SOIL SURVEY OF

Benton County, Mississippi

United States Department of Agriculture
Soil Conservation Service and Forest Service

In cooperation with
Mississippi Agricultural and Forestry
Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1968-71. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1972. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Mississippi Agricultural and Forestry Experiment Station. It is part of the technical assistance furnished to the Benton County Soil Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

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

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

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol, gives the capability classification and woodland suitability group of each, and shows the page where each soil is described.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the woodland groups.

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

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of Soils for Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, sewage disposal systems, and for recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

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

Newcomers in Benton County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication.

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SOIL SURVEY OF BENTON COUNTY, MISSISSIPPI

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION WITH MISSISSIPPI AGRICULTURAL AND FORESTRY EXPERIMENT STATION

BENTON COUNTY, located in north-central Mississippi, has an area of 263,680 acres, or 412 square miles (fig. 1). The incorporated towns are Ashland, the county seat, and Hickory Flat.

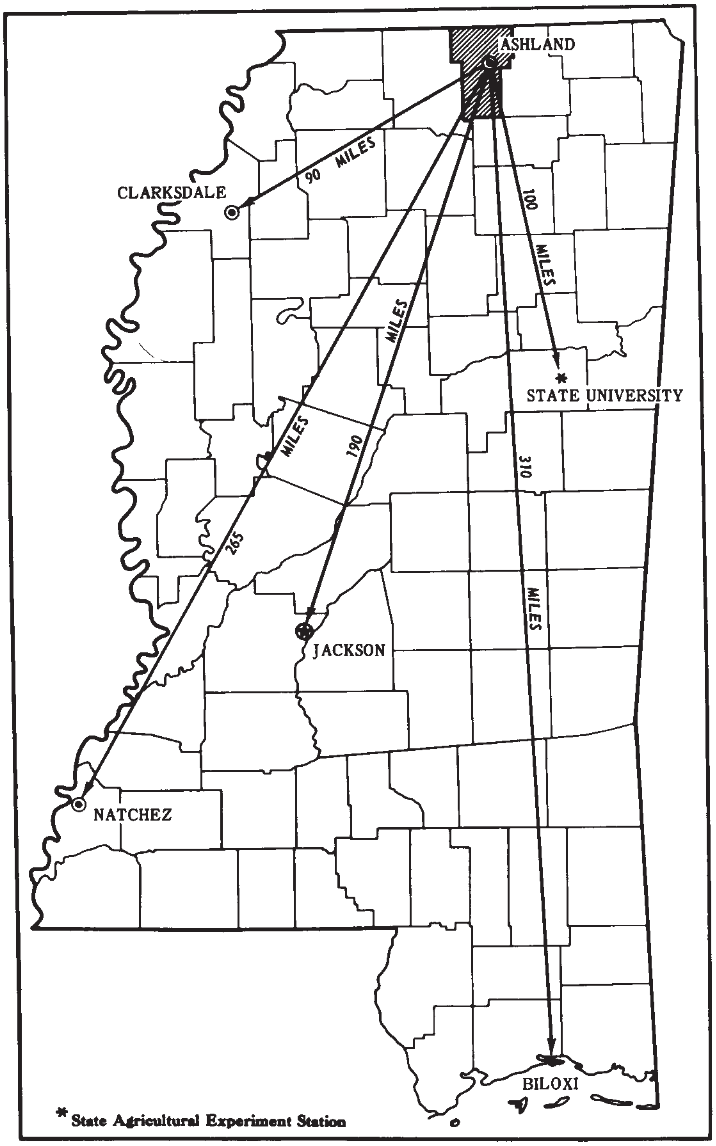

Figure 1.—Location of Benton County in Mississippi.

The county is served by two major railroads, two U.S. highways, and several state highways.

The southern part of the county is drained by the Tippah River, and the northern part, by the Wolf River. A small area in the west is on the headwaters of the Coldwater River.

The county is mainly agricultural. Farms are relatively small, and most of the cultivated land is in the northern half of the county. Forests occupy 63 percent of the county. The forests are mostly in the southern half. Fifty-one thousand three hundred and sixty four acres of the federally owned forest lands are in the Mississippi National Forest. Cotton, soybeans, and livestock are the chief sources of farm income. Truck crops for freezing are becoming important. Many farms are operated on a part-time basis; the owner is employed in some local industry and farms during his spare time. Harvesting of woodland products, particularly pulpwood, is of economic importance.

Convenience to Memphis, Tennessee, and easy access to all parts of the county have contributed to an increasing demand for recreational facilities and vacation housing. Several developments in Benton County cater to this need (fig. 2).

There are several small manufacturing plants, a few sawmills, and two cotton gins located in the county.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Benton County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

***Figure 2.*—Vacation housing and recreational development cater to an increased demand for such facilities. The trees in the background are in an area of Smithdale-Lucy-Lexington association, hilly.**

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 geographic feature near the place where a soil of that series was first observed and mapped. Lexington and Providence, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Providence silt loam, 2 to 5 percent slopes, eroded, is one of several phases within the Providence series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared on aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. 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 kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Benton County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Smithdale-Lexington complex, 12 to 17 percent slopes, eroded, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the expected use of this survey does not require delineating them separately. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Sweatman-Smithdale association, hilly, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and." Jena and Ochlockonee soils is an example.

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

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or to its high water table. They see that streets, road pavements, and foundations for houses are cracked on a particular soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the survey area. A soil association is a landscape that has a distinctive pattern of soils in defined proportions. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in an association can occur in other associations, but in different patterns.

A map showing soil associations is useful to people who want to have a general idea of the soils in a survey area, who want to compare different parts of that area, or who want to locate large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide for broad planning on a watershed, a wooded tract, or a wildlife area or for broad planning of recreational facilities, community developments, and such engineering works as transportation corridors. It is not a suitable map for detailed planning for management of a farm or field or for selecting the exact location of a road or building or other structure, because the soils within an association ordinarily vary in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in this survey area have been grouped into two general kinds of landscapes for broad interpretive purposes. Both of these broad groups and the soil associations in them are described on the following pages.

Nearly Level Soils of the Flood Plains

Soil associations 1, 2, and 3 are on flood plains throughout the county. Except where protected, these soils are subject to overflow.

1. Arkabutla-Ariel-Oaklimeter association

Somewhat poorly drained to well-drained loamy soils high in silt

This association is on flood plains along the Tippah River and Oaklimeter Creek and their tributaries. The flood plains are over a mile wide in places. Slopes are less than 2 percent.

This association makes up about 10 percent of the county. It is approximately 22 percent Arkabutla soils, 20 percent Ariel soils, and 20 percent Oaklimeter soils. The remaining 38 percent is mainly Jena, Kirkville, and Mantachie soils.

Arkabutla soils are on broad flats on lower elevations of the flood plain. They are somewhat poorly drained. The surface layer is dark-brown silt loam about 5 inches thick. The subsoil is dark-brown silt loam that has light brownish-gray mottles between depths of 5 and 16 inches, light-gray silty clay loam between depths of 16 and 36 inches, and light-gray silt loam that contains a noticeable amount of fine sand below a depth of 36 inches.

Ariel soils are on the higher elevations near stream channels. They are well drained. The surface layer is brown silt loam 8 inches thick. The subsoil is dark-brown and dark yellowish-brown silt loam to a depth of 26 inches. An old, buried surface layer of mottled pale-brown and dark yellowish-brown silt loam is at a depth of 26 to 35 inches. This overlies mottled dark-brown and light brownish-gray silt loam that extends to a depth of 50 inches. Below this is mottled dark-brown and light-brownish gray silt loam that has a high content of fine sand to a depth of 60 inches.

Oaklimeter soils are on the upper reaches of the main streams and on tributaries. They are moderately well drained. The surface layer is dark-brown silt loam about 11 inches thick. The subsoil is yellowish-brown very fine sandy loam in the upper 9 inches. The middle part is yellowish-brown silt loam that has grayish mottles. The lower part is mottled yellowish-brown, pale-brown, and light brownish-gray silt loam to a depth of 55 inches. Below this is light brownish-gray silt loam that has dark yellowish-brown mottles to a depth of 65 inches.

This association is used mostly for row crops and pasture where the soils have been drained and protected from overflow. Suitable crops are cotton, corn, soybeans, small grains, and most locally grown pasture plants. Pine and bottom land hardwood trees are also suited. Flooding is a limitation for residential and industrial uses.

2. Ariel-Gillsburg association

Well-drained and somewhat poorly drained loamy soils high in silt

This association is on flood plains in the northwestern part of the county. Slopes are less than 2 percent.

This association makes up about 4 percent of the county. It is 50 percent Ariel soils and 30 percent Gillsburg soils. The remaining 20 percent is mostly Oaklimeter, Kirkville, and Jena soils.

Ariel soils are near stream channels. They are well drained. The surface layer is brown silt loam about 8 inches thick. The subsoil is dark-brown and dark yellowish-brown silt loam to a depth of 26 inches. An old, buried surface layer of mottled pale-brown and dark yellowish-brown silt loam is between depths of 26 to 35 inches. Next is mottled dark-brown and light brownish-gray silt loam to a depth of 50 inches. Below this is mottled dark-brown and light brownish-gray silt loam that has a high content of fine sand to a depth of 60 inches.

Gillsburg soils are on the lower elevations. They are somewhat poorly drained. The surface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil is brown silt loam mottled in shades of gray to a depth of 18 inches and grayish-brown silt loam mottled in shades of brown and yellow to a depth of 32 inches. An old buried soil, consisting of light brownish-gray silt loam overlies light-gray silt loam mottled in shades of brown between depths of 32 and 65 inches.

This association is mostly used for row crops and pasture Suitable crops are cotton, corn, soybeans, and most locally grown pasture plants. Pine and bottom land hardwood trees are also suited. Flooding is a limitation for residential or industrial development.

3. Gillsburg-Jena association

Somewhat poorly drained and well-drained loamy soils, some high in silt

This association is on the flood plain along Wolf River and its tributaries in the northern part of the county. In places the flood plain is over a half mile wide. Slopes are less than 2 percent.

The association makes up about 8 percent of the county. It is about 50 percent Gillsburg soils and 15 percent Jena soils. The remaining 35 percent is Arkabutla, Kirkville, Mantachie, and Ariel soils.

Gillsburg soils are on the lower elevations. They are somewhat poorly drained. The surface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil is brown silt loam mottled in shades of gray to a depth of 18 inches. Below this is grayish-brown silt loam mottled in shades of brown and yellow to a depth of 32 inches. An old, buried soil, consisting of light brownish-gray silt loam over light-gray silt loam mottled in shades of brown, is between depths of 32 and 65 inches.

Jena soils are near stream channels. They are well drained. The surface layer is dark-brown loam about 11 inches thick. The subsoil is dark yellowish-brown or yellowish-brown fine sandy loam to a depth of 35 inches. A massive brownish sandy loam substratum extends to a depth of 60 inches.

Most of this association is in forest. It is used for crops or pasture where the soils have been cleared and drained. Suitable crops are cotton, corn, soybeans, and most locally grown pasture plants. Pine and bottom land hardwood trees are also suited. Flooding is a severe limitation for most uses. Where the association is used for farming, residential, or industrial purposes, drainage and protection from overflow are needed. The association provides good hunting and fishing. The game is largely deer, rabbit, and squirrel.

Soils of the Uplands

Soil associations 4, 5, 6, 7, and 8 are dominantly on rolling to hilly uplands that make up most of Benton County.

4. Smithdale-Loring-Providence association

Steep, well-drained loamy soils on side slopes; and gently sloping, moderately well drained loamy soils that are high in silt, have a fragipan, and are on wide ridgetops

This association is in the northwestern part of the county. The dominant soils are on relatively wide ridgetops and very steep side slopes. Slope ranges from 2 to 45 percent.

This association makes up about 10 percent of the county. It is about 18 percent Smithdale soils, 15 percent Loring soils, and 13 percent Providence soils. The remaining 54 percent is Calloway, Grenada, Calhoun, Lexington, and Lucy soils.

Smithdale soils are on the steeper side slopes. They are well drained. The surface layer is dark grayish-brown fine sandy loam, 3 inches thick, that overlies a subsurface layer of brown fine sandy loam about 6 inches thick. The subsoil is about 71 inches thick. In sequence from the top, the upper 8 inches is reddish-brown fine sandy loam, the next 11 inches is red sandy clay loam, and the lower 52 inches is red sandy loam.

Loring soils are on relatively wide ridgetops. They are moderately well drained. The surface layer is dark-brown silt loam 5 inches thick. The upper part of the subsoil is strong-brown silty clay loam that grades to silt loam with depth. The lower part is a dark-brown silt loam fragipan mottled in shades of gray and brown to a depth of 62 inches.

Providence soils are on ridgetops. They are moderately well drained. The surface layer is brown silt loam about 3 inches thick. The upper part of the subsoil is brown silty clay loam that grades to silt loam below a depth of 10 inches. The middle part, between depths of 22 and 36 inches, is a reddish-brown silt loam fragipan that has pale-brown mottles. The lower part is a yellowish-red silt loam fragipan that grades to loam between depths of 56 and 80 inches. It has brownish and grayish mottles.

The soils on ridgetops and gentle side slopes are used for crops or pasture. Suitable crops are cotton, corn, soybeans, small grain, truck crops, and most locally grown pasture plants. The steeper soils on side slopes are used for mixed pine and hardwood forest, or are idle. A considerable acreage has been planted to pine trees.

5. *Grenada-Calloway-Calhoun association*

Gently sloping and nearly level, moderately well drained to poorly drained loamy soils high in silt; on broad flats

This association is in the northern part of the county. The dominant soils are on a broad flat adjacent to the Wolf River flood plain. Slope ranges from 0 to 5 percent.

This association makes up about 4 percent of the county. It is about 24 percent Grenada soils, 22 percent Calloway soils, and 20 percent Calhoun soils. The remaining 34 inches is Gillsburg, Lexington, Loring, Providence, and Jena soils.

Grenada soils are on the higher elevations. They are moderately well drained. The surface layer is dark-brown silt loam about 7 inches thick. The upper part of the subsoil is yellowish-brown silt loam, about 17 inches thick, that has brownish mottles. The middle part is a silt loam fragipan mottled in shades of gray and brown to a depth of 54 inches. The lower part, to a depth of 67 inches, is a dark-brown silt loam fragipan that has grayish mottles.

Calloway soils are on broad flats. They are somewhat poorly drained. The surface is dark yellowish-brown silt loam 5 inches thick. The upper part of the subsoil is yellowish-brown silt loam mottled in shades of gray and brown to a depth of 15 inches. The lower part is a silt loam fragipan mottled in shades of gray and brown to a depth of 52 inches.

Calhoun soils are on relatively broad, slightly depressional flats. They are poorly drained. The surface layer is dark grayish-brown silt loam about 5 inches thick. The subsurface layer is gray silt loam 5 inches thick. The subsoil is gray silty clay loam that grades to light brownish-gray and gray silt loam at a depth of 24 inches. It has brown mottles. The substratum is light brownish-gray silt loam mottled in shades of yellow and brown to a depth of 78 inches.

This association is mostly used for crops and pasture. The Grenada and Calloway soils are suited to cotton, corn, soybeans, small grains, truck crops, and most locally grown pasture plants. The poorly drained Calhoun soils are better suited to adapted hardwoods and to loblolly pine and shortleaf pine than to crops.

6. *Providence-Lexington-Smithdale association*

Gently sloping and moderately sloping, moderately well drained and well drained loamy soils on wide ridgetops, all high in silt and some having a fragipan; and steep, well-drained loamy soils on side slopes

This association is principally in the north and north-central parts of the county. The dominant soils are on broad, gently sloping ridgetops and on steep side slopes. Slope ranges from 2 to 45 percent.

This association makes up about 18 percent of the county. It is approximately 35 percent Providence soils, 32 percent Lexington soils, and 12 percent Smithdale soils. The remaining 21 percent is mostly Lucy and Sweatman soils.

Providence soils are mostly on ridgetops. They are moderately well drained. The surface layer is brown silt loam about 3 inches thick. The upper part of the subsoil is brown silty clay loam that grades to silt loam below a depth of 10 inches. The middle part, between depths of 22 and 36 inches, is a reddish-brown silt loam fragipan that has pale-brown mottles. The lower part is a yellowish-red silt loam fragipan that grades to loam between depths of 56 and 80 inches. It has grayish and brownish mottles.

Lexington soils are mostly on ridgetops. They are well drained. The surface layer is dark-brown silt loam 8 inches thick. The upper part of the subsoil is reddish-brown silt loam that grades to silty clay loam at a depth of 17 inches. The middle part is yellowish-red silt loam that contains pockets of uncoated sand grains. The lower part is red loam to a depth of 65 inches and red clay loam to a depth of 80 inches.

Smithdale soils are steep and very steep on side slopes. They are well drained. The surface layer is dark grayish-brown fine sandy loam, about 3 inches thick, that overlies a subsurface layer of brown fine sandy loam about 6 inches thick. The subsoil is about 71 inches thick. In sequence from the top, the upper 8 inches is reddish-brown fine sandy loam, the next 11 inches is red sandy clay loam, and the lower 52 inches is red sandy loam.

This association is used mostly for row crops and pasture. Suitable crops are cotton, corn, soybeans, small grains, truck crops, and most locally grown pasture plants. The steep soils on side slopes are used mostly for mixed pine and hardwood forest, and a large acreage has been planted to pine trees. The town of Ashland and outlying residential developments are in this association.

7. *Smithdale-Lexington-Lucy association*

Steep, well-drained loamy soils on hillsides; and gently sloping to moderately sloping, well-drained loamy soils high in silt on narrow ridgetops

This association is in the northern and central parts of the county. The dominant soils are on narrow ridgetops and steep side slopes. Small streams and draws traverse the area. Active and stabilized gullies are prevalent in many areas. Slopes range from 2 to 45 percent.

This association makes up about 24 percent of the county. It is about 25 percent Smithdale soils, 25 percent Lexington soils, and 20 percent Lucy soils. The remaining 30 percent is Sweatman soils and small areas of alluvial material along drainageways.

Smithdale soils are on the steeper side slopes. The surface layer is dark grayish-brown fine sandy loam, about 3 inches thick, that overlies a subsurface layer of brown fine sandy loam 6 inches thick. The subsoil is about 71 inches thick. In sequence from the top, the upper 8 inches is reddish-brown fine sandy loam, the next 11 inches is red sandy clay loam, and the lower 52 inches is red sandy loam.

Lexington soils are on narrow ridgetops. The surface layer is dark-brown silt loam 8 inches thick. The upper part of the subsoil is reddish-brown silt loam that grades to silty clay loam at a depth of 17 inches. The middle part is yellowish-red silt loam that contains pockets of uncoated sand grains. The lower part is a red loam to a depth of 65 inches and a red clay loam to a depth of 80 inches.

Lucy soils are on the steeper side slopes. The surface layer is mottled brown and very dark grayish-brown loamy sand about 3 inches thick. The subsurface layer is yellowish-brown and strong-brown loamy sand 20 inches thick. The subsoil is dark-red sandy clay loam to a depth of 80 inches. It is dark red in the upper part and grades to red below a depth of 38 inches.

This association is better suited to forest than to other uses, and a large part of it is in Holly Springs National Forest. It is largely in mixed pine and hardwood stands, but a considerable acreage has been planted to loblolly pine. The association provides good hunting. The game is largely deer and squirrel. Steep slopes are a limitation for residential and industrial use.

8. Sweatman-Smithdale-Providence association

Steep, well-drained clayey and loamy soils on hillsides; and moderately well drained loamy soils that are high in silt, have a fragipan, and are on narrow ridgetops

This association is in the southern and eastern parts of the county. The dominant soils are on narrow ridgetops and steep side slopes. Small streams and draws traverse the area. Active and stabilized gullies are prevalent in certain areas. Slope ranges from 8 to 45 percent.

This association makes up about 22 percent of the county. It is about 25 percent Sweatman soils, 16 percent Smithdale soils, and 15 percent Providence soils. The remaining 44 percent is Lucy and Lexington soils and small areas of alluvial soils along drainageways.

Sweatman soils are on side slopes. They are well drained. The surface layer is a mixture of very dark grayish-brown and brown silt loam 3 inches thick. The subsurface layer is a mixture of brown and yellowish-red silt loam about 2 inches thick. The subsoil is red clay and clay loam that has shale fragments in the lower part. The upper part of the substratum is dark-red clay loam that has thin layers of light-gray and brownish-yellow weathered shale between depths of 37 and 47 inches. Below this is stratified light-gray and red clay loam to a depth of 65 inches.

Smithdale soils are on ridgetops and upper side slopes. They are well drained. The surface layer is dark grayish-brown fine sandy loam, about 3 inches thick, that overlies a subsurface layer of brown fine sandy loam about 6 inches thick. The subsoil is about 71 inches thick. In sequence from the top, the upper 8 inches is reddish-brown fine sandy loam, the next 11 inches is red sandy clay loam, and the lower 52 inches is red sandy loam.

Providence soils are on ridgetops. They are moderately well drained. The surface layer is brown silt loam about 3 inches thick. The upper part of the subsoil is brown silty clay loam that grades to silt loam below a depth of 10 inches. The middle part, between depths of 22 to 36 inches, is a reddish-brown silt loam fragipan that has pale-brown mottles. The lower part is a yellowish-red silt loam fragipan that grades to loam between depths of 56 and 80 inches. It has brownish and grayish mottles.

This association is better suited to forest than to other uses, and a large part of it is in Holly Springs National Forest. It is largely in mixed pine-hardwood stands, but a considerable acreage has been planted to loblolly pine. The association provides good hunting. The game is largely deer and squirrel. Steep slopes and clayey soils are a limitation to residential and industrial use.

Descriptions of the Soils

In this section, the soils of Benton County are described in detail and their use and management are discussed. Each soil series is described in detail, and then, briefly, the mapping units in that series are described. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for moist soil unless otherwise stated. The profile described in the soil series is representative for mapping units in that series. If a given mapping unit has a profile in some ways different from the one described in the series, these differences are stated in the description of the mapping unit or they are apparent in the name of the mapping unit. The description of each mapping unit contains suggestions on how the soil can be managed.

Not all mapping units, however, are members of a soil series. Udorthents, for example, do not belong to a soil series; nevertheless, they are listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and woodland suitability group in which the mapping unit has been placed.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in de-

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

Soil	Acres	Percent
Ariel silt loam	11,455	4.3
Arkabutla silt loam	6,550	2.5
Calhoun silt loam	2,875	1.1
Calloway silt loam, 0 to 2 percent slopes	3,590	1.4
Gillsburg silt loam	15,075	5.8
Grenada silt loam, 2 to 5 percent slopes	2,650	1.0
Grenada silt loam, 5 to 8 percent slopes, eroded	545	.2
Jena and Ochlockonee soils	6,015	2.3
Kirkville fine sandy loam	1,560	.6
Lexington silt loam, 2 to 5 percent slopes, eroded	11,930	4.5
Lexington silt loam, 5 to 8 percent slopes, eroded	5,070	1.9
Loring silt loam, 2 to 5 percent slopes	4,245	1.6
Mantachie and Kirkville soils	1,690	.6
Oaklimeter silt loam	5,330	2.0
Providence silt loam, 2 to 5 percent slopes, eroded	10,575	4.0
Providence silt loam, 5 to 8 percent slopes, eroded	8,985	3.4
Providence silt loam, 8 to 12 percent slopes, eroded	10,845	4.1
Smithdale-Lexington complex, 12 to 17 percent slopes, eroded	6,370	2.4
Smithdale-Lucy-Lexington association, hilly	66,370	25.2
Sweatman-Smithdale association, hilly	50,130	19.0
Udorthents-Lexington complex, 5 to 25 percent slopes, severely eroded	31,825	12.1
Total	263,680	100.0

scribing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*9*).[1]

Benton County joins two counties for which soil surveys have been recently published: Tippah County, Mississippi, and Fayette County, Tennessee. Soil surveys for these counties were published in 1966 and 1964, respectively. Delineations join, but soil names are not the same in all instances due to changes in series concepts brought about by the application of soil taxonomy.

Ariel Series

The Ariel series consists of well-drained soils that formed in loamy alluvium high in silt. Slopes are 0 to 2 percent.

In a representative profile, the surface layer is brown silt loam about 8 inches thick. The subsoil is dark-brown and dark yellowish-brown silt loam that extends to a depth of 26 inches. Below this is an old, buried soil. Its surface layer is mottled pale-brown and dark yellowish-brown silt loam between depths of 26 and 35 inches. Its subsoil is mottled dark-brown and light brownish-gray, firm silt loam to a depth of 50 inches and mottled dark-brown and light brownish-gray silt loam with a high content of fine sand to a depth of 60 inches.

Representative profile of Ariel silt loam, about 8 miles north of Ashland in a large area of crops 2,000 feet north of U.S. Highway 72, 600 feet west of canal, NE¼SE¼ sec. 32, T. 1 S., R. 1 E:

Ap—0 to 8 inches, brown (10YR 5/3) silt loam; massive; very friable; common fine roots; medium acid; abrupt, smooth boundary.

B21—8 to 18 inches, dark-brown (7.5YR 4/4) silt loam; weak, medium and coarse, subangular blocky structure; very friable; common fine roots; silt or oxide coatings on peds; strongly acid; clear, smooth boundary.

B22—18 to 26 inches, dark yellowish-brown (10YR 4/4) silt loam; few fine, faint, pale-brown mottles; weak, medium, subangular blocky structure; few fine roots; silt or oxide coatings on peds; strongly acid; clear, smooth boundary.

A2b—26 to 35 inches, mottled pale-brown (10YR 6/3) and dark yellowish-brown (10YR 4/4) silt loam; weak, fine and medium, subangular blocky structure; many medium, dark-brown stains; few fine, soft, black and brown concretions; strongly acid; clear, smooth boundary.

B21b—35 to 50 inches, mottled dark-brown (10YR 4/3) and light brownish-gray (10YR 6/2) silt loam; weak, coarse, prismatic structure parting to weak, fine and medium, subangular blocky; firm; tongues of gray between prisms; black and brown stains and soft concretions; strongly acid; clear, smooth boundary.

B22b—50 to 60 inches, mottled dark-brown (10YR 4/3) and light brownish-gray (10YR 6/2) silt loam with high content of fine sand; weak, coarse, prismatic structure parting to weak, fine and medium, subangular blocky; tongues of gray between prisms; black and brown stains and soft concretions; strongly acid.

The buried solum is at a depth of 20 to 39 inches. The A horizon is brown, dark brown, or dark yellowish brown. The B2 horizon is dark brown, dark yellowish brown, or yellowish brown. The A2b horizon is pale brown or is mottled in shades of brown and gray, and the B2b horizon is mottled in shades of gray and brown. Texture is silt loam or loam. Clay content between depths of 10 and 40 inches ranges from 12 to 18 percent. Soil reaction throughout the profile is strongly acid or very strongly acid except where the surface layer has been limed.

Ariel soils are associated with Arkabutla, Gillsburg, Jena, and Ochlockonee soils. They are better drained than Arkabutla and Gillsburg soils, and they have gray mottles at a greater depth. They are higher in silt than Jena and Ochlockonee soils and contain less sand.

[1] Italic numbers in parentheses refer to Literature Cited, p. 42.

Ar—Ariel silt loam. This well-drained soil is on flood plains. Slopes are 0 to 2 percent.

This soil is strongly acid or very strongly acid unless it has been limed. Permeability is moderately slow. Available water capacity is very high. Runoff is slow, and the erosion hazard is slight. The soil is subject to occasional overflow.

This soil can be cropped continuously if good conservation practices are followed. Row arrangement and field ditches are needed to remove excess surface water. Unless the soils are protected, occasional flooding causes slight to moderate damage. Returning crop residues helps prevent crusting and packing.

Most of the acreage of this soil is used for crops. Cotton, corn, soybeans, late truck crops, and most locally grown pasture plants are well suited to the soil. Bottom land hardwoods and pine trees are also well suited. Capability unit IIw-2; woodland suitability group 1o7.

Arkabutla Series

The Arkabutla series consists of somewhat poorly drained soils that formed in loamy alluvium high in silt. Slopes are less than 2 percent.

In a representative profile, the surface layer is dark-brown silt loam 5 inches thick. The upper part of the subsoil is dark-brown silt loam with light brownish-gray mottles. The lower part of the subsoil is light-gray silty clay loam between depths of 16 and 36 inches and light-gray silt loam with yellowish-brown mottles between depths of 36 and 55 inches.

Representative profile of Arkabutla silt loam, 2½ miles east of intersection of State Highways 4 and 5 and ½ mile south of State Highway 4, NE¼NE¼SE¼ sec. 12, T. 4 S, R. 1 E:

Ap—0 to 5 inches, dark-brown (10YR 4/3) silt loam; common fine, distinct, pale-brown and few fine, faint, dark yellowish-brown mottles; weak, fine, granular structure; friable; common fine roots; few fine, soft black and brown concretions; strongly acid; abrupt, smooth boundary.

B21—5 to 16 inches, dark-brown (10YR 4/3) silt loam; few and common fine, light brownish-gray mottles; weak, medium, subangular blocky structure; friable; few fine roots; few fine black and brown stains and soft concretions; strongly acid; clear, smooth boundary.

B22g—16 to 36 inches, light-gray (10YR 6/1) silty clay loam; weak, medium, subangular blocky structure; friable; slightly plastic; few fine roots; few fine black and brown stains and soft concretions; strongly acid; clear, smooth boundary.

B3g—36 to 55 inches, light-gray (10YR 6/1) silt loam containing noticeable fine sand; common fine and medium, yellowish-brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; friable; few fine roots; black and brown stains and soft concretions; strongly acid.

The Ap horizon is dark grayish-brown, dark brown, or dark yellowish brown. The upper part of the B horizon has a brown, dark-brown, dark yellowish-brown, grayish-brown, or dark grayish-brown matrix with gray mottles, or it is mottled in shades of gray and brown. Depth to dominantly gray material ranges from 11 to 19 inches. The Bg horizon is light gray or light brownish gray. Texture of the B horizon is silt loam or silty clay loam. Black and brown stains and soft concretions are present throughout the profile. Soil reaction throughout the profile is strongly acid or very strongly acid except where the surface layer has been limed.

Arkabutla soils are associated with Ariel, Gillsburg, and Oaklimeter soils. They are more poorly drained than Ariel and Oaklimeter soils and contain more clay in the B horizon. They contain more clay in the B horizon than Gillsburg soils and lack a buried profile.

At—Arkabutla silt loam. This somewhat poorly drained soil is on relatively wide flood plains. Slopes are less than 2 percent.

Included with this soil in mapping are small areas of Ariel, Gillsburg, and Oaklimeter soils. Also included are small areas of soils that have a clayey subsoil.

This soil is strongly acid or very strongly acid. Permeability is moderate. Available water capacity is very high. Runoff is slow, and the erosion hazard is slight. The land is subject to occasional overflow.

This soil can be cropped continuously if good conservation practices are followed. Row arrangement and field ditches are needed to remove excess surface water. Unless the soil is protected, occasional flooding causes moderate to severe damage. Returning crop residues helps prevent crusting and packing.

Most of the acreage of this soil has been cleared and drained and is used for row crops. A considerable acreage is in hardwood forest. Cotton, corn, soybeans, locally grown pasture plants, and bottom land hardwood and pine trees are well suited to the soil. Capability unit IIw-3; woodland suitability group 1w8.

Calhoun Series

The Calhoun series consists of poorly drained soils that formed in loamy material high in silt. Slopes are 0 to 2 percent.

In a representative profile, the surface layer is dark grayish-brown silt loam about 5 inches thick. The subsurface layer is gray silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches. The upper 14 inches of the subsoil is gray silty clay loam. Below this is light brownish-gray and gray silt loam with brown mottles in the lower part.

Representative profile of Calhoun silt loam, 2½ miles southwest of Michigan City, Mississippi, 100 feet north of local road and 300 feet northwest of farm house, SE¼-SW¼SW¼ sec. 22, T. 1 S., R. 1 W:

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; many fine roots; few fine black and brown stains; strongly acid; clear, smooth boundary.

A2g—5 to 10 inches, gray (10YR 6/1) silt loam; few fine, faint, yellowish-brown mottles; weak, medium, subangular blocky structure; very friable; common fine roots; common medium black and brown stains; strongly acid; clear, irregular boundary.

B21tg—10 to 24 inches, gray (10YR 6/1) silty clay loam; common medium, faint, dark grayish-brown (10YR 4/2) mottles; moderate, medium, subangular blocky structure; firm; hard; few fine roots; a few tongues of gray (10YR 5/1) silt extending through the horizon; common fine black and brown stains; patchy clay film on peds and in root channels; very strongly acid; clear, irregular boundary.

B22tg—24 to 32 inches, light brownish-gray (2.5Y 6/2) silt loam; few fine, faint, yellowish-brown mottles; moderate, medium, subangular blocky structure; firm, hard; silt coatings on some peds; a few silt tongues; common fine black and brown stains and soft fine concretions; patchy clay films on peds and in root channels; very strongly acid; clear, wavy boundary.

B23tg—32 to 43 inches, light brownish-gray (2.5Y 6/2) silt loam; common medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; firm, hard; few old root channels; few gray silt coatings; patchy clay films on peds; very strongly acid; clear, wavy boundary.

B3g—43 to 60 inches, gray (10YR 6/1) silt loam; common fine and medium, distinct, brownish-yellow (10YR 6/8) and strong-brown (7.5YR 5/8) mottles; weak, medium, subangular blocky structure; firm, hard; black and brown stains; very strongly acid; clear, wavy boundary.

Cg—60 to 78 inches, light brownish-gray (10YR 6/2) silt loam; few fine and medium, distinct, strong-brown (7.5YR 5/8) and brownish-yellow (10YR 6/8) mottles; weak, fine and medium, subangular blocky structure; firm, hard; black and brown stains; strongly acid.

The A1 horizon is dark grayish-brown, very dark grayish-brown, grayish-brown, or brown silt or silt loam. The A2 horizon is gray, light-gray, light brownish-gray, or grayish-brown silt or silt loam. Tongues of the A2 horizon extend well into the B horizon. The B2t horizon is gray, light-gray, or light brownish-gray silt loam or silty clay loam. Clay content of the upper 20 inches of the Btg horizon ranges from 22 to 31 percent. Soil reaction throughout the profile is strongly acid or very strongly acid.

Calhoun soils are associated with Calloway and Grenada soils. They are more poorly drained than Calloway or Grenada soils, have gray colors nearer the surface, and lack a fragipan.

Ca—Calhoun silt loam. This poorly drained soil is on wide, slightly depressional areas on ridgetops and stream terraces. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Calloway and Grenada soils that are on the higher elevations.

This soil is strongly acid or very strongly acid. Permeability is slow. Available water capacity is very high. Runoff is slow to very slow, and water tends to pond. There is a seasonal high water table below a depth of 10 inches.

This soil can be cropped continuously if good conservation practices are followed. Row arrangement and field ditches are needed to remove excess water. Cut banks erode easily. Returning crop residues helps reduce crusting and packing.

Small areas of this soil are cultivated or used for pasture. The larger areas are in hardwood forest. Soybeans, cotton, most locally grown pasture plants, adapted hardwood, shortleaf pine, and loblolly pine are suited to this soil. Capability unit IIIw-2; woodland suitability group 3w9.

Calloway Series

The Calloway series consists of somewhat poorly drained soils that formed in loamy material high in silt. Slopes are 0 to 2 percent.

In a representative profile, the surface layer is dark yellowish-brown silt loam about 5 inches thick. The upper part of the subsoil is yellowish-brown silt loam mottled in shades of gray and brown. The lower part of the subsoil is a silt loam fragipan mottled in shades of brown and gray to a depth of 52 inches.

Representative profile of Calloway silt loam, 0 to 2 percent slopes, 2 miles west of Michigan City, Mississippi, and 200 feet north of local road, SW¼SW¼NE¼ sec. 22, T. 1 S., R. 1 W:

Ap—0 to 5 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine, granular structure; very friable; few fine roots; few fine black and brown concretions; strongly acid; abrupt, smooth boundary.

B2—5 to 13 inches, yellowish-brown (10YR 5/6) silt loam; many medium, distinct, dark yellowish-brown (10YR 4/4) and light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; friable; few fine roots; many fine pores; few black and brown concretions and stains; few patchy clay films in pores and on peds; strongly acid; clear, smooth boundary.

A'2—13 to 15 inches, pale-brown (10YR 6/3) silt loam; common fine and medium, distinct, brown (7.5YR 4/4) and faint, light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; friable; few fine black and brown concretions and stains; silt coatings on ped surfaces; strongly acid; clear, smooth boundary.

B x1—15 to 26 inches, mottled pale-brown (10YR 6/3), brown (7.5YR 4/4), and light brownish-gray (10YR 6/2) silt loam; weak, coarse, prismatic structure parting to weak, fine and medium, subangular blocky; firm; compact and brittle; few fine voids; silt coats on peds and in pores; few fine black and brown concretions; patchy clay films on faces of peds; strongly acid; clear, smooth boundary.

B'x2—26 to 40 inches, mottled yellowish-brown (10YR 5/4), light brownish-gray (10YR 6/2), and pale-brown (10YR 6/3) silt loam; weak, coarse, prismatic structure parting to weak, fine and medium, subangular blocky; firm; compact and brittle; few fine voids; few fine black and brown concretions; gray silt loam between prisms; patchy clay films; strongly acid; clear, smooth boundary.

B'x3—40 to 52 inches, brown (7.5YR 4/4) silt loam; many medium, distinct, grayish-brown (10YR 5/2) mottles; weak, coarse, prismatic structure parting to moderate, fine and medium, subangular blocky structure; firm; compact and brittle; few fine voids; gray silt coats on ped faces; few fine black and brown concretions; gray silt loam between prisms; patchy clay films; strongly acid.

The Ap horizon is brown, dark brown, dark yellowish-brown, or dark grayish brown. The B horizon is brown, yellowish brown, or dark yellowish brown mottled with shades of gray. The A'2 horizon is gray, light brownish gray, grayish brown, or pale brown. The Bx horizon is strong brown, yellowish brown, grayish brown, or brown with few to many grayish mottles, or it is mottled in shades of gray, brown, and yellow. Texture is silt loam or silty clay loam. Depth to the Bx horizon ranges from 15 to 36 inches. Soil reaction is strongly acid throughout the profile except where the surface layer has been limed.

Calloway soils are associated with Calhoun, Grenada, and Loring soils. They are not so well drained as Grenada and Loring soils and have grayish mottles nearer the surface. They have a fragipan and are better drained than Calhoun soils.

CwA—Calloway silt loam, 0 to 2 percent slopes. This somewhat poorly drained soil is on ridgetops and stream terraces.

Included with this soil in mapping are small areas of Grenada and Calhoun soils.

This soil is strongly acid. Permeability is moderate in the upper part but slow through the fragipan. Available water capacity is medium. Runoff is slow to medium, and the erosion hazard is slight. The soil has a seasonal high water table in places.

This soil can be cropped continuously if good conservation practices are followed. Row arrangement and field ditches are needed to remove excess surface water. Returning crop residues helps prevent crusting and packing.

Most of the acreage of this soil has been cleared and is used for crops or pasture. Cotton, corn, soybeans, and most locally grown pasture plants are suited to this soil. It is also suited to shortleaf pine and loblolly pine and to recommended hardwoods. Capability unit IIIw-1; woodland suitability group 2w8.

Gillsburg Series

The Gillsburg series consists of somewhat poorly drained soils that formed in loamy alluvium high in silt. Slopes are 0 to 2 percent.

In a representative profile, the surface layer is dark grayish-brown silt loam 6 inches thick. The upper part of the subsoil is brown silt loam mottled in shades of gray. The lower part of the subsoil is grayish-brown silt loam mottled in shades of brown and yellow to a depth of 32 inches. Between depths of 32 and 65 inches is an old buried soil consisting of light brownish-gray silt loam over light-gray silt loam mottled in shades of brown.

Representative profile of Gillsburg silt loam, 300 feet east of State Highway 5 and 300 feet south of north fork of Chilli Creek, SE¼SW¼NW¼ sec. 35, T. 4 S., R. 1 E:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; massive; friable; common fine roots; medium acid; abrupt, smooth boundary.

B21—6 to 12 inches, brown (10YR 5/3) silt loam; few fine and medium, faint, light brownish-gray (10YR 6/2) mottles; weak, fine and medium, subangular blocky structure; friable; few fine roots; few fine pores and old root channels; few fine black and brown stains; silt coatings on peds; medium acid; gradual, smooth boundary.

B22—12 to 18 inches, brown (10YR 5/3) silt loam; common medium, faint, light brownish-gray (10YR 6/2) mottles; weak, fine and medium, subangular blocky structure; friable; few fine roots; few fine pores and old root channels; few fine black and brown stains; silt coatings on peds; strongly acid; gradual, smooth boundary.

B23g—18 to 32 inches, grayish-brown (10YR 5/2) silt loam; common to many medium, faint, pale-brown (10YR 6/3) and few fine and medium, distinct, brownish-yellow (10YR 6/6) mottles; weak, fine and medium, subangular blocky structure; friable to firm; common fine voids and pores; few black and brown stains and concretions; silt coatings on peds; very strongly acid; gradual, smooth boundary.

A2gb—32 to 40 inches, light brownish-gray (2.5Y 6/2) silt loam; common fine and medium, distinct, pale-brown (10YR 6/3) and yellowish-brown (10YR 5/4) mottles; weak, coarse, prismatic structure parting to weak, fine and medium, subangular blocky; friable to firm; slightly compact; common fine voids and pores; common fine black and brown stains and concretions; very strongly acid; clear, irregular boundary.

B21tgb—40 to 55 inches, light brownish-gray (2.5Y 6/2) silt loam containing noticeable fine sand; many medium and coarse, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; firm; compact and brittle; few fine voids and pores; black and brown stains and concretions; patchy clay films on prism faces; very strongly acid; clear, irregular boundary.

B22gb—55 to 65 inches, light-gray (10YR 6/1) silt loam; many medium and coarse, yellowish-brown (10YR 5/4, 5/6) and strong-brown (7.5YR 5/6) mottles; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; firm; compact and brittle; few fine voids and pores; black and brown stains and concretions; patchy clay films on prism faces; very strongly acid.

Depth to the buried soil ranges from 20 to 45 inches. The A horizon is brown, dark brown, yellowish brown, dark yellowish brown, or dark grayish brown. The B2 horizon is brown, dark brown, yellowish brown, or dark yellowish brown mottled in shades of gray. Depth to the Bg horizon ranges from 12 to 20 inches. The Bg horizon is light gray, light brownish gray, or grayish brown. The A2gb and Btgb horizons are similar in color to the Bg horizon. Soil reaction throughout the profile is strongly acid or very strongly acid except where the surface layer has been limed.

Gillsburg soils are associated with Ariel, Arkabutla, and Oaklimeter soils. They are more poorly drained than Ariel and Oaklimeter soils and have gray mottles closer to the surface. They contain less clay in the B horizon than Arkabutla soils.

Gb—Gillsburg silt loam. This somewhat poorly drained soil is on flood plains. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Ariel, Arkabutla, and Oaklimeter soils.

This soil is strongly acid or very strongly acid except where the surface layer has been limed. Permeability is moderately slow. Available water capacity is very high. Runoff is slow, and the erosion hazard is slight. The soils are subject to occasional overflow.

This soil can be cropped continuously if good conservation practices are followed. Row arrangement and field ditches are needed to remove excess runoff. Unless the soil is protected, occasional flooding causes slight to moderate damage. Returning crop residues helps prevent crusting and packing.

***Figure 3.*—Corn and soybeans on Gillsburg silt loam.**

A large acreage of this soil is in forest. The remainder is used mainly for row crops. Cotton, corn, soybeans, (fig. 3), most locally grown pasture plants, and bottom land hardwoods and pines are well suited to this soil. Capability unit IIw-3; woodland suitability group 1w8.

Grenada Series

The Grenada series consists of moderately well drained soils that have a fragipan. These soils formed in thick beds of loamy material high in silt. Slopes range from 2 to 8 percent.

In a representative profile, the surface layer is dark-brown silt loam about 7 inches thick. The upper 17 inches of the subsoil is yellowish-brown silt loam with brownish mottles in the lower part. The lower part of the subsoil is a fragipan that extends to a depth of 67 inches. Between depths of 24 and 54 inches the fragipan is silt loam mottled in shades of gray and brown; between depths of 54 and 67 inches it is dark-brown silt loam with grayish mottles.

Representative profile of Grenada silt loam, 2 to 5 percent slopes, 3 miles west of intersection of U.S. Highway 78 and State Highway 7 and 300 feet north of a property line fence, SE¼SE¼NW¼ sec. 31, T. 1 S., R. 1 W:

Ap—0 to 7 inches, dark-brown (10YR 4/3) silt loam; few medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, fine, granular structure; very friable; many fine roots; few fine yellowish-brown stains; strongly acid; clear, smooth boundary.

B21—7 to 17 inches, yellowish-brown (10YR 5/6) silt loam; weak, medium, subangular blocky structure; friable; common fine roots; many fine pores; worm casts filled with dark grayish-brown material; strongly acid; gradual, smooth boundary.

B22—17 to 24 inches, yellowish-brown (10YR 5/6) silt loam; common medium, distinct, pale-brown (10YR 6/3) mottles; moderate, fine and medium, subangular blocky structure; very friable; few fine roots; silt coatings on peds; few fine black and brown stains; strongly acid; clear, smooth boundary.

B'x1&A'2—24 to 33 inches, mottled dark yellowish-brown (10YR 4/4), pale-brown (10YR 6/3), and light brownish-gray (10YR 6/2) silt loam; weak, medium, subangular blocky structure; yellowish-brown part is slightly firm; compact and brittle; friable; common fine pores; few fine black and brown concretions; strongly acid; clear, irregular boundary.

B'x2—33 to 54 inches, mottled dark-brown (7.5YR 4/4), pale-brown (10YR 6/3), and light brownish-gray (10YR 6/2) silt loam; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm, compact and brittle; common fine pores; few fine black and brown concretions; light brownish-gray silt between prisms; patchy clay films on peds and in cracks; strongly acid; clear, wavy boundary.

B'x3—54 to 67 inches, dark-brown (7.5YR 4/4) silt loam; common medium and coarse, distinct, gray (10YR 6/1) and light brownish-gray (10YR 6/2) mottles; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm, compact and brittle; common fine pores; few fine black and brown stains; patchy clay films on faces of peds; strongly acid.

The Ap horizon is brown, dark brown, yellowish brown, or dark yellowish brown. The B horizon is yellowish brown or dark yellowish brown. Mottles in shades of gray or pale brown are below a depth of 16 inches in places. The A' horizon, if present, is light gray, light brownish gray, or grayish brown mottled in shades of brown and yellow. The B'x&A'2 horizon is a mixture of parts of the B'x and the A'2 horizons. Colors are mottled in shades of brown and gray. The Bx horizon is brown, dark brown, yellowish brown, or dark yellowish brown with mottles in shades of gray, or it is mottled in shades of brown and gray. Texture is silt loam or silty clay loam. Soil reaction throughout the profile is medium acid to very strongly acid except where the surface layer has been limed.

Grenada soils are associated with Calhoun, Calloway, Loring, and Providence soils. They are better drained than Calhoun and Calloway soils and have no grayish mottles within 16 inches of the surface. They differ from Loring soils by having a bisequal profile. The solum above sandy material is thicker in Grenada soils than in Providence soils.

GrB—Grenada silt loam, 2 to 5 percent slopes. This moderately well drained soil is on ridgetops. It has the profile described as representative of the series. In some places the surface layer has been thinned by erosion, and a few rills and shallow gullies are present.

Included with this soil in mapping are small areas of Calhoun, Calloway, Loring, and Providence soils.

This soil is medium acid to very strongly acid. Permeability is moderate in the upper part but slow through the fragipan. Available water capacity is medium. Runoff is slow to medium, and the erosion hazard is slight to moderate. A seasonal high water table may be above the fragipan during periods of high rainfall.

This soil can be cropped continuously if good conservation practices that include erosion control are followed. Returning crop residues helps prevent crusting and packing and reduces erosion.

The acreage of this soil is used mainly for row crops or pasture. The remainder is wooded. Cotton, corn, soybeans, truck crops, and locally grown pasture crops are suited to this soil. The soil is also suited to loblolly pine, shortleaf pine, and hardwoods. Capability unit IIe-2, woodland suitability group 3o7.

GrC2—Grenada silt loam, 5 to 8 percent slopes, eroded. This moderately well drained soil is on moderately sloping ridgetops and side slopes. It has a surface layer of dark-brown silt loam about 6 inches thick. The upper part of the subsoil is yellowish-brown silt loam about 16 inches thick. The next layer is light-gray silt loam about 10 inches thick. The lower part is a dark-brown silt loam fragipan mottled with light gray. In some places the surface layer has been thinned by erosion, and a few rills and shallow gullies are present. A few spots where the subsoil is exposed are present in some areas.

Included with this soil in mapping are small areas of Providence and Loring soils.

This soil is medium acid to very strongly acid. Permeability is moderate in the upper part but slow through the fragipan. Available water capacity is medium. Runoff is medium, and the erosion hazard is severe. A seasonal high water table may be above the fragipan during periods of high rainfall.

Cultivated crops can be grown if an adequate cropping system that includes erosion control and close growing crops part of the time is used. Returning large amounts of crop residue helps improve soil tilth, reduce runoff, and control erosion.

The acreage of this soil is used mainly for pasture or crops. Cotton, corn, soybeans, truck crops, and most locally grown pasture crops are suited. The soil is also suited to loblolly pine, shortleaf pine, and hardwoods. Capability unit IIIe-2; woodland suitability group 3o7.

Jena Series

The Jena series consists of well-drained soils that formed in loamy alluvium. Slopes are 0 to 2 percent.

In a representative profile, the surface layer is dark-brown loam 11 inches thick. The subsoil is dark yellowish-brown to yellowish-brown fine sandy loam that extends to a depth of 35 inches. The substratum is pale-brown sandy loam to a depth of 49 inches and brown sandy loam to a depth of 60 inches.

Representative profile of Jena loam, in a large cultivated area of Jena and Ochlockonee soils one-half mile west of State Highway 5 and 100 feet north of an old Tippah River run, SW¼SW¼SW¼ sec. 15, T. 4 S., R. 1 E:

Ap—0 to 11 inches, dark-brown (10YR 4/3) loam; weak, fine, granular structure; very friable; many fine roots; slightly acid; abrupt, smooth boundary.

B21—11 to 21 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; weak, medium, subangular blocky structure; very friable; many fine roots; strongly acid; clear, smooth boundary.

B22—21 to 35 inches, yellowish-brown (10YR 5/6) fine sandy loam; weak, medium, subangular blocky structure; very friable; few fine roots; strongly acid; clear, smooth boundary.

C1—35 to 49 inches, pale-brown (10YR 6/3) sandy loam; structureless; thin stratifications; loose; strongly acid; clear, smooth boundary.

C2—49 to 60 inches, brown (10YR 5/3) sandy loam; structureless; very friable; strongly acid.

Thickness of the solum ranges from 21 to 40 inches. The Ap horizon is brown, dark grayish-brown, dark-brown, or dark yellowish-brown sandy loam, fine sandy loam, loam, or silt loam. The B horizon is brown, pale brown, dark brown, yellowish brown, or dark yellowish brown. The various subhorizons of the B horizon are loam, fine sandy loam, or sandy loam. The C horizon is brown, dark-brown, pale brown, or yellowish-brown loam, sandy loam, or loamy sand. Reaction throughout the profile is strongly acid or very strongly acid except where the surface layer has been limed.

Jena soils are associated with Ariel, Kirkville, Mantachie, and Ochlockonee soils. They contain less silt and have more sand than Ariel soils. They are better drained than Kirkville and Mantachie soils and have gray mottles nearer the surface. They lack the stratification of Ochlockonee soils.

Je—Jena and Ochlockonee soils. This undifferentiated group of well-drained Jena and Ochlockonee soils is on flood plains. Slopes are 0 to 2 percent. Areas are relatively large, ranging from 50 to 200 acres.

Some areas of this unit consist of either soil, but most areas contain both. The mapping unit is about 46 percent Jena soils and about 32 percent Ochlockonee soils. The remaining 22 percent is mainly Ariel, Kirkville, and Mantachie soils. The Jena and Ochlockonee soils in this mapping unit have the profiles described as representative of the Jena and Ochlockonee series, respectively.

Jena soils are strongly acid or very strongly acid throughout except where the surface layer has been limed. Permeability is moderate. Available water capacity is medium. Runoff is slow. A seasonal high water table may be below a depth of 60 inches for short periods. The soils are subject to occasional overflow.

Ochlockonee soils are strongly acid or very strongly acid. Permeability is moderate. Available water capacity is medium. Runoff is slow. A seasonal high water table may be below a depth of 40 inches for 1 to 2 months during winter or early spring. The soils are subject to occasional overflow.

The soils of this unit can be cropped continuously if good conservation practices are followed. Row arrangement and field ditches are needed to remove excess surface water. Unless the soils are protected, occasional flooding causes moderate crop damage.

Most of the acreage of this mapping unit is used for crops and pasture. Areas that are not drained are used for bottom land hardwoods. Cotton, corn, soybeans, late truck crops, most locally grown pasture plants, and bottom land hardwoods and pines are well suited to this mapping unit. Capability unit IIw-1; woodland suitability group 1o7.

Kirkville Series

The Kirkville series consists of moderately well drained soils that formed in loamy alluvium. Slopes are 0 to 2 percent.

In a representative profile, the surface layer is dark-brown fine sandy loam 6 inches thick. The subsoil extends to a depth of 62 inches. The upper 11 inches of the subsoil is dark yellowish-brown fine sandy loam. The next 7 inches is dark-brown loam that has pale-brown and light brownish-gray mottles. Below that is 11 inches of mottled light brownish-gray, brownish-yellow, and yellowish-brown loam; 15 inches of light brownish-gray fine sandy loam; and 12 inches of light brownish-gray silt loam mottled in shades of brown and yellow.

Representative profile of Kirkville fine sandy loam, in a 100-acre area of crops, 100 feet west of canal, 8 miles southeast of Ashland, NE¼SW¼NE¼ sec. 17, T. 4 S., R. 2 E:

Ap—0 to 6 inches, dark-brown (10YR 4/3) fine sandy loam; weak, fine, granular structure; very friable; many fine roots; medium acid; abrupt, smooth boundary.

B21—6 to 17 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; few fine, faint, pale-brown mottles; weak, medium, subangular blocky structure; friable; common fine roots; strongly acid; clear, smooth boundary.

B22—17 to 24 inches, dark-brown (10YR 4/3) loam; many coarse, faint, pale-brown (10YR 6/3) and light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; friable; few fine roots and root holes; common medium black and brown stains; very strongly acid; clear, smooth boundary.

B23—24 to 35 inches, mottled light brownish-gray (10YR 6/2), brownish-yellow (10YR 6/8), and yellowish-brown (10YR 5/4) loam; weak, medium, subangular blocky structure; very friable; few fine root holes; common medium black and brown stains; very strongly acid; clear, smooth boundary.

B24g—35 to 50 inches, light brownish-gray (10YR 6/2) fine sandy loam; common medium and coarse, distinct, brownish-yellow (10YR 6/6) mottles; weak, medium, subangular blocky structure; very friable; few fine root holes; common medium black and brown stains; very strongly acid; clear, smooth boundary.

B25g—50 to 62 inches, light brownish-gray (10YR 6/2) silt loam; common medium and coarse, distinct, strong-brown (7.5YR 5/6) and reddish-yellow (7.5YR 6/6) mottles; weak, medium, subangular blocky structure; friable; very strongly acid.

The A horizon is dark brown, brown, or dark yellowish brown. The B2 horizon is brown, dark brown, or dark yellowish brown with grayish mottles or is mottled in shades of brown, yellow, and gray. The B2g horizon is dominantly light brownish gray mottled with shades of brown and yellow. Textures of the B horizon are sandy loam, fine sandy loam, loam, or silt loam. Soil reaction throughout the profile is strongly acid or very strongly acid except where the surface layer has been limed.

Kirkville soils are associated with Jena, Mantachie, and Ochlockonee soils. They are better drained than Mantachie soils and contain less clay in the B horizon. They are not so well drained as Jena and Ochlockonee soils and have gray mottles nearer the surface.

Kr—Kirkville fine sandy loam. This moderately well drained soil is on flood plains. Slopes are 0 to 2 percent. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Jena and Ochlockonee soils.

This soil is strongly acid or very strongly acid except where the surface layer has been limed. Permeability is moderate. Available water capacity is medium. Runoff is slow, and the erosion hazard is slight. This soil is subject to occasional overflow.

These soils can be cropped continuously if good conservation practices are followed. Row arrangement and field ditches are needed to remove excess surface water. Unless the soils are protected, occasional flooding causes moderate crop damage. Returning crop residues helps prevent crusting and packing.

A large part of this soil is in bottom land hardwoods. The soil is used for crops where it has been cleared and drained. Cotton, corn, soybeans, locally grown pasture crops, pine trees, and bottom land hardwoods are well suited to this soil. Capability unit IIw-1; woodland suitability group 1w8.

Lexington Series

The Lexington series consists of well-drained soils that formed in thin beds of loamy material high in silt and in the underlying Coastal Plain material. Slopes are mostly 2 to 25 percent.

In a representative profile, the surface layer is dark-brown silt loam 8 inches thick. The upper part of the subsoil is reddish-brown silt loam that grades to silty clay loam at a depth of 17 inches. The middle part of the subsoil is yellowish-red silt loam that contains pockets of uncoated sand grains in its lower part. The lower part of the subsoil is red loam to a depth of 65 inches and red clay loam to a depth of 80 inches.

Representative profile of Lexington silt loam, 2 to 5 percent slopes, eroded, six miles north of Hickory Flat, 300 feet west of State Highway 5, and 250 feet south of local road, SE¼NE¼ sec. 27, T. 4 S. R. 1 E:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; common fine roots; strongly acid; abrupt, smooth boundary.

B21t—8 to 17 inches, reddish-brown (5YR 4/4) silt loam; moderate, medium, subangular blocky structure; friable; common fine roots; thin patchy clay films on peds; strongly acid; clear, smooth boundary.

B22t—17 to 31 inches, reddish-brown (5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; friable; slightly plastic; few fine roots; few fine black and brown stains; thin patchy clay films on peds; strongly acid; clear, smooth boundary.

IIB23t&A'2—31 to 58 inches, yellowish-red (5YR 5/6) silt loam; weak and moderate, medium, subangular blocky structure; friable; common fine to coarse pockets of uncoated sand and silt; few fine black and brown stains; thin patchy clay films on peds; strongly acid; clear, smooth boundary.

IIB24t—58 to 65 inches, red (2.5YR 4/6) loam; moderate, medium, subangular blocky structure; friable; few pockets of uncoated sand and silt; few fine black and brown stains; thin patchy clay films on peds; strongly acid; clear, smooth boundary.

IIB25t—65 to 80 inches, red (2.5YR 4/6) clay loam; weak and moderate, medium, subangular blocky structure; friable; few pockets of uncoated sand; few patchy clay films on ped faces; strongly acid.

The Ap horizon is brown, dark brown, yellowish brown, or dark yellowish brown. The B21t and B22t horizons are brown, strong-brown, reddish-brown, or yellowish-red silt loam or silty clay loam. Clay content in the upper 20 inches of the Bt horizon ranges from 22 to 34 percent. Depth to the IIBt&A' horizon ranges from 24 to 48 inches. The IIBt&A' horizon is reddish-brown, yellowish-red, red, or brown silt loam, loam, or sandy loam. The IIBt horizon is red, yellow-

Figure 4.—**Corn in foreground and farmstead and pine plantation in background on a Lexington silt loam.**

ish-red, reddish-brown, dark-brown, or brown clay loam, loam, sandy clay loam, or sandy loam. Soil reaction throughout the profile is strongly acid or very strongly acid except where the surface layer has been limed.

Lexington soils are associated with Loring, Lucy, Providence, Smithdale, and Sweatman soils. Lexington soils are better drained and lack the fragipan that Loring and Providence soils have. They have more silt throughout the profile than Lucy and Smithdale soils. They lack the clayey B horizons of Sweatman soils.

LeB2—Lexington silt loam, 2 to 5 percent slopes, eroded. This well-drained soil is on ridgetops. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Loring, Providence, and Smithdale soils. In most places the surface layer has been thinned by sheet erosion. A few rills and shallow gullies are present, but these are usually obliterated after each cultivation.

This soil is strongly acid or very strongly acid except where the surface has been limed. Permeability is moderate. Available water capacity is very high. Runoff is medium, and the erosion hazard is slight to moderate.

This soil can be cropped continuously if good conservation practices that include erosion control are followed. Returning crop residues helps prevent crusting and packing and reduces erosion.

Most of the acreage of this soil is used for crops (fig. 4) or pasture. A small acreage is in woodland. Cotton, corn, soybeans, truck crops, pasture plants, loblolly pine, shortleaf pine, and native hardwoods are well suited to this soil. Capability unit IIe-1; woodland suitability group 3o7.

LeC2—Lexington silt loam, 5 to 8 percent slopes, eroded. This well-drained soil is on ridgetops and gentle side slopes. It has a surface layer of yellowish-brown silt loam 8 inches thick. The subsoil extends to a depth of more than 80 inches. In sequence from the top, it is brown silt loam, strong-brown silty clay loam, strong-brown to brown silt loam, yellowish-red loam that contains fine pockets of uncoated sand grains, and red clay loam that extends to below a depth of 80 inches. In most places the surface has been thinned by sheet erosion, and a few rills and shallow gullies are present after heavy rainfall. These are usually obliterated by tillage.

Included with this soil in mapping are small areas of Loring, Providence, and Smithdale soils. Also included are a few areas of severely eroded soils.

This soil is strongly acid or very strongly acid. Permeability is moderate. Available water capacity is very high. Runoff is rapid, and the erosion hazard is severe.

Cultivated crops can be grown if an adequate conservation system that includes erosion control is used. Returning crop residues helps prevent crusting and packing and reduces erosion.

Most of the acreage of this soil is cultivated or used for pasture. The remainder is wooded. Cotton, corn, soybeans, truck crops, pasture plants, loblolly pine, shortleaf pine, and mixed hardwoods are suited to this soil. Capability unit IIIe-1; woodland suitability group 3o7.

Loring Series

The Loring series consists of moderately well drained soils that have a fragipan. These soils formed in loamy material high in silt. Slopes are 2 to 5 percent.

In a representative profile, the surface layer is dark-brown silt loam about 5 inches thick. The upper part of the subsoil is strong-brown silty clay loam that grades to silt loam in the lower 11 inches. The lower part of the subsoil is a dark-brown silt loam fragipan mottled in shades of gray and brown to a depth of 62 inches.

Representative profile of Loring silt loam, 2 to 5 percent slopes, in a hayfield approximately one-half mile south of U.S. Highway 72 and 150 feet east of a local road running on the Benton-Marshall county line, NW¼NW¼SW¼ sec. 6, T. 2 S., R. 1 W:

Ap—0 to 5 inches, dark-brown (7.5YR 4/4) silt loam; massive; friable; few fine roots; few fine root or worm holes; medium acid; abrupt, smooth boundary.

B21t—5 to 14 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, fine and medium, subangular blocky structure; friable; few fine roots; few fine root and worm holes; common fine black and brown stains; thin patchy clay film on peds and in root channels; strongly acid; clear, smooth boundary.

B22t—14 to 25 inches, strong-brown (7.5YR 5/6) silt loam; common fine, faint, yellowish-brown mottles; moderate, fine and medium, subangular blocky structure; friable; few fine roots; common fine black and brown stains; thin patchy clay films on peds and in old root channels; strongly acid; clear, smooth boundary.

Bx1—25 to 32 inches, dark-brown (7.5YR 4/4) silt loam; common fine and medium, distinct, yellowish-brown (10YR 5/4) mottles; weak, coarse, prismatic structure parting to moderate, fine and medium, subangular blocky; firm, compact and brittle; few fine roots; few fine voids; common fine black and brown stains; thin patchy clay films; medium acid; clear, smooth boundary.

Bx2—32 to 48 inches, dark-brown (7.5YR 4/4) silt loam; common medium, distinct, grayish-brown (10YR 5/2) mottles; weak, coarse, prismatic structure parting to moderate, fine and medium, subangular blocky; firm, compact and brittle; seams between prisms filled with brown silt; common fine black and brown stains; few fine voids; thin patchy clay films; strongly acid; clear, smooth boundary.

Bx3—48 to 62 inches, dark-brown (7.5YR 4/4) silt loam; weak, coarse, prismatic structure parting to moderate, fine and medium, subangular blocky; firm, compact and brittle; seams between prisms filled with brown silt; common fine black and brown stains; few fine voids; thin patchy clay films; strongly acid.

The Ap horizon is brown, dark brown, yellowish brown, or dark yellowish brown. The Bt horizon, above the fragipan, is brown, strong-brown, dark-brown, or dark yellowish-brown silt loam or silty clay loam. The Bx horizon is brown, dark brown, strong brown, or dark yellowish brown with few to many mottles in shades of gray and brown. Fine to medium black and brown stains and fine, black and brown concretions are present in most profiles. Soil reaction throughout the profile is medium acid to strongly acid except where the surface layer has been limed.

Loring soils are associated with Calloway, Grenada, Lexington, and Providence soils. They lack the bisequal profile of the Calloway and Grenada soils. They are not so well drained as the Lexington soils and have a fragipan. They have less sand in the lower part of the fragipan than the Providence soils.

LoB—Loring silt loam, 2 to 5 percent slopes. This moderately well drained soil is on relatively wide ridgetops.

Included with this soil in mapping are small areas of Grenada, Lexington, and Providence soils. In some places the surface layer has been thinned by sheet erosion, and a few rills and shallow gullies are present. These are generally obliterated after each cultivation.

This soil is medium acid to strongly acid. Permeability is moderate in the upper part but moderately slow through the fragipan. Available water capacity is high. Runoff is slow to medium, and the erosion hazard is moderate.

This soil can be cropped continuously if good conservation practices that include erosion control are followed. Returning crop residues helps prevent crusting and packing and reduces erosion.

Almost all of the acreage of this soil is cultivated or used for pasture. A very small part is wooded. Cotton, corn, soybeans, truck crops, locally grown pasture plants, native hardwoods, and pine trees are well suited to this soil. Capability unit IIe-1; woodland suitability group 3o7.

Lucy Series

The Lucy series consists of well-drained soils that formed in sandy material and in the underlying loamy material. Slopes are 17 to 45 percent.

In a representative profile, the surface layer is mottled brown and very dark grayish-brown loamy sand 3 inches thick. The subsurface layer is yellowish-brown and strong-brown loamy sand 20 inches thick. The subsoil is sandy clay loam to a depth of 80 inches. It is dark red above a depth of 38 inches and red below.

In Benton County, Lucy soils are mapped only in association with Smithdale and Lexington soils.

Representative profile of Lucy loamy sand, in a large wooded area of Smithdale-Lucy-Lexington association, hilly, 10 miles southwest of Ashland and 800 feet west of local road, NW¼SE¼SW¼ sec. 15, T. 4 S., R. 1 W:

A1—0 to 3 inches, mottled brown (10YR 5/3) and very dark grayish-brown (10YR 3/2) loamy sand; weak, fine, granular structure; very friable; many fine roots; very strongly acid; clear, smooth boundary.

A21—3 to 10 inches, yellowish-brown (10YR 5/4) loamy sand; weak, fine, granular structure; very friable; many fine roots; very strongly acid; gradual, smooth boundary.

A22—10 to 23 inches, strong-brown (7.5YR 5/6) loamy sand; few fine, distinct, reddish-brown mottles; weak, fine, granular structure; very friable; few fine roots; very strongly acid; gradual, smooth boundary.

B21t—23 to 30 inches, dark-red (2.5YR 3/6) sandy clay loam; moderate, medium, subangular blocky structure; friable; pale-brown coatings on some peds; common fine to medium pockets of uncoated sand grains; patchy clay films and clay bridging of sand grains; very strongly acid; gradual, smooth boundary.

B22t—30 to 38 inches, dark-red (2.5YR 3/6) sandy clay loam; weak, medium, subangular blocky structure; friable, few patchy clay films; clay bridging sand grains; very strongly acid; gradual, smooth boundary.

B23t—38 to 80 inches, red (2.5YR 4/6) sandy clay loam; weak, medium, subangular blocky structure; friable; few patchy clay films; clay bridging sand grains; very strongly acid.

The A1 horizon is brown, dark grayish brown, or very dark grayish brown, or it is mottled brown or dark grayish-brown loamy sand or loamy fine sand. The A2 horizon is pale brown, light yellowish brown, strong brown, or yellowish brown. The combined A horizons range from 20 to 40 inches thick. The B horizon is red, dark-red, or yellowish-red sandy clay loam or loam. Many profiles are stratified in the lower B horizon.

Lucy soils are associated with Lexington and Smithdale soils. The thick loamy sand A horizons of Lucy soils set them apart from associated soils.

Mantachie Series

The Mantachie series consists of somewhat poorly drained soils that formed in loamy material. Slopes are 0 to 2 percent.

In a representative profile, the surface layer is dark-brown and brown fine sandy loam 12 inches thick. The upper part of the subsoil is light brownish-gray loam mottled in shades of brown and yellow. The lower part of the subsoil is gray sandy clay loam mottled in shades of yellow to a depth of 60 inches.

Representative profile of Mantachie fine sandy loam, in an area of Mantachie and Kirkville soils, 9 miles southeast of Ashland, one-fourth mile north of local road, 100 feet west of ditch, and 20 feet north of turnrow, SW¼NW¼SE¼ sec. 16, T. 4 S., R. 2 E:

Ap—0 to 6 inches, dark-brown (10YR 4/3) fine sandy loam; weak, fine, granular structure; very friable; many fine roots; strongly acid; abrupt, smooth boundary.

A12—6 to 12 inches, brown (10YR 5/3) fine sandy loam; many fine to coarse, distinct, grayish-brown and few fine, distinct, yellow mottles; weak, fine, granular structure; common fine roots; worm casts; common medium black and brown stains; very strongly acid.

B21g—12 to 20 inches, light brownish-gray (2.5Y 6/2) loam, common medium, distinct, yellow (10YR 7/6) and brownish-yellow (10YR 6/6) mottles; weak, medium, subangular blocky structure; very friable; few fine roots; pin holes; few fine black and brown stains; very strongly acid; clear, smooth boundary.

B22g—20 to 40 inches, light brownish-gray (10YR 6/2) loam; many medium, distinct, yellow (10YR 7/6) and brownish-yellow (10YR 6/6) mottles; weak, medium, subangular blocky structure; friable; few fine roots and old root holes; few fine black and brown stains; very strongly acid; clear, smooth boundary.

B23g—40 to 60 inches, gray (10YR 6/1) sandy clay loam; many medium to coarse, distinct, brownish-yellow (10YR 6/6) mottles; firm; common medium black and brown stains; few fine black and brown concretions; very strongly acid.

The A horizon is dark-brown, brown, or dark yellowish-brown fine sandy loam or loam. The B2 horizon, if present, is brown, yellowish brown, or strong brown with few to many mottles in shades of gray or is mottled in shades of brown and gray. The Bg horizon is dominantly light gray, light brownish gray, or gray, with mottles in shades of gray, yellow, and brown. Depth to the Bg horizon ranges from 12 to 20 inches. Texture of the B horizon is loam or sandy clay loam. Clay content between depths of 10 and 40 inches is 18 to 24 percent. Soil reaction throughout the profile is strongly acid or very strongly acid except where the surface layer has been limed.

Mantachie soils are associated with Jena, Kirkville, and Ochlockonee soils. They are more poorly drained than any of these and have grayish colors nearer the surface.

Ma—Mantachie and Kirkville soils. This undifferentiated group of somewhat poorly drained Mantachie soils and moderately well drained Kirkville soils is on flood plains. Slopes are 0 to 2 percent. Areas range from 25 to 100 acres in size.

Some areas of this unit consists of either soils, but most areas contain both. This Mantachie soil in this unit has the profile described as representative of the Mantachie series. The mapping unit is about 50 percent Mantachie soils and about 20 percent Kirkville soils. The remaining 30 percent is predominantly Ariel soils.

Kirkville soils have a surface layer of dark-brown fine sandy loam 7 inches thick. The subsoil is dark-brown sandy loam 8 inches thick that overlies a silt loam layer with a high content of sand. Light-gray, light brownish-gray, and pale-brown mottles are present. Below a depth of 27 inches, the substratum consists of brown sandy loam with grayish-brown mottles. It is underlain at a depth of 45 inches by mottled light-gray, dark-brown, and dark yellowish-brown loam.

Both of these soils are strongly acid or very strongly acid except where the surface layer has been limed. Permeability is moderate. Available water capacity is medium in Kirkville soils, but high in Mantachie soils. Surface runoff is slow. A seasonal high water table is present during winter and spring. The land is subject to occasional overflow.

These soils can be cropped continuously if good conservation practices are followed. Row arrangement and field ditches are needed to remove excess surface water. Unless the soils are protected, occasional overflow can cause moderate crop damage. Returning crop residues helps prevent crusting and packing.

A large acreage of this unit is in bottom land hardwood forest. The soils are used for crops and pasture where they have been cleared and drained. Cotton, corn, soybeans, most locally grown pasture plants, mixed hardwoods, and pine trees are well suited to this mapping unit. Mantachie part in capability unit IIw-3; Kirkville part in capability unit IIw-1; both in woodland suitability group 1w8.

Oaklimeter Series

The Oaklimeter series consists of moderately well drained soils that formed in recent deposits of loamy material high in silt. Slopes are 0 to 2 percent.

In a representative profile, the surface layer is dark-brown silt loam about 11 inches thick. The subsoil extends to a depth of 65 inches. In sequence from the top, it is yellowish-brown very fine sandy loam; yellowish-brown silt loam mottled in shades of gray and brown; mottled yellowish-brown, pale-brown, and light brownish-gray silt loam; and light brownish-gray silt loam with dark yellowish-brown mottles to a depth of 65 inches.

Representative profile of Oaklimeter silt loam, approximately 1.0 mile southeast of Hickory Flat, Mississippi; 1,800 feet south of U.S. Highway 78 and 200 feet east of drainage canal; SW¼SE¼ sec. 26, T. 5 S., R. 1 E:

Ap—0 to 11 inches, dark-brown (10YR 4/3) silt loam; few fine, faint, pale-brown mottles; weak, fine, granular, structure; very friable; many fine roots; few fine black and brown stains; very strongly acid; abrupt, smooth boundary.

B21—11 to 20 inches, yellowish-brown (10YR 5/4) very fine sandy loam; few fine, faint, pale-brown and light yellowish-brown mottles; weak, medium, subangular blocky structure; very friable; common fine roots; common fine pores; common fine and medium black and brown stains; very strongly acid; gradual, wavy boundary.

B22—20 to 34 inches, yellowish-brown (10YR 5/4) silt loam; common fine and medium, distinct, light brownish-gray (10YR 6/2) and faint, brown (7.5YR 5/4) mottles; weak, medium, subangular blocky structure; very friable; few fine roots; common fine pores; common fine and medium black and brown stains; very strongly acid; gradual, wavy boundary.

B23&A2b—34 to 55 inches, mottled yellowish-brown (10YR 5/4), pale-brown (10YR 6/3), and light brownish-gray (10YR 6/2) silt loam; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; friable; few fine roots; few fine pores and voids; common fine and medium black and brown stains; common pockets of uncoated sand grains; very strongly acid; gradual, wavy boundary.

Btgb—55 to 65 inches, light brownish-gray (10YR 6/2) silt loam; many medium and coarse, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; friable; many medium black and brown stains; few fine pores and voids; few thin clay films in pores, voids, and on faces of some peds; many pockets of gray silt loam between prisms; very strongly acid.

The solum is more than 60 inches thick. Soil reaction throughout the profile is strongly acid or very strongly acid except where the surface layer has been limed. The A horizon is dark grayish-brown, brown, dark-brown or dark yellowish-brown silt, silt loam, loam, or very fine sandy loam. The B21 horizon is brown, dark brown, dark yellowish brown, or yellowish brown. Few to common grayish mottles are present in some profiles. The B22 and B23 horizons have matrix colors similar to those in the B21 horizon, but they have few to many grayish mottles, or the horizon is mottled in shades of brown and gray. Texture is silt loam, loam, or very fine sandy loam. Clay content between depths of 10 and 40 inches is 7 to 18 percent; content of sand coarser than very fine sand is less than 15 percent. The Bg horizon is gray, light gray, light brownish gray, or grayish brown, or it is mottled in shades of brown and gray. Texture is silt loam or silty clay loam. There are few to many black and brown stains and soft concretions.

Oaklimeter soils are associated with Arkabutla, Gillsburg, and Ochlockonee soils. They are better drained than Arkabutla and Gillsburg soils and have gray mottles at a greater depth. They lack the high sand content of Ochlockonee soils.

Oa—Oaklimeter silt loam. This moderately well drained soil is on flood plains throughout Benton County. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Arkabutla, Gillsburg, and Ochlockonee soils.

This soil is strongly acid or very strongly acid. Permeability is moderate. Available water capacity is very high. Runoff is slow, and the erosion hazard is slight. The land is subject to occasional overflow.

This soil can be cropped continuously if good conservation practices are followed. Row arrangement and ditches are needed to remove excess surface water. Unless the soils are protected, occasional flooding causes slight or moderate damage. Returning crop residues helps prevent crusting and packing.

Most of the acreage of this soil is used for row crops where it has been cleared and drained. A considerable acreage is in hardwood forest. Cotton, corn, soybeans, truck crops, locally grown pasture crops, pine trees and hardwood trees are well suited to this soil. Capability unit IIw-2; woodland suitability group 1o7.

Ochlockonee Series

The Ochlockonee series consists of well-drained soils that formed in recent loamy alluvium. Slopes are 0 to 2 percent.

In a representative profile, the surface layer is dark-brown sandy loam 10 inches thick. The substratum is stratified yellowish-brown sandy loam and pale-brown silt loam. An old buried soil is below a depth of 29 inches. It is composed of pale-brown sandy loam over mottled pale-brown and yellowish-brown sandy loam to a depth of 60 inches.

In Benton County, Ochlockonee soils are mapped only in an undifferentiated unit with Jena soils.

Representative profile of Ochlockonee sandy loam, in an area of Jena and Ochlockonee soils; 1 mile southeast of Springhill, 600 feet south of local road, center of NE¼SE¼ sec. 9, T. 2 S., R. 1 E:

Ap—0 to 6 inches, dark-brown (7.5YR 4/4) sandy loam; weak, fine, granular structure; very friable; common fine roots; strongly acid; abrupt, smooth boundary.

A1—6 to 10 inches, dark-brown (7.5YR 4/4) sandy loam; structureless; very friable; common fine roots; very strongly acid; clear, smooth boundary.

C—10 to 29 inches, stratified yellowish-brown (10YR 5/4) sandy loam and pale-brown (10YR 6/3) silt loam; structureless; very friable; silt loam strata ⅛ inch thick, sandy loam strata 1 inch thick; very strongly acid; clear, smooth boundary.

Ab—29 to 46 inches, pale-brown (10YR 6/3) sandy loam; common fine and medium, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; very friable; common fine and medium black and brown stains; very strongly acid; clear, smooth boundary.

Bb—46 to 60 inches, mottled pale-brown (10YR 6/3) and yellowish-brown (10YR 5/6) sandy loam; weak, medium, subangular blocky structure; very friable; common fine and medium black and brown stains; strongly acid.

The Ap horizon is brown, pale-brown, dark-brown, dark yellowish-brown, or grayish-brown sandy loam, loam, or loamy sand. The C horizon is brown, dark brown, strong brown, yellowish brown, or pale brown, or is mottled in shades of brown. Textures are variable within the individual profile; they are silt loam, sandy loam, or loamy sand in stratified layers. In places, gray mottles are below a depth of 24 inches and the soil material is dominantly gray below a depth of 40 inches. In some places, buried horizons are below a depth of 25 inches. Soil reaction throughout the profile is strongly acid or very strongly acid except where the surface layer has been limed.

Ochlockonee soils are associated with Ariel, Jena, Kirkville, Mantachie, and Oaklimeter soils. They contain more sand and less silt throughout than Ariel amd Oaklimeter soils. They lack the structural development in the upper part of the subsoil of Jena soils. They are better drained than Kirkville and Mantachie soils and lack gray mottles in the upper 24 inches.

Providence Series

The Providence series consists of moderately well drained soils that have a fragipan. These soils formed in loamy material high in silt and in the underlying Coastal Plain material. Slopes are 2 to 12 percent.

In a representative profile, the surface layer is brown silt loam about 3 inches thick. The upper part of the subsoil is brown silty clay loam and silt loam. The lower part of the subsoil is a fragipan. Between depths of 22 and 36 inches, it is reddish-brown silt loam with pale-brown mottles; between depths of 36 and 56 inches it is yellowish-red silt loam with brownish and grayish mottles; and between depths of 56 and 80 inches, it is yellowish-red loam.

Representative profile of Providence silt loam, 2 to 5 percent slopes, eroded, 1 mile west of Canaan in a 60-acre pasture 200 feet north of local road, SW¼SW¼SE¼ sec. 1, T. 2 S., R. 1 E:

Ap—0 to 3 inches, brown (7.5 YR 4/4) silt loam; weak, fine, granular structure; very friable; many fine roots; medium acid; abrupt; smooth boundary.

B21t—3 to 10 inches, brown (7.5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; friable; common fine roots; patchy clay films on peds and in root channels; medium acid; gradual, smooth boundary.

B22t—10 to 22 inches, brown (7.5YR 4/4) silt loam; moderate, medium, subangular blocky structure; friable; few fine roots; few fine and medium black and brown stains; patchy clay films; strongly acid; gradual, smooth boundary.

Bx1—22 to 29 inches, reddish-brown (5YR 4/4) silt loam; common fine, distinct, pale-brown (10YR 6/3) mottles; moderate, medium, subangular blocky structure; firm; compact and brittle; few fine pores; few black and brown stains; patchy clay films; strongly acid; gradual, smooth boundary.

Bx2—29 to 36 inches, reddish-brown (5YR 4/4) silt loam; common fine and medium, distinct, pale-brown (10YR 6/3) mottles; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm; compact and brittle; few fine pores; few black and brown stains; pale-brown sandy loam between prisms; patchy clay films; strongly acid; gradual, smooth boundary.

IIBx3—36 to 47 inches, yellowish-red (5YR 4/6) silt loam; common fine and medium, distinct, pale-brown (10YR 6/3) mottles; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm; compact and brittle; common fine pores; few black and brown stains; pale-brown sandy loam between prisms; patchy clay films; strongly acid; gradual, smooth boundary.

IIBx4—47 to 56 inches, yellowish-red (5YR 5/6) silt loam; common fine and medium, distinct, light brownish-gray (10YR 6/2) and pale-brown (10YR 6/3) mottles; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm; compact and brittle; common fine pores; few black and brown stains; pale-brown sandy loam between prisms; patchy clay films; strongly acid; gradual, smooth boundary.

IIBx5—56 to 80 inches, yellowish-red (5YR 5/8) loam; common fine and medium, distinct, light brownish-gray (10YR 6/2) and pale-brown (10YR 6/3) mottles; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm; compact and brittle; common fine pores; few black and brown stains; pale-brown sandy loam between prisms; few black and brown stains; pale-brown sandy loam between prisms; patchy clay films; strongly acid.

The Ap horizon is brown, dark brown, yellowish brown, dark yellowish brown, or reddish brown. The Bt horizon is brown, dark-brown, strong-brown, or reddish-brown silt loam or silty clay loam. Clay content ranges from 21 to 30 percent. Depth to the fragipan ranges from 18 to 30 inches. The Bx horizon is reddish brown, strong brown, dark brown, or yellowish brown and mottled in shades of red, brown, yellow, and gray, or it is mottled in shades of brown, red, and gray. The sand content increases with increasing depth. Depth to the IIBx horizon ranges from 28 to 49 inches. The IIBx horizon is mottled in shades of red, yellow, brown, and gray, or it is reddish brown, yellowish red, strong brown, dark brown, or brown with gray, light brownish-gray, and pale-brown mottles. Textures are silt loam with high sand content, loam, sandy loam, sandy clay loam, or clay loam. Soil reaction throughout the profile is medium acid to very strongly acid.

Providence soils are associated with Grenada, Lexington, Loring, Smithdale, and Sweatman soils. They contain more sand in the lower part of the fragipan than Granada and Loring soils. They are not so well drained as Lexington and Smithdale soils, and they have a fragipan. Smithdale soils are more loamy in the upper part of the B horizon than Providence soils, which are less clayey in the B horizon than Sweatman soils.

PrB2—Providence silt loam, 2 to 5 percent slopes, eroded. This moderately well drained soil is on ridgetops and stream terraces. It has the profile described as representative of the series. In most places the surface layer has been thinned by sheet erosion, and a few rills and shallow gullies are present after heavy rain. These rills and gullies are usually obliterated after each cultivation.

Included with this soil in mapping are small areas of Grenada, Lexington, and Loring soils.

The soil is medium acid to very strongly acid. Permeability in the upper part of the subsoil is moderate, but it is moderately slow in the fragipan. Available water capacity is medium. Runoff is medium, and the erosion hazard is moderate.

This soil can be cropped continuously if good conservation practices that include erosion control are followed. Returning crop residues helps prevent crusting and packing and reduces erosion.

Most of the acreage of this soil is used for row crops and pasture. The remainder is wooded. Cotton, corn, soybeans, truck crops, pasture plants, loblolly and shortleaf pines, and mixed hardwoods are suited to the soil. Capability unit IIe-2; woodland suitability group 3o7.

PrC2—Providence silt loam, 5 to 8 percent slopes, eroded. This moderately well drained soil is on ridgetops and side slopes. It has a surface layer of dark yellowish-brown silt loam about 4 inches thick. The upper part of the subsoil is strong-brown silty clay loam to a depth of about 25 inches. The lower part is a fragipan. Between depths of 25 and 44 inches is dark-brown silt loam that is mottled with shades of gray. Between depths of 44 and 60 inches, the subsoil is reddish-brown loam with grayish mottles. In most places the surface layer has been thinned by erosion, and there are few rills and shallow gullies. These rills and gullies are usually obliterated after each cultivation.

Included with this soil in mapping are small areas of Lexington, Loring, and Smithdale soils, and a few areas of severely eroded soils.

This soil is medium acid to very strongly acid. Permeability is moderate above the fragipan and is moderately slow in the fragipan. Available water capacity is medium. Runoff is rapid, and the erosion hazard is severe.

Cultivated crops can be grown if an adequate conservation system that includes erosion control is used. Returning crop residues helps prevent crusting and packing and reduces erosion.

Most of the acreage of this soil is used for crops and pasture. The remainder is wooded. Cotton, corn, soybeans, truck crops, pasture plants, loblolly and shortleaf pines, and mixed hardwoods are suited to the soil. Capability unit IIIe-2; woodland suitability group 3o7.

PrD2—Providence silt loam, 8 to 12 percent slopes, eroded. This moderately well drained soil is on side slopes. The surface layer and upper part of the subsoil are dark-brown silt loam. The lower part of the subsoil is a fragipan. Between depths of 19 and 41 inches, it is silt loam mottled in shades of brown, yellow, red, and gray. The fragipan below a depth of 41 inches is brown loam. In most places the surface layer has been thinned by sheet erosion, and there are a few rills and shallow gullies after heavy rain. These rills and gullies are usually obliterated after each cultivation.

Included with this soil in mapping are small areas of Lexington and Smithdale soils and a few areas of severely eroded soils.

This soil is medium acid to very strongly acid. Permeability in the upper part of the subsoil is moderate, and it is moderately slow in the fragipan. Available water capacity is medium. Runoff is rapid, and the erosion hazard is very severe.

Because of the very severe hazard of erosion, this soil should be in close-growing crops most of the time. Row crops can be grown part of the time if an adequate system of conservation is used.

Most of the acreage of this soil is wooded or is used for pasture (fig. 5). A small part is cultivated. Most locally grown crops, pasture plants, loblolly and shortleaf pines, and mixed hardwoods are suited to the soil. Capability unit IVe-1; woodland suitability group 3o7.

Smithdale Series

The Smithdale series consists of well-drained soils that formed in loamy material. Slopes are 12 to 45 percent.

In a representative profile, the surface layer is dark grayish-brown fine sandy loam about 3 inches thick. The subsurface layer is brown fine sandy loam about 6 inches thick. The subsoil is about 71 inches thick. In sequence from the top, the upper 8 inches is reddish-brown fine sandy loam, the next 11 inches is red sandy clay loam, and the lower 52 inches is red sandy loam.

Representative profile of Smithdale fine sandy loam, in an area of Smithdale-Lucy-Lexington association, hilly, in a large wooded area 2 miles east of Ashland and one-fourth mile north of State Highway 370; SW¼SW¼NE¼ sec. 7, T. 3 S., R. 2 E:

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) fine sandy loam; few fine, distinct, dark-brown mottles; weak, fine, granular structure; very friable; many fine roots; few fine black and brown stains; very strongly acid; clear, smooth boundary.

A2—3 to 9 inches, brown (7.5YR 5/4) fine sandy loam; weak, fine, granular structure; very friable; common fine roots; very strongly acid; clear, smooth boundary.

B1—9 to 17 inches, reddish-brown (5YR 5/4) fine sandy loam; weak,

***Figure 5.*—Pasture on Providence silt loam, 8 to 12 percent slopes, eroded. Pond in background furnishes water for livestock, fishing, and recreation.**

fine and medium, subangular blocky structure; very friable; few fine roots; very strongly acid; clear, smooth boundary.

B21t—17 to 28 inches, red (2.5YR 4/6) sandy clay loam; few fine, faint, pale-brown mottles; moderate, fine and medium, subangular blocky structure; friable; few fine roots; thin clay film on peds; very strongly acid; clear, smooth boundary.

B22t—28 to 41 inches, red (2.5YR 4/6) sandy loam; few fine, faint, pale-brown mottles; weak, fine and medium, subangular blocky structure; friable; thin clay films on peds; very strongly acid; clear, smooth boundary.

B23t—41 to 65 inches, red (2.5YR 4/6) sandy loam; weak, fine and medium, subangular blocky structure; very friable; few uncoated sand grains; patchy clay films and oxide coatings on peds; very strongly acid; clear, smooth boundary.

B24t—65 to 80 inches, red (2.5 4/6) sandy loam; weak, fine and medium, subangular blocky structure; very friable; oxide coatings on peds and clay bridging sand grains; very strongly acid.

The A1 horizon is dark grayish brown, grayish brown, brown, or pale brown. The A2 and B1 horizons are pale-brown, brown, reddish-brown, or yellowish-brown fine sandy loam, sandy loam, or loam. The upper part of the Bt horizon is yellowish-red or red loam, clay loam, or sandy clay loam. The lower part has similar colors, but texture is loam or sandy loam. Soil reaction throughout the profile is strongly acid or very strongly acid except where the surface layer has been limed.

Smithdale soils are associated with Lexington, Lucy, Providence, and Sweatman soils. They are redder and contain less silt than the Lexington and Providence soils and lack the fragipan that is present in Providence soils. They have less sandy A horizons than the Lucy soils. They have less clay in the B horizons than Sweatman soils.

SdF2—Smithdale-Lexington complex, 12 to 17 percent slopes, eroded. This complex of well-drained Smithdale and Lexington soils is on rolling uplands with narrow ridgetops and short drainageways. Areas of this mapping unit range from 40 to 100 acres in size. Areas of exposed subsoil, rills, and shallow gullies are common. There are deep gullies in places.

The two dominant soils plus one or more minor soils are present in each mapped area. The mapping unit is 44 percent Smithdale soils and 37 percent Lexington soils. The remaining 19 percent is Providence soils, Lucy soils, and Ochlockonee soils in narrow alluvial areas.

Smithdale soils are on side slopes. They have a surface layer of pale-brown fine sandy loam 7 inches thick. The subsoil is yellowish-red sandy clay loam between depths of 7 and 22 inches, yellowish-red sandy loam between depths of 22 and 56 inches, and red sandy loam below a depth of 56 inches. These soils are strongly acid or very strongly acid. Permeability is moderate. Available water capacity is medium. Runoff is rapid.

Lexington soils are on ridgetops. They have a surface layer of brown silt loam about 4 inches thick. The subsoil is strong-brown silt loam to a depth of 34 inches and brown loam grading to sandy loam below a depth of 34 inches. The soils are strongly acid or very strongly acid. Permeability is moderate. Available water capacity is very high. Runoff is rapid.

Most of the acreage of this association is in mixed pine and hardwood forest. Steepness of slope and the erosion hazard make the soils unsuitable for crops and limit their use as pasture. Loblolly pine and shortleaf pine are suited to these soils. Capability unit VIe-1; woodland suitability group 3o1.

SLF—Smithdale-Lucy-Lexington association, hilly. This association consists of well-drained soils on rough, hilly, and steep uplands. Slopes range from 17 to 45 percent. The least sloping parts of this association are narrow, winding ridgetops. The steep soils on side slopes are commonly broken by short drainageways. The composition of this unit is more variable than that of most others in the county, but composition has been controlled well enough to interpret for the expected use of the soils. Mapped areas cover about 2,000 acres each.

This mapping unit is about 29 percent Smithdale soils, 24 percent Lucy soils, and 22 percent Lexington soils. The remaining 25 percent is Providence soils, Sweatman soils, and Ochlockonee soils in narrow alluvial areas.

Smithdale soils, on steep side slopes, formed in beds of loamy material. They have the profile described as representative of the Smithdale series. They are strongly acid or very strongly acid. Permeability is moderate. Available water capacity is medium. Runoff is rapid. The erosion hazard is severe.

Lucy soils are steeper in all positions on the landscape. They have the profile described as representative of the Lucy series. They are very strongly acid. Permeability is rapid in the upper part of the soil and moderate in the lower part. Available water capacity is low in the upper part but increases to medium with depth. Runoff is medium, and the erosion hazard is severe.

Lexington soils are on ridgetops and upper side slopes. They formed in beds of loamy material high in silt. The surface layer is mottled brown and yellowish-brown silt loam 4 inches thick. The subsoil between depths of 4 and 30 inches is yellowish-red silt loam that grades to dark brown. Between depths of 30 and 51 inches, it is yellowish-red loam, and below a depth of 51 inches it is reddish-brown and light reddish-brown clay loam. They are strongly acid or very strongly acid. Permeability is moderate. Available water capacity is very high. Runoff is rapid, and the erosion hazard is severe.

The soils in this mapping unit are largely used for woodland because the steepness of slope and the severe erosion hazard limit their use for crops. A small acreage is in pasture. Loblolly pine, shortleaf pine, and adapted hardwood species are better suited than crops to this mapping unit. Capability unit VIIe-1; Smithdale part in woodland suitability group 301; Lucy part in woodland suitability group 3s2; Lexington part in woodland suitability group 3o7.

Sweatman Series

The Sweatman series consists of well-drained soils that formed in clayey materials. Slopes are 17 to 45 percent.

In a representative profile, the surface layer is mixed very dark grayish-brown and brown silt loam about 3 inches thick. The subsurface layer is a mixture of brown and yellowish-red silt loam about 2 inches thick. The upper 23 inches of the subsoil is red clay with shale fragments in the lower part. The lower part of the subsoil is red clay loam with shale fragments to a depth of 37 inches. The substratum is dark-red clay loam with thin layers of light-gray and brownish-yellow weathered shale to a depth of 47 inches and stratified light-gray and red clay loam to a depth of 65 inches.

Representative profile of Sweatman silt loam, in an area of Sweatman-Smithdale association, hilly, 1 mile north of Hickory Flat and approximately 200 feet east of State Highway 5, NE¼NE¼NE¼ sec. 22, T. 5 S., R. 1 E:

O1—1 to 0 inch, partially decayed hardwood leaf litter.

A1—0 to 3 inches, mixed very dark grayish-brown (10YR 3/2) and brown (10YR 5/3) silt loam; weak, fine, granular structure; very friable; many fine roots; strongly acid; abrupt, smooth boundary.

A2—3 to 5 inches, mixed brown (10YR 5/3) and yellowish-red (5YR 5/6) silt loam; weak, fine, granular structure; friable; many fine roots; strongly acid; clear, wavy boundary.

B21t—5 to 18 inches, red (2.5YR 4/6) clay; moderate; fine and medium, subangular and angular blocky structure; plastic; few fine roots and root holes; patchy clay films; very strongly acid; clear, wavy boundary.

B22t—18 to 28 inches, red (2.5YR 4/6) clay with very thin strata of light brownish-gray and pale-brown partially weathered shale and feldspar; moderate, fine and medium, angular and subangular blocky structure; slightly plastic; few fine roots; patchy clay films; very strongly acid; clear, wavy boundary.

B23t—28 to 37 inches, red (2.5YR 4/6) clay loam stratified with light-gray and very pale brown weathered shale and feldspar; moderate, fine and medium, angular and subangular blocky structure; friable; patchy clay films; very strongly acid; clear, wavy boundary.

C1—37 to 47 inches, dark-red (2.5YR 3/6) clay loam with thin strata of light-gray and brownish-yellow shaly material; platy structure; friable; very strongly acid; clear, wavy boundary.

C2—47 to 65 inches, stratified light-gray (10YR 7/2) and red (2.5YR 4/6) clay loam; platy structure; friable; many fine mica flakes; very strongly acid; clear, wavy boundary.

The A1 horizon is mixed dark grayish-brown, very dark grayish-brown, or brown. The A2 horizon is mixed in shades of brown, yellow, and red. The B2t horizon is red or yellowish-red clay, silty clay, silty clay loam, or clay loam. The C horizons are stratified materials with weathered fragments of shale and feldspar. Mica is common in most profiles. Soil reaction is strongly acid or very strongly acid.

Sweatman soils are associated with Lexington, Providence, and Smithdale soils. They are redder and finer textured in the B horizon than Lexington soils. They lack the fragipan of Providence soils. They contain more clay and silt in the B horizon than Smithdale soils.

SSF—Sweatman-Smithdale association, hilly. This association consists of well-drained soils on hilly uplands. Slope ranges from 17 to 45 percent. The least sloping parts of this association are on narrow, winding ridgetops. The steep soils on side slopes are broken by many short drainageways. Mapped areas make up about 2,000 acres each.

The composition of this mapping unit is more variable than some others in the county, but composition has been controlled well enough to interpret for the expected uses of the soils. The association is about 32 percent Sweatman soils and about 28 percent Smithdale soils. The remaining 40 percent is well-drained soils in narrow drainageways and well-drained and moderately well drained Lexington and Providence soils on narrow ridgetops.

The clayey Sweatman soils are on the middle and upper side slopes. They have the profile described as representative of the Sweatman series. They are strongly acid or very strongly acid. Permeability is moderately slow. Available water capacity is high. Runoff is rapid, and the erosion hazard is severe.

Smithdale soils are on ridgetops and upper side slopes. They have a surface layer of thin brown fine sandy loam that overlies a subsurface layer of yellowish-brown sandy loam. The subsoil between depths of 5 and 12 inches is red sandy clay loam. It grades to yellowish-red clay loam, strongly acid or very strongly acid. Permeability is moderate. Available water capacity is medium. Runoff is rapid, and the erosion hazard is severe.

The acreage of this mapping unit is mostly wooded.

These soils are better suited to trees than to crops because of the steepness of slope and the severe erosion hazard. Loblolly pine and shortleaf pine trees are suited to this mapping unit. Sweatman part in capability unit VIIe-2; woodland suitability group 3c2. Smithdale part in capability unit VIIe-1; woodland suitability group 3o1.

Udorthents

Udorthents consist of soils on surfaces exposed by recent gully erosion. Only small areas of the original soil remain between the gullies. Slopes are 5 to 25 percent.

The gullies range from 2 to 30 feet deep, and the soil material washed from them ranges from loamy to sandy.

UdF3—Udorthents-Lexington complex, 5 to 25 percent slopes, severely eroded. This complex consists mainly of areas of soils that have been altered or destroyed by gully erosion. The intricate gully patterns imprinted on the original soil patterns make separation of each gully system or soil with any degree of accuracy impractical. The mapping unit is approximately 56 percent Udorthents and 25 percent Lexington soils.

Udorthents are largely on side slopes; however, many fingers extend back into the ridgetops. Lexington soils are on ridgetops. The two dominant soils plus one or more minor soils are in each mapped area.

Included with these soils in mapping are lesser amounts of Providence, Lucy, and Smithdale soils. Providence soils are on ridgetops, and Lucy and Smithdale soils are on side slopes.

Udorthents are in gullies that are wide and shallow on smooth slopes and deep and narrow on steeper slopes. They consist of soils which have been so severely eroded that soil horizons cannot be identified. These soils are variable in texture. They are strongly acid or very strongly acid. Permeability is variable. Available water capacity is medium. Runoff is very rapid.

The well-drained Lexington soils have a surface layer of brown silt loam 8 inches thick. In sequence from the top, the subsoil is 27 inches of strong-brown silty clay loam, 5 inches of brown silt loam, 10 inches of brown sandy loam, and 16 inches of dark-brown sandy clay loam. The substratum consists of stratified layers of reddish-brown sandy loam and reddish sand. These soils are strongly acid or very strongly acid. Permeability is moderate. Available water capacity is very high. Runoff is rapid, and the erosion hazard is severe.

Most of the acreage of this unit has reverted to or has been planted to pine trees. The remainder is idle or used for pasture. The Lexington part of this unit is well suited to pine trees. Udorthents, in gullied areas, are suited to pine trees, but production varies. Onsite investigations are needed to make accurate recommendations; therefore, a woodland suitability group is not assigned. Capability unit VIIe-3; woodland suitability group not assigned.

Use and Management of Soils

The use and management of soils for crops, pasture, woodland, wildlife, engineering, and town and country planning are discussed in this section. The capability classification system is explained, and the estimated yields of the principal crops grown in the county are given.

This section also contains tables rating the suitability of the soils for woodland, wildlife, various engineering purposes, and town and country planning.

Management of Soils for Crops and Pasture [2]

Approximately 37 percent of the acreage in Benton County is used for crops and pasture. Major crops are cotton, soybeans, corn, and grain sorghum. Vegetables for commercial freezing and canning are grown in some areas. A considerable acreage is used for livestock production.

Erosion, drainage, and fertility are the main problems in managing soils for crops and pasture.

Most crops require a complete fertilizer, one that includes nitrogen, phosphorus, and potash. Lime is needed for certain plants. General information on the kinds and amounts of fertilizer needed can be obtained either from a local representative of the Soil Conservation Service or from the county agent. More exact information can be obtained from a soil test.

Erosion is a hazard in most upland areas. The degree of hazard depends on the steepness of slope; the texture, structure and permeability of the soil; and on the amount and effectiveness of vegetative cover. Water erosion can be controlled by use of close-growing crops, terraces, contour stripcropping, and row arrangement with vegetated outlets and grassed waterways, crop residue management, minimum tillage, and water-control structures where needed.

Even where primary drainage and protection from overflow (fig. 6) are provided for flood plain soils, removal of excess surface water is usually necessary for greatest return. This can best be accomplished by smoothing and filling in potholes and by using properly run rows emptying into v-shaped or w-shaped ditches that drain into adequate field laterals. Diversion ditches are effective in intercepting runoff from adjacent uplands.

More detailed information is provided in the description of each mapping unit in the section "Descriptions of the Soils." A nationwide system of classification is used for rating the suitability of the soils for crops. This system is explained in the following paragraphs.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with capability classification can infer from it much about the behavior of soils when used for

[2] W. M. LIPE, conservation agronomist, Soil Conservation Service, helped prepare this section.

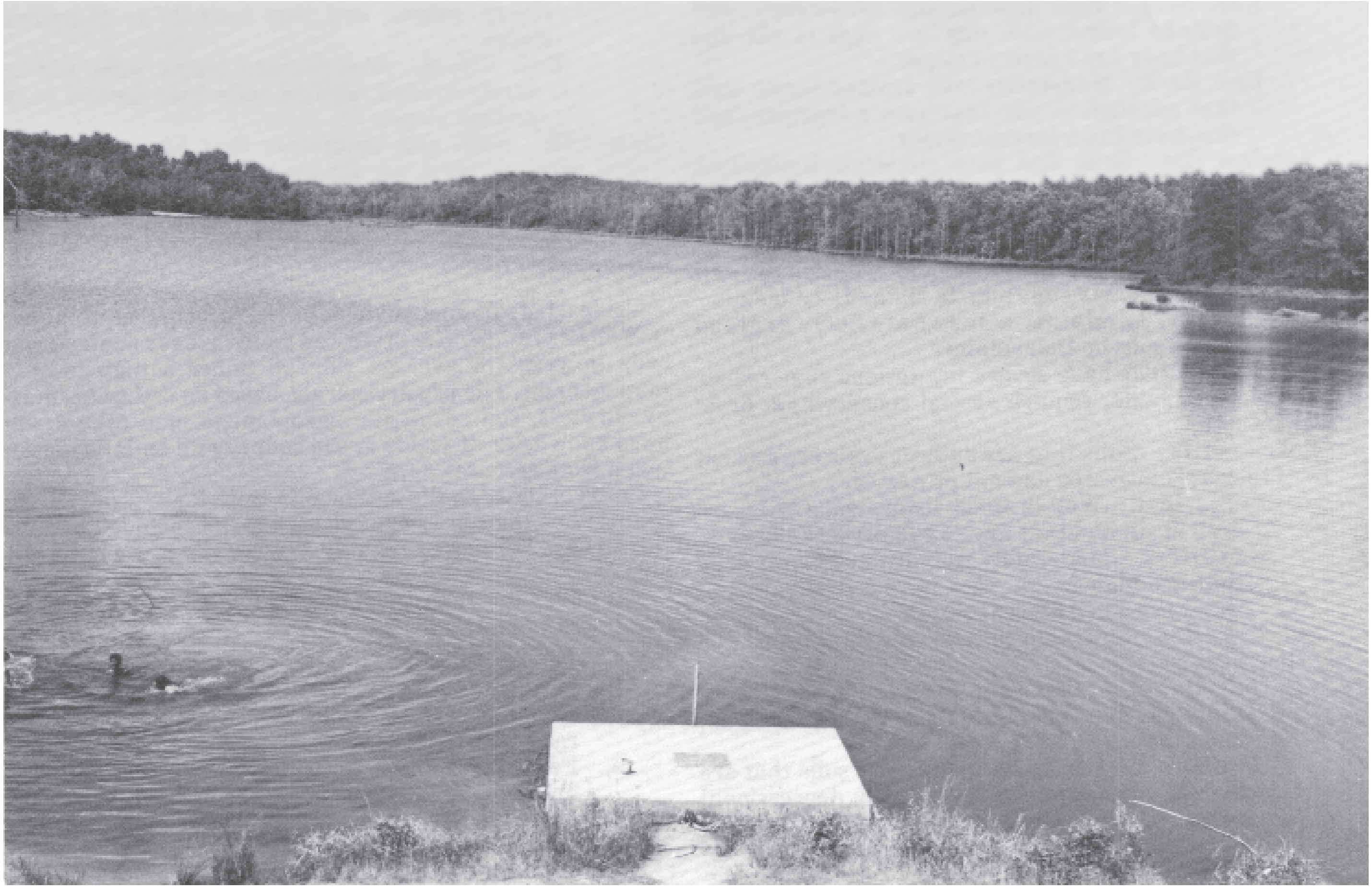

***Figure 6.*—Floodwater-retarding structure provides a recreation area as well as protection for agricultural land downstream. The trees in the background are in an area of Smithdale-Lucy-Lexington association, hilly.**

other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, forest trees, or engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are 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 designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

The following list describes the capability units, classes, and subclasses in Benton County.

Class I. Soils that have few limitations that restrict their use. (None in Benton County)

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

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

Unit IIe-1. Well drained and moderately well drained loamy soils that are high in silt and that have 2 to 5 percent slopes.

Unit IIe-2. Moderately well drained loamy soils that are high in silt, that have a fragipan, and that have 2 to 5 percent slopes.

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

Unit IIw-1. Well drained and moderately well drained loamy soils on flood plains.

Unit IIw-2. Well drained and moderately well drained loamy soils high in silt on flood plains.

Unit IIw-3. Mainly somewhat poorly drained loamy soils on flood plains.

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

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

Unit IIIe-1. Well-drained loamy soils that are high in silt and that have 5 to 8 percent slopes.

Unit IIIe-2. Moderately well drained loamy soils that are high in silt, that have a fragipan, and that have 5 to 8 percent slopes.

Subclass IIIw. Soils that have severe limitations due to excess water.

Unit IIIw-1. Somewhat poorly drained loamy soils that are high in silt, that have a fragipan, and that have 0 to 2 percent slopes.

Unit IIIw-2. Poorly drained loamy soils that are high in silt on upland flats and in depressional areas.

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

Subclass IVe. Soils that are subject to severe erosion if cultivated and not protected.

Unit IVe-1. Moderately well drained loamy soils that are high in silt, that have a fragipan, and that have 8 to 12 percent slopes.

Class V. Soils that are subject to little or no erosion but that have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover. (None in Benton County)

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

Subclass VIe. Soils that are severely limited, chiefly by risk of erosion, unless protective cover is maintained.

Unit VIe-1. Well-drained loamy soils that have 12 to 17 percent slopes.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation and that restrict their use largely to pasture, woodland, or wildlife food and cover.

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

Unit VIIe-1. Well-drained loamy soils that have 17 to 45 percent slopes.

Unit VIIe-2. Well-drained soils that have a clayey subsoil and that have 17 to 45 percent slopes.

Unit VIIe-3. Well-drained loamy soils and severely eroded, gullied soils that have 5 to 25 percent slopes.

Class VIII. Soils and landforms that have limitations that preclude their use for commercial plants and that restrict their use to recreation, wildlife, water supply, or esthetic purposes. (None in Benton County.)

Estimated yields [3]

Table 2 lists predicted yields of the principal crops grown in Benton County. The predicted yields are for nonirrigated soils in years of average rainfall under a high level of management. The predictions are based on estimates made by farmers, soil scientists, agronomists, and others who have knowledge of yields in the county and on information taken from research data.

Crops other than those shown in table 2 are grown in the county, but their predicted yields are not included because the acreage is small or reliable data on yields are not available.

The following management practices were assumed in making the estimates:

1. Effective use of rainfall.
2. Drainage or erosion control as needed.
3. Adapted crop varieties at recommended seeding rates.
4. Fertilizer applied according to soil test and crop needs.
5. Insect, disease, and weed control.
6. Minimum, but timely, tillage.
7. Crop residue management to maintain soil tilth.

Use of Soils for Woodland [4]

This section contains information concerning the influence that soils exert on the growth of trees. It can be used by woodland owners and operators, together with foresters and agricultural workers, as they develop and carry out plans for profitable tree farming.

The county has a total land area of 263,680 acres, of which 51,364 acres are National Forest and other public lands. Approximately 63 percent of the total area is classified as commercial forest. In 1967 growing stock was 40.0 million cubic feet of pine and 106.9 million cubic feet of hardwood. In 1967 sawtimber volume totaled 401.8 million board feet, of which 135.1 million board feet was pine and 266.7 million board feet was hardwood.

Soil and tree relationships

In addition to being a reservoir for moisture for a tree, soil provides all the essential elements required for growth except those derived from the atmosphere. Soil also provides the medium in which a tree is anchored. The many characteristics of soil such as chemical composition, texture, structure, depth, and position affect the growth of a tree to the extent to which the soils affect the supply of

[3] W. M. LIPE, conservation agronomist, Soil Conservation Service, helped prepare this section.

[4] T. M. NORTON, forester, helped prepare this section.

moisture and nutrients. A number of studies have shown strong correlations between productivity of site, or growth of trees, and various soil characteristics. The water- and nutrient-supplying ability of a soil is strongly related to its texture and structure, as well as to its depth. Coarse-textured soils, the sands, are low in nutrient content and in available water capacity. Fine-textured soils, the clays, may be high in nutrient content and have high available water capacity. However, aeration is impeded in heavy clays, particularly under wet conditions, so metabolic processes requiring oxygen in the roots are inhibited. In clay soils, percolation of water into the soil and soil aeration are favored by aggregated soil particles. Silvicultural practices to prevent the destruction of organic matter and the compaction of soil provide for better conditions of soil moisture and aeration.

Forest types

Stands of trees that cover a considerable area are classified as forest types according to the kinds and proportion of trees composing such stands.

Following is a list of forest types in Benton County, mainly in natural stands, and acreages occupied by each.

Forest Types	*Acres*
Hardwood Types:	
Oak-Hickory	66,300
Bottom land Hardwood [1]	13,900
Total	80,200
Softwood Types:	
Loblolly-Shortleaf Pine [2]	38,500
Oak-Pine	48,300
Total	86,800

[1] Includes oak-gum-cypress and elm-ash-cottonwood types.
[2] Includes mainly shortleaf pine which predominantly is almost pure natural stands. Loblolly pine is virtually absent in natural stands, but is planted pure in most plantations.

In 1966 softwood sawtimber net annual growth was 21.3 million board feet, while the cut was 15.5 million board feet. The hardwood sawtimber net annual growth was 12.2 million board feet, while the cut was 9.5 million board feet (*11*).

Woodland suitability groups

The soils of Benton County have been rated on the basis of their performance when used to produce wood crops. The ratings are based on actual tree measurements and on soils information collected by teams of soil scientists and foresters and further supported by published data and research information. This information is useful in managing timber on a particular soil. In table 3, the soils in each woodland suitability group are rated for woodland use and management.

The first column in table 3 gives the woodland suitability groups in the county and the soils in each group. Each group is made up of soils that are suited to the same kinds of trees, that need about the same kind of management to

TABLE 2.—*Estimated average yields per acre of principal crops under a high level of management*

[Dashes indicate the crop is not commonly grown or the soil is not suitable]

Soil	Cotton (lint)	Corn	Soybeans	Pasture: Coastal bermudagrass and legume	Pasture: Common bermudagrass and legume	Pasture: Fescue and legume
	Lbs	*Bu*	*Bu*	*AUM* [1]	*AUM*	*AUM*
Ariel silt loam	800	95	40	11.0	9.0	10.0
Arkabutla silt loam	700	85	35	11.0	9.0	10.0
Calhoun silt loam	400	----	25	7.0	5.5	7.5
Calloway silt loam, 0 to 2 percent slopes	650	85	30	9.5	6.5	8.0
Gillsburg silt loam	700	90	35	11.0	9.0	10.0
Grenada silt loam, 2 to 5 percent slopes	600	85	35	9.5	6.5	8.5
Grenada silt loam, 5 to 8 percent slopes, eroded	550	75	30	8.5	6.0	8.0
Jena and Ochlockonee soils	750	85	35	11.0	7.0	10.0
Kirkville fine sandy loam	700	85	35	11.0	8.0	10.5
Lexington silt loam, 2 to 5 percent slopes, eroded	750	85	35	10.0	7.5	9.0
Lexington silt loam, 5 to 8 percent slopes, eroded	600	80	30	9.0	7.0	8.0
Loring silt loam, 2 to 5 percent slopes	700	85	30	10.0	7.0	9.0
Mantachie and Kirkville soils	650	85	35	10.0	9.0	10.0
Oaklimeter silt loam	750	95	40	11.0	9.0	10.0
Providence silt loam, 2 to 5 percent slopes, eroded	650	75	35	10.0	7.0	9.0
Providence silt loam, 5 to 8 percent slopes, eroded	600	70	30	9.0	6.5	8.0
Providence silt loam, 8 to 12 percent slopes, eroded	500	55	25	8.5	6.0	7.0
Smithdale-Lexington complex, 12 to 17 percent slopes, eroded	----	----	----	8.0	5.0	----
Smithdale-Lucy-Lexington association, hilly	----	----	----	----	----	----
Sweatman-Smithdale association, hilly	----	----	----	----	----	----
Udorthents-Lexington complex, 5 to 25 percent slopes, severely eroded	----	----	----	----	----	----

[1] Animal-unit-months. This refers to the amount of forage or feed required to maintain one animal unit (1 cow, 1 horse, 1 mule, 5 sheep, or 5 goats) for a period of 30 days.

TABLE 3.—*Soil ratings for woodland use*

Woodland suitability group and map symbols	Potential productivity		Management concerns			Species suitable for planting
	Tree species	Average site class	Erosion hazard	Equipment restrictions	Seedling mortality	
Group 1o7: Moderately well drained and well drained soils on flood plains. Permeability is moderate to moderately slow. Available water capacity is medium to very high. Ar, Je, Oa.	Green and white ash Eastern cottonwood Cherrybark oak Nuttall oak Water oak Loblolly pine Sweetgum	90 100 100 100 100 90 100	Slight	Slight	Slight	Green ash, eastern cottonwood, cherrybark oak, Nuttall oak, loblolly pine, sweetgum, sycamore, and yellow-poplar.
Group 1w8: Somewhat poorly drained and moderately well drained soils on flood plains. Permeability is moderate to moderately slow. Available water capacity is medium to very high. At, Gb, Kr, Ma.	Green and white ash Eastern cottonwood Cherrybark oak Water oak Loblolly pine Sweetgum	90 110 110 100 90 100	Slight	Moderate	Slight to moderate.	Green ash, eastern cottonwood, cherrybark oak, loblolly pine, sweetgum, yellow-poplar.
Group 2w8: Somewhat poorly drained soils. Permeability is moderate in upper part but slow in the fragipan. Available water capacity is medium. CwA.	Green and white ash Cherrybark oak Water oak Willow oak Loblolly pine Sweetgum	70 90 90 90 90 90	Slight	Moderate	Slight to moderate.	Cherrybark oak, Shumard oak, chestnut oak, loblolly pine, shortleaf pine, yellow-poplar.
Group 3c2: Well-drained soils. Permeability is moderately slow. Available water capacity is high. SSF (Sweatman part). For Smithdale part, refer to Group 3o1.	Loblolly pine Shortleaf pine	80 70	Slight	Moderate	Slight to moderate.	Loblolly pine, shortleaf pine.
Group 3o1: Well-drained soils. Permeability is moderate. Available water capacity is medium. SdF2, SLF (Smithdale part); SSF (Smithdale part). For Lexington part of SLF refer to Group 3o7. For Lucy part of SLF, refer to Group 3s2.	Loblolly pine Shortleaf pine	80 70	Slight	Slight	Slight	Loblolly pine, shortleaf pine, slash pine.
Group 3o7: Well drained and moderately well drained soils. Permeability is moderate in the upper part but slow to moderately slow in the lower part where a fragipan is present. Available water capacity is medium to very high. GrB, GrC2, LeB2, LeC2, LoB, PrB2, PrC2, PrD2, SLF (Lexington part). For Smithdale and Lucy parts of SLF, refer to Groups 3o1 and 3s2, respectively.	Cherrybark oak Southern red oak White oak Loblolly pine Shortleaf pine Sweetgum	90 80 80 80 70 80	Slight	Slight	Slight	Cherrybark oak, Shumard oak, swamp chestnut oak, water oak, white oak, loblolly pine, shortleaf pine, sweetgum, yellow-poplar.
Group 3s2: Well-drained soils. Permeability is rapid in upper part but moderate in the lower part. Available water capacity is low in the upper part but medium in the lower part. SLF (Lucy part). For Smithdale and Lexington parts, refer to groups 3o1 and 307, respectively.	Loblolly pine Shortleaf pine	80+ 70+	Slight	Moderate	Moderate	Loblolly pine, shortleaf pine, slash pine.
Group 3w9: Poorly drained soils. Permeability is slow. Available water capacity is very high. Ca.	Cherrybark oak Nuttall oak Water oak Willow oak Loblolly pine Shortleaf pine Sweetgum	80 70 80 70 80 70 80	Slight	Severe	Moderate (severe in depressions).	Cherrybark oak, Shumard oak, loblolly pine, sweetgum.

produce these trees, and that have about the same potential productivity. Each woodland suitability group is identified by a three-part symbol.

The first part of the symbol indicates the relative productivity of the soils: 1 is very high, 2 is high, and 3 is moderately high.

The second part of the symbol, a letter, indicates the important soil property that imposes a moderate or severe hazard or limitation in managing the soils for wood production. The letter *w* shows that excessive water in or on the soil is the chief limitation; *c* shows that clay in the upper part of the soil is a limitation; *s* shows the soils are sandy; and *o* shows the soils have no significant restrictions or limitations for woodland use or management.

The third element in the symbol indicates the degree of management concerns and the general suitability of the soils for certain kinds of trees (*6*, *7*). The numeral 1 indicates soils with no to slight management concerns, and they are better suited to needleleaf trees than to others. The numeral 2 indicates soils with one or more moderate management concerns, and they are better suited to needleleaf trees than to others. The numeral 7 indicates soils with no to slight management concerns, and they are suitable for either needleleaf or broadleaf trees. The numeral 8 indicates soils with one or more moderate management concerns, and they are suitable for either needleleaf or broadleaf trees. The numeral 9 indicates soils with one or more severe management concerns, and they are suitable for either needleleaf or broadleaf trees.

The first column also gives a brief description of the soil in each woodland suitability group, including such characteristics as soil drainage, permeability, and broad textural groups.

Also in the first column, the soils in each group are listed by their mapping unit symbols. If a mapping unit is made up of soils of more than one series, each component soil is evaluated separately under the woodland suitability group in which it has been placed.

In the second column is a list of some of the commercially important trees which are adapted to the soil. These are the trees which woodland managers generally favor in intermediate or improvement cuttings. Also given is the potential productivity of these trees in terms of site class. The site class is the average height of dominant trees, in feet, at age 30 for cottonwood; at age 35 for sycamore; at age 25 for planted pines; and at age 50 for all other species or types.

The management concerns evaluated in the next three columns are erosion hazard, equipment restrictions, and seedling mortality. Erosion hazard measures the risk of soil losses in well-managed woodland. Erosion hazard is *slight* if expected soil loss is small, *moderate* if some measures to control erosion are needed in logging and construction, and *severe* if intensive treatment or special equipment and methods are needed to prevent excessive soil losses.

Equipment restriction ratings reflect the soil conditions that restrict the use of equipment normally used in woodland management or harvesting. *Slight* ratings indicate equipment use is not limited to kind or time of year. A rating of *moderate* indicates a seasonal limitation or need for modification in methods or equipment. *Severe* limitations indicate the need for specialized equipment or operations.

Seedling mortality ratings indicate the degree of expected mortality of planted seedlings when plant competition is not a limiting factor. Normal rainfall, good planting stock, and proper planting are assumed. A *slight* rating indicates expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, over 50 percent.

In the last column is a list of trees suitable to plant for commercial wood production.

Use of Soils for Wildlife [5]

Soils directly influence kinds and amounts of vegetation and amounts of water available, and in this way indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect the growth of wildlife habitat are thickness of soil useful to crops, surface texture, available water capacity to a depth of 40 inches, wetness, surface stoniness or rockiness, flood hazard, slope, and permeability of the soil to air and water.

In table 4 soils of this survey area are rated for producing six elements of wildlife habitat and for three groups, or kinds, of wildlife. The ratings indicate relative suitability for various elements. A rating of good means the element of wildlife habitat and habitats generally are easily created, improved, and maintained. Few or no limitations affect management, and satisfactory results are expected when the soil is used for the prescribed purpose.

A rating of fair means the element of wildlife habitat and habitats can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention may be required for satisfactory results, however.

A rating of poor means the element of wildlife habitat faces rather severe limitations for the designated use. Habitats can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

A rating of very poor means the element of wildlife habitat faces very severe limitations and that unsatisfactory results are to be expected. It is either impossible or impractical to create, improve, or maintain habitats on soils in this category.

The significance of each subheading in table 4 under "Elements of Wildlife Habitat" and "Kinds of Wildlife" is given in the following paragraphs.

Elements of wildlife habitat.—Each soil is rated in table 4 according to its suitability for producing various kinds of plants and other elements that make up wildlife habitats. The ratings take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account climate, present use of soils, or present distribution of wildlife and people. For this reason, selection of a site for development as a habitat for wildlife requires inspection at the site.

Grain and seed crops.—These crops are annual grain-producing plants, such as corn, sorghum, wheat, millet, and soybeans.

Grasses and legumes.—This group consists of domestic grasses and legumes that are established by planting. They provide food and cover for wildlife. Grasses include bahia-

[5] E. D. NORWOOD, biologist, Soil Conservation Service, helped prepare this section.

TABLE 4.—*Suitability of soils for elements of wildlife habitat and for kinds of wildlife*

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow-water areas	Openland	Woodland	Wetland
Ariel: Ar	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Arkabutla: At	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Calhoun: Ca	Poor	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Calloway: CwA	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Gillsburg: Gb	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Grenada:									
GrB	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
GrC2	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Jena: Je. For Ochlockonee part, refer to Ochlockonee series.	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Kirkville: Kr	Fair	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Lexington:									
LeB2	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
LeC2	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Loring: LoB	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Lucy. Mapped only in association with Smithdale and Lexington soils.	Very poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Mantachie: Ma. For Kirkville part, refer to Kirkville series.	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Oaklimeter: Oa	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ochlockonee. Mapped only in an undifferentiated unit with Jena soils.	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Providence:									
PrB2	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
PrC2, PrD2	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Smithdale: SdF2, SLF. For Lexington parts of SdF2 and SLF, refer to Lexington series. For Lucy part of SLF, refer to Lucy series.	Very poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Sweatman: SSF. For Smithdale part, refer to Smithdale series.	Very poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Udorthents: UdF3. For Lexington part, refer to Lexington series. No reliable estimates can be made for Udorthents.									

grass, ryegrass, and panicgrass; legumes include annual lespedeza, shrub lespedeza, and other clovers.

Wild herbaceous plants.—This group consists of native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Beggarweed, perennial lespedeza, wild bean, pokeweed, and cheatgrass are typical examples.

Hardwood trees.—These plants are nonconiferous trees that produce wildlife food in the form of fruits, nuts, buds, catkins, or browse. Such plants commonly grow in their natural environment, but they may be planted and developed through wildlife management programs. Typical species in this category are oak, beech, cherry, dogwood, and maple.

Wetland plants.—This group consists of annual and perennial herbaceous plants that grow wild on moist and wet sites. They furnish food and cover mostly for wetland wildlife. Typical examples of plants are smartweed, wild millet, spikerush and other rushes, sedges, burreed, tearthumb, and aneilema. Submerged and floating aquatics are not included in this category.

Shallow-water areas.—These developments are impoundments or excavations for controlling water, generally not more than 5 feet deep, to create habitats that are suitable for waterfowl. Some are designed to be drained, planted, and then flooded; others are permanent impoundments that grow submersed aquatics.

Kinds of wildlife. Table 4 rates soils according to their suitability as habitat for the three kinds of wildlife in the county—openland, woodland, and wetland wildlife. These ratings are related to ratings made for the elements of habitat. For example, soils rated unsuited for shallow water developments are rated unsuited for wetland wildlife.

Openland wildlife.—Birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, doves, meadowlarks, field sparrows, cottontail rabbits, and foxes are typical examples of openland wildlife.

Woodland wildlife.—Birds and mammals that normally live in wooded areas of hardwood trees, coniferous trees, and shrubs. Woodcocks, thrushes, wild turkeys, vireos, deer, squirrels, and raccoons are typical examples of woodland wildlife.

Wetland wildlife.—Birds and mammals that normally live in wet areas, marshes, and swamps. Ducks, geese, rails, shore birds, herons, minks, and muskrats are typical examples of wetland wildlife.

Engineering Uses of Soils [6]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, shear strength, compressibility, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of sand or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5, 6, and 7, which show, respectively, results of engineering laboratory tests, several estimated soil properties significant in engineering, and interpretations for various engineering uses.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 7 and 8, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning in soil science but are not known to all engineers. The Glossary defines many of these terms.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*2*) used by the SCS engineers, Department of Defense, and others; and the AASHTO system (*1*) adopted by the American Association of State Highway and Transportation Officials.

In the Unified system, soils are classified according to particle size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL-ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength when wet and that are poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as

[6] K. G. BRAY, engineer, Soil Conservation Service, assisted in preparation of this section.

TABLE 5.—*Engi-*

[Tests performed by Mississippi

Soil name and location	Parent material	Report no.	Depth	Moisture-density [1]		Volume change	Shrinkage limit	Plastic limit	Shrinkage ratio
				Maximum dry density	Optimum moisture				
			In	*Lb/cu ft*	*Pct*				
Sweatman silt loam:									
200 feet east of State Highway 5; NE¼ NE¼ NE¼, sec. 22, T. 5 S., R. 1 E.	Stratified marine shaly clays and sandy deposits.	S-1	0-5	102	18	15	20	26	1.58
		S-2	5-18	86	30	116	13	40	1.81
		S-3	18-28	86	40	97	14	44	1.78
		S-4	28-37	95	25	73	14	36	1.75
		S-5	37-47	96	24	64	17	36	1.69
		S-6	47-65	95	24	6	18	30	1.67

[1] Based on the moisture-density relations of soils using 5.5-lb. Rammer and 12-9n. Drop, AASHTO designation T 99, Method A(*1*).

[2] Mechanical analyses according to the AASHTO 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 AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-sized 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

follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for the tested soil, with group index numbers in parentheses, is shown in table 5; the estimated classification, without group index numbers, is given in table 6 for all soils mapped in the survey area.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary.

Engineering test data

Table 5 contains engineering test data for one of the major soil series in Benton County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Moisture-density (or compaction) data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density.*

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Shrinkage ratio is the relation of change in volume of the soil material to the water content of the soil material when at the shrinkage limit. The change in volume is expressed as a percentage of the air-dry volume of the soil material, and the water content is expressed as a percentage of the weight of the soil material when oven-dry.

The data on volume change indicate the amount of shrinkage and swelling that is obtained from samples prepared at optimum moisture content and then subjected to drying and wetting. The total change that can occur in a specified soil is the sum of the values given for shrinkage and for swelling.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Estimated soil properties significant in engineering

Several estimated soil properties significant in engineering are given in table 6. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 6.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil texture is described in table 6 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some *neering test data*

State Highway Department]

Mechanical analysis [2]							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—			Percentage smaller than—						AASHTO [3]	Unified [4]
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				
100	98	79	73	48	23	16	31	5	A-4(7)	ML
100	100	96	90	81	68	61	79	39	A-7(48)	MH
100	100	91	87	79	63	53	71	27	A-7(33)	MH
100	100	68	61	53	45	38	48	22	A-7(16)	MH
100	100	63	59	54	42	37	54	18	A-7(11)	MH
100	100	62	51	45	36	30	52	22	A-7(14)	MH

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

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO designation M 145-66.

[4] Unified Soil Classification System (*2*).

of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 6 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts. This rating should not be confused with the coefficient "K" used by engineers.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Engineering interpretations

The estimated interpretations in table 7 are based on the engineering properties of soils shown in table 6, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soils scientists with the soils of Benton County. In table 7, ratings are used to summarize suitability of the soils as sources of topsoil, sand, and road fill. Table 7 also lists those soil features not to be overlooked in planning, installation, and maintenance of highways, farm ponds, agricultural drainage, irrigation, terraces and diversions, and waterways.

Soil suitability is rated by the terms *good, fair,* and *poor*. *Good* means soil properties are generally favorable for the rated use. *Fair* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Poor* means soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special designs, or intensive maintenance.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Sand is used in great quantities in many kinds of construction. The ratings in table 7 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit. There are no soils in Benton County which are a suitable source of gravel within observed depths.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage, and the relative ease of excavating the material at borrow areas.

Highways, as rated in table 7, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built

TABLE 6.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one unit in this series is made of two or more kinds of soil. The soils in such mapping units may in the first column of this table.

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification	
				Unified	AASHTO
	Inches	*Inches*			
Ariel: Ar	24-40	0-35	Silt loam	ML	A-4
		35-60	Silt loam, loam	ML, CL	A-4, A-6
Arkabutla: At	12-20	0-5	Silt loam	CL, ML	A-6, A-4
		5-55	Silt loam, silty clay loam	CL	A-6
Calhoun: Ca	10-20	0-10	Silt, silt loam	ML, CL-ML	A-4
		10-60	Silt loam, silty clay loam	CL	A-6
		60-78	Silt loam	CL-ML, CL	A-4, A-6
Calloway: CwA	15-30	0-15	Silt loam	CL, ML	A-6, A-4
		15-52	Silt loam, silty clay loam	ML, CL	A-6, A-7
Gillsburg: Gb	12-20	0-40	Silt loam	ML, CL-ML	A-4
		40-65	Silt loam	ML, CL	A-4, A-6
Grenada: GrB, GrC2	15-30	0-7	Silt loam	ML, CL	A-4, A-6
		7-24	Silt loam	CL	A-6
		24-67	Silt loam, silty clay loam	CL	A-6
*Jena: Je For Ochlockonee part, see Ochlockonee series.	40-60	0-11	Loam, sandy loam, fine sandy loam, silt loam.	ML, SM	A-4
		11-35	Fine sandy loam, loam, sandy loam	ML, SM	A-4
		35-60	Sandy loam, loam, loamy sand	SM	A-4, A-2
Kirkville: Kr	15-30	0-6	Fine sandy loam	SM, ML	A-4
		6-35	Loam	ML	A-4
		35-50	Fine sandy loam, sandy loam	SM, ML	A-4, A-2-4
		50-62	Silt loam	ML	A-4
Lexington: LeB2, LeC2	> 60	0-8	Silt loam	CL	A-6
		8-31	Silty clay loam, silt loam	CL	A-6
		31-58	Silt loam, loam, sandy loam	ML, CL, SM	A-4, A-6
		58-80	Loam, clay loam, sandy clay loam, sandy loam.	ML, CL, SM	A-4, A-6
Loring: LoB	25-35	0-5	Silt loam	ML, CL	A-4
		5-25	Silty clay loam, silt loam	CL	A-6, A-4
		25-62	Silt loam	ML, CL	A-4, A-6
Lucy Mapped only in association with Smithdale and Lexington series.	> 60	0-23	Loamy sand, loamy fine sand	SM	A-2
		23-80	Sandy clay loam, loam	SC, CL	A-4, A-6
*Mantachie: Ma For Kirkville part, refer to Kirkville series.	12-20	0-12	Fine sandy loam, loam	ML, SM	A-4
		12-60	Loam, sandy clay loam	CL, SC	A-4, A-6
Oaklimeter: Oa	20-40	0-11	Silt loam, silt, very fine sandy loam	ML, CL-ML	A-4
		11-55	Very fine sandy loam, silt loam, loam	ML, CL, CL-ML	A-4
		55-65	Silt loam, silty clay loam	ML, CL	A-4
Ochlockonee Mapped only in an undifferentiated unit with Jena soil.	40-60	0-10	Sandy loam, loam, loamy sand	SM, ML	A-4, A-2
		10-29	Silt loam, sandy loam, loamy sand	ML, SM	A-4, A-2
		29-60	Sandy loam	SM	A-4, A-2
Providence: PrB2, PrC2, PrD2	22-30	0-3	Silt loam	CL, ML	A-4, A-6
		3-22	Silt loam, silty clay loam	CL	A-6
		22-36	Silt loam	ML, CL	A-4, A-6
		36-80	Silt loam, loam, sandy loam, sandy clay loam, clay loam.	ML, CL, SM, SC	A-4, A-6, A-2
*Smithdale: SdF2, SLF For Lexington parts of SdF2 and SLF, refer to Lexington series. For Lucy part of SLF, refer to Lucy series.	> 60	0-17	Fine sandy loam, sandy loam, loam	SM, SC, ML	A-4
		17-28	Loam, sandy clay loam, clay loam	SC, CL	A-4, A-6
		28-80	Sandy loam, loam	SM, SC, CL, ML	A-2, A-4, A-6
*Sweatman: SSF For Smithdale part of SSF, see Smithdale series.	> 60	0-5	Silt loam	ML, CL	A-4
		5-37	Clay, silty clay, silty clay loam, clay loam	MH, CH	A-7
		37-65	Clay loam	MH, CH, CL	A-6, A-7
*Udorthents: UdF3 Udorthents are too variable for valid estimates. For Lexington part, refer to Lexington series.					

significant in engineering

have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear
The symbol > means more than]

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
			Inches per hour	*Inches per inch of soil depth*	*pH*	
100	100	85-100	0.60-2.00	0.20-0.22	4.5-6.0	Low.
100	85-100	60-90	0.20-0.60	0.20-0.22	4.5-5.5	Low.
100	90-100	85-100	0.60-2.00	0.20-0.22	4.5-5.5	Moderate.
100	95-100	85-100	0.60-2.00	0.20-0.22	4.5-5.5	Moderate.
100	90-100	85-100	0.60-2.00	0.20-0.22	4.5-5.5	Low.
100	95-100	85-100	0.06-0.20	0.20-0.22	4.5-5.5	Moderate.
100	90-100	85-100	0.06-0.20	0.20-0.22	4.5-5.5	Low.
100	100	90-100	0.60-2.00	0.20-0.22	5.1-5.5	Moderate.
100	90-100	85-100	0.06-0.20	0.05-0.08	5.1-5.5	Moderate.
100	90-100	85-100	0.20-0.60	0.20-0.22	4.5-6.0	Low.
100	90-100	70-90	0.20-0.60	0.20-0.22	4.5-5.5	Low.
100	90-100	85-100	0.60-2.00	0.20-0.23	4.5-6.0	Low.
100	90-100	85-100	0.60-2.00	0.20-0.23	4.5-6.0	Moderate.
100	90-100	85-100	0.06-0.20	0.06-0.08	4.5-6.0	Moderate.
100	65-90	36-75	0.60-2.00	0.10-0.20	4.5-6.5	Low.
100	65-90	36-65	0.60-2.00	0.10-0.17	4.5-5.5	Low.
100	60-70	30-45	0.60-2.00	0.06-0.17	4.5-5.5	Low.
100	70-85	40-55	0.60-2.00	0.11-0.15	4.5-6.0	Low.
100	85-95	60-75	0.60-2.00	0.12-0.18	4.5-5.5	Low.
100	60-85	30-55	0.60-2.00	0.10-0.20	4.5-5.5	Low.
100	90-100	70-85	0.60-2.00	0.20-0.22	4.5-5.5	Low.
100	90-100	85-100	0.60-2.00	0.20-0.22	4.5-6.0	Low.
100	90-100	85-100	0.60-2.00	0.20-0.22	4.5-5.5	Moderate.
100	65-95	36-85	0.60-2.00	0.12-0.22	4.5-5.5	Low.
100	65-95	36-80	0.60-2.00	0.12-0.20	4.5-5.5	Moderate.
100	90-100	85-100	0.60-2.00	0.20-0.22	5.1-6.0	Low.
100	90-100	85-100	0.60-2.00	0.20-0.22	5.1-6.0	Low.
100	90-100	85-100	0.20-0.60	0.07-0.10	5.1-6.0	Low.
100	55-80	15-35	6.00-20.0	0.05-0.10	4.5-5.0	Low.
100	80-95	45-70	0.60-2.00	0.10-0.15	4.5-5.0	Low.
100	80-95	40-60	0.60-2.00	0.10-0.15	4.5-5.5	Low.
100	80-90	45-75	0.60-2.00	0.15-0.20	4.5-5.5	Low.
100	90-100	55-90	0.60-2.00	0.20-0.22	4.5-5.5	Low.
100	85-95	60-85	0.60-2.00	0.18-0.22	4.5-5.5	Low.
100	90-100	85-95	0.60-2.00	0.20-0.22	4.5-5.5	Low.
100	70-95	25-70	0.60-2.00	0.10-0.15	4.5-5.5	Low.
100	70-95	25-80	0.60-2.00	0.10-0.15	4.5-5.5	Low.
100	60-70	30-40	0.60-2.00	0.10-0.15	4.5-5.5	Low.
100	90-100	85-100	0.60-2.00	0.20-0.22	4.5-6.0	Low.
100	95-100	85-100	0.60-2.00	0.20-0.22	4.5-6.0	Moderate.
100	90-100	70-90	0.20-0.60	0.07-0.10	4.5-6.0	Low.
100	60-90	30-80	0.20-0.60	0.07-0.10	4.5-6.0	Low.
100	70-95	36-65	2.00-6.00	0.10-0.15	4.5-5.5	Low.
100	80-90	40-75	0.60-2.00	0.10-0.17	4.5-5.5	Low.
100	70-95	30-65	2.00-6.00	0.10-0.15	4.5-5.5	Low.
100	90-100	70-90	0.20-0.60	0.20-0.22	4.5-5.5	Low.
100	95-100	65-96	0.20-0.60	0.15-0.20	4.5-5.5	Moderate.
100	90-100	60-80	0.20-0.60	0.15-0.20	4.5-5.5	Moderate.

TABLE 7.—*Interpretations of*

[An asterisk in the first column indicates that at least one unit in this series is made of two or more kinds of soil. The soils in such mapping units may in the first column

Soil series and map symbols	Suitability as source of— Topsoil	Sand	Road fill	Soil features affecting— Highways
Ariel: Ar	Good	Unsuited	Fair moderate traffic-supporting capacity.	Flooding
Arkabutla: At	Fair: limited thickness of suitable material.	Unsuited	Fair: moderate traffic-supporting capacity; wetness.	Flooding; wetness
Calhoun: Ca	Poor: wetness	Unsuited	Poor: wetness; poor stability.	Wetness
Calloway: CwA	Fair: limited thickness of suitable material; wetness.	Unsuited	Fair: wetness, moderate traffic- supporting capacity.	Wetness; moderate traffic-supporting capacity.
Gillsburg: Gb	Good	Unsuited	Fair: wetness, moderate traffic-supporting capacity.	Wetness; flooding
Grenada: GrB, GrC2	Good	Unsuited	Fair: moderate traffic-supporting capacity; wetness.	Wetness; moderate traffic-supporting capacity.
*Jena: Je For Ochlockonee part refer to Ochlockonee series.	Good	Unsuited	Good	Flooding
Kirkville: Kr	Good	Unsuited	Good	Flooding
Lexington: LeB2, LeC2	Fair: limited thickness of suitable material.	Fair in lower part: excessive fines.	Fair: moderate traffic-supporting capacity.	Moderate traffic-supporting capacity.
Loring: LoB	Good	Unsuited	Fair: moderate traffic-supporting capacity.	Moderate traffic-supporting capacity.
Lucy Mapped only in association with Smithdale and Lexington soils.	Poor: sandy surface layer.	Fair: limited thickness; excessive fines.	Fair: strength and stability.	Steep slopes
*Mantachie: Ma For Kirkville part refer to Kirkville series.	Good	Unsuited	Fair: wetness; moderate traffic-supporting capacity.	Flooding; wetness
Oaklimeter: Oa	Good	Unsuited	Fair: moderate traffic-supporting capacity.	Flooding
Ochlockonee Mapped only in undifferentiated unit with Jena soils.	Good	Fair: excessive fines	Good	Flooding
Providence: PrB2, PrC2, PrD2	Fair: limited thickness of suitable material.	Unsuited	Fair: moderate traffic-supporting capacity.	Moderate traffic-supporting capacity.
*Smithdale: SdF2, SLF For Lexington part of SdF2 and SLF, refer to Lexington series. For Lucy part of SLF, refer to Lucy series.	Fair: limited thickness of suitable material.	Unsuited	Good	Steep slopes

engineering properties of soils

have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear of this table]

Soil features affecting—					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Moderately slow permeability.	Fair slope stability; medium compressibility.	Subject to flooding; needs surface drainage.	Moderately slow permeability; very high available water capacity.	Not needed; nearly level slopes.	Grows good sod.
Moderate permeability.	Fair slope stability; medium compressibility.	Subject to flooding; needs surface drainage.	Moderate permeability; very high available water capacity.	Not needed; nearly level slopes.	Grows good sod.
Slow permeability	Poor stability; poor resistance to piping; dispersive.	Wetness; needs surface drainage; cutbanks erode.	Slow permeability	Not needed; nearly level slopes.	Grows fair sod; fertility needed.
Slow permeability below a depth of 15 to 36 inches.	Moderate resistance to piping and erosion; fair slope stability.	Wetness; needs surface drainage.	Moderate permeability in upper part, slow permeability in fragipan; medium available water capacity.	Not needed; nearly level slopes.	Sod grows fairly well; special care and fertility needed on cut areas.
Moderately slow permeability.	Fair slope stability; moderate resistance to piping and erosion.	Subject to flooding; needs surface drainage.	Moderately slow permeability; very high available water capacity.	Not needed; nearly level slopes.	Grows good sod.
Slow permeability at a depth of about 24 inches.	Fair stability; fair resistance to erosion.	Not needed; moderately well drained.	Moderate permeability above fragipan; medium available water capacity.	Soil features favorable.	Grows good sod; special care needed on cut areas.
Moderate permeability; seepage.	Poor resistance to piping; fair slope stability; seepage.	Subject to flooding; needs surface drainage.	Moderate permeability; medium available water capacity.	Not needed; nearly level slopes.	Grows good sod.
Moderate permeability; seepage.	Poor resistance to piping and erosion; fair slope stability; seepage.	Subject to flooding; needs surface drainage.	Moderate permeability; medium available water capacity.	Not needed; nearly level slopes.	Grows good sod.
Seepage in lower horizons.	Moderate slope stability; moderate permeability.	Not needed; well drained.	Moderate permeability; very high available water capacity.	Soil features favorable.	Grows good sod.
Moderately slow permeability in lower part.	Piping; fair slope stability.	Not needed; moderately well drained.	Moderate permeability above fragipan; high available water capacity.	Soil features favorable.	Grows good sod; special care needed on cut areas.
Rapid permeability in surface layer seepage.	Seepage; piping; and erosion.	Not needed; well drained; steep slopes.	Steep slopes	Steep slopes	Steep slopes; erodible.
Moderate permeability.	Fair to poor stability and compaction.	Subject to flooding; needs surface drainage.	Moderate permeability; high available water capacity.	Not needed; nearly level slopes.	Grows good sod.
Moderate permeability.	Poor resistance to piping and erosion; medium compressibility.	Subject to flooding; needs surface drainage.	Moderate permeability; very high available water capacity.	Not needed; nearly level slopes.	Grows good sod.
Moderate permeability; seepage.	Seepage; fair slope stability; poor resistance to piping and erosion.	Subject to flooding; needs surface drainage.	Moderate permeability; medium available water capacity.	Not needed; nearly level slopes.	Grows good sod.
Possible seepage in lower horizons.	Moderate compressibility; moderate resistance to piping and erosion.	Not needed; moderately well drained.	Moderate permeability above fragipan; medium available water capacity.	Soil features favorable.	Grows good sod; special care needed on cut areas.
Moderate permeability; seepage.	Possible seepage; low compressibility.	Not needed; well drained; steep slopes.	Steep slopes	Steep slopes	Steep slopes; erodible.

TABLE 7.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—
	Topsoil	Sand	Road fill	Highways
*Sweatman: SSF For Smithdale part of SSF, refer to to Smithdale series.	Poor: thin surface layer over texture; clayey material.	Unsuited	Poor: low traffic-supporting capacity.	Steep slopes
*Udorthents: UdF3. Properties of Udorthents are too variable to rate. For Lexington part of UdF3, refer to Lexington series.				

mainly from soil at hand. Many cuts and fills are greater than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, texture, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade. No bedrock was observed in the county.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Agricultural drainage is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope, stability in ditchbanks; susceptibility to stream overflow; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

The use of soils for waterways is affected by such features as permeability, erodibility, and suitability for permanent vegetation.

Town and Country Planning [7]

This section provides information that can be used by planners, builders, developers, landscape architects, and others interested in nonfarm uses of the soils.

The degree and kind of soil limitations for selected nonfarm uses are given in table 8. Among the important soil features considered are depth, acidity, slope, permeability, depth to a water table, traffic-supporting capacity, and flood hazard. The information given in the table does not eliminate the need for onsite investigation, but it can help guide the selection of sites for a given use. In the following paragraphs the terms used in the table are defined and the basis for the ratings is explained.

In table 8 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these, is required.

Dwellings, as rated in table 8, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-

[7] GEORGE W. YEATES, staff conservationist, Soil Conservation Service, helped prepare this section.

properties of soils—Continued

Soil features affecting—						
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Moderately slow permeability.	High compressibility; fair slope stability.	Not needed; well drained; steep slopes.	Steep slopes	Steep slopes	Steep slopes; erodible.

swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor, and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and that the pond is protected from flooding. Properties that affect the pond floor and the embankment are considered. Those that affect the pond floor are permeability, organic matter, slope, and, if the floor needs to be leveled, depth.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 inches and 6 feet is evaluated. The soil properties that affect both absorption of effluent and construction and operation of the system are considered. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used mainly for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry; are free of flooding during the season of use; and do not have slopes or stoniness that greatly increases the cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Paths and trails are used for local and cross country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, and have slopes of less than 15 percent.

Formation and Classification of Soils

In this section, the factors in soil formation and the processes by which soil horizons develop are discussed. The system of soil classification is defined, and the soils of Benton County are placed in that system.

Factors of Soil Formation

Soil is the product of soil-forming processes acting on accumulated or deposited geologic material. There are five major factors in soil formation. These are parent material, climate, living organisms, topography, and time. Climate and living organisms are the active forces. Their effect on parent material is modified by topography and by the length of time that the parent material has been in place. The influence of each factor varies from place to place but normally all are present to some extent in the formation of every soil.

Parent material

Parent material is the unconsolidated geologic material from which soils form. It largely determines the chemical and mineral composition of the resulting soils. The parent material of soils in Benton County is loess, Coastal Plain sediment, or alluvium eroded from uplands.

It is generally believed that the loess was deposited by wind on an older Coastal Plain formation. It is silt in texture and varies from around 5 feet thick in the northern and western parts of the county to a few inches thick in the eastern part. The loess mantle is thickest on ridgetops in

TABLE 8.—*Limitations of soils*

[An asterisk in the first column indicates that at least one unit in this series is made of two or more kinds of soil. The soils in such mapping units may in the first column

Soil series and map symbols	Dwellings	Sewage lagoons	Septic tank absorption fields
Ariel: Ar	Severe: flooding	Severe: wetness; flooding	Severe: wetness; flooding
Arkabutla: At	Severe: wetness; flooding	Severe: wetness; flooding	Severe: wetness; flooding
Calhoun: Ca	Severe: wetness	Severe: wetness	Severe: wetness; slow permeability.
Calloway: CwA	Severe: wetness	Slight	Severe: wetness; slow permeability in fragipan.
Gillsburg: Gb	Severe: wetness; flooding	Severe: wetness; flooding	Severe: wetness; flooding
Grenada: GrB, GrC2	Moderate: wetness; moderate shrink-swell potential.	Moderate: slope	Severe: slow permeability in fragipan.
*Jena: Je For Ochlockonee part, see Ochlockonee series.	Severe: flooding	Severe: seepage; flooding	Severe: flooding
Kirkville: Kr	Severe: flooding	Severe: wetness; flooding	Severe: wetness; flooding
Lexington: LeB2, LeC2	Moderate: moderate shrink-swell potential.	Moderate: moderate permeability; slope.	Slight if slope is 2 to 5 percent; moderate if 5 to 8 percent.
Loring: LoB	Moderate: moderate bearing strength.	Moderate: slope	Severe: moderately slow permeability in fragipan.
Lucy Mapped only in association with Smithdale and Lexington soils.	Severe: slope	Severe: slope	Severe: slope
*Mantachie: Ma For Kirkville part, refer to Kirkville series.	Severe: wetness; flooding	Severe: wetness; flooding	Severe: wetness; flooding
Oaklimeter: Oa	Severe: wetness; flooding	Severe: wetness; flooding	Severe: wetness; flooding
Ochlockonee Mapped only in an association with Jena soils.	Severe: flooding	Severe: seepage; flooding	Severe:, flooding
Providence:			
PrB2, PrC2	Moderate: moderate shrink-swell potential.	Moderate: slope	Severe: moderately slow permeability in fragipan.
PrD2	Moderate: moderate shrink-swell potential.	Severe: slope	Severe: moderately slow permeability in fragipan.
*Smithdale:			
SdF2 For Lexington part, refer to Lexington series.	Moderate: slope	Severe: moderate permeability; slope.	Moderate: slope
SLF For Lexington part, refer to Lexington series. For Lucy part, refer to Lucy series.	Severe: slope	Severe: slope	Severe: slope
*Sweatman: SSF For Smithdale part, refer to Smithdale series, unit SLF.	Severe: slope	Severe: slope	Severe: moderately slow permeability; slope.
*Udorthents: UdF3. For Lexington part of UdF3, refer to Lexington series. Properties of Udorthents are too variable to rate.			

most places. Soils formed in loess are silt loam or silty clay loam in texture.

Coastal Plain sediment is largely at the surface in the eastern and southern parts of the county, but it also crops out on steeper slopes throughout the county. This sediment consists of sand, silt, and clay deposited in the ocean. Soils formed in this sediment are loamy to clayey.

Sediment eroded from the uplands is deposited on flood plains along streams throughout the county. Texture varies according to the source of sediments. Soils formed in alluvial sediments have weakly developed profiles because fresh soil material is periodically deposited on them.

Climate

The warm, humid climate of Benton County favored the rapid development of soils. Warm temperatures accelerate the growth of many kinds of organisms and the rate of chemical and physical changes in the soils. High rainfall has leached bases and other soluble material and has moved colloidal particles and less soluble material down-

for town and country planning

have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear of this table]

Camp areas	Picnic areas	Playgrounds	Paths and trails
Severe: flooding	Moderate: flooding	Severe: flooding	Slight.
Severe: wetness; flooding	Moderate: wetness	Severe: wetness; flooding	Moderate: wetness; flooding.
Severe: wetness; slow permeability.	Severe: wetness	Severe: wetness	Severe: wetness.
Moderate: wetness; slow permeability in fragipan.	Moderate: wetness	Moderate: wetness; slow permeability in fragipan.	Moderate: wetness.
Severe: wetness; flooding	Moderate: wetness; flooding	Severe: wetness; flooding	Moderate: wetness; flooding.
Moderate: wetness; slow permeability in fragipan.	Moderate: wetness	Moderate if slope is 2 to 5 percent; severe if more than 5 percent.	Slight.
Severe: flooding	Moderate: flooding	Severe: flooding	Slight.
Moderate: wetness; flooding	Moderate: wetness; flooding	Moderate: wetness; flooding	Slight.
Slight	Slight	Moderate if slope is 2 to 5 percent; severe if 5 to 8 percent.	Slight.
Slight	Slight	Moderate: slope	Slight.
Severe: slope	Severe: slope	Severe: slope	Moderate: loamy sand surface layer. Severe if slope is more than 25 percent.
Severe: wetness; flooding	Moderate: wetness	Severe: wetness; flooding	Moderate: wetness.
Severe: flooding	Moderate: flooding	Severe: flooding	Slight.
Severe: flooding	Moderate: flooding	Severe: flooding	Slight.
Slight	Slight	Moderate: slope	Slight.
Moderate: slope	Moderate: slope	Severe: slope	Slight.
Moderate: slope	Moderate: slope	Severe: slope	Slight.
Severe: slope	Severe: slope	Severe: slope	Moderate if slope is 17 to 25 percent; severe if more than 25 percent.
Severe: slope	Severe: slope	Severe: slope	Moderate if slope is 15 to 25 percent; severe if more than 25 percent.

ward through the profile. For more information refer to the section "Climate" near the back of the survey.

Living organisms

Micro-organisms, earthworms, plants, and other organisms that live on and in the soil are important in the formation of soils. Bacteria, fungi, and other micro-organisms help weather rock and decompose organic matter. They are mostly in the upper few inches of the soil. Earthworms and other small invertebrates are near the surface, where they continually mix the soil material. Plants alter the soil microclimate, supply organic matter, and transfer minerals from the subsoil to the surface.

Topography

Topography, or relief, affects soil formation through its influence on drainage, erosion, vegetation, and soil temperature. Slopes in Benton County range from 0 to about 45 percent. Differences in slope affect the characteristics of the soils. For example, both Loring and Calhoun soils formed in beds of loess, but Loring soils are on gently sloping ridgetops, and Calhoun soils are in flat, depressional areas. Loring soils are moderately well drained and have a brownish subsoil over a fragipan. By contrast, the Calhoun soils are poorly drained and have a fluctuating water table and a grayish subsoil.

Time

Under most conditions a long time is required for soil formation. Differences in time account for many differences in soils not accounted for by the other factors of soil formation. For example, Ariel soils, which formed in alluvial material on flood plains, are among the younger soils in the county. They have a weakly developed B horizon but still retain characteristics of the parent material and show no evidence of translocation of silicate clays. Loring soils are much older than Ariel soils. Although they formed in similar parent material, enough time has passed for them to develop a distinct soil profile with an argillic horizon and other evidences of alteration and translocation.

Processes of Horizon Differentiation

Four main processes have been active in the formation of soil horizons in Benton County. These are the accumulation of organic matter, the leaching of calcium carbonates and bases, the formation and translocation of silicate clay minerals, and the reduction and transfer of iron.

The accumulation of organic matter in the upper part of the profile results in the formation of an A1 horizon. Due to the climatic factor, soils of Benton County usually have a low content of organic matter.

Carbonates and bases have been moderately leached to strongly leached from most of the soils in the county. This process commonly precedes the translocation of silicate clay.

Translocation of clay has occurred in most of the older soils. This process contributes to the formation of an eluviated, or A2, horizon from which the clay has moved downward. This clay accumulates lower in the profile as clay films around peds or in pores and in places as coating or bridging of sand grains. This creates an illuviated, or Bt, horizon. The A2 horizon is lighter in color and contains less clay than the Bt horizon.

Reduction, segregation, and transfer of iron, called gleying, occurs in poorly drained soils. Reduction and loss of iron results in the soil having grayish colors in the subsoil. Segregation of iron is indicated by reddish-brown mottles and concretions.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 (*12*). Because this system is under continual study, readers interested in developments of the current system should search the latest literature available.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode or origin, are grouped. In table.9, the soil series of Benton County are placed in 4 categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

TABLE 9.—*Soil series classified according to current system of classification*

[Soil classification was approved in September 1972]

Series	Family	Subgroup	Order
Ariel	Coarse-silty, mixed, thermic	Fluventic Dystrochrepts	Inceptisols.
Arkabutla	Fine-silty, mixed, acid, thermic	Aeric Fluvaquents	Entisols.
Calhoun	Fine-silty, mixed, thermic	Typic Glossaqualfs	Alfisols.
Calloway	Fine-silty, mixed, thermic	Glossaquic Fragiudalfs	Alfisols.
Gillsburg	Coarse-silty, mixed, acid, thermic	Aeric Fluvaquents	Entisols.
Grenada	Fine-silty, mixed, thermic	Glossic Fraqiudalfs	Alfisols.
Jena	Coarse-loamy, siliceous, thermic	Fluventic Dystrochrepts	Inceptisols.
Kirkville	Coarse-loamy, siliceous, thermic	Fluvaquentic Dystrochrepts	Inceptisols.
Lexington	Fine-silty, mixed, thermic	Typic Paleudalfs	Alfisols.
Loring	Fine-silty, mixed, thermic	Typic Fragiudalfs	Alfisols.
Lucy	Loamy, siliceous, thermic	Arenic Paleudults	Ultisols.
Mantachie	Fine-loamy, siliceous, acid, thermic	Aeric Fluvaquents	Entisols.
Oaklimeter	Coarse-silty, mixed, thermic	Fluvaquentic Dystrochrepts	Inceptisols.
Ochlockonee	Coarse-loamy, siliceous, acid, thermic	Typic Udifluvents	Entisols.
Providence	Fine-silty, mixed, thermic	Typic Fragiudalfs	Alfisols.
Smithdale	Fine-loamy, siliceous, thermic	Typic Paleudults	Ultisols.
Sweatman	Clayey, mixed, thermic	Typic Hapludults	Ultisols.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates.

SUBORDER. Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and surface horizons that are thick and dark colored. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like.

SUBGROUP. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order.

FAMILY. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the basis of behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

SERIES. As explained in the section "How This Survey Was Made," the series is a group of soils having major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile.

Physical and Chemical Analyses

Physical and chemical data from laboratory analyses are useful to soil scientists in classifying and interpreting soils. Physical and chemical data for selected soils are shown in table 10. Analyses were made by the Soil Genesis and Morphology Laboratory of the Mississippi Agricultural and Forestry Experiment Station. Samples were collected from pits at typical locations for each soil and were air dried and crushed so no individual particle was more than 2 millimeters across.

In the section "Descriptions of the Soils," profiles of the soils analyzed are described. Soil textures reported in table 10 are not necessarily the same as those stated in the section "Descriptions of the Soils," which are field estimates. Particle-size distribution was determined by the hydrometer method of Day (*4*). Chemical analysis was made by methods described in commonly available references (*5*). Samples were prepared by air-drying, grinding, and screening through a standard 20-mesh sieve.

Soil reaction (pH) was determined by using a Beckman model pH meter on mixtures of soil and water at a ratio of 1:1.

Exchangeable cations were extracted by the neutral, 1*N* ammonium acetate method (*3, 10*). Exchangeable sodium and potassium were determined by flame photometry. Exchangeable calcium and magnesium were determined by atomic absorption. Extractable hydrogen was determined by the barium chloride-TEA method (*3, 10*).

Percentage of base saturation was calculated as the sum of exchangeable bases divided by the sum of the cations and the result is multiplied by 100.

Geology and Drainage

Benton County lies within the North-Central Hills physiographic province. A large part of the county has high hills and steep slopes. The northwestern part of the county is somewhat hilly, but rolling areas and wide ridgetops are common.

Elevation ranges from 280 feet above sea level on the Tippah River in the southwestern corner of the county to 770 feet in the northeastern corner. The average relief in any area is approximately 100 to 150 feet. The surface has a general slope to the southwest.

The stratigraphic section exposed at the surface in Benton County can be described as a series of sands, silts, clays, and lignites compacted to various degrees. Sand is dominant, particularly in the northern part. The outcropping formations belong to the Midway, Wilcox, and Claiborne beds (*8*).

The Midway bed is represented by the Porters Creek Clay Formation. This formation is the oldest in the county and crops out in the southeastern part. Only 70 to 80 feet are exposed.

The Wilcox bed is represented by the Fern Springs and Ackerman Formations, which extend north and south through the county. These consist of sand, silt, clay, and lignite and various combinations. The Fern Springs Formation, the upper member, ranges from 100 to 200 feet thick and the Ackerman Formation ranges from a feather edge on the east to about 150 to 200 feet thick on the west. The dip of both is to the southwest at about 15 to 20 feet per mile.

The Claiborne bed is represented by the Meridian, Tallahatta, and Kosciusko Formations. The Meridian Formation, the oldest, is a coarse to medium, micaceous sand with stringers of reworked clay in the basal part and large sandstones near the top. It is 100 to 150 feet thick. The Tallahatta Formation is composed of fine to very coarse, pebble bearing, micaceous quartz sand. Lenses of white clay are present. The Kosciusko Formation is composed of coarse to very coarse sand containing some ferruginous sandstone. It is confined to the high hills and ridges in the northwestern part of the county.

Over 95 percent of Benton County is drained by the Tippah and Wolf Rivers and their tributaries. The Tippah River, draining the southern half, is a tributary of the Tallahatchie River, which is part of the Yazoo River sys-

TABLE 10—*Physical and chemical*

[Analyzed by Soil Genesis and Morphology Laboratory of the Mississippi Agricultural and Forestry Experiment Station.

Series	Horizon	Depth from surface	Particle-size distribution			Reaction 1.1 H_2O
			Total clay (<0.002 mm)	Total silt (0.05 to 0.002 mm)	Total sand (2.0 to 0.05 mm)	
		Inches				
Calhoun	A1	0-5	10.2	84.7	5.1	5.2
	A2g	5-10	5.3	92.3	2.4	5.2
	B21tg	10-24	27.2	71.8	1.0	4.4
	B22tg	24-32	21.7	77.7	0.61	4.5
	B23tg	32-43	23.1	75.6	1.3	4.8
	B3g	43-60	20.5	74.7	4.8	5.0
	Cg	60-78	17.7	76.4	5.9	5.4
Grenada	Ap	0-7	12.1	82.4	5.5	5.3
	B21	7-17	25.0	73.2	1.8	5.3
	B22	17-24	23.0	73.9	3.1	5.3
	B'x1&A'2	24-33	17.3	79.4	2.8	5.2
	B'x2	33-54	20.4	76.4	3.2	5.2
	B'x3	54-67	17.3	73.6	9.1	5.2
Lexington	Ap	0-8	24.4	67.7	6.9	5.3
	B21t	8-17	23.7	67.0	9.3	5.2
	B22t	17-31	28.9	67.1	4.0	5.2
	IIB23t&A'2	31-58	20.3	63.4	16.3	5.3
	IIB24t	58-65	25.3	44.7	30.0	5.2
	IIB25t	65-80	32.5	45.5	22.0	5.3
Providence	Ap	0-3	21.4	70.1	8.5	5.4
	B21t	3-10	28.7	68.4	2.9	5.9
	B22t	10-22	21.4	72.3	6.3	5.4
	Bx1	22-29	19.0	68.6	12.4	5.2
	Bx2	29-36	16.2	66.6	17.2	5.2
	IIBx3	36-47	14.1	59.5	26.4	5.2
	IIBx4	47-56	17.4	53.3	29.3	5.3
	IIBx5	56-80	16.2	50.2	33.6	5.3
Sweatman	A1	0-3	16.7	55.3	28.0	4.7
	A2	3-5	27.3	49.7	23.0	4.8
	B21t	5-18	62.1	27.0	10.9	4.5
	B22t	18-28	56.2	31.6	12.2	4.5
	B23t	28-37	34.0	22.0	44.0	4.6
	C1	37-47	37.3	29.7	33.0	4.6
	C2	47-65	32.4	34.9	32.7	4.5

tem. The main tributaries of the Tippah River are Chilli Creek, Oaklimeter Creek, Snow Creek, Yellow Rabbit Creek, and others.

The Wolf River, draining the northern part, runs into the Mississippi River at Memphis, Tennessee. Some of its principal tributaries are Grays Creek, Indian Creek, and Grogg Creek.

The Coldwater River, a part of the Yazoo River system, originates in the extreme western part of the county, and Porters Creek, draining into the Hatchie River, is in the extreme northeastern part. Several minor tributaries of the Tallahatchie River originate in the southeastern corner.

Climate [8]

The information in this section was taken from Marshall County. The data were taken from the weather station at Holly Springs.

The climate of Benton County is subtropical and generally uniform throughout the county. Local variations caused by differences in topography are slight. Table 11 gives data on temperature and precipitation from Holly Springs.

In summer, prevailing winds are from the south, and the weather is hot and humid. Occasionally, winds from the west and north bring hot, dry weather. When prolonged, this dry weather can cause drought of varying severity. Widespread severe drought occurred in 1924 and 1952.

In winter, the county is subject alternately to moist, warm air from the south and cold, dry air from the north. The change from one to the other sometimes causes rather large and sudden changes in temperature. However, cold spells are usually short.

The temperature is 32° F or lower about 58 days every year and 90° or higher 73 days. From May through October the temperature is 90° or higher 11 percent of the time and 80° or higher 31 percent of the time. From November through April the temperature is 70° or higher about 7 percent of the time and below 50° about 30 percent of the time.

The freeze-free season, or the period between the last freeze in spring and the first in fall, is about 219 days. The chance is 50 percent that a temperature of 32° or lower

[8] By E. J. SALTSMAN, climatologist for Mississippi, National Weather Service, United States Department of Commerce.

analyses of selected soils

Absence of data indicates that analysis was made but no trace of the element was detected. The symbol < means less than]

Extractable cations (milliequivalents per 100 grams of soil)						Base saturation by sum of cations
Calcium	Magnesium	Potassium	Sodium	Extractable acidity	Sum cations	
						Percent
0.6	0.2	0.1	0.1	10.4	11.4	9
0.3	0.3		0.2	6.9	7.7	11
0.7	2.3		1.1	14.2	18.3	23
1.7	3.5		2.1	11.5	18.8	39
3.0	3.9		2.5	8.6	18.0	52
3.5	3.8		2.1	5.3	14.7	64
3.9	3.9	0.1	2.1	6.9	16.9	59
2.0	0.9	0.2		9.1	12.2	26
3.1	2.1	0.3	0.2	8.1	13.8	41
2.9	2.6	0.2	0.3	8.2	14.2	42
1.3	2.1	0.2	0.3	9.5	13.4	29
0.6	3.6	0.2	0.5	10.5	15.4	32
0.6	3.9	0.1	0.6	7.4	12.6	41
3.3	2.6	0.5		8.0	14.4	45
1.3	2.8	0.2	0.2	8.5	13.0	34
2.3	4.3	0.3	0.1	8.2	15.2	46
0.8	2.4	0.2	0.2	12.6	16.2	22
0.9	2.7	0.2	0.1	7.5	11.4	34
1.2	3.3	0.2	0.2	8.8	13.7	36
3.8	3.0	0.6	0.1	6.1	13.6	55
4.2	4.4	0.6	0.1	6.4	15.6	59
1.8	3.8	0.5	0.1	6.1	12.3	50
0.6	3.1	0.4	0.1	7.9	12.1	34
0.4	2.8	0.3	0.1	6.2	9.8	36
0.3	2.6	0.2	0.1	6.2	9.4	34
0.3	2.3	0.2	0.1	5.1	8.0	37
0.3	2.3	0.2	0.1	6.2	9.1	31
0.8	1.1	0.2		8.3	10.4	20
1.3	2.7	0.4		6.0	10.4	42
3.4	6.5	0.7		22.1	32.7	32
1.9	5.0	0.6		19.5	27.0	28
1.4	3.6	0.3		12.6	17.9	30
0.6	3.9	0.4		12.8	17.7	28
0.8	5.6	0.4	0.1	13.7	20.6	33

TABLE 11.—*Temperature and precipitation*

[Data from Holly Springs, elevation 495 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Record high	Record low	Average	Record low	Record high	Average snowfall
	°F	*°F*	*°F*	*In*	*In*	*In*	*In*
January	43.2	80	-9	7.03	5.14	8.32	2.4
February	45.0	81	-9	5.30	4.57	8.86	1.0
March	52.6	87	10	6.30	0.42	2.68	0.1
April	61.7	93	26	4.27	4.91	6.50	0
May	70.0	100	35	3.64	4.74	5.84	0
June	78.2	107	45	3.88	3.47	4.92	0
July	80.8	115	49	4.59	3.24	7.07	0
August	80.4	106	46	3.26	2.64	1.70	0
September	73.9	110	34	3.96	1.05	6.16	0
October	64.0	100	23	2.99	2.42	3.73	0
November	51.4	84	6	4.94	2.25	9.82	0
December	44.3	80	0	5.32	3.57	4.61	0.6
Year	62.1	115	-9	55.48	34.42	70.21	4.4

[1] Average temperature based on a 21-year record through 1952; record high and low temperature based on a 67-year record through 1958.
[2] Average precipitation and snowfall based on a 21-year record through 1952; record high and low totals based on a 67-year record through 1958.

will occur after March 29 or before November 4; it is 20 percent after April 8 or before October 23. A temperature of 20° or lower occurs at least once in 9 out of 10 years.

Generally, winter and spring are wet, and summer and fall are dry. Fall is the driest season. This is beneficial for farming because harvesting generally is not interrupted by wet weather. In summer, rainfall generally is sufficient for good growth of most crops, and heavy rains in winter provide adequate moisture for crops planted in spring. Measurable amounts of snow fall at least once in 3 out of 4 years.

A tornado occurs in some parts of the county once in about 10 years; a severe thundersquall, once in about 3 years; and a damaging hailstorm, once in about 8 years. A tropical storm or hurricane that damages property or crops occurs about once in 25 years.

Relative humidity is 60 percent or higher 66 percent of the time, and less than 40 percent 9 percent of the time. When the termperature is 90° or higher, the relative humidity is between 50 and 79 percent 30 percent of the time. Even at low temperatures, the relative humidity is high. When the temperature is 50° or less, the relative humidity is 50 to 79 percent 53 percent of the time, and 80 to 100 percent 37 percent of the time.

Literature Cited

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) American Society of Agronomy. 1956. Methods of soil analysis. Part 2, Mono. No. 9.

(4) Day, P. R., *et. al.* 1956. Report of the committee on physical analysis. Soil Sci. Soc. Am. Proc. 20, pp. 167-169.

(5) Jackson, M. L. 1958. Soil chemical analysis. Prentice-Hall, Inc., 498 pp., illus.

(6) Lemmon, Paul E. 1958. Soil interpretations for woodland conservation. Proc. First North Am. For. Soils Conf. Mich. Agr. Exp. Sta., pp. 153-158.

(7) ———— 1968. Grouping soils on the basis of woodland suitability. Proc. Third North Am. For. Soils Conf. Oregon State University Press, pp. 413-426.

(8) Lusk, Tracy Wallace. 1956. Benton County geology. Miss. State Geol. Surv. Bull. 80, 104 pp., illus.

(9) United States Department of Agriculture. 1951. Soil Survey Manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(10) ———— 1967. Soil survey laboratory methods and procedures for collecting soil samples. Soil Survey Invest. Rep. No. 1, 50 pp., illus. [Revised April 1972]

(11) ———— 1969. Forest statistics for Mississippi counties. U.S. For. Serv. Resour. Bull. S0-15, 24 pp., illus.

(12) ———— In press. Soil taxonomy of the National Cooperative Soil Survey.

Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical mineral, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Reaction, soil. The degree of acidity of alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and it not large enough to be an obstacle to farm machinery.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent of more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles) adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the series to which the unit is a part. The suitability of the soils for crops, pasture, wildlife, and woodland is defined in the description of each mapping unit. The capability classification system is described on pages 20 through 22. Woodland suitability groups and wildlife suitability groups are described in the sections beginning on pages 22 and 25, respectively.

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