, and that of the first freezing temperature in fall is October 19. The average growing season is 190 days.

Probabilities of freezing temperature are shown in figure 19. To determine from figure 19 the probability that there will be a temperature at Cookeville of 28° or lower after April 1, lay a rule horizontally on the April 1 line. Look upward from the point where the rule crosses the diagonal 28° F. line, and read the percentage listed at the top of the graph. For this example the probability is 50 percent. In the same manner you can determine from figure 20 the probability that the temperature listed will occur before any date in fall.

A freezing temperature between 28° and 32° causes little or no damage to most plants, particularly those hardened by drought or by low temperature on sunny days. But tomatoes, peppers, and other tender plants may be killed. Also, the anthers of small grains may be destroyed, as well as the pistils and anthers of strawberries and other flowering plants. Thus, the yield of these plants may be reduced (*3*).

Some damage is caused to most plants by a temperature of 24° to 32°. This temperature will probably destroy tender plants, and it heavily damages fruit blossoms and semihardy plants.

A temperature of 24° or lower heavily damages all plants.

The highest temperature at Cookeville between 1931 and 1960 was 102°, and the lowest was −13°. Each year, on the average, the temperature at Cookeville exceeds 90° on about 32 days and drops below 32° on about 64 days. During the average winter the ground freezes to an estimated depth of about 5 inches.

Evapotranspiration

The growth of plants depends to a large degree on the amount of available moisture in the soil. This moisture decreases when more moisture is lost through evapotranspiration and internal drainage than is resupplied by precipitation or irrigation.

Figure 21 shows the average water balance at Cookeville throughout the year. The data for the figure were computed by the Thornthwaite method (*11*). Available soil moisture at field capacity is assumed to be 4 inches per foot. Field capacity is the largest amount of moisture that a soil will hold, under conditions of free drainage, after the excess water has drained away following a rain or an irrigation.

Evapotranspiration is the loss of soil water through transpiration by plants and through evaporation from the soil. Potential evapotranspiration is an estimate of how much moisture is lost from a moist soil covered with vegetation. Actual evapotranspiration is the actual loss of soil moisture; it differs from potential evapotranspiration be-

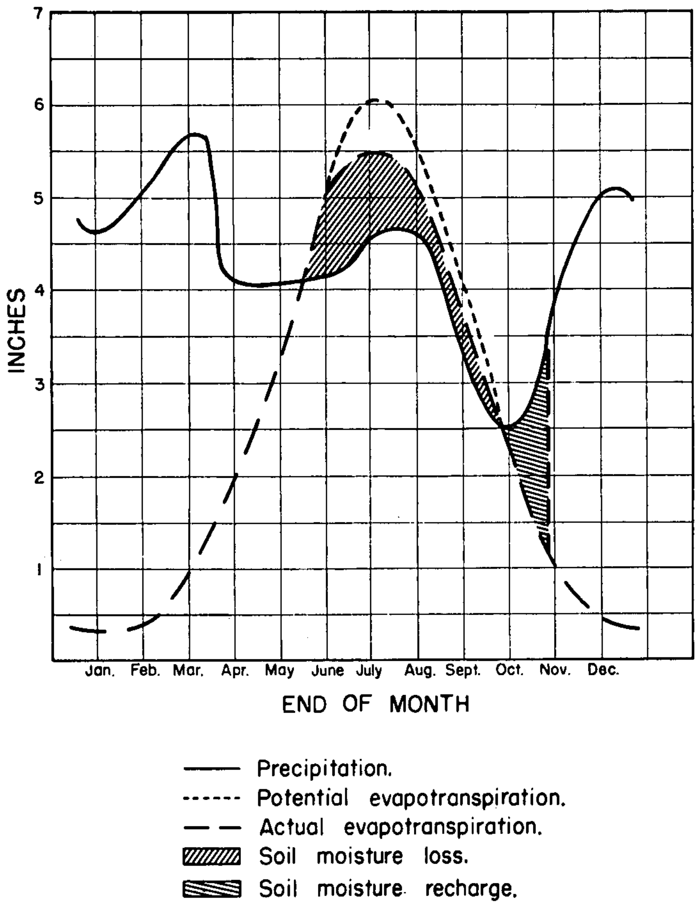

Figure 21.—**Average precipitation and evapotranspiration at Cookeville, Tennessee, computed from data recorded in period extending from 1931 through 1952. Average water-holding capacity assumed to be 4 inches per foot of soil.**

cause, as soils dry, the moisture remaining in them is more tightly held and less readily removed by transpiration and evaporation.

The precipitation and evapotranspiration curves in figure 21 show moisture conditions at the end of each month, not daily conditions. In the average year from January through May, precipitation is greater than estimated actual evapotranspiration. From June through September the loss of soil moisture, or estimated actual evapotranspiration, exceeds precipitation, and the soil progressively dries out. By the end of September, on the average, 2.61 inches of the original 4 inches of available water have been removed from the soil. This amount is indicated by the vertical distance between the point where the actual evapotranspiration curve crosses the September line and the highest point of that curve. During this period from June through September, vigorously growing plants draw heavily on the available moisture in the soil. The rate of plant growth is related to the amount of available moisture in the soil. The vertical distance between the actual and potential evapotranspiration curves indicates the amount of irrigation water needed to maintain maximum plant growth. By October, precipitation again exceeds evapotranspiration, and the excess water begins to recharge the soil. This recharge is completed in November; then part of the excess precipitation runs off the surface, and part of it is added to the ground water. During the year, 21.76 inches more water is received in precipitation than is lost in evapotranspiration.

Agriculture

According to the 1959 Census of Agriculture, the income earned from nonfarm sources by families living on 1,087 farms exceeded the income from the farm products sold from these farms. During the year, 633 farmers worked off the farm 100 days or more.

The census reported 759 commercial farms in the county in 1959. Generally, a farm that has a value of sales products amounting to 50 dollars or more is classed as commercial if the operator worked off the farm less than 100 days. In 1959, 905 farms were operated part time by farmers under 65 years old. These farmers worked off the farm 100 days or more, or received from other sources income greater than the income from their farm products. The sales of their farm products ranged from 50 to 2,499 dollars. There were 370 part-retirement farms operated by farmers 65 years old or over, and the sales of their farm products ranged from 50 to 2,499 dollars.

Type, number, and size of farms

Land in farms amounted to 170,465 acres, or 65.6 percent of the county, in 1959. The rest of the county was largely in forest, urban, and industrial areas. A total of 84,296 acres, or 49.5 percent of the land in farms, was cropland; 49,392 acres, or 29.0 percent, was woodland not pastured; and 30,411, or 17.8 percent, was woodland and other land pastured.

In 1959 there were 1,997 farms in Putnam County, grouped as follows:

Type of farm	*Number*
Field crop other than vegetable and fruit-and-nut	280
Tobacco	270
Other field crop	10
Poultry	15
Dairy	65
Livestock	327
General farms	65
Miscellaneous and unclassified	1,245

In 1959 the number of farms of Putnam County classed according to size in acres were:

	Number
Under 10	180
10 to 49	714
50 to 69	279
70 to 99	284
100 to 139	203
140 to 179	134
180 to 219	81
220 to 259	37
260 to 499	68
500 to 999	13
1,000 or more	4

Principal crops

Most of the farmers of Putnam County produce feed for livestock and food crops for home use. The commercial farms generally have several farming enterprises, and practically all farms have some livestock. Forest products are an important source of income on a few farms. The principal crops are corn, tobacco, oats, wheat, and lespedeza, but many other kinds of crops are grown. Although most of the crops are used on the farms, some corn and hay and all of the tobacco are sold. Practically all of the feed grown is fed to livestock, and the livestock is sold. Table 10 lists the acreage of the principal crops.

TABLE 10.—*Acreage of the principal crops*

Crop	1944	1949	1954	1959
	Acres	*Acres*	*Acres*	*Acres*
Corn for all purposes	27, 098	23, 868	20, 093	15, 010
Corn harvested for grain	26, 764	23, 464	18, 477	14, 137
Small grains threshed or combined:				
Oats	900	2, 349	1, 484	721
Wheat	712	1, 204	1, 734	721
Barley	59	117	320	356
Rye	147	34	33	20
Soybeans for all purposes, grown alone	3, 024	1, 942	2, 819	1, 427
Soybeans for beans, grown alone	(1)	422	300	404
Soybeans for hay, grown alone	(1)	1, 440	2, 450	918
Cowpeas for all purposes, grown alone	949	231	132	39
Hay crops:				
Alfalfa	752	1, 323	1, 128	1, 723
Clover or timothy	994	1, 539	1, 503	3, 510
Lespedeza	10, 618	13, 173	6, 378	5, 635
Small grains	461	1, 565	2, 471	821
Other	2, 115	1, 729	1, 566	827
Potatoes, Irish	436	[2] 204	[3] 132	[3] 87
Sweetpotatoes	263	[2] 74	[3] 36	[3] 44
Tobacco	722	1, 091	1, 240	999
Vegetables for sale	36	28	55	69
Strawberries	(1)	60	97	74
Tree fruits, nuts, and grapes	[4] 831	694	460	252
Nursery products	(1)	41	69	132

[1] Not reported.
[2] Excludes acres for farms with less than 15 bushels harvested.
[3] Does not include acreage for farms with less than 20 bushels harvested.
[4] For 1945.

Livestock

The number of beef cattle and swine are increasing in Putnam County. Table 11 lists the number of livestock on farms in 1945, 1950, 1954, and 1959.

TABLE 11.—*Number of livestock on farms in stated years*

Livestock	1945	1950	1954	1959
Horses and mules	4, 209	4, 030	2, 551	1, 991
Cattle and calves	11, 053	13, 635	16, 502	16, 408
Sheep and lambs	2, 723	3, 924	1, 743	1, 517
Swine	8, 301	15, 838	11, 939	20, 063
Chickens (over 4 months old)	121, 145	106, 767	101, 971	56, 593

Farm power

Horses and mules once provided most of the farm power, but recently tractors have replaced many of the draft animals, especially on the larger farms. From 1945 to 1959, the number of tractors in the county increased from 80 to 734, and the number of horses and mules decreased from 4,209 to 1,991. In 1945 there were 716 automobiles on farms, and in 1959 there were 1,279.

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Glossary

Acidity, soil. The degree of acidity or alkalinity of a soil mass, technically expressed in pH values, or in words, as follows:

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6–7.3
Very strongly acid	4.5–5.0	Mildly alkaline	7.4–7.8
Strongly acid	5.1–5.5	Moderately alkaline	7.9–8.4
Medium acid	5.6–6.0	Strongly alkaline	8.5–9.0
Slightly acid	6.1–6.5	Very strongly alkaline	9.1 and higher

Aggregate. A mass or cluster of many fine soil particles held together in the form of a clod, crumb, block, or prism.

Alluvial soils. A great soil group of the azonal order. These soils are forming in material recently deposited by water. The soil-forming processes have modified this material little or none; consequently, the soils have little profile development.

Alluvium. Soil materials deposited on land by streams.

Bedrock. The solid rock underlying soils.

Chert. A structureless form of silica (SiO_2) that breaks into angular fragments. Soils containing large quantities of fragments as much as 3 inches in diameter are called cherty soils.

Clay. (1) As a soil separate, mineral soil particles less than 0.002 millimeter in diameter. (2) 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.

Colluvium. Mixed deposits of rock fragments and coarse soil materials near the base of steep slopes. The deposits have accumulated as the result of soil creep, slides, or local wash.

Consistence, soil. The combination of soil properties that causes particles in an aggregate to crumble or stick together under pressure. An aggregate may be hard when dry and plastic when wet because the consistence of soil varies with moisture content. The descriptions of soil profiles in this report, unless otherwise indicated, give consistence of moist soil. Terms:

Friable. When moist, the soil is easily crushed by hand and coherent when pressed together. Friable soils are easily tilled.

Firm. When moist, the soil can be crushed under moderate pressure, but resistance is distinctly noticeable. Firm soils are likely to be difficult to till.

Hard. When dry, the soil is moderately resistant to pressure; can be broken in the hands without difficulty but is barely breakable between thumb and forefinger.

Loose. The soil is noncoherent when moist or dry. Loose soils are generally coarse textured and are easily tilled.

Plastic. When wet, the soil is molded easily and retains an impressed shape. Plastic soils are high in clay and are difficult to till.

Soft. The soil is weakly coherent and is fragile; when dry, it breaks to powder or individual grains under slight pressure.

Eluviation. The removal of material from a soil horizon by downward or lateral movement in solution and, to a lesser extent, in colloidal suspension. Soil horizons that have lost material through eluviation are eluviated; those that have received material are illuviated.

Erosion. The wearing away or removal of soil material by water, wind, or other geological processes.

Fertility, soil. The inherent quality of a soil that enables it to provide compounds in adequate amounts and in proper balance for the growth of plants when light, moisture, temperature, and the physical condition of the soil are favorable.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. See First bottom.

Fragipan. A dense and brittle pan or layer that is hard mainly because of extreme density or compactness rather than because of cementation or content of clay. Removed fragments are friable, but the material in place is so dense that roots cannot penetrate it, and water moves through it very slowly.

Genesis, soil. The mode of origin of the soil. Soil genesis refers especially to the processes causing the development of the solum from unconsolidated parent materials.

Gray-Brown Podzolic soils. A great soil group of the zonal order. These soils have a thin organic covering and organic-mineral layer over a grayish-brown, leached layer that rests on an illuvial, brown horizon. Gray-brown Podzolic soils formed under deciduous forest in a temperate, moist, climate.

Horizon, soil. A layer of soil, approximately parallel to the soil surface, with distinct characteristics produced by soil-forming processes.

Horizon A. The upper horizon of the soil mass, from which material has been removed by percolating water; the eluviated part of the solum; the surface soil. This horizon generally is divided into two or more subhorizons, as A_0, A_1, A_2. The subhorizon, A_0, is not a part of the mineral soil but is the accumulation of organic debris on the surface.

Horizon B. The horizon of deposition, to which materials have been added by percolating water; the illuviated part of the solum; the subsoil. This horizon may also be divided into several subhorizons, depending on the color, structure, consistence, or character of the material deposited. These subhorizons are designated as B_1, B_2, B_3, and so on.

Horizon C. The horizon of partly weathered material underlying the B horizon; the substratum; generally the parent material.

Humic Gley soils. A great soil group in the intrazonal order. These soils are poorly drained or very poorly drained and have a thick, black A horizon, high in content of organic matter, over a gray or mottled B or C horizon. Humic Gley soils formed under marsh plants or swamp forest in subhumid, cool-temperate to warm-temperate climate.

Lithosols. A group of soils in the azonal order. Lithosols have no distinct soil morphology, and they consist of a freshly and imperfectly weathered mass of rock fragments. They are largely confined to steeply sloping land.

Loess. A geological deposit of relatively uniform, fine material, mostly silt, presumably transported by wind.

Low-Humic Gley soils. A great soil group of the intrazonal order. These soils have a brown or dark-gray surface horizon underlain by light-gray material. They have formed in humid regions under mixed grasses and forest.

Moisture-supplying capacity. The capacity of the soil to absorb, hold, and supply moisture in amounts favorable to most plants. Slope, rate of infiltration, moisture retentiveness, and depth of soil affect moisture-supplying capacity. The capacity is expressed as very high, high, medium, low, or very low.

Morphology, soil. The physical constitution of the soil, including the thickness and arrangement in the profile, and the texture, structure, consistence, color, and other physical and chemical properties of the various soil horizons that make up the soil profile.

Mottles, soil. Contrasting color patches that vary in size and number. Descriptive terms are as follows:

Abundance. Few, common, many.

Contrast. Faint, distinct, prominent.

Size. Fine, medium, and coarse.

The size measurements are: Fine, commonly less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; medium, commonly between 5 and 15 millimeters (about 0.2 to 0.6 inch) along the greatest dimension; and coarse, commonly more than 15 millimeters (about 0.6 inch) along the greatest dimension.

Parent material. The horizon of weathered rock or partly weathered soil material from which the soil is formed. Horizon C of the soil profile.

Permeability. The quality of a soil that enables it to transmit water and air, measured in terms of rate of flow of water through a unit cross section of saturated soil in unit time. The permeability of a soil may be limited by one impermeable horizon, even though the other horizons are permeable. Following is a list of ratings, expressed in words, and in inches per hour:

	Inches per hour
Slow	less than 0.2
Moderately slow	0.2 to 0.8
Moderate	0.8 to 2.5
Moderately rapid	2.0 to 5.0

Phase, soil. A subdivision of a soil type. A soil phase varies from the type chiefly in such external characteristics as slope, stoniness, or erosion.

Planosols. A great soil group of the intrazonal order. These soils have an eluviated surface horizon underlain by a claypan or fragipan. Planosols have formed on nearly level or gently sloping uplands in a humid or subhumid climate.

Reaction. The degree of acidity or alkalinity of a soil mass technically expressed in pH values. (See Acidity.)

Red-Yellow Podzolic soils. A great soil group of the zonal order. These soils are well developed, well drained, and are acid. They have a thin organic (A_0) and organic-mineral (A_1) horizon over a light-colored, bleached (A_2) horizon. The A_2 horizon is underlain by a red, yellowish-red, or yellow and more clayey (B) horizon. Parent materials are all more or less siliceous. Coarse, reticulate streaks or mottles of red, yellow, brown, and light gray are common in the deep horizons of Red-Yellow Podzolic soils where parent materials are thick.

Reddish-Brown Lateritic soils. A great soil group of the zonal order. These soils have a dark reddish-brown surface layer, a B horizon of red, friable clay, and lateritic parent material that is red or reticulately mottled. They have formed under a forest in warm humid or tropical climate having wet and dry seasons.

Regosols. A great soil group of the azonal order. These soils consist of deep, unconsolidated, soft, mineral deposits in which few or no clearly defined soil characteristics have developed. They are largely confined to recent sand dunes and to loess and glacial drift on steeply sloping land.

Relief. The elevations or inequalities of the land surface, considered collectively.

Residuum. Unconsolidated and partly weathered parent material presumed to have developed from the same kind of rock as that on which it lies.

Sand. (1) As a soil separate, particles ranging in diameter from 0.05 millimeter to 2.0 millimeters. (2) As a textural class, soil material that is 85 percent or more sand and not more than 10 percent clay.

Second bottom. The first terrace level above the flood plain, rarely or never flooded. (See First bottom.)

Series, soil. A group of soils similar in all respects except the texture of the surface soil.

Silt. (1) As a soil separate, particles ranging in diameter from 0.002 to 0.05 millimeter. (2) As a textural class, soil material that is 80 percent or more silt and less than 12 percent clay.

Soil. The natural medium for the growth of land plants. A dynamic, natural body on the surface of the earth in which plants grow; composed of mineral and organic materials and living forms.

Solum. The part of a soil profile, above the parent material. The surface layer and the subsoil.

Structure, soil. The arrangement of individual soil particles into aggregates. Soil structure is classified according to grade, class, and type.

Grade. Distinctness or strength of aggregation, described as structureless (single grain or massive), weak, moderate, and strong.

Class. Size of soil aggregates, described as very fine or very thin, fine or thin, medium, coarse or thick, and very coarse or very thick.

Type. Shape of aggregates, described as platy, prismatic, columnar, blocky, subangular blocky, granular, and crumb.

Subsoil. That part of the profile below plow depth and above the parent material. It may be the B horizon in soils with distinct horizons.

Substratum. Any layer beneath the solum or true soil. The parent material or other layers unlike the parent material that lie below the B horizon, or subsoil. (See also Horizon C and Parent material.)

Surface soil. Technically, the A horizon. The surface layer. The plow layer, or its equivalent in uncultivated soil, about 5 to 8 inches thick.

Talus. Fragments of rock and soil material collected at the foot of cliffs or steep slopes, mainly as the result of gravity.

Terrace, geological. A generally flat or undulating area that was part of an alluvial plain before the adjacent streambed was lowered to its present level; frequently called a second bottom to distinguish it from the flood plain or first bottom; seldom subject to overflow.

Texture, soil. The relative proportions of the various size groups of individual soil grains in a mass of soil. Specifically, texture refers to the proportions of sand, silt, and clay. (See Sand, Silt, and Clay.)

Topsoil. Presumably fertile soil material, generally rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Type, soil. A subdivision of a soil series based on the texture of the surface layer.

Upland, geologic. Land consisting of material unworked by water in recent geologic time and ordinarily lying at a higher elevation than an alluvial plain or a stream terrace.

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