SOIL SURVEY
Banks and Stephens Counties Georgia

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
AND FOREST SERVICE
In cooperation with
UNIVERSITY OF GEORGIA, COLLEGE OF AGRICULTURE,
AGRICULTURAL EXPERIMENT STATIONS
Issued December 1971

Major fieldwork for this soil survey was done in the period 1964 through 1966. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1966. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the University of Georgia, College of Agriculture, Agricultural Experiment Stations. It is part of the technical assistance furnished to the Broad River Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250

HOW TO USE THIS SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms 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 Banks and Stephens Counties are shown on the soil map at the back of this survey. 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 and gives the capability classification, woodland suitability group, and wildlife suitability group of each. It also shows the page where each soil is described and the page for the capability unit, woodland group, and wildlife group.

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 them can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and woodland groups.

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

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

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section "Major Nonfarm Uses of the Soils."

Engineers and builders can find, under "Use of the Soils for Engineering," 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 Banks or Stephens 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 counties given at the beginning of the publication and in the section "General Nature of the Area."

***Cover picture.*—Flood-retarding structure on Cecil soils and Toccoa soils on North Fork Broad River, a pilot watershed. Many similar structures are in the survey area.**

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Contents

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SOIL SURVEY OF BANKS AND STEPHENS COUNTIES, GEORGIA

SURVEY BY GEORGE G. BROCK

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION WITH THE UNIVERSITY OF GEORGIA COLLEGE OF AGRICULTURE, AGRICULTURAL EXPERIMENT STATIONS

BANKS AND STEPHENS COUNTIES, in the northeastern part of Georgia (fig. 1), have a land area of 411 square miles or 263,040 acres. The counties

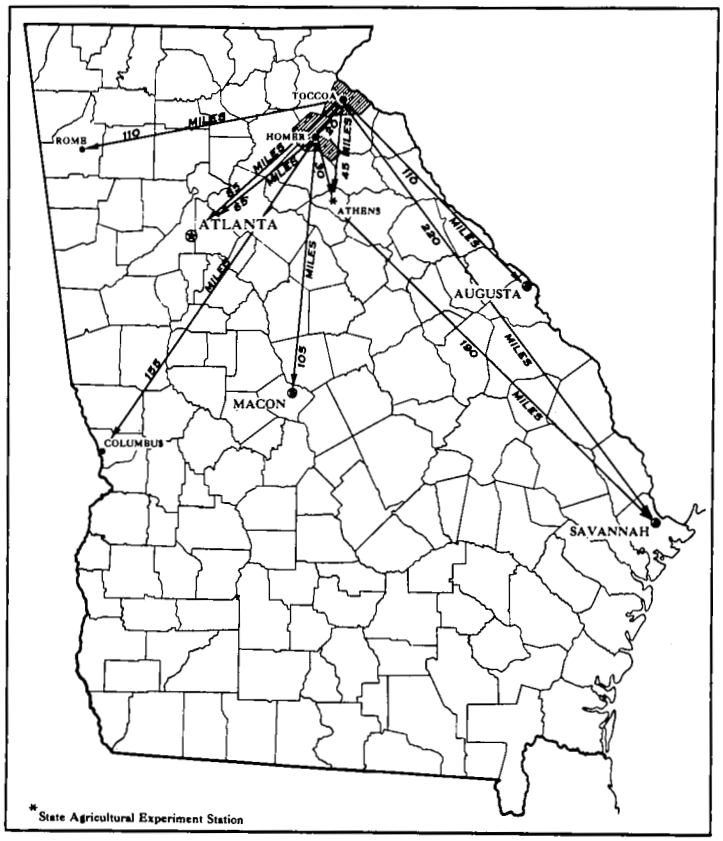

Figure 1.—Location of Banks and Stephens Counties in Georgia.

join each other for about 3¾ miles. The survey area is 33 miles long from the northeastern border of Stephens County to the southwestern border of Banks County. The Tugaloo River forms the boundary between Stephens County and the State of South Carolina.

About 20 percent of the survey area is in the sloping to very steep foothills of the Blue Ridge Mountain range. This range begins at Lula in the northwestern part of Banks County and extends northeasterly in a line south of Bellton, Alto, and Baldwin in Banks County to a line in Stephens County running just south of Currahee Mountain. From this point the line extends through Toccoa and just south of U.S. Highway No. 123 to the South Carolina border. The highest elevation, about 1,700 feet, is in the Currahee Mountain.

Most soils in the foothills have never been cleared for crops, because the slopes are too steep and the hazard of erosion is severe. Areas 1 to 5 acres in size are used by part-time farmers to grow garden crops or to pasture hogs and cattle.

Most of the survey area is south of the foothills and is made up of gently rolling broad ridges that have gentle to strong side slopes and nearly level flood plains of rivers and creeks that are frequently flooded for short periods. Soils in this area have been cultivated since early settlement. Corn, small grains, grass crops, soybeans, and cotton are the main crops. Less cotton and more grains and grass fodder for cattle have been grown in recent years. Raising beef cattle and poultry is an important enterprise for small farmers.

In recent years industry has become the main economic activity in the area. More people were employed in industry than in farming in 1964, and one or more members of most farm families is employed in some industry not related to agriculture. The most important industries are sewing-thread mills, textile mills, machinery plants, lumber yards and lumber mills, and furniture and coffin manufacturers.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Banks and Stephens Counties, 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. As they traveled over the county, 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.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Cecil and Madison, 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 soil 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, Cecil sandy loam, 2 to 6 percent slopes, eroded, is one of several phases within the Cecil 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 in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning 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 other 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. Two such kinds of mapping units are shown on the soil map of Banks and Stephens Counties: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled 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. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Louisa-Tallapoosa complex, 10 to 25 percent slopes, is an example.

An undifferentiated soil 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. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." The group Musella and Gwinnett stony soils, 25 to 60 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gullied land is a land type in Banks and Stephens Counties.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, 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 present 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 Banks and Stephens Counties. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are

suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

Soil associations and delineations on the general soil map in this soil survey do not fully agree with those of the general soil maps in adjacent counties published at a different date. Differences in the maps are the result of improvements in classification of soils, particularly in the modifications or refinements in soil series concepts. In addition, more precise and detailed maps are needed because the uses of the general soil maps have expanded in recent years. The more modern maps meet this need. Still another difference is caused by the range in slope that is permitted within associations in different surveys.

The nine soil associations in Banks and Stephens Counties are discussed in the following pages. More detailed information about the soils is given in the section "Descriptions of the Soils."

1. Toccoa-Cartecay Association

Well-drained to somewhat poorly drained soils that are subject to flooding

This association is characterized by broad to narrow, nearly level flood plains that consist of recent alluvium and occur along streams that overflow more than once every 5 years. The channels of these streams are well defined and have cut to bedrock in some places, especially along the streams that flow out of the foothills. In many places, however, the channels are clogged and silted. The Soil Conservation Districts, in their small watershed program, are improving the channels. The depth to the water table generally is about 15 to 30 inches. Separate tracts of this association are scattered throughout the survey area.

This association makes up about 9 percent of the two counties. Of this, about 52 percent is Toccoa soils, 30 percent is Cartecay soils, and the rest is minor soils.

Dominant in this association are the Toccoa and Cartecay soils. The Toccoa soils are well drained. Typically, they are reddish brown and loamy throughout and have evident bedding planes. The clay content at depths between 10 and 40 inches averages less than 18 percent.

The Cartecay soils are moderately well drained to somewhat poorly drained. Typically, they have a dark-brown loam surface layer over dark grayish-brown and grayish-brown material that grades to gray, stratified, sandy material. These soils also have evident bedding planes.

Among the minor soils in this association are the moderately well drained Altavista, the well drained Masada soils, and the poorly drained Wehadkee soils.

In some areas the naturally better drained soils in this association are used for row crops and for permanent grass-legume pasture. The row crops are corn, sorghums, and soybeans. In some areas the naturally less well drained soils that have been artificially drained are suited to row crops, pasture, or trees. The poorly drained Wehadkee soils support stands of mixed hardwoods that are tolerant of wetness.

In this association no particular type of farming or size of farm is dominant. About 35 percent of the association is wooded, and about 30 percent is too wet for row crops. Flooding is damaging, particularly in areas of row crops that are mechanically harvested.

Because of wetness the major soils of this association are poorly suited to residential or industrial development. Most areas are favorable for recreational development, especially for fishing and hunting. Some areas can be flooded so as to attract wildlife.

2. Madison-Cecil-Grover Association

Well-drained soils that have a red to yellowish-red clay to sandy clay loam subsoil; on broad ridgetops and adjacent side slopes

This association consists of very gently sloping soils on broad ridgetops and gently sloping to sloping soils on side slopes and in narrow, winding drainageways. Most of it is in Banks County.

This association makes up about 1 percent of the survey area. It is about 40 percent Madison soils, 30 percent Cecil Soils, and 25 percent Grover soils, and the rest is minor soils.

The Madison, Cecil, and Grover soils are dominant in this association. These soils are well drained. They have a friable surface layer of fine sandy loam to sandy loam in the less eroded areas and of sandy clay loam in the more eroded areas. The subsoil is chiefly red clay in the Madison and Cecil soils and yellowish-red sandy clay loam in the Grover soils. The Madison and Grover soils contain numerous mica flakes throughout the profile, but the Cecil soils have very little mica, if any.

The minor soils are in the Louisa and Gwinnett series.

About 60 percent of the acreage is cultivated or pastured, 30 percent is in forest, and the rest is used for residential areas, improved roads, and small businesses. The soils are well suited to general farming. Owners, who are part-time farmers, operate most of the small farms. Some of the crops grown are cotton, corn, small grain, sorghums, millet, and soybeans. Loblolly pine, shortleaf pine, white oak, red oak, and similar trees grow well.

3. Cecil-Appling-Louisburg Association

Well-drained and somewhat excessively drained soils that have a red to yellowish-brown clay to sandy loam subsoil; on broad, uniform ridgetops

This association consists of very gently sloping to

gently sloping soils on broad, uniform ridgetops. It is widely scattered in small areas. Slopes range from 2 to 6 percent in about 20 percent of the association and from 6 to 10 percent in the rest.

This association makes up about 4 percent of the two counties. It is about 45 percent Cecil soils, 25 percent Appling soils, and 10 percent Louisburg soils, and the rest is minor soils.

The Cecil and Appling soils are well drained. They have a friable surface layer of yellowish-brown to dark-brown sandy loam in the less eroded areas and of sandy clay loam in the more eroded areas. In the Cecil soils the finer textured part of the subsoil is red sandy clay to clay, but in the Appling soils this part is mottled yellowish-brown to yellowish-red sandy clay to clay. The Louisburg soils are well drained to somewhat excessively drained. They have a loamy sand and stony loamy sand surface layer. The subsoil is mainly yellowish-brown sandy loam. Depth to hard rock is about 4 feet.

Minor soils in this association are the well-drained Madison, Hiwassee, and Gwinnett soils on uplands and the Toccoa and Cartecay soils on alluvial plains. Small, narrow areas of well-drained Toccoa soils and the moderately well drained to somewhat poorly drained Cartecay soils occur in depressions, at the head of drains, and along the numerous drainageways in this association.

About 60 percent of the acreage is in field crops or is pastured, 30 percent is in forest or is idle, and the rest is used for roads, residential areas, small businesses, or other nonfarm uses. Cecil and Appling soils are well suited to cultivated crops, but Louisburg soils are too droughty and steep for cultivated crops or pasture. The Louisburg soils are mostly in trees, mainly post oak, red oak, and mixed slow-growing pines. In this association the farms are small and are operated part time by owners and tenants.

4. Cecil-Hiwassee-Madison Association

Well-drained soils that have a red to dark-red clayey layer in the subsoil; on ridgetops and side slopes

This association is characterized by gently sloping soils on medium to broad ridgetops and gently sloping soils on long side slopes that are cut by numerous small streams and a few large ones. Slopes range from 2 to 10 percent. The association occurs in the southeastern part of Stephens County and throughout most of Banks County.

This association makes up about 39 percent of the two counties. It is about 48 percent Cecil soils, 20 percent Hiwassee soils, and 15 percent Madison soils, and the rest is minor soils.

Dominant in the association are the Cecil, Madison, and Hiwassee soils. The surface layer of Cecil soils is grayish-brown to yellowish-brown sandy loam in the less eroded areas and yellowish-red sandy loam in the more eroded areas. The subsoil is red sandy clay to clay. The thickness of the combined surface layer and subsoil is more than 40 inches. Depth to hard rock is 8 feet or more in most places.

The Madison soils have a surface layer of dark yellowish-brown to brown sandy loam, gravelly fine sandy loam, or fine sandy loam in less eroded areas and of yellowish-red sandy clay loam in the severely eroded areas. The subsoil is red sandy clay to clay. Madison soils are highly micaceous throughout the profile. Depth to bedrock generally is about 6 feet or more.

The Hiwassee soils have a dark reddish-brown loam or clay loam surface layer and a dark-red clay subsoil. The thickness of the combined surface layer and subsoil is 40 inches or more. Depth to bedrock generally is more than 8 feet.

Also in the association are small areas of Gwinnett, Appling, Wilkes, and Louisburg soils on uplands and of Toccoa and Cartecay soils along streams. Of these soils, the Gwinnett soils have the largest acreage.

This association is made up of some of the better soils for farming in the survey area, and most of the row crops are grown on them. The soils respond well to good management, and except in the severely eroded areas, tilth is good. These soils are suited to many kinds of row crops and to small grains, sorghums, and grasses and legumes for hay, pasture, or seed. All of the acreage has been cleared, but about 20 percent of it has reverted to mixed pines and hardwoods.

Most of the farms in this association are farmed by their owners and are generally larger than those in other soil associations in the two counties. Most farms are of the general type, though some beef cattle are also raised.

The Madison and Cecil soils are well suited to nonfarm uses, such as building sites, septic tank fields, roads, playgrounds, and golf courses, but the Hiwassee soils are only moderately well suited.

5. Hiwassee-Musella-Wilkes Association

Well-drained soils that have a dark-red to yellowish-brown clay to sandy loam subsoil; some areas are stony

This association is characterized by sloping soils on narrow to medium ridges and steep soils on side slopes. Small drainageways are numerous. The association occurs chiefly in the southwestern part of Stephens County and in three small areas in Banks County; the largest tract is north of Homer. Slopes are more than 15 percent in about 60 percent of the association and are 10 to 15 percent in the rest.

This association makes up about 1 percent of the survey area. It is about 50 percent Hiwassee soils, 20 percent Musella soils, and 20 percent Wilkes soils, and the rest is minor soils.

Dominant in this association are the Hiwassee, Musella, and Wilkes soils. The Hiwassee soils occur on the smoother slopes. They have a dark reddish-brown to dusky-red loam and clay loam surface layer and a dark reddish-brown to dark-red clay subsoil. The thickness of the combined surface layer and subsoil is 50 inches or more. Bedrock is 8 feet or more below the surface.

The Musella and Wilkes soils generally occur on the rougher, steeper slopes. The Musella soils have a reddish-brown stony clay loam surface layer and a thin, red clay loam subsoil underlain with fractured and broken rock.

The Wilkes soils have a grayish-brown sandy loam and fine sandy loam surface layer and a thin yellowish-brown sandy loam to sandy clay loam subsoil. Saprolite is at a depth of less than 20 inches, and fragments of rock generally occur throughout the profile.

The minor soils are in the Gwinnett, Toccoa, and Cartecay series. Gwinnett soils occur on uplands and are well drained. Small narrow areas of the well-drained Toccoa soils and the moderately well drained to somewhat poorly drained Cartecay soils occur in depressions, at the head of drains, and along the numerous drainageways on the less sloping parts of this association.

On the smoother ridges and slopes, mostly in Banks County, the Hiwassee soils are used for temporary pasture, permanent pasture, or trees. The Musella and Wilkes soils are too stony for cultivation and are in trees. The steeper soils in this association are forested.

This association is also used for wildlife and to a limited extent for recreation, particularly for hunting deer and wild turkey. Because of the steep slopes and stony soils, this association is not suitable for uses such as residential sites, septic tank fields, and sewage lagoons.

6. Madison-Hiwassee-Pacolet Association

Well-drained soils that have a red to dark-red clay layer in the subsoil; on highly dissected ridges

This association is characterized by sloping soils on narrow to medium ridges and steep soils on the side slopes of the ridges. These side slopes are dissected by numerous small drainageways and a few large ones. The association, which generally joins or is near soil association 4, is steeper than that association, and in some places, has hard rock nearer the surface. Soil association 6 is mostly in the eastern part of Stephens County and throughout Banks County.

This association makes up about 23 percent of the two counties. It is about 30 percent Madison soils, 30 percent Hiwassee soils, and 13 percent Pacolet soils, and the rest is minor soils.

Dominant in this association are Madison, Hiwassee, and Pacolet soils. Typically, the Madison soils have a dark yellowish-brown to dark-brown fine sandy loam surface layer in the less eroded areas and a yellowish-red sandy clay loam surface layer in the severely eroded areas. The finer textured part of the subsoil is red sandy clay to clay. The Madison soils are micaceous throughout the profile.

The Hiwassee soils have a dark reddish-brown or dusky-red surface layer and a dark-red clayey subsoil. The thickness of the combined surface layer and subsoil is 50 inches or more. Depth to hard bedrock generally is more than 8 feet.

The Pacolet soils have a dark grayish-brown or dark yellowish-brown sandy loam surface layer in the less eroded areas and a yellowish-red sandy clay loam surface layer in the severely eroded areas. The main part of the subsoil is red sandy clay to clay. The thickness of the combined surface layer and subsoil is less than 40 inches. Depth to hard bedrock is 8 feet.

Also in the association are small areas of Gwinnett, Grover, Louisa, Louisburg, Toccoa, and Cartecay soils.

About 70 percent of the association was once cleared for cultivation, but about 40 percent of this formerly cleared acreage has reverted to mixed pines and oaks. The native vegetation consists chiefly of shortleaf pine, Virginia pine, white oak, red oak, poplar, and hickory. The less sloping soils are moderately well suited to many kinds of row crops and pasture grasses and legumes. The steep soils are not suited to cultivation. On all the soils sawtimber and pulpwood are of good quality, but on the steeper slopes logging operations are hazardous and expensive unless adapted equipment is used.

The farms in this association are mostly small and operated by their owners. In addition to growing crops, broilers and a few beef cattle are raised. Because most of the soils are too steep, this association has severe limitations for nonfarm uses, such as development of areas for homes and light industry and for picnic and intensive play areas.

7. Pacolet-Wedowee-Chandler Association

Sloping to very steep, well-drained to somewhat excessively drained soils that have a red to yellowish-brown clay loam to loam subsoil; on mountain foothills

The soils of this association occur only in the mountainous areas of Banks and Stephens Counties. Most of the acreage is in the Chattahoochee National Forest in Stephens County, but a small area occurs in the northern part of Banks County. Elevations range from 900 to 1,700 feet. The break in topography is sharp, and in most places the slopes are very steep. In some places the soils are stony.

This association makes up about 6 percent of the two counties. It is about 43 percent Pacolet soils, 30 percent Wedowee soils, and 8 percent Chandler soils, and the rest is minor soils.

The dominant soils are the Pacolet, Wedowee, and Chandler. The Pacolet soils are sloping to moderately steep. Typically, their surface layer is dark yellowish-brown sandy loam in the less eroded areas and yellowish-red sandy clay loam in the severely eroded areas. Severe erosion occurs in only a few places. The subsoil is friable to firm, red sandy clay to clay. The thickness of the combined surface layer and subsoil is less than 40 inches. Depth to bedrock is 6 feet or more.

The Wedowee soils generally occupy the smooth slopes. Typically, their surface layer is yellowish-brown fine sandy loam. The subsoil is yellowish-red heavy clay loam 25 to 30 inches thick. Depth to bedrock is more than 5 feet.

The Chandler soils are steep. Typically, the surface layer of these soils is very dark grayish-brown loam. The subsoil is yellowish-brown loam and is underlain by dark yellowish-brown sandy loam. Next is partly decomposed mica schist. Depth to bedrock varies but generally is 5 feet or more.

Minor soils in the association are the well-drained Grover, Musella, and Mecklenburg soils and the well-drained to somewhat excessively drained Louisa and Louisburg soils.

Most areas of this association have never been cleared. The soils are mostly in trees. The native vegetation is Virginia pine, shortleaf pine, scarlet oak, southern red oak, white oak, sweetgum, and hickory. The soils are moderately well suited to trees that are used for saw logs and pulpwood, but growth is fairly slow, particularly on the southern slopes. This association is moderately well suited to wildlife and to limited use for recreation, particularly for hunting deer and wild turkey.

8. Pacolet-Louisburg-Appling Association

Mainly steep, well-drained to somewhat excessively drained soils that have a red to yellowish-brown clay to sandy loam subsoil; on mountain foothills

The soils of this association are steeper than those in association 3, and some of them are not so deep to bedrock. Most of this association is east of Toccoa in the mountain foothills. Runoff is more rapid than on soils in association 3, and erosion is a greater hazard if the surface layer is disturbed and trees or other vegetation is removed.

This association makes up about 6 percent of the two counties. It is about 40 percent Pacolet soils, 20 percent Louisburg soils, and 15 percent Appling soils, and the rest is minor soils.

Dominant in this association are the Pacolet, Louisburg, and Appling soils. The Pacolet soils have a dark-grayish-brown to dark yellowish-brown sandy loam surface layer in the less eroded areas and a yellowish-red sandy clay loam surface layer in the severely eroded areas. The main part of the subsoil is red sandy clay or clay. The thickness of the combined surface layer and subsoil is less than 40 inches. Saprolite is at a depth of 2 to 8 feet.

The Louisburg soils are well drained to excessively drained. They have a sandy loam or stony sandy loam surface layer. The subsoil is chiefly yellowish-brown sandy loam, but in some areas Louisburg soils have a thin discontinuous layer of sandy clay loam to clay loam in the subsoil. Depth to hard rock is about 4 feet.

The surface layer of the Appling soils is yellowish-brown sandy loam in the less eroded areas and is brownish-yellow or yellowish-red sandy clay loam in the severely eroded areas. The subsoil is mainly yellowish-red sandy clay to clay mottled with dark yellowish brown and red. The thickness of the combined surface layer and subsoil is more than 40 inches.

The minor soils in this association are the well-drained Madison, Wedowee, and Gwinnett soils on uplands and the well-drained Toccoa and the moderately well drained to somewhat poorly drained Cartecay soils along the streams.

Almost all of this association is in trees. The native vegetation is loblolly pine, shortleaf pine, Virginia pine, white oak, red oak, yellow-poplar, and hickory. Trees grow moderately well on the Pacolet and Appling soils, but scrubby mixed pines and oaks are dominant on the Louisburg soils. This association is also used for wildlife and, to a limited extent, for recreation. On part of this association, organized turkey and deer hunts are held yearly by the Georgia State Game and Fish Commission.

9. Madison-Pacolet-Gwinnett Association

Mainly steep and very steep, well-drained soils that have a red to dark-red, clayey layer in the subsoil; on short side slopes that are cut by numerous drainageways

This association, which is in several tracts in Stephens and Banks Counties, is characterized by sloping to very steep soils that are cut by numerous drainageways in a dendritic pattern. Slopes range from 10 to 15 percent in about 20 percent of the association and are as much as 60 percent in the rest. The flood plains are narrow, and slopes adjacent to the drainageways are short and steep.

This association makes up about 11 percent of the survey area. It is about 32 percent Madison soils, 30 percent Pacolet soils, and 25 percent Gwinnett soils, and the rest is minor soils.

Dominant in the association are the Madison, Pacolet, and Gwinnett soils. These soils are well drained. They have a friable surface layer of gravelly sandy loam to sandy loam in the less eroded areas and sandy clay loam to light clay loam in the more eroded areas. The subsoil is chiefly red in the Madison and Pacolet soils and dark red or dusky red in the Gwinnett soils. The subsoil of Madison soils contains many more flakes of mica schist than that of the Pacolet and Gwinnett soils. Hard rock ordinarily is at a depth of more than 10 feet in the Madison soils. Depth to rock in the Pacolet and Gwinnett soils ranges from 3 to more than 10 feet but is 3 to 5 feet in about 30 percent of the acreage.

Also in this association are small areas of Grover, Hiwassee, Louisa, Musella, and Louisburg soils.

The dominant soils in this association are eroded in most places. In the severely eroded areas, erosion has removed all or nearly all of the original surface layer and has exposed the red sandy clay loam to clay subsoil.

Some of this association is in the Chattahoochee National Forest, and part of this acreage is operated by the owners, who are part-time farmers. Most of the association consists of cutover forest, but small areas of improved pasture have been developed on the lesser slopes in areas of the privately owned land. This association is also used for wildlife and to a limited extent for recreation.

Descriptions of the Soils

In this section the soils of Banks and Stephens Counties are described in detail. The approximate acreage and proportionate extent of each mapping unit are shown in table 1.

The procedure in this section is first to describe a soil series, and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read both the description of that unit and the description of the soil series to which the unit belongs. The description of the soil series mentions features that apply to all the mapping units in the series. Differences among the soils of a series are pointed out in the description of the unit described or are indicated by the soil name.

A profile typical for each series is described in two ways. Many will prefer to read the short description in narrative form. The technical description of the profile is mainly for soil scientists, engineers, and others who need to make thorough and precise studies of the soils. Colors are for moist soils unless otherwise indicated.

As explained in the section "How This Survey Was Made," not all mapping units are members of a soil series. Gullied land, for example, is a land type that does not belong to any soil series. It is listed in alphabetic order along with the soil series.

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

Soil	Banks County		Stephens County		Total	
	Acres	Percent	Acres	Percent	Acres	Percent
Altavista sandy loam, 2 to 6 percent slopes	280	0.2	175	0.2	455	0.2
Appling sandy loam, 2 to 6 percent slopes, eroded	515	.4	155	.1	670	.3
Appling sandy loam, 6 to 10 percent slopes, eroded	1,225	.8	645	.6	1,870	.7
Appling sandy loam, 10 to 25 percent slopes, eroded	1,065	.7	795	.7	1,860	.7
Appling sandy clay loam, 2 to 10 percent slopes, eroded	785	.5	335	.3	1,120	.4
Cartecay soils	5,255	3.6	2,805	2.4	8,060	3.1
Cecil sandy loam, 2 to 6 percent slopes, eroded	3,635	2.5	1,320	1.1	4,955	1.9
Cecil sandy loam, 6 to 10 percent slopes, eroded	7,095	4.8	4,930	4.3	12,025	4.6
Cecil sandy loam, 10 to 15 percent slopes, eroded	4,885	3.3	3,580	3.1	8,465	3.2
Cecil sandy clay loam, 2 to 6 percent slopes, eroded	1,990	1.3	530	.5	2,520	1.0
Cecil sandy clay loam, 6 to 10 percent slopes, severely eroded	8,360	5.7	4,225	3.7	12,585	4.8
Cecil sandy clay loam, 10 to 15 percent slopes, severely eroded	10,525	7.1	6,415	5.6	16,940	6.4
Chandler complex, 25 to 75 percent slopes	50	(1)	1,195	1.0	1,245	.5
Chandler and Rock land, 60 to 90 percent slopes	70	(1)	1,090	.9	1,160	.4
Grover fine sandy loam, 6 to 15 percent slopes, eroded	320	.2	1,190	1.0	1,510	.6
Grover fine sandy loam, 15 to 60 percent slopes	240	.2	1,640	1.4	1,880	.7
Gullied land	2,270	1.5	225	.2	2,495	.9
Gwinnett sandy loam, 2 to 6 percent slopes, eroded	1,910	1.3	575	.5	2,485	.9
Gwinnett sandy loam, 10 to 15 percent slopes, eroded	2,725	1.8	1,895	1.6	4,620	1.8
Gwinnett sandy loam, 15 to 45 percent slopes	3,185	2.2	4,740	4.1	7,925	3.0
Hiwassee clay loam, 2 to 6 percent slopes, eroded	1,730	1.2	440	.4	2,170	.8
Hiwassee clay loam, 6 to 10 percent slopes, eroded	12,090	8.2	4,875	4.2	16,965	6.5
Hiwassee clay loam, 10 to 15 percent slopes, eroded	8,175	5.5	3,920	3.4	12,095	4.6
Hiwassee clay loam, 15 to 25 percent slopes, eroded	3,900	2.6	3,025	2.6	6,925	2.6
Hiwassee loam, 2 to 6 percent slopes	610	.4	210	.2	820	.3
Hiwassee loam, 6 to 10 percent slopes, eroded	970	.7	365	.3	1,335	.5
Hiwassee loam, 10 to 15 percent slopes	270	.2	895	.8	1,165	.4
Louisa-Tallapoosa complex, 10 to 25 percent slopes	1,490	1.0	640	.6	2,130	.8
Louisburg loamy sand, 10 to 25 percent slopes	1,360	.9	1,040	.9	2,400	.9
Louisburg loamy sand, 25 to 60 percent slopes	565	.4	1,505	1.3	2,070	.8

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

Soil	Banks County		Stephens County		Total	
	Acres	Percent	Acres	Percent	Acres	Percent
Louisburg-Rock land complex, 25 to 60 percent slopes	80	.1	1,105	1.0	1,185	.5
Madison fine sandy loam, 2 to 6 percent slopes, eroded	1,605	1.1	175	.2	1,780	.7
Madison fine sandy loam, 6 to 10 percent slopes, eroded	4,140	2.8	2,170	1.9	6,310	2.4
Madison fine sandy loam, 10 to 15 percent slopes, eroded	3,090	2.1	3,245	2.8	6,335	2.4
Madison fine sandy loam, 15 to 25 percent slopes	3,575	2.4	5,095	4.4	8,670	3.3
Madison sandy clay loam, 6 to 10 percent slopes, severely eroded	3,480	2.4	2,800	2.4	6,280	2.4
Madison sandy clay loam, 10 to 15 percent slopes, severely eroded	3,280	2.2	3,280	2.9	6,560	2.5
Madison sandy clay loam, 15 to 25 percent slopes, severely eroded	2,340	1.6	3,095	2.7	5,435	2.1
Madison-Louisa-Tallapoosa complex, 25 to 60 percent slopes	3,570	2.4	5,375	4.7	8,945	3.4
Masada fine sandy loam, 2 to 6 percent slopes	295	.2	230	.2	525	.2
Mecklenburg fine sandy loam, 10 to 25 percent slopes	430	.3	610	.5	1,040	.4
Musella-Gwinnett stony complex, 10 to 25 percent slopes	1,300	.9	550	.5	1,850	.7
Musella and Gwinnett stony soils, 25 to 60 percent slopes	50	(1)	255	.2	305	.1
Pacolet sandy loam, 15 to 25 percent slopes	8,865	6.0	6,915	6.0	15,780	6.0
Pacolet sandy clay loam, 15 to 25 percent slopes, severely eroded	5,470	3.7	5,125	4.5	10,595	4.0
Pacolet-Louisburg complex, 25 to 60 percent slopes	6,820	4.6	4,035	3.5	10,855	4.1
Tate fine sandy loam, 10 to 25 percent slopes	80	.1	1,620	1.4	1,700	.6
Toccoa sandy loam, local alluvium	695	.5	430	.4	1,125	.4
Toccoa soils	6,940	4.7	6,100	5.3	13,040	5.0
Wedowee fine sandy loam, 10 to 25 percent slopes, eroded	635	.4	2,145	1.9	2,780	1.1
Wedowee fine sandy loam, 25 to 60 percent slopes	55	(1)	1,080	.9	1,135	.4
Wedowee sandy clay loam, 10 to 25 percent slopes, severely eroded	865	.6	515	.4	1,380	.5
Wehadkee soils	980	.7	370	.3	1,350	.5
Wickham sandy loam, 2 to 6 percent slopes	650	.4	495	.4	1,145	.4
Wickham sandy loam, 6 to 10 percent slopes	360	.2	415	.4	775	.3
Wickham sandy loam, 10 to 15 percent slopes	10	(1)	405	.4	415	.2
Wickham clay loam, 6 to 10 percent slopes, severely eroded	260	.2	450	.4	710	.3
Wilkes complex, 10 to 25 percent slopes	310	.2	320	.3	630	.2
Wilkes stony complex, 25 to 60 percent slopes	65	(1)	1,420	1.2	1,485	.6
Total	147,840	100.0	115,200	100.0	263,040	100.0

[1] Less than 0.1 percent.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the soil map. Listed at the end of a description of a mapping unit is the capability unit, the woodland suitability group, and the wildlife suitability group in which the mapping unit has been placed. The "Guide to Mapping Units" at the back of this survey lists the pages where the capability unit, the woodland suitability group, and the wildlife suitability group are described. Many terms used in the soil descriptions are defined in the Glossary and in the "Soil Survey Manual" (*6*).[1]

Descriptions, names, and delineations of the soils in this soil survey do not fully agree with soil maps in adjacent counties published at a different date. Differences are the result of better knowledge of soils, modifications in the series concept, intensity of mapping, and the extent of the soils within the survey. In

[1] Italic numbers in parentheses refer to Literature Cited, p. 77.

some places it is more feasible to combine small acreages of similar soils that respond to use and management in much the same way than it is to separate these soils and give them names.

Altavista Series

The Altavista series consists of deep, moderately well drained soils on stream terraces at the head of and along small drainageways. Slopes range from 2 to 6 percent.

Typically, the surface layer is dark grayish-brown sandy loam about 7 inches thick. The mottled subsoil is yellowish-brown sandy clay loam that extends to a depth of 48 inches or more. The mottles are strong brown in the upper part and yellowish red in the lower part.

These soils have good tilth, a thick root zone, and moderate permeability. The available water capacity is medium to high in the uppermost 3 feet of soil. Runoff and internal drainage are medium.

The Altavista soils are not used extensively for cultivated crops. The native vegetation on these soils is mixed pines and hardwoods.

Typical profile of Altavista sandy loam, 2 to 6 percent slopes, 3½ miles from Toccoa, on U.S. Highway No. 123 to Clarkesville:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, fine, granular structure; very friable; many fine roots; few fine mica flakes; strongly acid; clear, smooth boundary.

AB—7 to 11 inches, yellowish-brown (10YR 5/6) sandy clay loam; moderate, medium, subangular blocky structure; friable; few roots; few fine mica flakes; strongly acid; clear, smooth boundary.

B21t—11 to 23 inches, yellowish-brown (10YR 5/6) sandy clay loam; few, fine, distinct mottles of strong brown (7.5YR 5/6); moderate, medium, subangular blocky structure; friable; few fine mica flakes; strongly acid; clear, smooth boundary.

B22t—23 to 48 inches +, yellowish-brown (10YR 5/6) sandy clay loam; common, distinct mottles of light gray (10YR 7/2) and yellowish red (5YR 5/6); weak, medium, subangular blocky structure; friable; few fine mica flakes; strongly acid.

In a few small areas the Ap horizon, or A1 horizon where it is present, is fine sandy loam and silt loam. In most places the A horizon is about 6 to 7 inches thick, but it ranges to 18 inches thick in some places. In wooded areas, the A horizon is chiefly very dark grayish brown, but in cultivated fields the range in color includes dark grayish brown, grayish brown, and yellowish brown. The Bt horizon ranges from yellowish brown to strong brown. Deposits of gravel occur at a depth of 6 to 8 feet.

The Altavista soils occur with the Wickham soils but generally are at lower elevations, are not so well drained, and lack a reddish color.

Altavista sandy loam, 2 to 6 percent slopes (AlB).—This soil occurs in small, long areas along stream terraces. The subsoil is 32 inches or more thick. Depth to the light-gray and yellowish-red mottles in the lower part of the subsoil ranges from about 22 to 28 inches.

Included in mapping were small areas of well-drained soils that have a yellowish-red sandy clay loam subsoil 40 inches or more thick. These inclusions make up as much as 35 percent of the mapped areas.

This soil is not well suited to cultivated crops. It is better suited to trees or pasture. The native vegetation is mostly red oak, white oak, and yellow-poplar. (Capability unit IIe–2; woodland suitability group 3; wildlife suitability group 1)

Appling Series

The Appling series consists of deep, well-drained soils on broad, gently rolling uplands and sloping to steep mountainsides. These soils formed in material weathered from granite, gneiss, and coarse-grained schist.

Typically these soils, where they are not severely eroded, have a yellowish-brown surface layer about 5 inches thick. The subsoil extends to a depth of 54 inches or more. It is yellowish-red sandy clay loam mottled with dark yellowish brown to a depth of 8 inches, is yellowish-red sandy clay loam mottled with red and dark yellowish brown to a depth of 32 inches, and is strong-brown clay loam mottled with red and yellowish brown to a depth of 42 inches. The rest of the subsoil is sandy clay loam mottled with yellowish brown, reddish yellow, and red.

These soils are low in natural fertility, contain little organic matter, and are strongly acid. Permeability is moderate, and the available water capacity is medium in the uppermost 3 feet of soil. Surface runoff is moderate to rapid.

The Appling soils occur along the boundary between Banks and Stephens Counties, in the northeastern part of Banks County, and in patchy areas throughout both counties. Most of the acreage has been cultivated, but where slopes are strong and steep, these soils have reverted to trees, mostly loblolly pine and Virginia pine. Where Appling soils are less sloping, they are used extensively for row crops, small grains, hay, and pasture. The less sloping soils are well suited to those crops. Appling soils respond well to good management, especially to additions of fertilizer and lime.

Typical profile of Appling sandy loam, 6 to 10 percent slopes, eroded, in cultivated field, 1.1 miles west of Irvin's store at Hollingsworth, and up dirt road through woods 300 feet to Duckett's farm in Banks County:

Ap—0 to 5 inches, yellowish-brown (10YR 5/4) sandy loam; weak, fine, granular structure; friable; few small quartz fragments; strongly acid; abrupt, smooth boundary.

B21t—5 to 8 inches, yellowish-red (5YR 5/6) sandy clay loam; few, fine, faint, dark yellowish-brown mottles; weak, fine to medium, subangular blocky structure; friable to firm; few small angular quartz fragments; patchy clay films on peds; strongly acid; clear, wavy boundary.

B22t—8 to 32 inches, yellowish-red (5YR 5/6) sandy clay, yellowish red (5YR 4/8) when crushed; many, medium, distinct mottles of red (2.5YR 4/8) and dark yellowish brown (10YR 4/4); moderate, medium, subangular blocky structure; firm; few fine mica flakes; patchy clay films on peds; strongly acid; gradual, smooth boundary.

B23t—32 to 42 inches, strong-brown (7.5YR 5/6) clay loam, yellowish red (5YR 5/8) when crushed; many medium, distinct, red (2.5YR 4/8) and yellowish-brown (10YR 5/6) mottles; weak, fine, subangular

blocky structure; firm to friable; few fine mica flakes; strongly acid; clear, wavy boundary.

B3—42 to 54 inches +, mottled yellowish-brown (10YR 5/6), reddish-yellow (7.5YR 6/6), and red (2.5YR 5/6) sandy clay loam; friable; massive to weak, subangular blocky structure; strongly acid.

The Ap horizon ranges from light yellowish brown to yellowish brown. It is sandy clay loam or clay loam in severely eroded areas. In most places, however, the A horizon is sandy loam, but it ranges from loamy sand to fine sandy loam. Where present, the A1 horizon ranges from brown and olive brown to grayish brown and the A2 horizon ranges from light yellowish brown to pale brown. The B21t horizon is from 2 to 5 inches thick. The B22t horizon and the B23t horizon both range from clay loam to clay. The Bt horizon ranges from yellowish red to yellowish brown and has mottles that are high in value and chroma. The solum ranges from 40 to 60 inches in thickness.

The C horizon is weathered gneiss, granite, or schist that is mottled with shades of red, brown, yellow, and gray in many places. It is 2 to more than 40 feet thick.

Depth to bedrock is more than 5 feet.

The Appling soils occur with the Cecil, Wedowee, and Louisburg soils but, unlike them, have distinct red and dark yellowish-brown mottles in the B horizon. The solum of the Appling soils is thicker than that of the Wedowee soils. The Appling soils have a thicker solum and a more distinct, more clayey subsoil than the Louisburg soils.

Appling sandy loam, 2 to 6 percent slopes, eroded (AmB2).—The profile of this soil is similar to the one described as typical for the series, except that the surface layer of this soil is 3 to 5 inches thick. The subsoil, 40 inches or more thick, is sandy clay to clay. Depth to hard rock is 8 feet or more. This soil occurs on broader ridgetops and side slopes than Appling sandy loam, 6 to 10 percent slopes, eroded.

Included with this soil in mapping were a few severely eroded areas where the surface layer was strong-brown sandy clay loam. Also included were some small areas of a soil having a gray to grayish-brown sandy loam surface layer underlain by pale-yellow to yellow sandy clay or clay. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil has good tilth and a thick root zone. It responds well to good management, especially to additions of fertilizer. This soil is cultivated extensively and is suited to all crops grown locally. The native vegetation is loblolly pine, shortleaf pine, white oak, red oak, and various gums. (Capability unit IIe–2; woodland suitability group 2; wildlife suitability group 1)

Appling sandy loam, 6 to 10 percent slopes, eroded (AmC2).—This soil generally occurs on long side slopes. It has the profile described as typical for the Appling series. It has a surface layer 3 to 8 inches thick. The upper few inches of the subsoil is sandy clay loam. The rest of the subsoil is sandy clay or clay and has distinct, strong-brown and yellowish-brown mottles.

Included with this soil in mapping were a few severely eroded areas where the surface layer is strong-brown sandy clay loam. Also included were some small areas having a gray to grayish-brown sandy loam surface layer, underlain by pale-yellow to yellow sandy clay or clay. In addition, there were included a few areas where the surface layer was coarse sandy loam. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil has a thick root zone and is well suited to all crops or pasture plants grown locally. Most of the acreage has been cultivated, but approximately 55 percent of it has reverted to trees. The native vegetation is loblolly pine, shortleaf pine, red oak, white oak, and various gums. (Capability unit IIIe–2; woodland suitability group 2; wildlife suitability group 1)

Appling sandy loam, 10 to 25 percent slopes, eroded (AmE2).—The profile of this soil is similar to the one described as typical for the series, but in this soil the combined surface layer and subsoil are 4 to 8 inches thinner. This soil has a surface layer 4 to 7 inches thick. The upper 3 to 6 inches of the subsoil is sandy clay loam that has a few brownish-yellow mottles. The rest of the subsoil is 32 inches or more of strong-brown sandy clay to clay.

Included with this soil in mapping were a few severely eroded areas where the surface layer is yellowish-brown sandy clay loam. These inclusions make up as much as 20 percent of the mapped areas of this soil.

Although this Appling soil has a thick root zone, it is too steep to be well suited to cultivated crops. It is better suited to pasture plants, trees, and to use for wildlife and recreation. The native vegetation is loblolly pine, shortleaf pine, Virginia pine, red oak, white oak, and various gums. (Capability unit VIe–2; woodland suitability group 2; wildlife suitability group 2)

Appling sandy clay loam, 2 to 10 percent slopes, eroded (AnC2).—This soil occurs on narrow ridgetops and side slopes in the uplands. The plow layer is sandy clay loam 4 to 7 inches thick. This layer is a mixture of remnants of the original surface layer and material from the upper part of the subsoil. The subsoil is sandy clay to clay 40 inches or more thick.

Included with this soil in mapping were areas where little soil has been lost through erosion. Also included in mapping were small areas of a severely eroded soil. In these severely eroded areas all of the original surface layer had been removed, and about 75 percent of the subsoil was present. Many areas were gullied. The existing surface layer was yellowish-red to strong-brown sandy clay or clay. These inclusions make up about 20 percent of the mapped areas of this soil.

This soil has a moderately thick root zone, and although tilth is poor, it is suited to a wide range of crops if management is good. The hazard of erosion is moderate to severe on barren fields where surface runoff is medium to rapid because of slope and the slow rate of infiltration. This soil is well suited to permanent pasture plants and trees. (Capability unit IIIe–2; woodland suitability group 4; wildlife suitability group 1)

Cartecay Series

The Cartecay series consists of deep, nearly level, moderately well drained to somewhat poorly drained soils. These soils occur on flood plains of small branches, creeks, and rivers. They are subject to fre-

quent flooding when rains are heavy. Cartecay soils formed in sediments washed from Cecil, Wedowee, Madison, and similar soils.

The surface layer is dark yellowish-brown to dark-brown loam, loamy sand, or sandy loam. It is 7 to 10 inches thick. Beneath the surface layer is strong-brown to brown loam or sandy loam. Mottles of pale brown to light gray are at a depth of about 15 inches, and they become grayer and more numerous as depth increases. Gravelly material occurs at a depth of 45 inches or less.

In most places Cartecay soils have a water table at a depth of 30 to 36 inches, but in some places it is at a depth of as much as 40 inches.

These soils are low in natural fertility, contain little organic matter, and are medium acid to slightly acid. The available water capacity is medium. Runoff is slow, but permeability is moderately rapid.

Cartecay soils occur in narrow, long tracts along most streams in the survey area. They are suited to few cultivated crops. Most cleared areas are in hay, pasture, or corn, and these crops grow well where adequate drainage is provided. These soils are well suited to white oak and yellow-poplar.

Typical profile of nearly level Cartecay soils, 1½ miles northwest from Carnes Creek Baptist Church in Stephens County, on paved road 200 feet northeast of bridge that crosses Carnes Creek, on south side of creek:

Ap—0 to 9 inches, dark-brown (10YR 4/3) loam; weak, fine, granular structure; very friable; many fine roots; many fine mica flakes; medium acid; abrupt, smooth boundary.

C1—9 to 16 inches, dark-brown (10YR 4/3) loam; few, fine, faint mottles of dark grayish brown; weak, fine, granular structure; friable; many fine roots; numerous common mica flakes; medium acid; clear, smooth boundary.

C2—16 to 22 inches, grayish-brown (2.5Y 5/2) fine sandy loam; common, faint, mottles of pale brown (10YR 6/3); massive (structureless); friable; thin bedding planes; common mica flakes; medium acid; gradual, wavy boundary.

C3g—22 to 48 inches +, gray (10YR 5/1), stratified sand and loamy sand; single grain; friable; few, fine and medium, subrounded pebbles; numerous common mica flakes; medium acid.

The Ap horizon ranges from dark grayish brown through reddish brown in color and is loam, fine sandy loam, loamy sand, and coarse sandy loam in texture. The C1 horizon has matrix colors of brown and strong brown. In some places between depths of 10 and 40 inches, very thin strata of clay loam and of sandy loam occur. Within a depth of 20 inches, there are faint to distinct patterns of gray colors that have a chroma of 2 or less. The C2 horizon and the C3 horizon are gray or grayish brown and are distinctly mottled. The C horizon is mainly sandy loam, fine sandy loam, loam, and loamy sand. Underlying the C3 horizon are sandy strata in some places, but the material beneath this horizon is gravelly in most places. Mica flakes are common to many in abundance and very fine to medium in size.

The Cartecay soils occur with the Toccoa and the Wehadkee soils. Cartecay soils are not so well drained as the Toccoa soils but are better drained than the Wehadkee soils. The Cartecay soils contain less clay between depths of 10 and 40 inches and occupy fewer depressions on the flood plains.

Cartecay soils (Cab).—These nearly level soils occur in long, narrow areas along the flood plains of streams. The surface layer is loam, fine sandy loam, sandy loam, coarse sandy loam, or loamy sand and is 7 to 10 inches thick.

Included with these soils in mapping were areas where thin strata of silt occurred throughout the profile. Also included were a few areas where the loam surface layer was about 8 inches thick and the sandy clay loam subsoil was highly mottled and 60 inches or more thick. Other included areas were of a soil that was grayer and more poorly drained than are these soils. These inclusions make up about 20 percent of the mapped areas of Cartecay soils.

These soils are suited to few cultivated crops. Cleared areas are in hay, pasture, or row crops, mainly corn. Where row crops are grown, adequate drainage must be maintained (fig. 2). These soils are well suited to white oak and yellow-poplar. (Capability unit IIIw–2; woodland suitability group 1; wildlife suitability group 7)

Cecil Series

The Cecil series consists of deep, well-drained soils that developed in material weathered from granite, gneiss, and schist. These soils are in the uplands on the top of broad plateaus, on ridgetops, and on hillsides. Slopes range from 2 to 15 percent. Cecil soils are widely distributed throughout the survey area.

Typically, the surface layer of these soils in the less eroded areas is yellowish-brown to brown sandy loam about 5 inches thick. The upper part of the subsoil is yellowish-red sandy clay loam about 6 inches thick, the middle is red sandy clay or clay about 25 inches thick, and the lower part is red sandy clay loam that extends to a depth of about 56 inches. Bedrock is at a depth of 6 to 8 feet in most places.

These soils are low in natural fertility, contain little organic matter, and are strongly acid throughout the profile. Permeability is moderate. The available water capacity is medium in the uppermost 3 feet of soil. Where they are not severely eroded, these soils have good tilth, have a thick root zone, and respond well to good management.

The Cecil soils are extensive in both counties. The larger tracts are in the southern part of the survey area. In the less sloping areas, these soils are well suited to such crops as cotton, corn, small grains, and pasture and are used extensively for them. On slopes of more than 10 percent, the vegetation is chiefly loblolly pine, shortleaf pine, Virginia pine, white oak, red oak, and gums, though small areas are cultivated. The less sloping areas of Cecil soils are some of the soils best suited to crops in the two counties.

Typical profile of Cecil sandy loam, 2 to 6 percent slopes, eroded, 1.2 miles east of junction of State Routes 51 and 98, 60 feet west of Route 98, and in a stand of young pines, in Banks County:

Ap—0 to 5 inches, yellowish-brown (10YR 5/6) sandy loam; weak, fine, granular structure; friable; many fine roots; strongly acid; clear, smooth boundary.

B1t—5 to 11 inches, yellowish-red (5YR 5/8) sandy clay loam; weak, fine and medium, subangular blocky structure; friable; many roots; few pores; very few fine mica flakes; strongly acid; clear, wavy boundary.

Figure 2.—**Open ditch draining Cartecay soils so that they can be cultivated earlier than undrained soils.**

B2t—11 to 36 inches, red (2.5YR 4/8) clay; moderate, medium, subangular blocky structure; firm; faint, patchy clay films on peds; few, fine and medium roots; few fine mica flakes; strongly acid; gradual, wavy boundary.

B3—36 to 56 inches, red (2.5YR 4/8) sandy clay loam; weak, medium, subangular blocky structure; friable to firm; few fine mica flakes; strongly acid; gradual, wavy boundary.

C—56 to 62 inches +, mottled, yellowish-red (5YR 5/8), brownish-yellow (10YR 6/6), and gray loam (10YR 6/1); structureless; very friable; many fine mica flakes; strongly acid.

In eroded areas the Ap horizon ranges from brown to yellowish brown and is sandy loam. In the severely eroded areas, the Ap horizon ranges from yellowish red to red and is sandy clay loam. A few small fragments of quartz, gneiss, or granite are on the surface in some places.

The B2 horizon is dominantly red clay, but it ranges to sandy clay. The clay content of the B2t horizon ranges from 35 to 55 percent. In most places the solum ranges from 42 to 56 inches in thickness. The depth to bedrock is mainly between 6 and 8 feet but ranges to 50 feet in some places.

The Cecil soils occur with the Madison, Appling, Hiwassee, and Louisburg soils. The subsoil of Cecil soils is mainly red, whereas that of the Appling soils is yellowish red to red and is mottled in the lower part. The Cecil soils are less micaceous than the Madison soils and are less sticky and less reddish in the surface layer than the Hiwassee soils. Cecil soils are clayey in the subsoil and have a thicker solum than the Louisburg soils.

Cecil sandy loam, 2 to 6 percent slopes, eroded (CYB2).—This eroded soil occurs on broad ridgetops and side slopes of the uplands. It has the profile described as typical for the Cecil series. The surface layer of this soil is sandy loam, 4 to 8 inches thick, and the subsoil is mainly clay 40 inches or more thick.

Included with this soil in mapping were small areas of a similar soil that is only slightly eroded. In these areas the plow layer is entirely within the original surface layer. Also included were small areas of a soil having a dark-red subsoil. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil has good tilth, has a thick root zone, and responds well to good management. Erosion is a slight to moderate hazard, however, if cultivated crops are grown. This soil is well suited to locally grown row

crops, pasture, small grains, hay, and trees and is used extensively for them. The native vegetation is shortleaf pine, longleaf pine, gums, white oak, and red oak. (Capability unit IIe–1; woodland suitability group 2; wildlife suitability group 1)

Cecil sandy loam, 6 to 10 percent slopes, eroded (CYC2).—This is a deep, well-drained soil on the side slopes of the uplands. It has a brown sandy loam surface layer 4 to 6 inches thick. The upper part of the subsoil is sandy clay loam, and it is underlain by clay that extends to a depth of 40 inches or more.

Included with this soil in mapping were irregularly shaped areas that were only slightly eroded. In these areas the plow layer was entirely within the original surface layer. Also included were several small areas of a soil that has a brown sandy loam surface layer and a darker red, more sticky clay subsoil. In addition, there were small areas of a soil having a red subsoil that was 8 to 15 inches thinner than the subsoil of this soil. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil has good tilth and a thick root zone. It responds to good management and is well suited to all of the locally grown cultivated crops. Almost all of the acreage has been cultivated, but 25 percent or more has reverted to shortleaf pine, loblolly pine, and mixed hardwoods, such as red oak, white oak, and gums. Although this soil is suited to cultivated crops, there is enough runoff for erosion to be a severe hazard in cultivated areas unless management is good. (Capability unit IIIe–1; woodland suitability group 2; wildlife suitability group 1)

Cecil sandy loam, 10 to 15 percent slopes, eroded (CYD2).—This soil is on the long side slopes of the uplands. It has a surface layer 4 to 6 inches thick. The upper few inches of the subsoil is sandy clay loam, and this is underlain by clay that extends to a depth of 40 inches or more.

Included with this soil in mapping were irregularly shaped areas that were only slightly eroded. In these areas, the plow layer was entirely within the original surface layer. Also included were several small areas of a soil having a brown sandy loam surface layer and a darker red, more sticky clay subsoil than that in this soil. In addition, there were areas having a red subsoil that was 8 to 15 inches thinner than that in this soil. These inclusions make up as much as 15 percent of the mapped areas of this soil.

Strong slopes and the hazard of erosion generally restrict use of this soil for farming. This soil is mostly in trees or pasture, or it is idle. It is used extensively for wildlife and recreation, but a few small areas are in row crops. Unless these areas are carefully managed, there is enough runoff for erosion to be a severe hazard. (Capability unit IVe–1; woodland suitability group 2; wildlife suitability group 2)

Cecil sandy clay loam, 2 to 6 percent slopes, eroded (CZB2).—The surface layer of this soil is more clayey than that in the profile described as typical for the Cecil series. It is a mixture of some of the original surface layer and some of the clayey subsoil. Areas that have a few shallow gullies and galled spots commonly occur.

Included with this soil in mapping were small areas of severely eroded Cecil soils. In these areas all of the original surface layer generally had been removed. Also included were small, irregularly shaped areas where the plow layer was entirely within the original surface layer. These inclusions make up as much as 25 percent of the mapped areas of this soil.

Nearly all of the acreage has been cultivated, but much of it has reverted to pine trees. Although the root zone is thick, tilth is not good. This soil is suited to permanent pasture, hay, and trees. Because of the high content of clay in the surface layer, this sandy clay loam is not so well suited to row crops as is Cecil sandy loam, 2 to 6 percent slopes, eroded. (Capability unit IIe–1; woodland suitability group 4; wildlife suitability group 1)

Cecil sandy clay loam, 6 to 10 percent slopes, severely eroded (CZC3).—This soil occurs on the long hillsides of the uplands. Its profile is similar to the one described as typical for the Cecil series except that this soil has had nearly all of the original surface layer and part of the subsoil removed by accelerated erosion. The present surface layer is a mixture of the upper part of the subsoil and the remnants of the original surface layer. Shallow gullies and galled spots are common, and in a few places deep gullies occur.

Included in mapping were small areas where many shallow gullies and a few deep ones formed an intricate pattern. These inclusions make up as much as 15 percent of the mapped areas of this soil.

Nearly all of the acreage has been cultivated, but most of it has reverted to shortleaf pine and loblolly pine. Although this soil has a thick root zone, it is only moderately well suited to row crops because tilth is poor, slopes are steep, and the hazard of erosion is severe. It is well suited to permanent pasture, hay, trees, and use for wildlife and recreation. (Capability unit IVe–1; woodland suitability group 4; wildlife suitability group 3)

Cecil sandy clay loam, 10 to 15 percent slopes, severely eroded (CZD3).—This soil occurs on long hillsides of the uplands and mountains. It has a profile similar to the one described as typical for the series, except that this soil has had nearly all of the original surface layer and part of the subsoil removed by accelerated erosion. In most areas of this soil, the surface layer is yellowish-red sandy clay loam 3 to 7 inches thick. It is a mixture of the upper part of the subsoil and remnants of the original surface layer.

Included in mapping were small areas of other Cecil soils in which erosion had formed an intricate pattern of the many shallow gullies and the few deep ones. Also included were a few small areas of a soil similar to this soil except that its surface layer was 6 to 12 inches thinner. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil is not suited to row crops, because slopes are too steep and the hazard of erosion is severe. It is moderately well suited to pasture, but it is better suited to trees and to use for wildlife and recreation. The native vegetation consists of shortleaf pine, loblolly pine, Virginia pine, white oak, red oak, and vari-

ous gums. (Capability unit VIe–2; woodland suitability group 4; wildlife suitability group 3)

Chandler Series

The Chandler series consists of steep, somewhat excessively drained soils that formed in material weathered from mica schist and phyllite. These soils occur in the foothills and mountains, on ridges, knobs, and steep side slopes.

Typically, the surface layer is very dark grayish-brown loam about 2 inches thick. It is over olive-brown loam about 8 inches thick. The subsoil, about 14 inches thick, is yellowish-brown loam underlain by dark yellowish-brown sandy loam material that extends to mica schist at a depth of 60 inches or more.

These soils are low in natural fertility, contain little organic matter, and are strongly acid. Permeability is moderately rapid, and the available water capacity is low.

The Chandler soils are not extensive in the survey area. The largest acreage of these soils is on or near Yellowback Mountain, but small areas are interspersed throughout the foothills. Slope, a shallow root zone, and internal drainage limit the use of these soils to trees. The native vegetation is mixed hardwoods, shortleaf pine, and Virginia pine.

Typical profile of Chandler loam, 25 to 60 percent slopes, on State Route 17, north of Toccoa City limits for 1.9 miles to intersection with Black Mountain Road, then 4.3 miles northeast on Black Mountain Road to stand of mixed hardwoods; in Stephens County:

A1—0 to 2 inches, very dark grayish-brown (2.5Y 3/2) loam; weak, fine, granular structure; friable; many fine mica flakes; few small fragments of rock; many fine roots; abrupt, wavy boundary; strongly acid.

A2—2 to 10 inches, olive-brown (2.5Y 4/4) loam; weak, fine, granular structure; friable; few small fragments of rock; many fine to medium mica flakes; many fine roots; strongly acid; gradual, wavy boundary.

B—10 to 24 inches, yellowish-brown (10YR 5/4) loam; weak, fine, granular structure; friable; many fine to medium roots; few small fragments of rock; many fine to medium mica flakes; gradual, wavy boundary; strongly acid.

C—24 to 60 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, fine, granular structure; friable; many medium roots; few small fragments of rock; many medium mica flakes; strongly acid.

Some angular to slightly platy fragments of schist and gneiss are scattered on the surface of these soils. The A horizon ranges from loam and silt loam to sandy loam. The A1 horizon ranges from dark grayish brown to very dark grayish brown and is 2 to 5 inches thick. The loam B horizon shows no appreciable accumulation of clay. The solum ranges from 20 to 30 inches in thickness. The C horizon ranges from sandy loam to partly weathered mica schist.

The Chandler soils occur with the Louisa, Madison, Grover, and Louisburg soils. The Chandler soils contain slightly less sand throughout than the Louisa soils and have weathered more deeply. They lack the distinct horizon development and the clayey subsoil of the Madison and Grover soils. The Chandler soils are slightly finer textured than the Louisburg soils, which do not contain mica.

Chandler complex, 25 to 75 percent slopes (CsF).—The soils in this complex occur in such an intricate pattern that they could not be separated on the soil map. About 55 percent of the complex is Chandler soils, and 25 percent is soils that are similar to Chandler soils but that have a sandy clay loam or clay loam subsoil.

Included in mapping, and making up as much as 20 percent of the mapped areas, were small areas where the surface layer was yellowish-brown sandy loam 2 to 5 inches thick. This layer was underlain by about 40 inches of red sandy clay that has many, distinct, strong-brown and yellowish-brown mottles.

The Chandler soils in this complex have a profile similar to that described as typical for the Chandler series.

The soils in this complex are too steep for cultivation. They require plant cover at all times because the hazard of erosion is severe. They are mainly suited to trees, wildlife, and recreation, but trees do not grow well. (Capability unit VIIe–2; woodland suitability group 6; wildlife suitability group 5)

Chandler and Rock land, 60 to 90 percent slopes (CrG).—This undifferentiated unit consists of somewhat excessively drained soils and Rock land on foothills. The Chandler soils make up about 60 percent of this unit, and Rock land makes up about 20 percent. Included in mapping, and making up about 20 percent of the mapped areas, were small areas of Louisburg and Wilkes soils.

The surface layer of the Chandler soils is loam about 10 inches thick or more. In most places the subsoil is loam, but in a few places a thin layer of light sandy clay loam has formed. The subsoil ranges from 12 to about 20 inches in thickness. Below the subsoil loamy material extends to a depth of 50 inches or more.

Rock land consists of rock outcrops and pockets of coarse-textured soil material that has little or no stratification. These pockets occupy about 40 percent of Rock land. The soil material between the rock outcrops is loamy sand or sandy loam 12 to 18 inches thick.

This mapping unit is used only for growing trees, but the slopes are too steep for conventional logging. On the Chandler soils the growth of trees is moderate or poor. Plants and trees on Rock land normally cannot grow continuously, but a few trees, shrubs, and grasses have survived for years in small pockets of soil material in crevices in the rocks. Some areas of Rock land are scenic (fig. 3). Plants that provide food and cover for wildlife can be grown to a limited extent. (Capability unit VIIe–2; woodland suitability group 7; wildlife suitability group 5)

Grover Series

The Grover series consists of moderately deep to deep, well-drained soils on uplands. These soils formed in material weathered from mica schist and mica gneiss. Slopes range from 6 to 60 percent but, in most places, are less than 45 percent.

Typically, the surface layer in the less eroded areas is yellowish-brown fine sandy loam about 7 inches thick. The subsoil is highly micaceous sandy clay

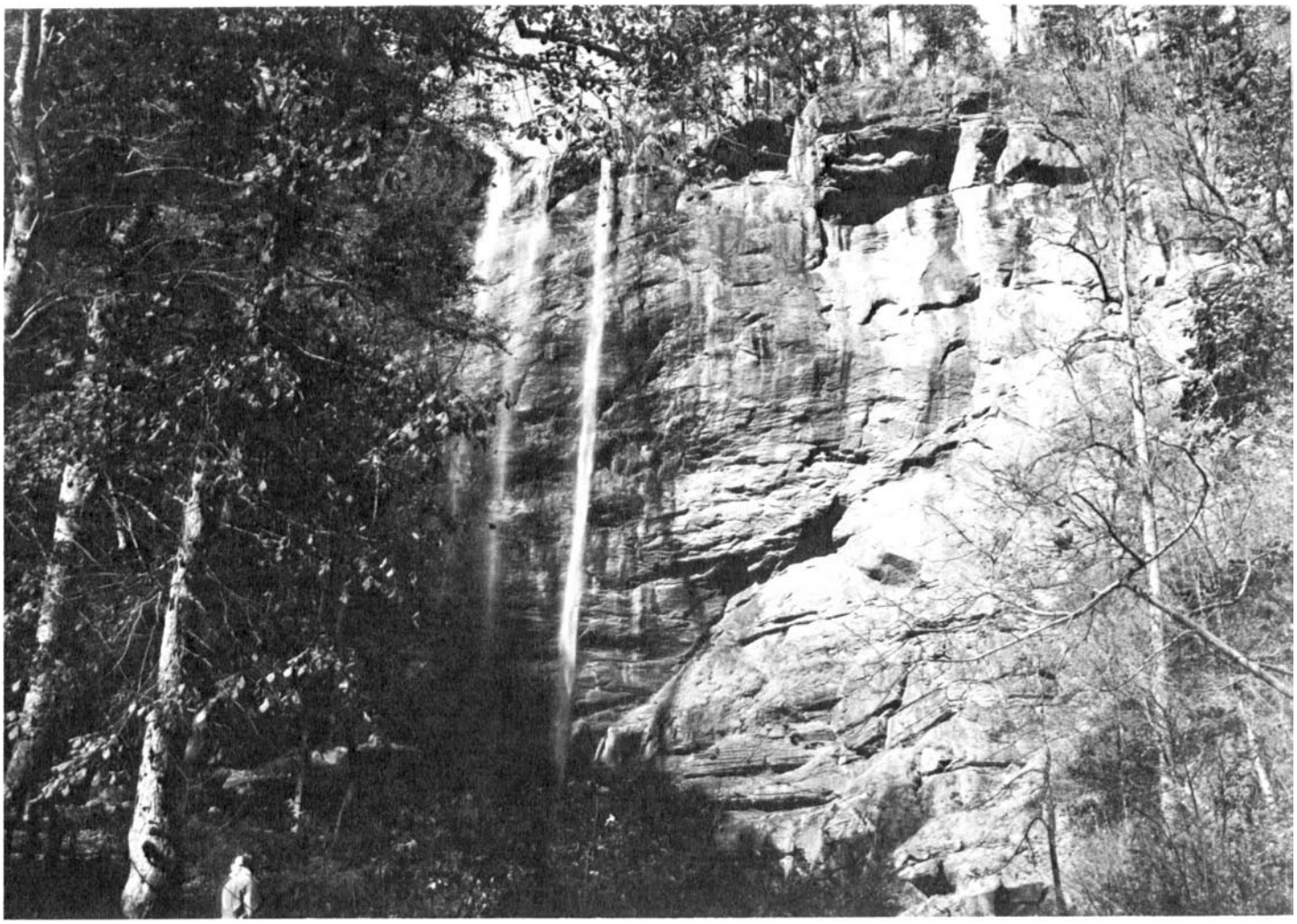

Figure 3.—**Toccoa Falls where rock similar to that underlying much of the foothills area is exposed. The water falls 186 feet.**

loam about 30 inches thick. The upper few inches is strong brown, and the rest is yellowish red. The underlying material is reddish-yellow loam. Depth to bedrock is 5 to 10 feet or more.

These soils are low in natural fertility, contain little organic matter, and are strongly acid throughout the profile. They have good tilth and a thick to moderately thick root zone. Permeability is moderate, and the available water capacity is medium.

The Grover soils are not extensive in Banks and Stephens Counties. Most of the acreage occurs as small areas in the western part of Stephens County, and a small acreage is in the northwestern part of Banks County. Where slopes are less than 10 percent, these soils are well suited to cultivated crops or pasture. Where slopes are more than 10 percent, these soils are better suited to permanent pasture, trees, wildlife, or recreation.

Typical profile of Grover fine sandy loam, 6 to 15 percent slopes, eroded, 7 miles west of courthouse in Homer, Ga., on State Route 98 to crossroad; then west on paved road 2.1 miles to trail; 900 feet south on trail, on east side; Banks County:

Ap—0 to 7 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, fine, granular structure; very friable; few small quartz grains; many fine roots; many fine mica flakes; strongly acid; abrupt, smooth boundary.

B1—7 to 13 inches, strong-brown (7.5YR 5/6) light sandy clay loam; weak, fine, subangular blocky structure; friable; few quartz grains; many fine roots; many fine mica flakes; strongly acid; clear, wavy boundary.

B2t—13 to 25 inches, yellowish-red (5YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; friable; many small quartz grains; some fine and medium roots; numerous fine mica flakes that impart a slick or greasy feel; patchy clay films on peds; strongly acid; clear, smooth boundary.

B3—25 to 37 inches, yellowish-red (5YR 5/6) light sandy clay loam; weak, fine, subangular blocky structure; friable; few fine and medium roots; numerous fine mica flakes; strongly acid; clear, wavy boundary.

C—37 to 55 inches, reddish-yellow (5YR 7/8) loam; massive (structureless); very friable; few roots; very high mica content; strongly acid; horizon gradually grades to horizon below.

R—55 inches +, weathered mica schist and mica gneiss.

In areas not cultivated, the A1 horizon ranges from olive gray and dark gray to dark grayish brown. In cultivated areas, the Ap horizon ranges from light yellowish brown to brown. The A horizon is fine sandy loam, sandy loam, and

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sandy clay loam in most places. The B2t horizon ranges from sandy clay loam to light clay loam in texture and from yellowish red to strong brown in color. In places, the B3 horizon has mottles of red, reddish yellow, and white. In thickness, the B horizon ranges from 22 to 37 inches and the solum from 25 to 42 inches. Depth to bedrock ranges from 5 to 10 feet or more.

The Grover soils occur with the Appling, Madison, and Wedowee soils. Grover soils resemble the Appling soils in color but have a less clayey subsoil and contain much more mica throughout the profile. The subsoil in the Grover soils is not so red and clayey as that in the Madison soils, though the two kinds of soils have comparable parent material and content of mica. The Grover and the Wedowee soils are similar in color, but the Grover soils have a less clayey, much more micaceous subsoil.

Grover fine sandy loam, 6 to 15 percent slopes, eroded (GiD2).—This micaceous soil occurs on hillsides in the uplands. It has the profile described as typical for the series. The surface layer is 3 to 7 inches thick, and the subsoil is 22 to 30 inches thick.

Included with this soil in mapping were areas of soils that were similar but had slopes ranging from 2 to 6 percent. Also included were a few areas where the soil was only slightly eroded. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This Grover soil is not extensive in Banks and Stephens Counties, but it occurs in small, widely distributed areas. Most of the acreage has reverted to mixed pines and hardwoods. This soil is well suited to shortleaf pine and Virginia pine and is fairly well suited to red oak and white oak. Under good management, it is fairly well suited to cultivated crops. (Capability unit IVe–1; woodland suitability group 2; wildlife suitability group 2)

Grover fine sandy loam, 15 to 60 percent slopes (GiF).—This micaceous soil occurs on mountain foothills. The surface layer is 3 to 7 inches thick, and the sandy clay loam subsoil is 22 to 28 inches or more thick.

Included with this soil in mapping were areas of soils that were similar but more eroded. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil has a thick to moderately thick root zone, but it is too steep to be suited to cultivated crops. Practically none of it has been cultivated. The vegetation consists of shortleaf pine, Virginia pine, and various oaks and gums. Where woodland management is good, growth of trees is moderate to good. (Capability unit VIIe–1; woodland suitability group 6; wildlife suitability group 6)

Gullied Land

Gullied land (Gul) consists of small areas where erosion has removed most of the soil material and has formed intricate patterns of shallow and deep gullies (fig. 4). In many places the gullies are cut down into the weathered mica schist, granite, or gneiss. The soil material that remains on the ridges generally is sandy clay to clay that was mainly in the lower part of the original profile.

This land type is not suitable for farming, but it can be managed to protect watersheds or to produce a small amount of food and cover for wildlife. Establishing vegetation on this land type is difficult. To establish a close-growing crop to help control erosion requires reshaping with machinery and large additions of fertilizer (fig. 5). (Capability unit VIIe–4; not assigned a woodland suitability group; wildlife suitability group 4)

Gwinnett Series

The Gwinnett series consists of moderately deep to deep, well-drained, gently sloping to steep soils on uplands. These soils formed on ridgetops and side slopes in material weathered from acidic and basic rocks.

Typically, the surface layer of these soils is dark-brown and dark reddish-brown sandy loam about 7 inches thick. The upper 3 inches of the subsoil is dark reddish-brown sandy clay loam, and the next 26 inches is dark-red clay. Below this, to a depth of 50 inches, is dark reddish-brown clay loam. The underlying material is yellowish-red, loose loam, weathered from schist or gneiss, and dark-brown, brown, and black minerals.

The Gwinnett soils are extensive and scattered throughout Banks and Stephens Counties. Where slopes are less than 10 percent, these soils are well suited to row crops. Where slopes are more than 10 percent, these soils are better suited to permanent pasture, to trees, wildlife, or recreation.

Typical profile of Gwinnett sandy loam, 10 to 15 percent slopes, eroded, 3 miles southeast of Dick's Hill on State Route 17 and one-quarter mile west of Locust Stake Road in Stephens County:

O1—2 inches to 1 inch, loose litter from mixed pines and hardwoods.

O2—1 inch to 0, thin mat of partly decomposed organic material.

A1—0 to 4 inches, dark-brown (7.5YR 3/2) sandy loam; weak, fine, granular structure; friable; numerous fine and medium roots; strongly acid; abrupt, smooth boundary.

A3—4 to 7 inches, dark reddish-brown (5YR 3/4) sandy loam; weak, fine, granular structure; friable; numerous fine and medium roots; strongly acid; abrupt, wavy boundary.

B1—7 to 10 inches, dark reddish-brown (2.5YR 3/4) sandy clay loam; weak, fine, subangular blocky structure; friable; numerous fine and medium roots; strongly acid; abrupt, wavy boundary.

B2t—10 to 36 inches, dark-red (2.5YR 3/6) clay; moderate, medium, subangular blocky structure; firm; faint and patchy clay films on peds; many medium and fine roots; few small rock fragments; some material from horizons above has penetrated old root channels; strongly acid; gradual, wavy boundary.

B&C—36 to 50 inches, dark reddish-brown (2.5YR 3/4) clay loam that tongues into weathered, yellowish-brown (10YR 5/6), soft fragments of schist and gneiss that are about 40 percent or more, by volume; clay loam part has weak, fine, subangular blocky structure, is friable to firm, has few medium roots and few fine mica flakes, is strongly acid, and has clear, wavy boundary.

C—50 to 60 inches +, yellowish-red, loose loam saprolite from schist or gneiss and dark-brown, brown, and black minerals, possibly from common hornblende.

The A1 or Ap horizon ranges from dark brown, dark reddish brown to dusky red, or dark red in color and is sandy loam, sandy clay loam, clay loam in texture. The A horizon

Figure 4.—**Typical intricately patterned landscape of Gullied land before skilled, intensive management.**

is 4 to 8 inches thick. The Bt horizon ranges from dark red to dark reddish brown in color and is from clay to sandy clay in texture. This horizon is 40 to 60 percent clay. In some places a B3 horizon occurs. In thickness the B2t horizon is 18 to 30 inches and the solum is 22 to 40 inches. The B2t horizon varies in thickness within short distances, and broken and fractured rocks are vertically interspersed in the horizon. This horizon has an irregular lower boundary. Dark-colored bedrock occurs at a depth of 5 to 8 feet.

The Gwinnett soils occur with the Appling, Cecil, Madison, and Musella soils. Gwinnett soils have a thinner solum than do the Appling soils or the Cecil soils and are redder in the B horizon. They contain little or no mica and have a redder B2t horizon than the highly micaceous Madison soils. The B horizon of Gwinnett soils contains few rock fragments and is thicker than that of the Musella soils, which is 20 to 40 percent rock fragments, by volume.

Gwinnett sandy loam, 2 to 6 percent slopes, eroded (GfB2).—This soil occurs on ridgetops and side slopes of the uplands. It has a profile similar to the one described for the series except that the surface layer, because of erosion, is only about 6 inches thick. The subsoil is sandy clay loam or clay loam in the upper part and is clay or heavy clay loam in the lower part. The hazard of erosion is moderate.

Included with this soil in mapping were areas where erosion was only slight. Also included were areas of a soil similar to this soil that had a combined surface layer and subsoil more than 40 inches thick. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil is extensive in Banks and Stephens Counties and occurs throughout in small to large areas. It is suited to many kinds of crops. It responds well to good management, especially to additions of fertilizer, and is well suited to moderately intensive use. Most of the acreage has been cultivated to row crops, chiefly cotton and corn, but about 50 percent is now farmed or is used as pasture. The rest has reverted to trees, mostly shortleaf pine and loblolly pine. (Capability unit IIe–1; woodland suitability group 2; wildlife suitability group 1)

Gwinnett sandy loam, 10 to 15 percent slopes, eroded (GfD2).—This soil occurs on hillsides of uplands and foothills of mountains. It has the profile described as typical for the Gwinnett series. The surface layer is

Figure 5.—Gullied land healed by establishment of good ground cover of close-growing kudzu.

about 7 inches thick. The subsoil is sandy clay loam or clay loam in the upper part and is clay or heavy clay loam in the lower part.

Included with this soil in mapping were areas of a similar soil that was only slightly eroded. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil is moderately to severely susceptible to erosion, but it is suited to many kinds of row crops, pasture or hay, and trees if management is good. Most of it has been cleared and cultivated, but about 80 percent has reverted to trees, mainly shortleaf pine and loblolly pine. (Capability unit IVe–1; woodland suitability group 2; wildlife suitability group 6)

Gwinnett sandy loam, 15 to 45 percent slopes (GfF).—This soil occurs on side slopes of uplands and on foothills of mountains. It has a profile similar to the one described as typical for the Gwinnett series except that the surface layer is about 8 inches thick because erosion is only slight. The subsoil is sandy clay loam or clay loam in the upper part and is clay or heavy clay loam in the lower part.

Included with this soil in mapping were areas of an eroded soil that otherwise was similar. In these included areas, 25 to 75 percent of the surface layer remained, and there were a few small gullies and a few deep gullies. Also, galled spots were on the surface. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This Gwinnett soil is extensive only in the foothills in Banks and Stephens Counties. It is not suited to row crops or pasture but is suited to trees, wildlife,

and recreation. Little of the acreage has been cleared. (Capability unit VIIe–1; woodland suitability group 2; wildlife suitability group 2)

Hiwassee Series

The Hiwassee series consists of deep, well-drained, gently sloping to steep soils. These soils occur on broad ridgetops and side slopes and terraces near streams.

Typically, the surface layer is dark reddish-brown clay loam about 4 inches thick. The subsoil is mainly dark reddish-brown and dark-red clay more than 40 inches thick.

These soils are low in natural fertility, contain little organic matter, and are strongly acid throughout the profile. Permeability is moderate. The available water capacity is medium. These soils have a thick root zone. Tilth is good in the less eroded areas where normally the surface layer is loam or sandy loam but is poor in areas where the surface layer is clay loam.

The Hiwassee soils occur in somewhat large areas that are uniform in size and are extensive in the survey area. Because these soils have a sticky surface layer, they generally are difficult to cultivate. But they are well suited to many kinds of crops where slopes are less than 10 percent and management is good. These less sloping areas are used for any of the row crops grown in the survey area and for hay and pasture. Where slopes are more than 10 percent, vegetation is mainly shortleaf pine, loblolly pine, white oak, red oak, blackgum, and sweetgum.

Typical profile of Hiwassee clay loam, 6 to 10 percent slopes, eroded, three-quarters of a mile on left of paved Banks County road from first crossroad of State Route 164 and east of U. S. Highway No. 441:

Ap—0 to 4 inches, dark reddish-brown (5YR 3/4) clay loam; moderate, fine to medium, granular structure; very friable; numerous fine and medium roots; strongly acid; clear, smooth boundary.

B1—4 to 7 inches, dark reddish-brown (5YR 3/4) clay loam; moderate, medium, subangular blocky structure; friable; strongly acid; gradual, smooth boundary.

B21t—7 to 41 inches, dark reddish-brown (2.5YR 3/4) clay, reddish brown (2.5YR 3.5/4) when dry; moderate, medium, subangular blocky structure; sticky and hard when dry; patchy clay films on peds; strongly acid; gradual, smooth boundary.

B22t—41 to 65 inches, dark-red (2.5YR 3/6) clay, red (2.5YR 4/6) when dry; few, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; sticky and hard; numerous mica flakes; patchy clay films on peds; strongly acid; clear, wavy boundary.

C—65 to 73 inches +, yellowish-brown (10YR 5/6), disintegrated rock mixed with clayey material and fragments of basic rock.

In some places on the surface and throughout the profile are a few small, rounded quartz pebbles and a few medium-sized, rounded concretions of magnesium. The A horizon ranges from sandy loam to clay loam in texture and from dark red and dark reddish brown to dark brown in color. It is 3 to 8 inches thick. The B2t horizon normally is clay but, in places, ranges to heavy clay loam and silty clay. The Bt horizon is dark reddish brown, reddish brown, dark red, and red. In most places the C horizon is sandy clay, but it ranges to clay intermixed with common, rounded and angular pebbles or fragments of quartz and basic rocks.

The Hiwassee soils occur with the Appling, Cecil, Gwinnett, and Wickham soils. The Hiwassee soils have a thicker B horizon than have the Gwinnett soils in which that horizon is less than 40 inches thick. The characteristic dark-red B horizon in the Hiwassee soils also is present in the Gwinnett soils but not in the Appling, Cecil, and Wickham soils.

Hiwassee clay loam, 2 to 6 percent slopes, eroded (HTB2).—This soil occupies ridgetops on the uplands. Shallow gullies and galled spots are common, and a few deep gullies occur. The subsoil is mixed with remnants of the original surface layer.

Included with this soil in mapping were areas of a less eroded soil that had a surface layer that was reddish brown or paler instead of the typical dark reddish brown. In these included areas, the surface layer was sandy clay loam and less sticky than that in this soil. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil has a thick root zone, but tilth is poor. All of this soil has been cleared, but about half of it has reverted to mixed pines and hardwoods. Although this soil is difficult to cultivate, it is well suited to cultivated crops, hay, and pasture grasses if management is good. (Capability unit IIIe–1; woodland suitability group 4; wildlife suitability group 1)

Hiwassee clay loam, 6 to 10 percent slopes, eroded (HTC2).—This soil occurs on side slopes of the uplands. It has the profile described as typical for the Hiwassee series. It has a surface layer 3 to 6 inches thick and a clay subsoil 50 to 65 inches thick.

Included with this soil in mapping were areas of a severely eroded soil that has a dark-red clay loam surface layer and a dark-red clay subsoil that was less than 50 inches thick. These inclusions make up about 20 percent of the mapped areas of this soil.

This soil has a thick root zone but poor tilth. Cultivated crops are suited if they are grown in rotation and management is good. Most of this soil has been cleared and cultivated, but more than half of it has reverted to mixed pines and hardwoods. (Capability unit IIIe–1; woodland suitability group 4; wildlife suitability group 1)

Hiwassee clay loam, 10 to 15 percent slopes, eroded (HTD2).—This soil occurs on hillsides of the uplands. It has a surface layer 3 to 6 inches thick and a clay subsoil 50 inches or more thick. Because of the strong slopes, runoff is fast enough for erosion to be a serious hazard.

Included with this soil in mapping were small areas of a severely eroded soil that had a dark-red clay loam surface layer, underlain by dark-red clay about 40 inches thick. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil has a thick root zone but tilth is poor. Cultivated crops are well suited if they are grown in rotation and management is good. Most of this soil has been cleared and cultivated, but about 75 percent of it has reverted to mixed hardwoods and pines. Recreation and wildlife are moderately good uses. (Capability unit IVe–1; woodland suitability group 4; wildlife suitability group 2)

Hiwassee clay loam, 15 to 25 percent slopes, eroded (HTE2).—This soil occurs on hillsides of uplands and

mountains. It has a surface layer 3 to 8 inches thick and a clay subsoil 50 inches or more thick. A few, fine, faint mottles of yellowish brown occur at a depth of 40 to 50 inches.

Included with this soil in mapping were areas of a severely eroded soil that had a surface layer of dark reddish-brown to dark-red sandy clay loam that was underlain by dark-red clay about 24 inches or more thick. These inclusions make up about 20 percent of the mapped areas of this soil.

This soil has a thick root zone but poor tilth. It is not suited to cultivated crops, because slopes are strong to steep and runoff is rapid. The erosion hazard is severe, and permanent vegetation is needed for protection. Under suitable woodland management, this soil is moderately well suited to shortleaf pine, loblolly pine, Virginia pine, and mixed hardwoods. It also is moderately well suited to use for wildlife, but it is poorly suited to use for recreation. (Capability unit VIe–2; woodland suitability group 4; wildlife suitability group 2)

Hiwassee loam, 2 to 6 percent slopes (HSB).—This soil is undulating and occurs on broad ridgetops of the uplands. It has a profile similar to that described as typical for the series, except that the surface layer is thicker and coarser textured. The surface layer is 6 to 8 inches thick, and the clay subsoil is 50 inches or more thick.

Included with this soil in mapping were eroded areas where the surface layer was not the dark reddish brown that is characteristic of the Hiwassee soils. A few, fine, faint mottles of yellowish brown occurred in the subsoil at a depth of about 40 inches. These inclusions make up as much as 15 percent of the mapped areas of this soil.

This soil is mostly cultivated. It is well suited to all kinds of locally grown row crops, small grains, and pasture. This soil also is well suited to shortleaf pine, loblolly pine, Virginia pine, and various oaks and gums. (Capability unit IIe–1; woodland suitability group 2; wildlife suitability group 1)

Hiwassee loam, 6 to 10 percent slopes, eroded (HSC2).—This soil occurs on hillsides of the uplands. It has a profile similar to the one described as typical for the Hiwassee series, except that the surface layer is thicker and coarser textured. The surface layer is 4 to 8 inches thick, and the clay subsoil is 50 inches or more thick.

Included with this soil in mapping were areas where the surface layer was slightly eroded and lacked the dark reddish-brown color characteristic in the Hiwassee soils. In these areas the loam surface layer ranged from dark grayish brown to reddish brown and the deeper horizons of clay ranged from the red in the Cecil soils to the dark red in the Hiwassee soils.

This soil has a thick root zone and is well suited to all of the locally grown row crops, small grains, and temporary and permanent grass-legume pasture. It is suited to shortleaf pine, loblolly pine, Virginia pine, and various oaks and gums. About 50 percent of this soil is in cultivated crops, and the rest is in trees or permanent pasture. (Capability unit IIIe–1; woodland suitability group 2; wildlife suitability group 1)

Hiwassee loam, 10 to 15 percent slopes (HSD).—This soil occurs on hillsides in areas that range from 5 to 15 acres in size. Its profile is similar to the one described as typical for the series, except that the surface layer is thicker and coarser textured. The surface layer is 6 to 8 inches thick, and the clay subsoil is 50 inches or more thick.

Included with this soil in mapping were areas where erosion had removed most of the original surface layer and the existing surface layer was a mixture of part of the subsoil and remnants of the original surface layer. Also included were areas of Cecil soils. These inclusions make up as much as 25 percent of the mapped areas of this soil.

This soil is moderately well suited to the locally grown cultivated crops and pasture plants, but it is better suited to trees and use for wildlife and recreation because slopes are steep. The vegetation consists of mixed pines and hardwoods. (Capability unit IVe–1; woodland suitability group 2; wildlife suitability group 2)

Louisa Series

The Louisa series consists of shallow to moderately deep, well-drained to somewhat excessively drained, sloping to steep soils that are micaceous. These soils occur on the side slopes of uplands and mountains. Slopes range from 10 to 25 percent.

Typically the surface layer is yellowish-brown fine sandy loam 5 to 8 inches thick. In more than half of the acreage, the subsoil is yellowish-brown or yellowish-red to red fine sandy loam about 6 to 26 inches thick. In the rest of the acreage, the subsoil is yellowish-red clay loam 4 to 8 inches thick. The underlying material is yellowish-brown loamy sand. Bedrock is at a depth of about 4 feet. Mica occurs throughout the profile.

These soils have a shallow root zone. They are low in natural fertility, contain little organic matter, and are strongly acid. Permeability is moderately rapid, and the available water capacity is low.

The Louisa soils are in scattered areas throughout Banks and Stephens Counties but are most extensive in mountainous areas. In about 5 percent of the acreage, the Louisa soils have been cultivated but have reverted to pasture. These soils are better suited to trees, wildlife, and recreation than to cultivated crops or pasture. The native vegetation is blackjack oak, various gums, and a few shortleaf pine. Because the root zone is shallow and the available water capacity is low, plant growth is slow on these soils.

In this survey area, the Louisa soils are mapped only in complexes with the Tallapoosa soils and the Madison soils.

Typical profile of Louisa fine sandy loam, 10 to 15 percent slopes, 1¼ miles west of U.S. Highway No. 441, near Hollingsworth on a secondary road, 1⅛ miles northwest along trail and 100 yards west of trail, in Banks County:

O1—1 inch to 0, leaf litter.
A1—0 to 7 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, fine, granular structure; friable; numerous fine and medium roots; many fine mica flakes; strongly acid; abrupt, smooth boundary.
B—7 to 28 inches, yellowish-brown (10YR 5/6) fine sandy loam; weak, medium, subangular blocky structure; friable; numerous fine and medium roots; many fine to medium mica flakes; strongly acid; clear, wavy boundary.
C—28 to 50 inches, yellowish-brown loamy sand; few, fine mottles of dark yellowish brown mixed with fragments of partly weathered mica schist that have a few lenses of gneiss; highly micaceous.

Fragments of schist and gneiss are scattered on the surface in many places. The A1 or Ap horizon ranges from dark grayish brown and brown to yellowish brown. The A horizon is sandy loam, fine sandy loam, or loamy sand. The B horizon ranges from yellowish brown to yellowish red and red in color and from fine sandy loam to sandy loam in texture. In some places the B horizon is a discontinuous thin layer of yellowish-red sandy clay loam 4 to 8 inches thick. It is underlain by yellowish-red to red loamy sand, fine sandy loam, or sandy loam. The C horizon ranges from brown to red, though both brown and red occur in some areas in only a few places. This horizon ranges from partly weathered schist, at a depth of less than 20 inches, to loamy sand. Depth to bedrock ranges from 1 to 4 feet in many places.

The Louisa soils occur mainly with the Tallapoosa, Madison, and Chandler soils. Louisa soils have a less clayey B horizon than the Tallapoosa soils. The B horizon of the Louisa soils is yellowish brown to yellowish red, whereas that of the Chandler soils is yellowish brown or brown. The Louisa soils have not weathered so deeply as have the Chandler soils and are not so deep to bedrock as the Madison soils. Louisa soils have less distinct horizon development than the Madison soils and have less clay in the B horizon.

Louisa-Tallapoosa complex, 10 to 25 percent slopes (LOE).—The soils in this complex occur on side slopes of foothills of mountains. These soils are so closely intermingled that it is not practical to separate them on the soil map. The Louisa soils make up about 60 percent of this complex, and the Tallapoosa soils about 30 percent. These proportions are reasonably consistent in all mapped areas.

The surface layer of the soils in this complex is fine sandy loam, loamy sand, or sandy loam. The subsoil of the Louisa part of the complex is fine sandy loam or sandy loam, and in less than 50 percent of the acreage, a thin, discontinuous layer of sandy clay loam occurs. The subsoil of the Tallapoosa part is silty clay loam about 8 inches thick.

Included with these soils in mapping were small areas of similar soils where depth to schist fragments was more than 20 inches. Also included were small eroded areas. In these areas, erosion had removed a greater part of the original surface layer, and a few shallow and deep gullies had formed. These inclusions make up as much as 15 percent of the mapped areas of this soil.

This complex is not suited to row crops or pasture grasses and legumes. It is suited to trees, wildlife, and recreation. The vegetation is chiefly post oak, blackjack oak, sweetgum, and various dogwoods. Some shortleaf pine and Virginia pine also grow. (Capability unit VIIe–2; woodland suitability group 5; wildlife suitability group 5)

Louisburg Series

The Louisburg series consists of shallow to moderately deep, well-drained to somewhat excessively drained, sloping to steep soils that occur on uplands and were derived from medium- and coarse-grained acidic gneiss and granite. These soils occur in small areas on long, narrow side slopes of uplands and mountains.

The surface layer is yellowish-brown to dark-brown loamy sand or stony loamy sand about 6 inches thick. The subsoil is yellowish-brown sandy loam about 24 inches thick. Below this is strong-brown sandy loam. Depth to bedrock is about 4 feet.

These soils are low in natural fertility, contain little organic matter, and are strongly acid. Permeability is rapid, and the available water capacity is low.

The Louisburg soils normally occur in small, narrow strips that are scattered throughout Banks and Stephens Counties. They also occur in a few large areas in the foothills of Stephens County. These soils are not well suited to cultivated crops or pasture, because available water capacity is too low for the good growth of plants and slopes are too steep for the effective use of farm implements. These soils are better suited to use for wildlife and recreation or for producing a limited quantity of lumber.

Typical profile of Louisburg loamy sand, 10 to 25 percent slopes, 1½ miles north of Taylor's Store on State Route 184, on right side of road near Toccoa:

A1—0 to 6 inches, yellowish-brown (10YR 5/4) loamy sand; granular; loose; many fine and medium roots; strongly acid; clear, smooth boundary.
B—6 to 30 inches, yellowish-brown (10YR 5/6) sandy loam; weak, subangular blocky structure; friable; many fine and medium roots; strongly acid; clear, smooth boundary.
C—30 to 37 inches +, strong-brown (7.5YR 5/6) light sandy loam; weak, fine, subangular blocky structure; friable; few roots; few fine mica flakes; horizon is mostly partly decomposed material high in quartz fragments mixed with rock; strongly acid.

Stony and cobbly places commonly occur in the A horizon that typically is loamy sand, but it ranges to sandy loam or sand. It is very dark gray to brown or yellowish brown. In the B horizon, a thin discontinuous layer of sandy clay loam or sandy clay is present in some places. Where this thin layer occurs, it is less than 6 inches thick, ranges from 2 to 4 inches in thickness, and is yellowish brown to red. Content of clay in the B horizon generally is less than 18 percent. In places, mica flakes occur throughout the solum. In many places, depth to bedrock, such as granite, gneiss, and schist is between 24 and 48 inches. Content of silt in these soils generally is low.

The Louisburg soils occur mainly with the Wedowee, Appling, and Pacolet soils. The Louisburg soils have a yellowish-brown sandy loam subsoil, whereas the subsoil of the Wedowee soils is yellowish-red clay loam, that of the Appling soils is strong-brown and yellowish-red to red sandy clay to clay, and that of the Pacolet soils is yellowish red to red clay.

Louisburg loamy sand, 10 to 25 percent slopes (LnE).—This soil occurs on the narrow side slopes of uplands and on foothills of mountains. It has the profile described as typical for the Louisburg series.

Included in mapping were a few eroded areas that had shallow gullies. Also included were small areas of a soil that had thin layers of sandy clay loam to sandy

clay in the subsoil. These inclusions make up about 20 percent of the mapped areas of this soil.

This soil is not suited to cultivated crops or pasture, because slopes are too steep and the available water capacity is low. The native vegetation is scattered pines and scrub oak. (Capability unit VIIe–2; woodland suitability group 5; wildlife suitability group 5)

Louisburg loamy sand, 25 to 60 percent slopes (LnF).—This soil occurs on side slopes of foothills of the mountains. The surface layer is about 12 inches thick, and a few boulders are on the surface. The subsoil is fine sandy loam to loamy sand that grades to partly disintegrated rock, which is mixed with fine soil material in crevices and between rocks.

Included with this soil in mapping were areas of a soil that was similar except that erosion had formed shallow and a few deep gullies. Also included were small areas where the B horizon contained thin layers of sandy clay loam to sandy clay 2 to 4 inches thick. These inclusions make up as much as 25 percent of the mapped areas of this soil.

This soil is not suited to crops or pasture, because slopes are too steep. The native vegetation is scattered pines and oaks. Logging operations are hazardous and very expensive on this soil. (Capability unit VIIe–2; woodland suitability group 6; wildlife suitability group 5)

Louisburg-Rock land complex, 25 to 60 percent slopes (LRF).—This complex consists of steep soils on narrow ridges and side slopes where there are granitic boulders and outcrops of bedrock. Louisburg soils make up about 65 percent of the complex, Rock land about 15 percent, and included soils about 20 percent.

The Louisburg soils in this complex have a surface layer of sand or stony loamy sand about 6 inches thick. The subsoil is yellowish-brown or strong-brown to yellowish-red loamy sand about 18 inches or more thick. Depth to bedrock is 2 to 3 feet.

Rock land consists of boulders and bedrock at, above, or on the surface of the Louisburg soils. Between the rock outcrops are pockets of coarse-textured, slightly stratified soil material that cover 40 to 50 percent of the Rock land areas. Yellowish-brown to brown loamy sand or sandy loam is in the crevices of the rocks.

Included in this complex in mapping, where the Louisburg soils were dominant, were areas of a soil that had a subsoil containing a discontinuous layer 4 to 8 inches thick. This layer was yellowish red to red in color and loam to sandy loam in texture. Also included were a few small areas of a yellowish-brown soil that had a continuous, clayey layer in the subsoil.

This complex occurs only in a few small areas in Banks and Stephens Counties. It is not suited to cultivated crops or pasture, because it normally is inaccessible for the use of farm implements. Where the Louisburg soils are dominant in the complex, the vegetation consists mostly of scattered pines and oaks. In the pockets of soil between the rocks and in the crevices of the rocks grow a few shrubs, grass sprigs, and a few scrub pines and hardwoods. (Capability unit VIIe–2; woodland suitability group 6; wildlife suitability group 5).

Madison Series

The Madison series consists of moderately deep to deep, well-drained soils that generally are highly micaceous throughout the profile. These soils formed on uplands in material weathered from quartz and mica schist. Most of the acreage is on broad stream divides and on smooth side slopes that range from 2 to 15 percent. In mountainous areas these soils have slopes of as much as 60 percent.

In the severely eroded areas, the surface layer is typical, and consists of yellowish-red sandy clay loam about 4 inches thick. The subsoil is red, micaceous clay and clay loam about 26 inches thick. The surface layer in less eroded areas is dark yellowish-brown to dark-brown, micaceous fine sandy loam about 6 inches thick. Small fragments of schist commonly occur on the surface and throughout the profile in some places. The underlying material is red, partly weathered mica schist.

These soils are low in natural fertility, contain little organic matter, and are strongly acid throughout the profile. Permeability is moderate, and the available water capacity is medium.

The Madison soils are widely distributed throughout Banks and Stephens Counties. Where slopes are less than 10 percent, these soils are well suited to and extensively used for cotton, corn, small grains, and pasture. Where slopes are more than 10 percent, the vegetation is chiefly pines, white and red oaks, and various gums. Plants grow well on Madison soils.

Typical profile of Madison sandy clay loam, 6 to 10 percent slopes, severely eroded, 12 miles southeast of Homer, 4 miles southeast of Davis Academy on State Route 164, on left side of road 1,000 feet beyond bridge across Grove Creek:

Ap—0 to 4 inches, yellowish-red (5YR 4/6) sandy clay loam mixed with remnants of the yellowish-brown original surface layer; moderate, fine, subangular blocky structure; friable; numerous fine roots; common fine mica flakes; strongly acid; clear, wavy boundary.

B2t—4 to 21 inches, red (2.5YR 4/6) clay; moderate, medium, subangular blocky structure; firm; faint and patchy clay films on peds; few medium roots; numerous fine mica flakes that impart a slick or greasy feel; strongly acid; clear, wavy boundary.

B3—21 to 30 inches, red (2.5YR 4/6) clay loam; weak, medium, subangular blocky structure; friable; thin, patchy clay films on peds; numerous medium and large mica flakes that impart a greasy feel; strongly acid; gradual, smooth boundary.

C—30 to 52 inches, red (2.5YR 4/8) partly weathered mica schist with some clayey material; massive (structureless); strongly acid.

The A1 horizon in slightly eroded areas is very dark grayish brown and dark grayish brown in color and fine sandy loam and sandy loam in texture. The Ap horizon in the eroded areas is brown to yellowish brown and in the severely eroded areas is yellowish-red sandy clay loam. In places the upper part of the B2t horizon is sandy clay loam, and it is underlain by sandy clay to clay. The B2t horizon is red (2.5YR 4/6, 4/8, 5/6, and 5/8). The solum ranges from 28 to 35 inches in thickness.

Schist fragments, quartz gravel, and garnets commonly occur on the surface. Mica flakes in the A horizon range from few to many and are ample enough in the B2t horizon to give it a slick, greasy feel. Schist laminas in the C horizon are mainly tilted. In some places they extend upward into the lower B3 horizon.

The Madison soils occur mainly with the Cecil, Appling, Grover, and Louisa soils. Madison soils contain much more mica schist throughout the profile than the Cecil or Appling soils. The B horizon of the Madison soils is redder than that in the Appling, Grover, or Louisa soils. Madison soils have a more clayey B horizon than the Louisa soils.

Madison fine sandy loam, 2 to 6 percent slopes, eroded (MjB2).—This moderately deep soil occurs on undulating, broad ridgetops of uplands. It has a profile similar to the one described as typical for the Madison series, except that a significant part of the original surface layer is mixed with the upper part of the subsoil. The present surface layer is fine sandy loam about 6 inches thick. The subsoil is clay about 26 inches or more thick. Many mica flakes occur throughout the profile.

Included with this soil in mapping were areas where the surface layer was sandy loam mixed with gravel. Also included were areas where the subsoil ranged from sandy clay to clay and was less than 20 inches thick. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil has good tilth and a thick root zone. Nearly all of this soil is well suited to and is used extensively for all row crops, small grains, hay and pasture plants, and trees commonly grown in the two counties. (Capability unit IIe–1; woodland suitability group 2; wildlife suitability group 1)

Madison fine sandy loam, 6 to 10 percent slopes, eroded (MjC2).—This soil occurs on the side slopes of broad upland ridges. The present surface layer is a mixture of remnants of the original surface layer and the upper part of the subsoil. Galled spots where the red subsoil is exposed are scattered throughout the area mapped. The surface layer is fine sandy loam about 6 inches thick. The subsoil is sandy clay or clay about 20 inches or more thick. Many mica flakes occur throughout the profile.

Included with this soil in mapping were areas of a similar soil that had a gravelly surface layer and other areas where the sandy clay to clay subsoil was less than 20 inches thick. A few areas were only slightly eroded. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil has good tilth and a thick root zone. Nearly all of this soil is well suited to and is used extensively for all row crops, small grains, hay, pasture plants, and trees commonly grown in the two counties. (Capability unit IIIe–1; woodland suitability group 2; wildlife suitability group 1)

Madison fine sandy loam, 10 to 15 percent slopes, eroded (MjD2).—This soil occurs on upland side slopes. The present plow layer is a mixture of remnants of the original surface layer and the upper part of the subsoil. The red subsoil is exposed in places. The surface layer is fine sandy loam about 4 inches thick. The subsoil is sandy clay to clay about 25 inches thick. Many mica flakes occur throughout the profile.

Included with this soil in mapping were areas of a gravelly soil and other areas where the sandy clay to clay subsoil was less than 20 inches thick. A few areas were only slightly eroded. These inclusions make up as much as 25 percent of the mapped areas of this soil.

This soil has good tilth and a thick root zone. It is moderately well suited to row crops that are grown in rotation with close-growing crops, such as small grains, hay, or pasture. Slopes are steep enough for accelerated erosion to be a hazard. Most of this soil has been cleared and cultivated, but about 60 percent of it has reverted to pine trees. If woodland management is adequate, trees grow well on this soil. (Capability unit IVe–1; woodland suitability group 2; wildlife suitability group 2)

Madison fine sandy loam, 15 to 25 percent slopes (MjE).—This soil occurs on side slopes of uplands and mountains. It has a profile similar to the one described as typical for the Madison series, except that the surface layer is thicker. The fine sandy loam surface layer is 6 to 9 inches thick. The subsoil is sandy clay to clay about 20 inches thick. Many mica flakes occur throughout the profile.

Included with this soil in mapping were areas where the eroded surface layer was yellowish brown and other areas where it was gravelly. Also included were areas where the sandy clay to clay subsoil was less than 20 inches thick. These inclusions make up as much as 20 percent of the mapped areas of this soil.

Because it is mostly steep, this soil is not used for cultivated crops. About 10 percent is in pasture, and the rest is woodland or is used for wildlife and recreation. This soil is well suited to all trees commonly grown in the two counties. (Capability unit VIe–2; woodland suitability group 2; wildlife suitability group 2)

Madison sandy clay loam, 6 to 10 percent slopes, severely eroded (MlC3).— This soil occurs on the side slopes of uplands. It has the profile described as typical for the Madison series. The present surface layer consists mostly of the upper part of the subsoil and remnants of the original surface layer. Shallow and a few deep gullies occur in most areas. Many mica flakes are throughout the profile.

Included with this soil in mapping were small areas where the sandy clay to clay subsoil was only 15 to 20 inches thick and other areas where slopes were only 2 to 6 percent. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil has only fair to poor tilth because of the severe erosion, but the root zone is thick. Nearly all of this soil has been cultivated, but about 40 percent has reverted to trees, mostly shortleaf pine and loblolly pine. (Capability unit IVe–1; woodland suitability group 4; wildlife suitability group 3)

Madison sandy clay loam, 10 to 15 percent slopes, severely eroded (MlD3).—This soil occurs in areas of 10 to 15 acres in size. The surface layer is about 3 to 5 inches thick, and the sandy clay to clay subsoil is 20 to 26 inches thick. Many shallow and a few deep gullies are scattered throughout the mapped areas. Runoff is faster on this soil than on Madison sandy clay loam, 6 to 10 percent slopes, severely eroded.

Included with this soil in mapping were areas where the sandy clay to clay subsoil was only about 15 inches thick. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil has fair to poor tilth because of the severe erosion, but the root zone is thick. Slopes are too steep for cultivated crops. Wildlife, recreation, woodland, and pasture are good uses. Trees commonly grown in the two counties grow well on this soil. (Capability unit VIe–2; woodland suitability group 4; wildlife suitability group 3)

Madison sandy clay loam, 15 to 25 percent slopes, severely eroded (MlE3).—This soil is on uplands and mountains. The sandy clay loam surface layer is about 5 inches thick. It is mostly a mixture of the upper part of the subsoil and remnants of the original surface layer. The subsoil is sandy clay to clay about 20 to 30 inches thick. Many shallow and a few deep gullies are scattered throughout the mapped areas.

Included with this soil in mapping were areas where the sandy clay to clay subsoil was only about 15 inches thick. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil has only fair to poor tilth because erosion is severe and the surface layer is clayey. Although the root zone is thick, cultivated crops are not suited. Slopes are too steep, and the hazard of erosion is severe. This soil is suited to pasture and to use for wildlife, recreation, and woodland. Trees commonly grown in the two counties grow well on this soil. (Capability unit VIIe–1; woodland suitability group 4; wildlife suitability group 4)

Madison-Louisa-Tallapoosa complex, 25 to 60 percent slopes (MAF).—This mapping unit consists of deep to shallow, well-drained to somewhat excessively drained micaceous soils on choppy side slopes of foothills of the mountains. The Madison, Louisa, and Tallapoosa soils are so intermingled that it is not practical to map them separately. Madison soils make up about 40 percent of the complex, Louisa soils 30 percent, Tallapoosa soils 15 percent, and an included soil about 15 percent. The included soil had a thicker combined surface layer and subsoil and was about 6 feet deep to bedrock.

The surface layer of the Madison soils is fine sandy loam, sandy loam, or sandy clay loam. It is gravelly in some places. The subsoil is red, micaceous clay or sandy clay about 20 inches or more thick. The surface layer of the Louisa soils is sandy loam or loamy sand, and the subsoil is fine sandy loam or sandy loam that occurs at varying depths. Depth to bedrock ranges from 1 to 4 feet in most places. The surface layer of the Tallapoosa soils is fine sandy loam to loam about 4 inches thick, and the subsoil is silty clay loam about 8 inches thick.

This soil complex is so steep that it is not suited to cultivated crops or pasture. It is better suited to trees and wildlife. The vegetation is chiefly post oak, blackjack oak, sweetgum, and various dogwoods. Shortleaf pine and Virginia pine grow in some places. (Capability unit VIIe–2; woodland suitability group 6; wildlife suitability group 5)

Masada Series

The Masada series consists of nearly level to gently sloping, deep, well-drained soils that occur on high second bottoms and terraces. These soils formed from old alluvial deposits of sand, silt, clay, and various rounded, water-worn fragments of quartzite and sandstone.

Typically, the surface layer is dark grayish-brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of 26 inches and is mainly yellowish-brown sandy clay loam. Below this is yellowish-brown sandy loam to sandy clay loam.

These soils have good tilth and a thick root zone. They are low to medium in natural fertility, contain little organic matter, and are medium acid to strongly acid. Permeability is moderate, and the available water capacity is medium in the uppermost 3 feet of soil. Runoff is slow to medium, and internal drainage is medium.

The Masada soils occur in small areas on the larger stream terraces throughout Banks and Stephens Counties. These soils are well suited to cultivated crops or pasture. The natural vegetation is mostly red oak, white oak, shortleaf pine, and loblolly pine. Under good management plants grow well on these soils.

Typical profile of Masada fine sandy loam, 2 to 6 percent slopes, 3½ miles north of Toccoa, on State Route 184, one-half mile west of that highway, on stream terrace:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable; many fine roots; few fine mica flakes; strongly acid; clear, smooth boundary.

AB—7 to 11 inches, mixed dark grayish-brown (10YR 4/2) and yellowish-brown (10YR 5/6) sandy loam to sandy clay loam; weak, medium, subangular blocky structure; friable; many fine roots; few fine mica flakes; strongly acid; clear, smooth boundary.

B2t—11 to 26 inches, yellowish-brown (10YR 5/6) sandy clay loam; few, fine, faint mottles to strong brown; moderate, medium, subangular blocky structure; friable; few roots; patchy clay films on peds; few fine mica flakes; strongly acid; clear, smooth boundary.

C—26 to 50 inches, yellowish-brown (10YR 5/6) sandy loam to sandy clay loam; common, medium, distinct mottles of light gray (10YR 7/2) and yellowish red (5YR 5/8) at depth of 38 inches; massive (structureless); friable; strongly acid.

The A horizon ranges from light brown to dark grayish brown in color and is fine sandy loam or sandy loam in texture. It ranges from 6 to 10 inches in thickness. The B2t horizon is brownish yellow or yellowish brown in color, ranges from sandy clay loam to heavy sandy clay loam in texture and is 15 to 24 inches thick. Some areas are stony. In these areas sandstone and quartzite fragments that are mainly rounded and subangular are on the surface and throughout the profile. The C horizon ranges from sandy loam to sandy clay loam.

The Masada soils occur with the Wickham and Hiwassee soils, generally at lower elevations. Masada soils do not have the reddish colors of the Wickham soils nor the dark-red colors of the Hiwassee soils.

Masada fine sandy loam, 2 to 6 percent slopes (MoB).—This soil occurs in small areas along the larger stream terraces of Banks and Stephens Counties.

Included with this soil in mapping were small areas where the subsoil was yellowish-red sandy clay loam 40 inches or more thick. Also included were small pockets of a soil that was wetter than this soil and that had mottles of gray within a depth of 30 inches.

These inclusions make up as much as 35 percent of the mapped areas of this soil.

This fine sandy loam has a thick root zone and is well suited to cultivated crops or pasture. A small acreage is in row crops, but most of the cleared acreage is in pasture. Where management is good, plants grow well on this soil. The native vegetation is mostly red oak, white oak, shortleaf pine, and loblolly pine. (Capability unit IIe–2; woodland suitability group 3; wildlife suitability group 1)

Mecklenburg Series

The Mecklenburg series consists of deep, sloping to moderately steep, well-drained soils that formed in material weathered from dark-colored basic rocks, such as diorite and hornblende gneiss. These soils occur on side slopes of the uplands.

Typically, the surface layer is dark grayish-brown to dark-brown fine sandy loam about 6 inches thick. The subsoil extends to a depth of about 46 inches. It is yellowish-red, plastic clay to a depth of about 30 inches. The rest of the subsoil is strong-brown clay loam that has a few mottles of red and brownish yellow.

These soils are low in natural fertility, contain little organic matter, and are strongly acid. Permeability is moderate to slow, and the available water capacity is medium. Tilth is fair to good.

The Mecklenburg soils are not extensive in the survey area. They occur mostly in Stephens County in the Chattahoochee National Forest. Trees grow on most of the acreage. Although plants grow moderately well if management is good, these soils are difficult to cultivate because they are clayey and erodible.

Typical profile of Mecklenburg fine sandy loam, 10 to 25 percent slopes, 3.8 miles south of U.S. Highway No. 123, on State Route 184 to first road south of Big Leatherwood Creek, 2 miles west of State highway, on trail in Stephens County:

Ap—0 to 5 inches, dark-brown (7.5YR 4/4) fine sandy loam; few, fine, faint mottles of yellowish brown; weak, fine and medium, subangular blocky structure; friable; many fine roots; few fine mica flakes, strongly acid; clear, smooth boundary.

B21t—5 to 10 inches, yellowish-red (5YR 5/8) clay loam; few, fine, faint mottles of yellowish brown; moderate, medium, subangular blocky structure; friable to firm; plastic; clay films on most peds; many fine and medium roots; few fine mica flakes; strongly acid; gradual, wavy boundary.

B22t—10 to 30 inches, yellowish-red (5YR 4/8) clay; common, medium, distinct mottles of reddish yellow (5YR 6/8); moderate, medium, subangular blocky structure; very firm; plastic; clay films on most peds; few medium roots; many fine mica flakes; few dark-brown concretions; medium acid; diffuse, wavy boundary.

B3—30 to 46 inches, strong-brown (7.5YR 5/6) clay loam; common, medium, distinct mottles of red (2.5YR 4/6) and brownish yellow (10YR 6/6); moderate, medium, subangular blocky structure; firm; plastic; medium acid; clear boundary.

C—46 to 64 inches, greenish-yellow and black, loamy, partly disintegrated basic rock; slightly acid.

The Ap horizon is dark brown, reddish brown, dark grayish brown, and grayish brown and is fine sandy loam, loam, silt loam, sandy loam, and clay loam. The B22t horizon ranges from 40 to 60 percent clay. The B22t horizon is yellowish red to red. The B3 horizon has strong-brown to yellowish-red matrix colors and varying amounts of mottling. This horizon ranges from sandy clay loam to clay and contains weathered rocks. The solum ranges from 20 to 46 inches in thickness and generally contains manganese concretions. Depth to bedrock normally is more than 5 feet.

The Mecklenburg soils occur with the Hiwassee, Musella, and Wilkes soils. The subsoil of the Mecklenburg soils is not so thick or so red as that of the Hiwassee soils. Mecklenburg soils are not so red as the Musella soils and are less stony on the surface and throughout the profile. They are darker and have a more distinctly developed profile than the Wilkes soils, which developed in mixed acidic and basic materials.

Mecklenburg fine sandy loam, 10 and 25 percent slopes (MrE).—This soil is on uplands and on foothills of mountains.

Included with this soil in mapping were eroded areas where the surface layer was yellowish-red sandy clay loam to clay loam. These areas had a few shallow gullies, less numerous deep ones, and some galled spots. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This fine sandy loam occurs only in small areas that are mostly in the foothills of Stephens County. Most of the acreage is in trees, and a very small part is pasture. This soil also is used for wildlife and, to a limited extent, for recreation. (Capability unit VIe–4; woodland suitability group 5; wildlife suitability group 2)

Musella Series

The Musella series consists of shallow and moderately deep, well-drained soils that formed in material weathered from basic rocks, such as diorite, hornblende gneiss, or schist. These soils occur on somewhat broken interstream divides in the southern part of the survey area and on side slopes of foothills of mountains in other parts of the area. Slopes range from 10 to 60 percent, but are less than 45 percent in most of the acreage. On the divides, slopes are less than 20 percent, and in the foothills are 25 to 60 percent.

Typically the surface layer is dark reddish-brown clay loam about 6 inches thick that contains many small to large fragments of basic rocks. The subsoil is red clay loam that normally is not more than 20 inches thick. The underlying material is partly disintegrated basic rock mixed with some soil material. Stone and limestone fragments commonly occur on the surface and throughout the profile.

These soils are low in natural fertility, contain little organic matter, and are strongly acid. Permeability is moderate to slow, and the available water capacity is low to medium. Tilth is poor in most places because there is an excess of exposed rocks on the surface.

The Musella soils are not extensive in Banks and Stephens Counties. Most of the acreage occurs in the foothills of the Blue Ridge Mountains, especially in the Lake Russell area and in the vicinity of Yellowback Mountain. These soils are used mostly for woodland, wildlife, and recreation. They are too shallow to bed-

rock and too stony to be cultivated. In this survey area, Musella soils are mapped only in complex with the Gwinnett soils.

Typical profile of an eroded area of Musella stony clay loam on a 15 percent slope, on triangle at intersection of U.S. Highway 441 west of highway on State Route 164, south of Homer:

Ap—0 to 6 inches, dark reddish-brown (5YR 3/4) clay loam; moderate, medium, subangular blocky structure; friable to firm; many fine and medium roots; many small to large basic rock fragments; strongly acid; gradual, wavy boundary.

B2t—6 to 21 inches, red (2.5YR 4/6) clay loam; moderate, medium, subangular blocky structure; firm; many medium roots; clay films on peds; manganese coats and concretions; few mica flakes; many small to large basic rock fragments; strongly acid; irregular, broken boundary.

C—21 to 37 inches, partly disintegrated basic rock and some soil material; massive (structureless); rock structure evident; strongly acid.

The surface layer is dark reddish brown, dark brown, or dusky red in colors, and is gravelly loam, cobbly loam, stony loam, or stony clay loam in texture. The B2t horizon dominantly is red in hue 2.5YR and has many yellowish fragments of rock. This horizon is mostly clay loam, but in some profiles thin lenses of clay occur. The solum ranges from 12 to 24 inches in thickness. In most places, depth to bedrock ranges from 3 to 5 feet.

The Musella soils commonly join or are near the Gwinnett, Madison, Wilkes, and Louisburg soils. The profile of the Musella soils is not so well developed as that of the Gwinnett or Madison soils, and it has a thinner B horizon and is more shallow to bedrock. The Musella soils are much redder than the Wilkes and Louisburg soils. Musella soils formed from material weathered from basic rocks, but the Wilkes soils formed from a mixture of materials weathered from acidic and basic rocks, and the Louisburg soils formed from material weathered from acidic rocks.

Musella-Gwinnett stony complex, 10 to 25 percent slopes (MFE).—The soils in this complex are gravelly to stony and occur on uplands. These soils are so intermingled that it is not practical to separate them on the soil map. About 45 percent of the complex is Musella soils, 30 percent is Gwinnett soils, and 25 percent is soils that are similar to Musella and Gwinnett soils but that are eroded or severely eroded.

The surface layer of the Musella soils is stony loam to clay loam about 6 inches thick. The subsoil is clay loam that has a high content of rock fragments and is less than 18 inches thick. The Gwinnett soils have a profile similar to the one described as typical for the series, and typically the clayey subsoil combined with the surface layer is less than 40 inches thick.

This complex is not suited to cultivated crops or pasture because the soils are very stony and slopes are steep. It is suited to use for woodland, wildlife, and recreation. The vegetation is mostly mixed pines and oaks. (Capability unit VIIe–2; woodland suitability group 5; wildlife suitability group 6)

Musella and Gwinnett stony soils, 25 to 60 percent slopes (MGF).—This undifferentiated unit consists of well-drained, mainly moderately deep soils that occur together without regularity of pattern. These soils are on choppy, uneven slopes of mountain foothills. The Musella soils make up about 50 percent of this unit, the Gwinnett soils about 25 percent, and the included soils about 25 percent.

The Musella soils have a profile similar to the one described as typical for its series, except that the subsoil contains fragments of rock. The Gwinnett soils have a profile similar to the one described as typical for its series, and typically the clayey subsoil combined with the surface layer is less than 40 inches thick.

Included in this mapping unit were areas of soils that lacked the well-developed subsoil of the Musella and Gwinnett soils and that had a depth to bedrock between 1 and 3 feet. Also included were areas where the subsoil was dark red and more than 40 inches thick.

The soils in this mapping unit are not suited to cultivated crops or pasture. They are suited to trees or to use for wildlife. Because slopes are too steep, adapted equipment is needed for logging. The vegetation is mostly mixed pines and oaks. (Capability unit VIIe–2; woodland suitability group 6; wildlife suitability group 6)

Pacolet Series

The Pacolet series consists of strongly sloping to steep, well-drained soils on uplands. These soils formed in material weathered from granite, gneiss, and schist. Slopes range from 15 to 60 percent but are mostly less than 45 percent.

The surface layer in the less eroded areas is grayish-brown to dark yellowish-brown sandy loam about 5 inches thick. In the severely eroded areas, it is yellowish-red sandy clay loam. The subsoil in both the less eroded areas and the severely eroded areas is red and about 22 inches thick. The main part is clay, but the upper and lower few inches are sandy clay loam. The combined surface layer and subsoil is less than 40 inches thick.

These soils are low in natural fertility, contain little organic matter, and are strongly acid throughout the profile. Tilth is good in the less eroded Pacolet soils, but it is only fair to poor in the severely eroded ones. Permeability is moderate, and surface runoff is medium to rapid according to slopes, erosion, and plant cover. Because slopes are steep, these soils are not well suited to cultivated crops. They are better suited to trees or use for wildlife and recreation. Loblolly pine, shortleaf pine, Virginia pine, and various gums and oaks grow well on these soils.

The Pacolet soils are extensive in Banks and Stephens Counties. Most of the acreage is in the northern half of each county. About 40 percent of it has been cleared and planted to hay and pasture, but more than half of this acreage has reverted to mixed pines and hardwoods.

Typical profile of Pacolet sandy loam, 15 to 25 percent slopes, 4¼ miles southwest of Alto, on U.S. Highway No. 23, 1¾ miles southeast of dirt road junction with highway on south side of road in Banks County:

Ap—0 to 5 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, fine, granular structure; very friable;

abundant small roots; strongly acid; clear, smooth boundary.

B1—5 to 7 inches, red (2.5YR 4/6) sandy clay loam; weak, fine, subangular blocky structure; friable; few small roots; few coarse sand grains; strongly acid; gradual, smooth boundary.

B2t—7 to 21 inches, red (2.5YR 4/6) clay; moderate medium, subangular blocky structure; firm; few small and medium roots; few fine mica flakes; patchy clay films on peds; strongly acid; gradual, smooth boundary.

B3—21 to 27 inches, red (2.5YR 4/6) sandy clay loam; moderate, medium, subangular blocky structure; friable; few medium roots; few fine mica flakes; strongly acid; clear, wavy boundary.

C—27 to 50 inches, saprolite of sandy loam texture; few fine mica flakes.

Rock crops out in a few places on these soils. The A horizon is loamy sand to sandy clay loam that ranges from dark grayish brown to yellowish brown and from 1 to 10 inches in thickness. The B2t horizon ranges from yellowish red to red in color and from heavy clay loam to clay in texture. This horizon normally is 14 to 18 inches thick, but in some places it is 10 to 24 inches thick. The B2t horizon and the B3 horizon contain few to common mica flakes, but in some places they also contain a few feldspar crystals. The underlying saprolite is about 25 to 96 inches thick.

The Pacolet soils occur mainly with the Appling, Madison, Hiwassee, and Louisburg soils. The B horizon of the Pacolet soils is red and is not mottled, but that of the Appling soils is yellowish red and is mottled in the lower part. Pacolet soils are less micaceous than Madison soils. The solum of the Pacolet soils is not so sticky and red as that of the Hiwassee soils. The Pacolet soils have a thick, more clayey solum than have the Louisburg soils.

Pacolet sandy loam, 15 to 25 percent slopes (PfE).—This soil occurs in long narrow areas on the side slopes of uplands and on foothills of mountains. It has the profile described as typical for the Pacolet series. Erosion is slight.

Included in mapping were areas where the subsoil, especially the B2t horizon, was dark-red clay. Also included were small areas where there was moderate accelerated erosion. Although 25 to 75 percent of the original surface remains in these eroded areas, shallow gullies, a few deep gullies, and galled spots have formed. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil is not suited to cultivated crops, because slopes are steep. The vegetation is mostly in stands of mixed shortleaf pine, loblolly pine, and Virginia pine. These trees grow moderately well on this soil. (Capability unit VIe–2; woodland suitability group 2; wildlife suitability group 2)

Pacolet sandy clay loam, 15 to 25 percent slopes, severely eroded (PgE3).—This soil occurs in long narrow areas on the side slopes of uplands and on foothills of mountains. The surface layer is thinner and contains more clay than that in the profile described as typical for the Pacolet series. Shallow gullies and galled spots commonly occur, and there are a few deep gullies. The plow layer consists largely of a mixture of material from the subsoil and remnants of the original surface layer. It is yellowish-red sandy clay loam about 5 inches thick. The subsoil is sandy clay about 18 inches thick.

Included with this soil in mapping were areas where the subsoil was dark-red sandy clay to clay. These inclusions make up as much as 20 percent of the mapped areas of this soil.

Because slopes are steep and erosion is severe, this soil is not suited to cultivated crops. The vegetation consists of mixed pines and scattered hardwoods. Shortleaf pine, loblolly pine, and Virginia pine grow moderately well on this soil, but the gullies cause logging to be more difficult than on Pacolet sandy loam, 15 to 25 percent slopes. (Capability unit VIIe–1; woodland suitability group 4; wildlife suitability group 4)

Pacolet-Louisburg complex, 25 to 60 percent slopes (PjF).—The soils in this complex occur on side slopes of the foothills of mountains. Because these soils occur together in such an intermingled pattern, they could not be separated on the soil map. About 50 percent of the complex is Pacolet soils, 30 percent is Louisburg soils, and 20 percent is an included soil.

The Pacolet soils have a sandy loam surface layer about 5 inches thick. The subsoil is sandy clay to clay and is about 15 inches thick. The Louisburg soils have a loamy sand to sandy loam surface layer about 4 inches or more thick. This is underlain, in most of the acreage, by loamy material about 15 inches thick. In some places, a layer of clay loam 4 to 8 inches thick may be present. Depth to bedrock varies. In many places the surface layer of these Louisburg soils directly overlies a layer of weathered rock, and in a few places the surface layer directly overlies bedrock.

Included in mapping were small areas where a layer of dark-red clay about 20 inches thick was in the subsoil.

The soils in this complex have poor tilth and are not suited to cultivated crops, because slopes are steep, runoff is rapid, and the available water capacity is mainly low. All of the acreage is wooded. Trees grow slowly. Also, logging is expensive and hazardous on the steeper slopes. (Capability unit VIIe–1; woodland suitability group 6; wildlife suitability group 5)

Tallapoosa Series

The Tallapoosa series consists of well-drained soils that occur on the narrow ridges and the steeply dissected side slopes of foothills. Slopes range from 10 to 65 percent slopes. Characteristically, these soils have a thin, continuous subsoil.

Typically, the surface layer is brown fine sandy loam about 4 inches thick. The subsoil is yellowish-red silty clay loam and is 8 inches thick. Just below is yellowish-red sandy loam over weathered mica schist.

These soils are low in natural fertility, contain little organic matter, and are strongly acid. Permeability is moderate, and the available water capacity is low. Because slopes are steep, runoff is rapid on bare soils.

These soils are not extensive in the survey area. Most of the acreage is in the northern part of Stephens County, near the intersection of Panther Creek and Tugaloo River. All of the acreage is wooded, primarily with hardwoods but also with white pine and shortleaf pine.

The Tallapoosa soils are not mapped separately, but they are mapped as parts of Louisa-Tallapoosa complex,

10 to 25 percent slopes, and Madison-Louisa-Tallapoosa complex, 25 to 60 percent slopes.

Typical profile of a Tallapoosa fine sandy loam on a slope of 25 percent, north of the junction of Davidson and Panther Creeks in the northeastern part of Stephens County:

A1—0 to 4 inches, brown (10YR 4/3) fine sandy loam; weak, fine, granular structure; very friable; common fine roots; few small rock fragments of quartz and schist; strongly acid; clear, smooth boundary.

B2t—4 to 12 inches, yellowish-red (5YR 4/8) light silty clay loam; weak to moderate fine, subangular blocky structure; friable; many fine roots; few small fragments of rock; common mica flakes; strongly acid; gradual, broken boundary.

C1—12 to 20 inches, yellowish-red (5YR 4/6) sandy loam and micaceous schist; structureless; very friable; few roots; small fragments of rock coated with some clay; strongly acid; clear, irregular boundary.

C2—20 to 45 inches, mixed reddish-yellow (5YR 6/8), yellowish-red (5YR 4/6), and brownish-yellow (10YR 6/6) soft schist; rock structure; numerous mica flakes that feel slick and have a silky sheen.

The A1 horizon ranges from fine sandy loam to silt loam in texture, and from dark grayish brown to light yellowish brown, brownish yellow, and brown in color. The B2t horizon is silty clay loam or loam. Its color is dark yellowish brown, brownish yellow, reddish brown, yellowish red, or light red. The B2t horizon is continuous and normally ranges from 3 to 10 inches in thickness. Tongues of the B2t horizon, ½ to 7 inches thick, commonly extend into the C horizon to a depth of as much as 6 feet from the surface. Large roots of trees generally follow these tongues and cause a mixing of material from the B2t with some of that from the C horizon. The C horizon primarily is soft micaceous schist, but admixtures with gneiss do occur. The C horizon includes a hue of 10YR or redder and a value of 4 or more.

The Tallapoosa soils occur mainly with the Chandler, Louisa, Louisburg, and Madison soils. The B horizon of the Tallapoosa soils is more clayey than that of the Chandler or the Louisburg soils. The Tallapoosa soils have a thin and continuous silty clay loam B horizon, but the Louisa soils generally have a discontinuous fine sandy loam and sandy clay loam B horizon. The B horizon of the Tallapoosa soils is thinner than that of the Madison soils, which have a kaolinitic B horizon more than 10 inches thick.

Tate Series

The Tate series consists of deep, well-drained soils that formed on old, alluvial and colluvial fans and toe slopes in the foothills of mountains. Slopes range from 10 to 25 percent.

The surface layer is grayish-brown to dark grayish-brown sandy loam about 6 inches thick. The subsoil is sandy clay loam and is 30 inches thick. It is grayish brown in the upper part and yellowish brown in the lower part. The underlying material is weathered gneiss.

These soils are low in natural fertility, contain little organic matter, and are strongly acid. Permeability is moderate, and the available water capacity is medium. Surface runoff on bare soils is medium to rapid.

In Banks and Stephens Counties, the Tate soils occur only in the foothills. Because slopes are too steep, these soils are not suited to cultivated crops or pasture. They are suited to perennial plants and also to use for wildlife and recreation. The entire acreage is wooded. The chief vegetation consists of white oak, red oak, shortleaf pine, and Virginia pine. If woodland management is good, trees grow well on these soils.

Typical profile of Tate fine sandy loam, 10 to 25 percent slopes, 4 miles west on State Route 184 from its junction with U.S. Highway No. 123 to county dirt road, then west on road for 1 mile; 20 feet on south side of road in Stephens County:

O1—2 inches to 0, decayed litter.

A1—0 to 6 inches, grayish-brown (10YR 5/2) sandy loam; weak, fine, granular structure; friable; few slightly weathered granite rocks on surface; many fine and medium roots; strongly acid; abrupt, smooth boundary.

B1—6 to 10 inches, grayish-brown (10YR 5/2) light sandy clay loam; weak, fine to medium, subangular blocky structure; friable; few roots; few fine mica flakes; few concretions; strongly acid; diffuse, smooth boundary.

B2t—10 to 20 inches, yellowish-brown (10YR 5/6) sandy clay loam; weak to moderate, medium, subangular blocky structure; friable; few large roots; few fine mica flakes; patchy clay films on peds; few concretions; strongly acid; clear, smooth boundary.

B3—20 to 36 inches, yellowish-brown (10YR 5/4) light sandy clay loam; weak, fine, subangular blocky structure; friable; few fine mica flakes; few concretions; strongly acid; abrupt, wavy boundary.

C—36 to 45 inches, weathered, fine-grained gneiss, high in mica.

The A horizon is loam, fine sandy loam, or silt loam. The B2t horizon is sandy clay loam or silty clay loam. The B horizon ranges from pale yellow to strong brown. The solum ranges from about 23 to 45 inches in thickness. In less well-drained areas, mottles occur in the lower part of the B3 horizon and the C horizon. Tate soils are strongly acid to very strongly acid throughout the profile. Depth to bedrock ranges from about 3 feet to as much as 50 feet in a few places.

The Tate soils occur mainly with the Pacolet, Madison, Wedowee, and Louisburg soils. The B horizon of the Tate soils is mainly yellowish-brown sandy clay loam, but in the Pacolet and the Madison soils the B horizon is red and clayey. Color in the B horizon of Tate soils is similar to that in the clayey B horizon of the Wedowee soils but not so dark. The B horizon of the Tate soils is well developed, but that of the Louisburg soils is not.

Tate fine sandy loam, 10 to 25 percent slopes (TfE).—This soil has the profile described as typical for the Tate series. Most of the acreage occurs in the area of Chattahoochee National Forest in Stephens County.

Included with this soil in mapping were areas of a soil that was similar, except that the subsoil was yellowish red to strong brown and dark brown and was more than 45 inches thick. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This fine sandy loam has a thick root zone, but the soil is not suited to cultivated crops or pasture because slopes are too steep. The vegetation on this soil is mostly shortleaf pine, Virginia pine, and mixed hardwoods. (Capability unit VIe–2; woodland suitability group 3; wildlife suitability group 2)

Toccoa Series

The Toccoa series consists of well-drained soils that occur in Banks and Stephens Counties on the flood plains of small branches, creeks, and larger streams.

These soils formed from alluvium. They are occasionally flooded for short periods.

Typically, these soils are reddish-brown sandy loam and fine sandy loam to a depth of 52 inches. Sandy and silty strata are throughout the profile. Content of mica and other weatherable minerals is medium to high throughout the profile.

These soils are low to medium in natural fertility, contain little organic matter, and are slightly acid to medium acid. Runoff is slow, permeability is moderately rapid, and tilth is good.

Most of the acreage of these soils has been cleared. About half of it is used for corn, grain sorghums, small grains, and vegetables. The rest is used for pasture, hay, and trees. Native vegetation is mixed hardwoods, porous gums, yellow-poplar, and mixed pines.

Typical profile of Toccoa soils, 2.5 miles north of Maysville, on a tributary of Grove Creek, and one-half mile east of the cemetery and about 50 yards south of road in Banks County.

Ap—0 to 10 inches, reddish-brown (5YR 4/4) sandy loam; weak, fine, granular structure; very friable; many fine roots; few fine mica flakes; medium acid; gradual, smooth boundary.

C1—10 to 24 inches, reddish-brown (5YR 4/4) heavy sandy loam; structureless; friable; stratified; few fine roots; few fine mica flakes; medium acid; gradual, smooth boundary.

C2—24 to 34 inches, reddish-brown (5YR 4/4) fine sandy loam; structureless; friable; few fine roots; many fine mica flakes; medium acid; gradual, smooth boundary.

C3—34 to 52 inches, reddish-brown (5YR 4/4) sandy loam; structureless; friable; many fine mica flakes; thin horizontal bedding planes; medium acid.

The Ap horizon is mainly sandy loam, but may range to loamy sand or loam. The C1 horizon ranges from loamy sand to fine sandy loam in texture and from reddish brown to brown and strong brown in color. The C2 horizon has color and texture ranges similar to those in the Ap horizon and the C1 horizon. The C3 horizon in some places is similar to the C1 horizon, though in other places common mottles of light brownish gray or grayish brown occur below a depth of 20 inches. Bedding planes of the contrasting textures are more pronounced in the C3 horizon in places where there also are thin gravelly layers.

Between depths of 10 and 40 inches, very thin, irregular bands of clay loam and sandy clay occur in some places. Between these depths, content of clay is from 8 to 18 percent and the sand fraction averages more than 15 percent coarser than very fine sand. Soil reaction in these places ranges from slightly acid to medium acid. Buried B horizons may be at a depth of more than 20 inches.

The Toccoa soils occur mainly with the Altavista, Cartecay, and Wehadkee soils. The Toccoa soils are not so fine textured between depths of 10 and 40 inches as are the Altavista and the Wehadkee soils. Above a depth of 20 inches, the Toccoa are not mottled but the Cartecay soils are mottled with gray. The Toccoa soils are not so wet as are the Cartecay and the Wehadkee soils.

Toccoa sandy loam, local alluvium (Tod).—This soil occurs in small, colluvial areas in depressions and at the head of drains throughout the survey area. The texture of the surface layer and the color and texture of the subsoil are similar to those of the surrounding soils, for this sandy loam formed in material washed from those soils. In other respects, this soil has a profile similar to that described as typical for the series.

This soil is used intensively for row crops, including cotton, corn, soybeans, peas, millet, and sorghums. It is well suited to truck and garden crops, and to pasture, hay, and trees. Flooding is not a hazard on this soil as it is on the mapping unit Toccoa soils. Native vegetation consists of loblolly pine, shortleaf pine, white oak, red oak, yellow-poplar, and various gums. About 75 percent of the acreage is cultivated or pastured, and the rest is wooded. (Capability unit I–1; woodland suitability group 1; wildlife suitability group 1)

Toccoa soils (Toc).—These nearly level, well-drained soils occur in long, narrow areas on flood plains throughout the two counties. They have the profile described as typical for the Toccoa series. The surface layer is mainly sandy loam, but ranges to loamy sand and loam.

Included with these soils in mapping were small areas of a wetter soil along the stream channels. These inclusions make up as much as 20 percent of the mapped areas of these soils.

Toccoa soils are well suited to many kinds of row crops, hay crops, and pasture plants. Although flooding is a slight to moderate hazard in some wet years (fig. 6), these soils are used intensively. Native vegetation consists of loblolly pine, shortleaf pine, red oak, white oak, and yellow-poplar. (Capability unit IIw–2; woodland suitability group 1; wildlife suitability group 7)

Wedowee Series

The Wedowee series consists of well-drained soils in the foothills of mountains. These soils formed in material weathered from light-colored gneiss and schist. Slopes range from 10 to 60 percent, but dominant slopes are 10 to 45 percent.

Typically, the surface layer is fine sandy loam about 6 inches thick. It is yellowish brown in the upper part and dark brown in the lower part. The yellowish-red subsoil extends to a depth of 32 inches and is mainly clay loam. The underlying material is yellowish-red to brown fine sandy loam.

These soils are low in natural fertility, contain little organic matter, and are strongly acid. Runoff is medium to rapid on bare soils because slopes are strong or steep. Permeability is moderate, and the available water capacity is medium. The root zone is medium to thick.

The Wedowee soils occur mostly on the mountain foothills in Stephens County, north and west of Toccoa. They are not suited to cultivated crops, because they are strongly sloping and steep. The vegetation is shortleaf pine, Virginia pine, southern red oak, chestnut oak, various hickories, and a few other kinds of trees. Logging is difficult if conventional equipment is used, particularly where slopes are more than 20 percent. These soils are suited for wildlife and, to a limited extent, for recreation.

Typical profile of Wedowee fine sandy loam, 10 to 25 percent slopes, eroded, 700 yards east of county road in Banks County, heading north 0.4 mile from Wilson Shoals on Hudson River:

Figure 6.—**Silted Toccoa soils on flood plains of the Hudson River before construction of flood-retarding structure.**

A1—0 to 2 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, fine, granular structure; friable; few small quartz grains; numerous fine and medium roots; strongly acid; clear, smooth boundary.

A2—2 to 6 inches, dark-brown (7.5YR 4/4) fine sandy loam; weak, fine, granular structure; friable; few small quartz grains; numerous fine and medium roots; few fine mica flakes; few stains from organic material along old root channels; strongly acid; clear, smooth boundary.

B1—6 to 9 inches, yellowish-red (5YR 5/8) fine sandy clay loam; weak, fine, subangular blocky structure; friable; few small quartz grains; many fine and medium roots; few fine mica flakes; few stains from organic material and gray sandy material from upper horizons along old root channels; strongly acid; clear, smooth boundary.

B2t—9 to 26 inches, yellowish-red (5YR 5/8) heavy clay loam; moderate, fine and medium, subangular blocky structure; firm; faint, patchy clay films on peds; few small quartz grains; many medium and fine roots; few fine mica flakes; few stains from organic material along old root channels; strongly acid; gradual, wavy boundary.

B3—26 to 32 inches, yellowish-red (5YR 5/6) light clay loam; weak, fine and medium, subangular blocky structure; friable to firm; many fine quartz grains; few roots; few fine mica flakes; very slightly variegated or streaked with strong-brown and reddish-yellow stains along old root channels; strongly acid; clear, smooth boundary.

C—32 to 45 inches, yellowish-red (5YR 5/6) to brown (7.5YR 4/4) fine sandy loam that grades to partly disintegrated rock; structureless; friable; common fine mica flakes; many small quartz grains; strongly acid.

The Ap horizon is light yellowish brown to grayish brown. The A1 horizon is coarse sandy loam to very fine sandy loam in texture, and ranges from gray and dark grayish brown to yellowish brown in color. The A2 horizon is yellow to yellowish brown and dark brown. The B2t horizon ranges from yellowish brown to yellowish red in color and from heavy clay loam to clay in texture. This horizon normally is 15 to 17 inches thick, but in places it is 10 to 25 inches thick. The saprolite is thick.

The Wedowee soils occur mainly with the Madison, Chandler, Appling, and Louisburg soils. The Wedowee soils, like the Madison soils, have a solum less than 40 inches thick, but the Appling soils have a solum 40 inches or more thick. Wedowee soils typically are less micaceous than Madison soils. The B horizon of the Wedowee soils is not so brown or clayey as that of the Chandler soils. Wedowee soils are not coarse textured throughout the profile, as are the Louisburg soils.

Wedowee fine sandy loam, 10 to 25 percent slopes, eroded (WtE2).—This deep, yellowish-brown soil occurs

in the foothills of mountains. It has the profile described as typical for the Wedowee series. Erosion has removed 25 to 75 percent of the original surface layer. The present surface layer is 4 to 6 inches thick. A few shallow gullies, rills, and galled spots are present.

Included with this soil in mapping were small areas of a severely eroded Wedowee soil that had an exposed, yellowish-red, clavey subsoil. This severely eroded soil had slower infiltration and more rapid runoff than this soil. The included areas make up as much as 20 percent of the mapped areas.

Because slopes are moderately steep and steep and the hazard of erosion is severe, this soil is not suited to cultivated crops. But under good management, row crops grow moderately well. This soil is better suited to pasture, hay, and trees than to cultivated crops. About 95 percent of this soil is woodland. The native vegetation consists of loblolly pine, shortleaf pine, Virginia pine, white oak, red oak, and hickory. (Capability unit VIe–2; woodland suitability group 2; wildlife suitability group 2)

Wedowee fine sandy loam, 25 to 60 percent slopes (WtF).—This yellowish-brown soil occurs on the side slopes of mountain foothills. It has a fine sandy loam surface layer 5 to 8 inches thick. The subsoil is heavy clay loam.

This soil has not been cleared. Erosion is little or none because the surface is thickly covered with southern red, black, white, and post oaks, and white and shortleaf pines. These trees grow moderately well on this soil, but logging is restricted by the steep slopes. (Capability unit VIIe–1; woodland suitability group 6; wildlife suitability group 6)

Wedowee sandy clay loam, 10 to 25 percent slopes, severely eroded (WuE3).—This soil occurs on the side slopes of mountain foothills. Less than 25 percent of the original surface layer remains in place, and in many places the yellowish-red, clayey subsoil is exposed. A few shallow and some deep gullies have formed.

Included with this soil in mapping were small areas of a less eroded Wedowee soil where 25 to 75 percent of the fine sandy loam surface layer had remained. In these places a few shallow and some deep gullies had formed. These inclusions make up as much as 20 percent of the mapped areas of this soil.

This soil is not suited to cultivated crops, because slopes are steep and the hazard of erosion is severe. It is suited to trees and to use for wildlife. The native vegetation consists of loblolly, white, shortleaf, and Virginia pines, red and white oaks, and various hickories. These trees grow moderately well on this soil, but in wet periods, logging is hampered by the slick surface and by the slopes. (Capability unit VIIe–1; woodland suitability group 4; wildlife suitability group 4)

Wehadkee Series

The Wehadkee series consists of deep, poorly drained soils on first bottoms along the larger streams in the survey area. These soils formed from alluvial sediments washed from soils underlain primarily by granite, gneiss, schist, and other rocks. Slopes range from 0 to 2 percent.

The surface layer is dark grayish-brown to dark-brown sandy loam or silt loam about 6 inches thick. The subsoil is mottled, dark-gray loam that extends to a depth of about 50 inches.

These soils are low to medium in natural fertility and in organic matter, and they are medium acid throughout the profile. Tilth generally is poor. Runoff is very slow, permeability is moderate, and the available water capacity is medium. Most areas are subject to frequent flooding.

Most of the acreage is forested, mainly with water-tolerant hardwoods, such as sweetgum, blackgum, water oak, yellow-poplar, hickory, elm, and alder. Drained areas are used for pasture and, to a limited extent, for corn and hay.

Typical profile of a Wehadkee silt loam, 11 miles south of Toccoa on State Route 106, about 1,320 feet south of concrete bridge and 300 feet on right side of road in a pasture:

Ap—0 to 6 inches, dark-brown (7.5YR 4/4) silt loam; few, fine, faint mottles of brown (7.5YR 5/4); weak, fine, granular structure; slightly sticky; few fine mica flakes; many fine roots; strongly acid; abrupt, smooth boundary.

B21g—6 to 18 inches, dark-gray (5Y 4/1) heavy loam; few, fine, faint mottles of dark brown; massive to weak subangular blocky structure; slightly sticky; medium acid; clear, smooth boundary.

B22g—18 to 50 inches, dark-gray (5Y 4/1) loam; few, medium, distinct mottles of dark brown (7.5YR 4/4); massive to weak, subangular blocky structure; slightly sticky; medium acid; clear, smooth boundary.

C—50 to 60 inches, gray (5Y 6/1) stratified fine sand, silt, and clay.

The A horizon ranges from very dark gray to gray, but dominantly is dark grayish brown to dark brown mottled with brown or grayish brown. This horizon is fine sandy loam, loam, silt loam, and loamy sand to light silty clay loam. The B horizon has matrix colors of dark gray through light gray and is mottled with dark brown, strong brown, brownish yellow, and yellowish brown. Each layer in the B horizon ranges from heavy sandy loam to light silty clay loam. At a depth between 10 and 40 inches, the B horizon, by volume, is 18 to 35 percent clay and more than 15 percent sand that is coarser than very fine sand. The solum is 36 to 60 inches thick. Depth to bedrock commonly is about 6 feet but ranges to 20 feet or more in places. Throughout the profile content of mica ranges from low to medium and reaction ranges from medium acid to strongly acid.

The Wehadkee soils occur mainly with the Toccoa and Cartecay soils. Wehadkee soils are not so well drained as the Toccoa and Cartecay soils and are finer textured in the subsurface layers.

Wehadkee soils (Whs).—These soils are nearly level and occupy depressional or pocketed areas along the larger streams in the two counties.

Included with these soils in mapping were small, flat areas of wet, loamy or clayey soils where water stands on the surface for much longer periods than on the typical Wehadkee soils. Also included were areas of soils that are similar to Wehadkee soils, but that were darker brown in the upper 20 inches of the profile. These inclusions make up as much as 30 percent of the mapped areas of this unit.

Wehadkee soils are not well suited to cultivation, because they are frequently flooded, have a high water table, and are poorly drained. A small percentage of the acreage is artificially drained and is in pasture and corn. About 85 percent of the acreage is in trees, chiefly water-tolerant hardwoods. (Capability unit IVw–1; woodland suitability group 7; wildlife suitability group 8)

Wickham Series

The Wickham series consists of deep, well-drained soils that formed on stream terraces in old alluvium 2 to 10 feet thick. These soils occur in small areas where sediment has been deposited just above the flood plains and adjacent to the larger streams in the survey area. Wickham soils generally are near a bluff or sharp bend in the stream. Slopes range from 2 to 15 percent.

The surface layer is dark-brown to dark reddish-brown sandy loam about 6 inches thick. The subsoil is yellowish-red to red sandy clay loam to clay loam. Strong-brown and light-gray mottles occur at a depth of about 28 inches.

These soils are low in natural fertility, contain little organic matter, and are strongly acid throughout the profile. Runoff is medium to rapid where these soils are bare. Internal drainage is medium. Permeability is moderate, and the available water capacity is medium. These soils have a thick root zone. Tilth is good in areas not severely eroded.

Most of the acreage has been cleared, but about 60 percent has reverted to mixed pines and hardwoods. Where cultivated, these soils generally are used for corn, soybeans, small grains, or pasture. Under good management that includes additions of fertilizer, these soils respond well and crop growth is fair to good. The native vegetation consists of shortleaf pine, loblolly pine, Virginia pine, white oak, red oak, and various gums.

Typical profile of Wickham sandy loam, 2 to 6 percent slopes, 5½ miles northeast of Toccoa and 100 feet on right side of State Route 184:

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

B1—6 to 9 inches, reddish-brown (5YR 5/4) sandy clay loam; weak, fine, subangular blocky structure; friable; few fine roots; few fine mica flakes; strongly acid; clear, smooth boundary.

B21—9 to 18 inches, yellowish-red (5YR 5/6) sandy clay loam; moderate, medium and fine, subangular blocky structure; friable to firm; few fine roots; few fine mica flakes; patchy clay films on peds; strongly acid; gradual, wavy boundary.

B22t—18 to 28 inches, yellowish-red (5YR 5/6) clay loam; few, fine, faint mottles of strong brown; moderate, medium, subangular blocky structure; firm; few roots; many fine mica flakes; patchy clay films on peds; strongly acid; gradual, wavy boundary.

B3—28 to 48 inches, yellowish-red (5YR 5/6) sandy clay loam; common, medium, distinct mottles of yellowish red (5YR 5/8) and light gray (10YR 7/1) in the lower part; weak, fine, subangular blocky structure; few mica flakes; strongly acid; gradual, wavy boundary.

C—48 to 56 inches, sandy loam that is yellowish red (7.5YR 5/8) when crushed; massive; friable; many mica flakes.

The A horizon is fine sandy loam, loam, sandy loam, or silt loam in most places. It is clay loam in severely eroded areas. In the less eroded, cultivated areas, the Ap horizon is brown to dark brown and dark reddish brown, but in the severely eroded areas, it is yellowish red and reddish brown. In wooded areas, the A1 horizon, 1 to 4 inches thick, generally is very dark brown. In these areas, the A2 horizon, 4 to 9 inches thick, generally is brown to pale brown. The B2t horizon ranges from yellowish red to reddish brown or red in colors and from sandy clay loam to clay loam in texture. The solum is 24 to 60 inches thick. In many places it is underlain by stratified sand and gravel, and in some places at a depth between 4 and 7 feet, strata of clay occur. The C horizon grades to coarse textured soil material at depths below 56 inches. In places, rounded quartz gravel is commonly on the surface and throughout the profile.

The Wickham soils occur chiefly with the Altavista, Hiwassee and Masada soils. The Wickham soils have a B horizon that is mainly sandy clay loam, as do the Altavista soils and the Masada soils. The B horizon of Wickham soils is yellowish red and not mottled, but that of the Altavista soils is yellowish and brownish mottled with gray and that of the Masada soils is yellowish brown. In the Wickham soils the B horizon is not clayey or so dark red, as is that in the Hiwassee soils.

Wickham sandy loam, 2 to 6 percent slopes (WgB).—This soil occurs on stream terraces. It has the profile described as typical for the Wickham series.

Included with this soil in mapping were areas of a soil that was similar to this sandy loam but was eroded. In these areas, a few shallow and deep gullies had formed and, in galled spots, a subsoil of yellowish-brown sandy clay loam was exposed. These inclusions make up as much as 30 percent of the mapped areas of this soil.

This soil is suited to many kinds of crops. It responds well to good management, especially to additions of fertilizer. All of the acreage has been cultivated, but about 25 percent of it has reverted to mixed pines and hardwoods. (Capability unit IIe–1; woodland suitability group 3; wildlife suitability group 1)

Wickham sandy loam, 6 to 10 percent slopes (WgC).—This soil occurs on stream terraces. The surface layer is sandy loam about 6 inches thick. The subsoil is sandy clay loam or clay loam about 36 inches or more thick.

Included with this soil in mapping were areas of a soil that is similar to this sandy loam, except that erosion had removed from 25 to 75 percent of the original surface layer. In these areas, a few shallow and deep gullies had formed and, in galled spots, reddish-brown sandy clay loam was exposed. In a few areas included was a soil that had slopes of as much as 15 percent but otherwise was similar to this soil. These inclusions make up as much as 30 percent of the mapped areas of this soil.

This soil is suited to cultivated crops grown in rotation with close-growing crops if management is good. All of the acreage has been cultivated, but about 35 percent of it has reverted to mixed pines and hardwoods. (Capability unit IIIe–1; woodland suitability group 3; wildlife suitability group 1)

Wickham sandy loam, 10 to 15 percent slopes (WgD).—This soil has a profile similar to the one

described as typical for the Wickham series, except that this soil has a surface layer 6 to 8 inches thick and a subsoil 30 to 36 inches thick.

Included with this soil in mapping were areas of a soil similar to this sandy loam, except that the included soil was eroded. In these areas are a few galled spots where the reddish-brown sandy clay loam subsoil was exposed and where a few shallow gullies had formed. These inclusions make up as much as 20 percent of the mapped areas of this soil.

All of this soil has been cultivated, but about 75 percent of the acreage has reverted to mixed pines and hardwoods. This soil is suited to row crops grown in a suitable rotation, but it is better suited to pasture grasses and legumes or trees. (Capability unit IVe–1; woodland suitability group 3; wildlife suitability group 2)

Wickham clay loam, 6 to 10 percent slopes, severely eroded (WhC3).—This soil occurs mostly on the escarpments of stream terraces. The present surface layer is yellowish-red to reddish-brown clay loam about 4 to 5 inches thick. It is a mixture of the upper part of the subsoil and remnants of the original surface layer. The subsoil is yellowish-red clay loam about 30 to 36 inches thick. Shallow gullies and a few deep ones have formed.

Included with this soil in mapping were less eroded areas where a greater part of the original surface layer remained. These inclusions make up as much as 30 percent of the mapped areas of this soil.

All of the acreage has been in cultivated crops, but most of it has reverted to mixed pines and hardwoods. This soil is suited to tilled crops in a suitable rotation, but it is better suited to pasture grasses and legumes, trees, and use for wildlife or recreation. (Capability unit IVe–1; woodland suitability group 4; wildlife suitability group 3)

Wilkes Series

The Wilkes series consists of shallow to moderately deep, well-drained soils on uplands. These soils formed in a mixture of materials weathered from acidic and basic rocks. In most places slopes range from 10 to 35 percent, but in some places they range from 10 to 60 percent.

Typically, the surface layer is sandy loam about 5 inches thick. It is dark gray in the upper part and dark yellowish brown in the lower part. Below this is an irregular, or broken, subsoil of yellowish-brown heavy sandy loam to sandy clay loam. In some places the subsoil is interbedded with resistant rock material, and in other places the soil material occurs as pockets surrounded by broken or weathered rock. The soil material is mottled below a depth of 14 inches. Fractured bedrock is at a depth of about 23 inches.

These soils are low in natural fertility, contain little organic matter, and are slightly acid. Runoff is slow to rapid, and internal drainage is medium. Permeability is moderately slow.

The Wilkes soils occur mainly with the Musella, Mecklenburg, Hiwassee, and Louisburg soils. The subsoil of the Wilkes soils is thin, discontinuous, yellowish brown, and loamy, but that of the Musella, Hiwassee, and Mecklenburg is well developed and red to dark red. The Wilkes soils formed from mixed acidic and basic rocks, but the Louisburg soils formed from acidic rocks. Wilkes soils are more clayey in the subsoil than Louisburg soils.

Wilkes soils occupy small areas in Banks and Stephens Counties. Approximately 90 percent of the acreage is in trees or pasture. The dominant trees are shortleaf pine, Virginia pine, redcedar, blackjack oak, and post oak. Because slopes are steep, these soils are not suited to row crops.

Typical profile of a Wilkes sandy loam in Wilkes complex, 10 to 25 percent slopes, 1¼ miles east of U.S. Highway No. 441 from Hollingsworth, on left side of Banks County road:

A11—0 to 2 inches, dark-gray (10YR 4/1) sandy loam; weak, fine, granular structure; very friable; strongly acid; clear, smooth boundary.

A12—2 to 5 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak to moderate, fine, granular structure; very friable; common, fine to medium roots; strongly acid; clear, smooth boundary.

B2t—5 to 14 inches, yellowish-brown (10YR 5/6) heavy sandy loam to sandy clay loam mottled and streaked with strong brown (7.5YR 5/6), light gray (N 7/0), and olive-brown (2.5Y 4/4); weak, medium, subangular blocky structure; friable to plastic; medium acid; clear, wavy boundary.

B3&C—14 to 23 inches, mottled, yellowish-brown (10YR 5/6) and olive-brown (2.5Y 4/4) sandy loam to light sandy clay loam; structureless; friable; streaked saprolite from granitic rock cut by dikes of basic rock; some loamy material in cracks; grades into hard rock below; slightly acid; abrupt, wavy boundary.

R—23 inches +, fractured bedrock.

The A horizon is fine sandy loam, sandy loam, or loamy sand and is gravelly or stony in places. The A11 horizon is dark grayish brown and olive brown to dark gray. In the sandier soils the A2 horizon commonly is faint. The B2t horizon in most places is heavy sandy loam and sandy clay loam to clay loam, but in some places it is replaced by a faint B horizon. Depth to saprolite ranges from 10 to 20 inches, and depth to bedrock ranges from 18 to 42 inches or more. Mica flakes commonly occur throughout the profile, but they are not abundant.

Wilkes complex, 10 to 25 percent slopes (WpE).—This complex consists of soils that occur on foothills of mountains. It has a profile similar to that described as typical for the series, except that the surface layer of this complex is fine sandy loam, sandy loam, and loamy sand. The soils of these various textures are so intricately intermingled that it is not practical to separate them on the soil map.

Included with these soils in mapping were areas of soils that were similar to the Wilkes soils, except that in the included soils the combined surface layer and subsoil was more than 20 inches thick, and in some places, stones and boulders are on the surface. These inclusions make up about 20 percent of the mapped areas of this complex.

Most of this mapping unit is in the Chattahoochee National Forest and is used for wildlife, recreation, and trees. Growth of trees is slow. On the steep slopes, logging operations are hazardous and lengthy

if conventional equipment is used. (Capability unit VIIe–2; woodland suitability group 5; wildlife suitability group 5)

Wilkes stony complex, 25 to 60 percent slopes (WjF).—This complex consists of soils on the foothills of mountains. It has a profile similar to the one described as typical for the Wilkes series, except that the surface layer of this complex is stony sandy loam and sandy loam. The soils of these textures are so intricately intermingled that it is not practical to separate them on the soil map. The surface layer is about 6 inches thick and, in most places, is stony. Stones cover about 35 percent of the surface, and a few boulders are present. In most places the subsoil is sandy clay loam to heavy sandy clay loam about 9 inches or more thick. In a few places the subsoil is thin, discontinuous sandy loam 4 to 6 inches thick.

Included with these soils in mapping were areas of the Mecklenburg soils in which the combined surface layer and subsoil are more than 20 inches thick.

This mapping unit is used only for wildlife, recreation, and trees, dominantly sparse stands of post oak, redcedar, and mixed pines. Growth of trees is slow on this complex. Adapted equipment eases logging operations. (Capability unit VIIe–2; woodland suitability group 6; wildlife suitability group 5)

Use and Management of the Soils

This section describes the suitability of the soils in Banks and Stephens Counties for cultivated crops and pasture, trees, engineering structures and practices, nonfarm uses, and wildlife and fish.

Use of the Soils for Cultivated Crops and Pasture [2]

In this section the system of capability grouping used by the Soil Conservation Service is discussed, the soils in each capability unit are described, and management suited to the soils in each unit is suggested. Following this, estimated acre yields of the principal crops are given for all the soils in the county, and the management required to obtain these yields is described.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the 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.

[2] JOHN B. HUNGERFORD, conservationist agronomist, Soil Conservation Service, assisted in preparing this section.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

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, defined as follows:

Class I soils have few limitations that restrict their use.

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (None in Banks and Stephens Counties)

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

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

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

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 some parts of the United States but not in Banks and Stephens Counties, 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

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little or no erosion, though they have other limitations that restrict their use mainly to pasture, range, woodland, wildlife, 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–2 or IIIe–1. 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 paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Banks and Stephens Counties are described and suggestions for the use and management of the soils are given. The capability units are not in consecutive numerical order, because a statewide system is used to number the units in Georgia and all of the units in the State are not in the two counties. To identify the capability unit assigned to any soil, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I–1

Toccoa sandy loam, local alluvium, is the only soil in this unit. It is a deep, well-drained soil that occurs in depressions and at the head of drains. Slopes range from 0 to 2 percent.

The surface layer varies in texture and consistence but is commonly friable or loose sandy loam or loam. The subsurface layer also varies in texture and consistence but is dominantly friable sandy loam. Plant roots can penetrate to a depth of 36 inches or more. Generally, depth to bedrock is 5 to 8 feet, but in some places it is 15 feet or more.

Tilth is good, natural fertility is low to medium, and the organic-matter content is low. Permeability is moderately rapid, the rate of infiltration is moderate, and the available water capacity is medium.

Figure 7.—**Mixed cattle grazing bermudagrass-white Dutch clover pasture on Toccoa sandy loam, local alluvium, in capability unit I–1.**

About 75 percent of the acreage is cultivated or is used for pasture (fig. 7). The remaining acreage is wooded or is idle.

The soil in this unit is well suited to truck crops, corn, small grains, soybeans, grain sorghum, and most hay and pasture crops grown locally. Tilth and organic-matter content can be maintained by returning plant residues to the soil and by including a perennial crop occasionally in rotation. Crops respond well to nitrogen, phosphorus, and potassium fertilizers and lime.

CAPABILITY UNIT IIe–1

This unit consists of deep, well-drained, slightly eroded and moderately eroded soils on broad interstream divides and on high stream terraces. These soils have smooth slopes that range from 2 to 6 percent.

The plow layer, 6 to 8 inches thick, is sandy loam, sandy clay loam, or clay loam. The subsoil is sandy clay or clay that is moderately permeable. It is friable to firm when moist and hard when dry. The effective root depth is 30 to 48 inches. Bedrock is at a depth of more than 6 feet.

These soils have slow or medium surface runoff, moderate infiltration, and medium available water capacity. The content of organic matter is low, and the supply of available plant nutrients is low to medium. These soils have good tilth, are strongly acid, and respond well to fertilizer.

The soils of this unit are well suited to all cultivated crops grown locally, including cotton (fig. 8). They are suited to peas, millet, bicolor lespedeza, and similar plants that provide food and cover for wildlife. Yellow-poplar, loblolly pine, shortleaf pine, and other commercial trees grow well. About 30 percent of the acreage is pastured, 40 percent is cultivated, and 20 percent is wooded. The rest is idle.

Where these soils are cultivated, the farmer generally has a choice of cultivating them in straight rows, on the contour with or without terraces, or in strips. The choice depends on the kinds of crops and soils.

The steepness and length of slope govern the crop-

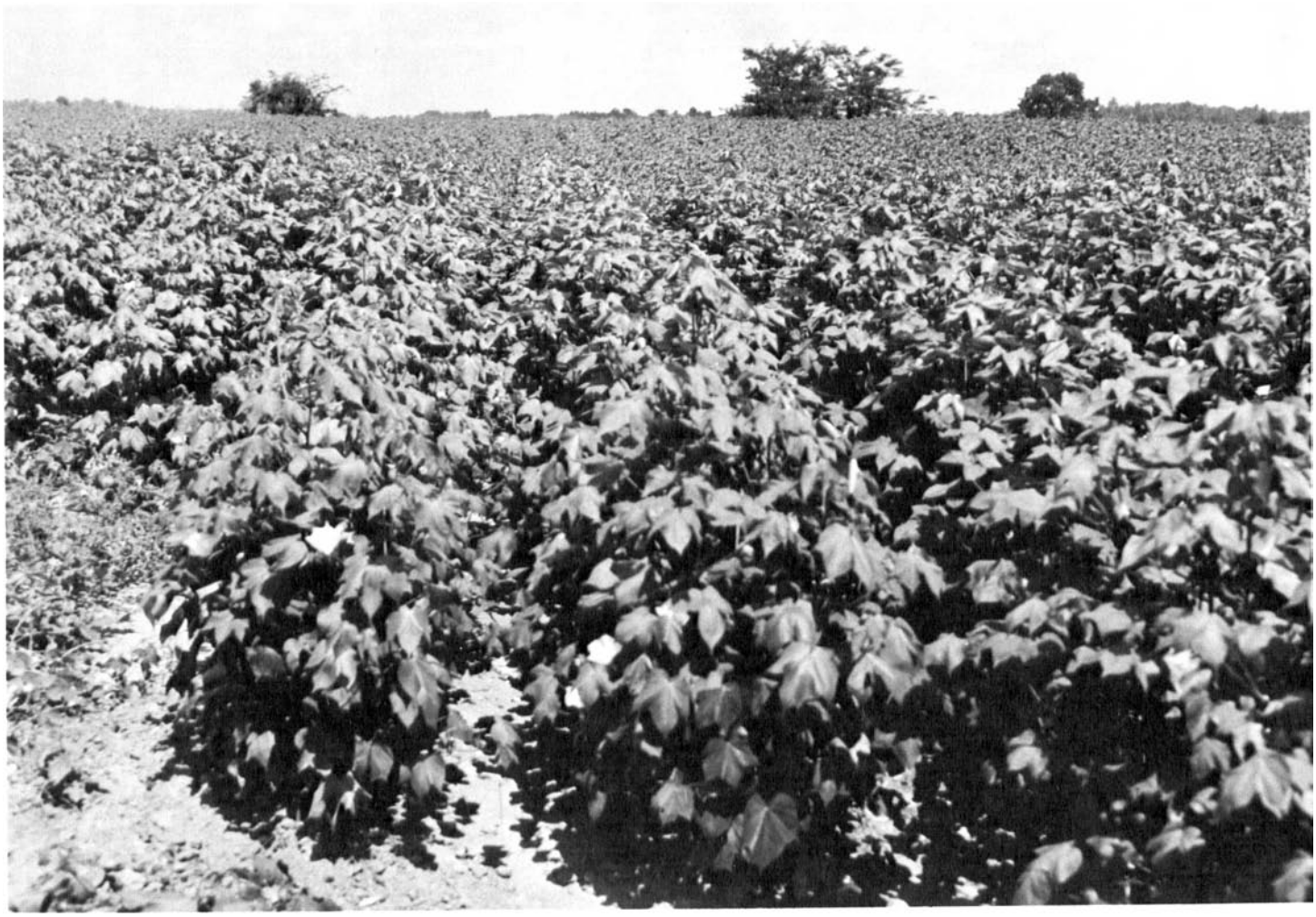

Figure 8.—Cotton growing on Cecil sandy loam, 2 to 6 percent slopes, eroded, in capability unit IIe–1.

ping system needed to hold soil losses from erosion within allowable limits. For a soil of this unit that has a slope of 3 percent that is 150 feet long, an example of a suitable system is a row crop, such as cotton, and a close-growing crop, such as a small grain grown for grain, planted in alternating parallel strips on the contour. These crops are rotated each year. Adequate applications of fertilizer and lime are needed, and all crop residues should be left on the surface between seasons of cropping.

Among the practices that help to maintain good tilth and crop growth, and to control erosion, are (1) applying lime and fertilizer regularly; (2) managing crop residues well, normally by shredding them and leaving them on the surface between seasons of cropping; and (3) using suitable cropping systems.

Complementary practices are (1) establishing grassed waterways or outlets for the disposal of runoff water from areas of straight row farming, contour farming, terracing, or stripcropping; (2) establishing field borders in perennial grass to prevent erosion at the edge of fields and to reduce weed growth; and (3) locating farm roads and fences on the crest of the slopes where the watershed divides. The field borders suggested are attractive, they encourage wildlife, and they allow more efficient operation of farm equipment.

CAPABILITY UNIT IIe–2

This unit consists of moderately well drained and well drained, strongly acid soils on broad interstream divides and low stream terraces. Slopes range from 2 to 6 percent.

The surface layer is sandy loam or fine sandy loam. The subsoil is mottled sandy clay to clay that is friable to firm. Plant roots penetrate to a depth of more than 36 inches.

Natural fertility and organic-matter content are low. The rate of infiltration is moderate, and the available moisture capacity is medium. Runoff is slow to medium, and the erosion hazard is slight to moderate. The soils have good tilth, and response to fertilizer is good.

Most of these soils are well suited to all the crops grown locally. They are suited to peas, millet, bicolor lespedeza, beggarweed, and similar plants that provide food and cover for wildlife. They are also well suited to yellow-poplar, loblolly pine, shortleaf pine, and most other trees grown commercially. About 15 percent of the acreage is pastured, 50 percent is cultivated, 30 percent wooded, and the rest is idle.

These soils can be cultivated in straight rows, on the contour with or without terraces, or in strips. The choice depends on the kinds of crops and soils.

The steepness and length of slopes govern the cropping system needed to hold soil losses from erosion within allowable limits. For example, corn can be grown continuously on a slope of 3½ percent that is terraced if all residues are left on the surface during the winter. Another suitable system is a 2-year rotation of mulch-planted corn followed by cotton.

Among the practices that help to maintain good tilth and crop growth and to control erosion are (1) applying lime and fertilizer regularly, (2) managing crop residues well, normally by shredding them and leaving them on the surface between seasons of cropping; and (3) using suitable cropping systems.

Complementary practices are (1) establishing grassed waterways or outlets for the disposal of runoff water from areas of straight row farming, contour farming, terracing, or stripcropping; (2) establishing field borders in perennial grass to prevent erosion at the edge of fields and to reduce weed growth; and (3) locating farm roads and fences on the contour or on the crest of slopes where the watershed divides. These roads and fences should be located so as to permit an arrangement of fields and rows that facilitates efficient farming operations. The fences may be located in or near natural waterways. The field borders suggested are attractive, encourage wildlife, and allow more efficient use of farm equipment.

CAPABILITY UNIT IIw–2

Toccoa soils is the only mapping unit in this capability unit. These well-drained, nearly level soils occur on first bottoms that are flooded occasionally. Slopes range from 0 to 2 percent.

The plow layer or surface layer is sandy loam, fine sandy loam, or loam 6 to 9 inches thick. Some soils have stratified layers of sand and silt that were recently deposited by floodwater. The subsoil is loam or sandy loam that is very friable and moderately to rapidly permeable. Plant roots penetrate to a depth of 30 to 36 inches or more.

Runoff is slow, infiltration is moderately rapid to rapid, and the available water capacity is medium. The content of organic matter and available plant nutrients is low to medium. Crops grown on these soils respond well to additions of fertilizer and lime, tilth is good, and plants grow well (fig. 9).

These soils are suited to corn, grain sorghum, oats, rye, ryegrass, fescue, dallisgrass, bahiagrass, annual lespedeza, and vetch. They are poorly suited to alfalfa. Cotton and bermudagrass grow only on soils in the highest areas. Small grains, corn, and sorghum planted for grain are occasionally damaged by floodwater. Yellow-poplar, loblolly pine, and shortleaf pine grow rapidly. About 50 percent of the acreage is in pasture, 30 percent is in trees, and the rest is in row crops.

Excess water is the main problem in managing these soils, and drainage may be needed in some places. The management of water depends on the crop to be grown. If drainage is needed, a system of main and lateral ditches may be used. Suitable drains are open ditches or underground tile.

Where these soils are adequately drained, any suitable crop can be grown continuously if enough plant residues are returned to the soil to maintain good tilth. A planned sequence of crops helps in controlling weeds, insects, and plant diseases, and in using fertilizer more efficiently.

CAPABILITY UNIT IIIe–1

This unit consists of deep, well-drained, slightly eroded to eroded soils along the crest of ridges. Slopes range from 6 to 10 percent.

The surface layer is friable sandy loam, fine sandy loam, loam, or clay loam. In small severely eroded areas, the plow layer is chiefly subsoil material. The subsoil is sandy clay loam and sandy clay to clay. Plant roots penetrate to a depth of 36 inches or more. Depth to bedrock is 6 feet or more.

Natural fertility and organic-matter content are low. Tilth is generally good, but in severely eroded areas it is medium. Permeability is moderate, the infiltration is moderate to slow, and the available water capacity is medium. These soils are strongly acid throughout the profile.

About 65 percent of the acreage is cultivated to row crops or used for improved pasture. The remaining acreage is used for growing commercial trees, for wildlife, and for recreation.

These soils are suited to all the crops grown locally, including pasture grasses and legumes. Crops are more difficult to establish and grow less well on these soils than on the soils in capability unit IIe–1.

Where these soils are cultivated, the farmer generally has a choice of cultivating them in straight rows, on the contour with or without terraces, or in strips. The choice depends on the kinds of crops and soils.

The steepness and length of slopes govern the cropping system needed to hold soil losses from erosion within allowable limits. For a soil that has a slope of 6 percent that is 150 feet long, an example of a suitable cropping system is a row crop, such as cotton, and a close-growing crop, such as tall fescue, planted in alternating parallel strips on the contour and rotated every 2 years.

Among the practices that help to maintain crop growth and good tilth and to control soil losses are (1) applying lime and fertilizer regularly; (2) managing crop residues well, normally by shredding them and leaving them on the surface between seasons of cropping; and (3) using suitable cropping systems.

Complementary practices are (1) establishing grassed waterways or outlets for the disposal of run-

Figure 9.—Corn on the mapping unit Toccoa soils in capability unit IIw–2. Corn is the main crop on these occasionally flooded soils.

off water from areas of straight row farming, contour farming, terracing, or stripcropping; (2) establishing field borders in perennial grass to prevent erosion at the edge of fields and to reduce weed growth; and (3) locating farm roads and fences on the contour or on the crest of the slopes where the watershed divides. These roads and fences should be located to permit an arrangement of fields and rows that will facilitate efficient farming operations. Fences may be located in or near natural waterways. The field borders suggested are attractive, and they allow more efficient operation of farm equipment.

CAPABILITY UNIT IIIe–2

This unit consists of well-drained, eroded soils on the crests and side slopes of the ridges in the uplands. Slopes range from 2 to 10 percent.

In less eroded soils, the plow layer or surface layer is friable sandy loam or slightly plastic sandy clay loam 3 to 8 inches thick. The subsoil is firm sandy clay or clay. Plant roots penetrate to a depth of 36 inches or more. Depth to bedrock generally is 8 feet or more.

Natural fertility and organic-matter content are low. The soils are strongly acid throughout the profile. The rate of infiltration is medium to slow, permeability is moderate, and the available water capacity is medium. The sandy loams have good tilth. Sandy clay loams must be tilled within a narrower range of moisture content to prevent adverse effects on structure and tilth.

These soils are suited to all the cultivated crops grown locally. They are suited to peas, millet, bicolor lespedeza, and similar plants that provide food and cover for wildlife. They are also well suited to most of the trees grown commercially, such as yellow-poplar, loblolly pine, and shortleaf pine. About 25 percent of the acreage of these soils is cultivated, 30 percent pastured, and 35 percent wooded, and the rest is idle or used for nonfarm purposes.

Where these soils are cultivated, the farmer generally has a choice of cultivating them in straight rows, on the contour with or without terraces, or in strips. The choice depends on the kinds of crops and soils.

The steepness and length of slopes govern the cropping system needed to hold soil losses from erosion within allowable limits. For a soil that has a slope of 9 percent that is 100 feet long, an example of a suitable cropping system is a 6-year rotation of a row crop, such as cotton, and a close-grown crop, such as tall fescue, planted in alternating strips on the contour and rotated every 2 years.

Among the practices that help to maintain crop growth and good tilth and to control erosion are (1) applying lime and fertilizer regularly; (2) managing crop residues well, normally by shredding them and leaving them on the surface between seasons of cropping; and (3) using suitable cropping systems.

Complementary practices are (1) establishing grassed waterways or outlets for the disposal of runoff water from straight row farming, contour farming, terracing, or stripcropping; (2) establishing field borders in perennial grass to prevent erosion at the edge of fields and to reduce weed growth; and (3) locating farm roads and fences on the contour or on the crest of the slopes where the watershed divides. These roads and fences should be located to permit efficient farming operations. Fences may be located in or near natural waterways. The field borders suggested are attractive, encourage wildlife, and allow more efficient use of farm equipment.

CAPABILITY UNIT IIIw–2

Only the mapping unit Cartecay soils is in this capability unit. These soils occur on flood plains and are deep and moderately well drained to somewhat poorly drained. Slopes range from 0 to 2 percent. The surface layer is mainly loamy sand, sandy loam, and loam. The subsoil is mainly mottled loam to sandy loam. In these soils are stratified thin layers of sand and silt or clay. Because of the high water table, roots penetrate to a depth of only about 24 inches.

These soils have slow surface runoff, moderately rapid permeability, moderate infiltration, and medium available water capacity. Organic-matter content and natural fertility are low. Plant nutrients, however, are not leached rapidly, and response to added fertilizer is fairly good. These soils are medium acid to slightly acid throughout the profile. Except in a few wet spots, tilth is good.

These soils are well suited to tall fescue and white-clover and are moderately well suited to corn, grain sorghum, and annual lespedeza. Because the soils warm late in spring, corn and other row crops ordinarily are late in maturing. About 75 percent of the acreage of these soils is wooded, and most of the rest is in permanent pasture. The soils have a small total acreage and are widely scattered throughout the survey area.

Excess water is the main hazard on these soils, and drainage is needed in some places. The management of water depends on the crop to be grown. If drainage is needed, a system of main and lateral drains can be used. Suitable drains are open ditches or underground tile.

Where these soils are adequately drained, any suitable crop can be grown continuously if enough plant residues are returned to the soil. A planned sequence of crops aids in the control of weeds, insects, and disease. It also encourages more efficient use of fertilizer. Fertility can be maintained by applying lime and fertilizer regularly.

CAPABILITY UNIT IVe–1

This unit consists of deep, well-drained, slightly eroded to severely eroded soils that occur on the side slopes of interstream divides. Slopes range from 6 to 15 percent.

The slightly eroded and moderately eroded soils have a surface layer that is mainly friable sandy loam or fine sandy loam. The severely eroded soils have a surface layer of sandy clay loam to clay loam. Plant roots penetrate effectively to a depth of 36 inches or more. Bedrock generally is at a depth of 5 feet or more.

These soils have rapid surface runoff, moderate permeability, moderate to slow infiltration, and medium available water capacity. They have low organic-matter content and natural fertility and are strongly acid.

These soils are suited to most locally grown crops but are better suited to grasses and legumes than to row crops. About 30 percent of the acreage is cultivated or pastured, and the rest is in trees.

Where these soils are cultivated, the farmer generally has a choice of cultivating them in straight rows, on the contour with or without terraces, or in strips. The choice depends on the kind of crop to be grown.

The steepness and length of slopes govern the cropping system needed to hold soil losses from erosion within allowable limits. For a soil of this unit that has a slope of 8 percent that is 130 feet long, an example of a suitable cropping system is a 6-year rotation of a row crop, such as corn, and a close-growing crop, such as tall fescue. This system requires three units of land, either in one field or three separate fields. On one field corn is grown for 2 years, and then on another field for the next 2 years, and on the third field for the fifth and sixth years.

Among the practices that help to maintain good tilth and control soil losses are (1) applying lime and fertilizer regularly; (2) managing crop residues well, normally by shredding them and leaving them on the surface between seasons of cropping; and (3) using suitable cropping systems.

Complementary practices are (1) establishing grassed waterways or outlets for the disposal of runoff water from areas of straight row farming, contour farming, terracing, or stripcropping; (2) establishing field borders in perennial grass to prevent erosion at the edge of fields and to reduce weed growth; and (3) locating farm roads and fences on the contour and on the crest of slopes where the watershed divides. The field borders suggested are attractive, they encourage wildlife, and they allow more efficient use of farm equipment.

CAPABILITY UNIT IVw–1

Only Wehadkee soils are in this capability unit. These soils are deep, poorly drained, and frequently flooded. They generally occur on the larger flood plains in the lowest positions, where water is trapped for longer periods than on the rest of the flood plains. Slopes range from 0 to 2 percent.

The surface layer is silty clay loam to loamy sand. The subsoil is mottled and made up of layers of silty clay loam to loamy coarse sand. Because the water table is commonly near the surface, plant roots penetrate only to a depth of about 8 to 12 inches.

Natural fertility and organic-matter content are low. The soils are medium acid. Runoff is slow to ponded. Permeability is moderate, though water remains on some horizons for long periods. Infiltration is moderate to slow, and the available water capacity is medium. These soils are wetter than the soils in unit IIIw–2 and are flooded for longer periods.

These soils are too wet for row crops unless drainage is provided. They are fairly well suited to tall fescue, white clover, and dallisgrass. Response to fertilizer and lime is fairly good. About 85 percent of the acreage is in trees, and the rest is in permanent pasture.

Corn can be grown continuously if drainage is provided. Permanent pasture of tall fescue and white clover can be grown in undrained areas, but the pasture should not be grazed during rainy periods. Pasture plants grow well if grazing is controlled.

Frequent flooding is the main hazard. A system of ditches or tile is needed to remove the excess surface water and improve internal drainage.

CAPABILITY UNIT VIe–2

This unit consists of well-drained, slightly eroded to severely eroded, strongly acid soils that occur on interstream divides and in areas that join or are near drainageways. These soils occupy side slopes that range from 10 to 25 percent. Slightly eroded and eroded soils are deep, and severely eroded soils are mainly moderately deep.

The surface layer of the slightly eroded or eroded soils is chiefly friable sandy loam or fine sandy loam 4 to 8 inches thick. The surface layer of the severely eroded soils is friable clay loam or sandy clay loam. The subsoil is sandy clay loam to clay. Generally, plant roots penetrate to a depth of 36 inches or more, and depth to bedrock is 5 to 8 feet or more.

Natural fertility and organic-matter content are low. The slightly eroded and eroded soils have good tilth, but the severely eroded soils have poor tilth and can be tilled within only a narrow range of moisture content. They become clodded or puddled if plowed when wet. Permeability and infiltration are moderate, and the available water capacity is medium. Runoff is moderate on the slightly eroded and eroded soils and is rapid on the severely eroded soils.

These soils are suited to trees and pasture but not to cultivated crops. Fescue, bermudagrass, crimson clover, sericea lespedeza, annual lespedeza, and kudzu are suitable pasture plants. Also suitable are fescue, bicolor lespedeza, and other plants that provide food and cover for wildlife. About 85 percent of the acreage is in trees, and the rest is in permanent pasture.

In establishing pasture, all tillage and planting should be done on the contour. These soils should be protected at all times by a layer of mulch, plant residues, or by a close-growing crop. Grazing should be controlled to prevent damage to the pasture grasses and legumes. Pasture plants grow moderately well to well if a complete fertilizer is applied regularly and lime is applied occasionally. Legumes need a nitrogen fertilizer only at the time of planting.

CAPABILITY UNIT VIe–4

Mecklenburg fine sandy loam, 10 to 25 percent slopes, is the only soil in this unit. This well-drained, strongly acid, slightly eroded soil occurs on broken interstream divides.

The surface layer is friable fine sandy loam 3 to 6 inches thick. The subsoil is red, plastic sandy clay or clay.

Natural fertility and organic-matter content are low. The root zone ranges from thin to thick. The available water capacity is medium.

This soil is suited to bermudagrass, tall fescue, sericea lespedeza, and similar pasture and hay plants. It occupies less than 1 percent of the total acreage in the survey area and is mostly in trees.

In establishing pasture, this soil should be tilled and seeded on the contour to control erosion. Lime and a complete fertilizer are needed annually. Grazing should be controlled to conserve pasture plants.

CAPABILITY UNIT VIIe–1

This capability unit consists of deep, well-drained to somewhat excessively drained, slightly eroded to severely eroded soils. These soils occur on side slopes of uplands and mountains. Slopes range from 10 to 60 percent, but in most areas the range is 10 to 25 percent.

The surface layer is sandy loam, fine sandy loam, sandy clay loam, or loam 3 to 8 inches thick. The subsoil is sandy clay to clay in most places, but in some areas it is sandy loam. Many mica flakes are common in some of these soils, though others have no or very few mica flakes. Plant roots penetrate to a depth of 36 inches or more. Depth to bedrock is 6 feet or more.

These soils are low in natural fertility, contain little organic matter, and are strongly acid. The slightly eroded and eroded areas have good tilth, but the severely eroded areas have poor tilth.

Because slopes are strong to very steep and the erosion hazard is severe, these soils are not suited to cultivated crops. They are suited to trees. The total acreage is about 3 percent of the two counties, and about 85 percent of it is in trees.

CAPABILITY UNIT VIIe–2

This capability unit consists of well-drained to somewhat excessively drained, strongly sloping to very steep soils on uplands and mountains. These soils occur on side slopes that range from 15 to 90 percent, but about 90 percent of the acreage has slopes of 15 to 40 percent. These soils are shallow to moderately shallow and are slightly eroded.

The surface layer is fine sandy loam, loamy sand, or clay loam. Many areas are stony. The subsoil is thin or moderately thin and, in many places, consists of discontinuous layers of loam and clay loam.

Natural fertility and organic-matter content are low, and the soils are strongly acid to medium acid throughout the profile. Runoff is rapid, and infiltration is moderate to rapid. The available water capacity ranges from low to medium.

These soils are too shallow, steep, and droughty to be used for cultivated crops, hay, or pasture. They are moderately suited to trees.

Strips in open areas or in woods may be planted to bicolor lespedeza to attract deer and turkey. Frequent applications of a complete fertilizer are needed to establish and maintain grazing patches that provide food and cover for wildlife.

CAPABILITY UNIT VIIe–4

Only Gullied land is in this capability unit. Gullied land consists of shallow and deep gullies, and it cannot be used for crops and pasture unless it is reclaimed. Reclamation would be expensive. A few stunted trees grow, but most of this land is idle.

Estimated yields

Table 2 gives estimated acre yields of the principal crops grown in Banks and Stephens Counties under a high level of management. The figures are based (1) on yields obtained in long-term experiments, (2) on yields obtained on farms used for cooperative soil productivity studies, and (3) on estimates made by agronomists who have had experience with the crops and soils of Banks and Stephens Counties. Losses by flooding were not considered in making estimates for soils that are subject to flooding, because this hazard varies greatly from place to place.

Not listed in table 2 are the soils that are not commonly used or are not suited to the field or pasture crops specified.

Management practices needed to obtain yields equal to those estimated are based on research findings. For all crops, these practices include the following: (1) adding fertilizer according to the needs indicated by chemical soil tests and by past cropping and fertilization, (2) planting high-yielding seed varieties that are suited to the survey area, (3) adequately preparing the seedbed, (4) planting or seeding by suitable methods and at proper rates and dates, (5) cultivating row crops to a shallow depth and at a proper time so as to control weeds, (6) inoculating legumes, (7) controlling diseases and insects, (8) using soil conserving cropping systems, (9) controlling grazing in pastures, and (10) managing water by terracing, stripcropping, sodding waterways, and cultivating on the contour.

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

Soil	Corn	Cotton	Oats	Grain sorghum	Sericea lespedeza hay	Tall fescue and white clover for—	
						Pasture	Hay
	Bu.	*Lbs.*	*Bu.*	*Bu.*	*Ton*	*Animal-unit-month* [1]	*Tons*
Altavista sandy loam, 2 to 6 percent slopes	65	525	60	55	3.0	6.0	3.6
Appling sandy loam, 2 to 6 percent slopes, eroded	70	625	68	48	3.0	6.0	3.6
Appling sandy loam, 6 to 10 percent slopes, eroded	58	525	58	42	2.5	5.2	3.1

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

Soil	Corn	Cotton	Oats	Grain sorghum	Sericea lespedeza hay	Tall fescue and white clover for—	
						Pasture	Hay
	Bu.	*Lbs.*	*Bu.*	*Bu.*	*Ton*	*Animal-unit-month* [1]	*Tons*
Appling sandy loam, 10 to 25 percent slopes, eroded	--	---	--	--	1.5	4.6	2.7
Appling sandy clay loam, 2 to 10 percent slopes, eroded	42	425	45	40	2.0	4.3	2.6
Cartecay soils	--	---	--	--	---	6.8	4.1
Cecil sandy loam, 2 to 6 percent slopes, eroded	70	630	68	47	3.2	6.0	3.6
Cecil sandy loam, 6 to 10 percent slopes, eroded	66	600	65	48	2.9	5.3	3.2
Cecil sandy loam, 10 to 15 percent slopes, eroded	50	440	52	38	2.4	4.8	2.9
Cecil sandy clay loam, 2 to 6 percent slopes, eroded	48	425	50	40	2.5	4.7	2.8
Cecil sandy clay loam, 6 to 10 percent slopes, severely eroded	47	410	45	38	2.0	4.3	2.6
Cecil sandy clay loam, 10 to 15 percent slopes, severely eroded	--	---	--	--	---	4.0	2.4
Grover fine sandy loam, 6 to 15 percent slopes, eroded	45	475	50	35	2.4	4.7	2.8
Gwinnett sandy loam, 2 to 6 percent slopes, eroded	70	525	75	55	3.0	5.8	3.5
Gwinnett sandy loam, 10 to 15 percent slopes, eroded	65	450	65	45	2.6	5.3	3.2
Hiwassee clay loam, 2 to 6 percent slopes, eroded	57	420	55	40	2.6	5.3	3.2
Hiwassee clay loam, 6 to 10 percent slopes, eroded	48	380	50	35	2.5	4.8	2.9
Hiwassee clay loam, 10 to 15 percent slopes, eroded	40	325	40	30	2.2	4.5	2.7
Hiwassee loam, 2 to 6 percent slopes	70	525	75	55	3.0	5.8	3.5
Hiwassee loam, 6 to 10 percent slopes, eroded	65	500	65	48	2.9	5.7	3.5
Hiwassee loam, 10 to 15 percent slopes	65	450	65	45	2.6	5.3	3.2
Madison fine sandy loam, 2 to 6 percent slopes, eroded	65	610	70	48	2.8	5.8	3.5
Madison fine sandy loam, 6 to 10 percent slopes, eroded	60	525	60	40	2.6	5.2	3.1
Madison fine sandy loam, 10 to 15 percent slopes, eroded	55	475	56	40	2.4	5.0	3.0
Madison fine sandy loam, 15 to 25 percent slopes	--	---	--	--	---	4.8	2.9
Madison sandy clay loam, 6 to 10 percent slopes, severely eroded	45	400	45	38	2.1	4.3	2.6
Madison sandy clay loam, 10 to 15 percent slopes, severely eroded	--	---	--	--	---	4.0	2.4
Madison sandy clay loam, 15 to 25 percent slopes, severely eroded	--	---	--	--	---	3.7	--
Masada fine sandy loam, 2 to 6 percent slopes	65	525	60	55	3.0	6.0	3.6
Mecklenburg fine sandy loam, 10 to 25 percent slopes	--	---	--	--	1.8	5.0	3.0
Pacolet sandy loam, 15 to 25 percent slopes	--	---	--	--	2.4	4.3	2.6
Pacolet sandy clay loam, 15 to 25 percent slopes, severely eroded	--	---	--	--	1.4	---	---
Toccoa sandy loam, local alluvium	70	500	60	35	2.5	4.8	2.9
Toccoa soils	70	500	60	35	2.5	4.8	2.9
Wedowee fine sandy loam, 10 to 25 percent slopes, eroded	--	---	--	--	2.0	4.0	2.4
Wedowee sandy clay loam, 10 to 25 percent slopes, severely eroded	--	---	--	--	---	3.6	2.2
Wickham sandy loam, 2 to 6 percent slopes	70	625	70	50	3.0	6.0	3.6
Wickham sandy loam, 6 to 10 percent slopes	60	500	60	45	2.6	5.2	3.1
Wickham sandy loam, 10 to 15 percent slopes	45	350	60	40	2.4	5.0	3.0
Wickham clay loam, 6 to 10 percent slopes, severely eroded	45	400	42	40	2.1	4.3	2.6
Wilkes complex, 10 to 25 percent slopes	--	---	--	--	---	1.5	---

[1] Number of months in a year that an acre will provide grazing for one animal unit (one cow, steer, or horse, or seven sheep or goats) without injury to pasture.

Use of the Soils as Woodland [3]

About 70 percent of the 263,040 acres of Banks and Stephens Counties is in forest. Most of the acreage is privately owned, but approximately 22,000 acres are in the federally owned Chattahoochee National Forest, which is managed by the Forest Service, U.S. Department of Agriculture.

The original forest was stands of mixed pine and hardwoods on the uplands and mountains, and yellow-poplar, gum, oak, and maple on the flood plains. These stands were cut by the early settlers. The uplands and mountains reseeded naturally to loblolly, shortleaf, and Virginia pines. These second-growth pine trees have been heavily cut in recent years, and many undesirable hardwoods have replaced them. The better second-growth hardwoods on the flood plains have also been heavily cut.

Most of the soils in the counties are well suited to trees used for lumber, veneer, and pulpwood. Markets are adequate for the principal wood products, but not for low-grade hardwoods.

Progress has been made in selective cutting and in proper spacing of seedlings. More economical methods of removing underbrush on steep slopes are needed to help pine regenerate naturally. One such method is aerial spraying.

Erosion is a hazard on some of the steeper slopes, but it can be reduced by performing all forestry operations on the contour. These operations include establishing firebreaks and logging roads, planting seedlings, and cutting selectively.

Woodland suitability groups

Management of woodland can be planned more effectively if soils are grouped according to those characteristics that affect the growth of trees. The soils of Banks and Stephens Counties have been placed in seven woodland suitability groups. The soils in each suitability group can be identified by referring to the "Guide to Mapping Units" at the back of this survey. Each group consists of soils that have about the same suitability for wood crops, require about the same management, and have about the same potential productivity.

Among the important factors to be considered in planning woodland management are the potential productivity, plant competition, equipment limitation, seedling mortality, windthrow hazard, and erosion hazard. Each of these factors is discussed in the following paragraphs.

Potential productivity of a soil for a specified kind of tree is expressed as a site index. A site index for a given soil is the total height, in feet, that trees growing on the soil will reach in 50 years. Tree growth depends mainly on the available moisture and nutrients and the depth to which roots can penetrate the soil. The site index expresses the average productivity of all the soils in a suitability group. For any one soil in the group, the site index may differ somewhat from the average.

[3] WILLIAM P. THOMPSON, State forester, Soil Conservation Service, assisted in writing this subsection.

The average annual growth for southern pines was interpolated from tables 56, 88, and 152 in USDA Miscellaneous Publication 50 (*5*). Yearly growth to age 50 is shown for fully stocked stands of even-aged trees that are 8 inches or more in diameter. All yields given in board feet are measured by the Scribner log rule. Yields for hardwoods generally are not given, because the quality of logs and composition of stands vary so widely.

Plant competition refers to the rate of invasion by undesirable trees, shrubs, or vines when openings are made in the canopy. The invading plants compete with the desirable trees and hinder natural regeneration and growth of seedlings. Competition is *slight* if invader plants do not prevent natural regeneration or the growth of seedlings. It is *moderate* if invader plants delay but do not prevent the establishment of a fully stocked stand. Competition is *severe* if invader plants prevent adequate natural regeneration and if intensive site preparation is required to establish seedlings. Where competition is moderate, seedbed preparation is generally not needed and selective burning or some other inexpensive practice is generally sufficient to eliminate invader plants. Where competition is severe, the invader plants must be weeded out and the seedbed must be carefully prepared.

Equipment limitation caused by drainage, slope, stoniness, soil texture, or other unfavorable soil characteristics and topographic features may restrict or prohibit the use of equipment for site preparation and for planting, thinning, and harvesting trees. The limitation is *slight* if there is little or no restriction on the type of equipment or on the time of year that equipment can be used. It is *moderate* if the use of equipment is restricted by slopes that are moderately steep, by wetness in winter and early in spring, or by a high risk of damage to tree roots and soil. The limitation is *severe* if many types of equipment cannot be used, if equipment cannot be used during 3 or more months each year, and if the use of equipment severely damages tree roots and soil. The equipment limitation is severe on stony soils that are moderately steep to very steep and on bottom lands and low terraces that are wet.

Seedling mortality refers to the expected loss of seedlings caused by unfavorable soil characteristics and topographic features, excluding losses caused by plant competition. Mortality is *slight* if not more than 25 percent of seedlings die or if trees ordinarily regenerate naturally in places where there are enough seeds. It is *moderate* if 25 to 50 percent of seedlings die, or if trees do not regenerate naturally in numbers sufficient to restock the site. Mortality is *severe*, if more than 50 percent of seedlings die, or if trees do not ordinarily reseed naturally where there are enough seeds.

Windthrow hazard refers to the resistance of trees to strong winds. The resistance is determined by the depth to which roots penetrate and the protection provided by surrounding trees. This hazard must be considered in selecting trees for planting and in planning release cuttings and harvest cuttings. The windthrow hazard is *slight* if roots normally hold the tree firmly

against a wind, and if individual trees are likely to remain standing where surrounding trees are removed. The hazard is *moderate* if roots hold the tree firmly except when the soil is excessively wet and the wind velocity very high. It is *severe* if roots are not deep enough to stabilize the trees that are not protected by other trees.

Erosion hazard is rated according to the degree of potential soil erosion. It is *slight* where only a slight loss of soil is expected. Generally, erosion is slight if slopes range from 0 to 12 percent and runoff is slow to very slow. The erosion hazard is *moderate* if loss of soil is moderate in places where runoff is not controlled and the plant cover is not adequate for protection. It is *severe* if steep slopes, rapid runoff, slow infiltration and permeability, and past erosion make the soil susceptible to severe erosion.

WOODLAND SUITABILITY GROUP 1

This group consists of deep, well-drained to somewhat poorly drained soils on flood plains, in depressions, and at the head of drains.

On these soils the average site index is 100 for loblolly pine, 85 for shortleaf pine, 90 for sweetgum, 80 for red oak and white oak, and 120 for yellow-poplar. The average yearly growth per acre on a fully stocked, unmanaged stand is 700 board feet for loblolly pine and 570 board feet for shortleaf pine.

Plant competition from cull trees, underbrush, and vines is the only significant management hazard. Competition is severe after a major harvest if the overstory is removed. Clearing, harrowing, furrowing, burning, poisoning, and selective planting may be needed to control invader plants and to insure a well-stocked stand.

The equipment limitation is moderate because the soils are wet for short periods in winter and spring.

WOODLAND SUITABILITY GROUP 2

This group consists of deep, well-drained, gently sloping to very steep soils on uplands. Permeability is moderate. Most of these soils are eroded.

On these soils the average site index is 80 for loblolly pine and 70 for shortleaf pine (fig. 10). The average yearly growth per acre on a fully stocked, unmanaged stand 50 years old is about 470 board feet for loblolly pine and 370 board feet for shortleaf pine.

Soils on slopes of less than 10 percent are well suited to tree growth and management. Plant competition is moderate on gentle slopes and severe on many steep slopes. Invader plants generally require some control.

Equipment limitation is slight except on steep slopes, and logging can be done at all times during the year.

Seedling mortality is slight. Adequate moisture is available in the soils, and there is no risk of drought. The windthrow hazard is slight.

The erosion hazard is slight on slopes of less than 10 percent and moderate on steep slopes.

WOODLAND SUITABILITY GROUP 3

This group consists of deep, moderately well drained and well drained soils that occur mainly on stream terraces. Slopes are dominantly gentle, but slopes of 25 percent occur in a few areas.

Figure 10.—A well-stocked stand of loblolly pine, 15 years old, on Cecil sandy loam, 6 to 10 percent slopes, eroded, in woodland suitability group 2.

On these soils the average site index is 85 for loblolly pine, 75 for shortleaf pine, 75 for Virginia pine, 90 for yellow-poplar, and 75 for red oak. The average annual growth per acre on a fully stocked, unmanaged stand 50 years old is about 540 board feet for loblolly pine and 440 board feet for shortleaf pine.

Plant competition is slight. The equipment limitation is also slight, and common types of equipment can be used the year round. The windthrow hazard is slight, and the erosion hazard is slight to moderate.

WOODLAND SUITABILITY GROUP 4

This group consists of clay loam and sandy clay loam soils that have slopes ranging from 2 to 25 percent. These soils are eroded or severely eroded, well drained, and moderately permeable.

On these soils the average site index is 75 for loblolly pine, 65 for shortleaf pine, and 60 for Virginia pine. The average annual growth per acre on a well-stocked, unmanaged stand 50 years old is about 410 board feet for loblolly pine and 360 board feet for shortleaf pine.

After the overstory is removed, plant competition is slight from brush and other undesirable plants. Special treatment is not needed to maintain normal growth.

Equipment limitation is moderate to severe. Because erosion has exposed the clayey subsoil and these soils are slippery for short periods after heavy rains, equipment is difficult to use and may injure plant roots, destroy soil structure, and reduce the stability of the soils.

Seedling mortality is moderate because of past erosion. Losses after planting may be 25 to 50 percent, and some replanting may be needed to fill openings. Seedling mortality after excessive drought is severe. Windthrow hazard is slight.

The hazard of erosion is moderate on gentle slopes and severe on steeper slopes.

WOODLAND SUITABILITY GROUP 5

This group consists of medium- to coarse-textured, well-drained to excessively drained soils that are moderately slow to rapid in permeability. Slopes range from 10 to 25 percent.

On these soils the average site index is 80 for loblolly pine and 70 for shortleaf pine. The average yearly growth per acre on a fully stocked, unmanaged stand 50 years old is about 400 board feet for loblolly pine and 340 board feet for shortleaf pine.

Plant competition is slight because the sandy surface layer of these soils contains little moisture. Seedling mortality is slight to moderate because the moisture in the surface layer may not be adequate for tree growth during periods of drought. The hazard of drought is moderate. Unless it rains frequently following planting and during the first year of growth, 25 to 50 percent seedling mortality can be expected.

Equipment limitation, windthrow, and erosion are slight hazards.

WOODLAND SUITABILITY GROUP 6

This group consists of steep to very steep, medium- to coarse-textured, moderately shallow soils. These soils have a clayey to sandy subsoil and are well drained to somewhat excessively drained. Slopes are irregular and dominantly 15 to 60 percent. Rock crops out in some areas, and the hazard of erosion on barren areas is severe.

These soils are suited to pines and some hardwoods. Hardwoods grow better on soils in colluvial deposits and coves than on soils that occupy ridgetops.

On these soils the average site index is 80 for loblolly pine, 70 for shortleaf pine, 70 for Virginia pine, 85 for eastern white pine, and 85 for yellow-poplar. The yearly growth per acre on a well-stocked, unmanaged stand 50 years old is about 430 board feet for loblolly pine and 410 board feet for shortleaf pine.

Plant competition is moderate. Equipment limitation is severe because slopes are steep and boulders are common on the surface.

Plant competition is moderate. Equipment limitation is severe because slopes are steep and boulders are common on the surface.

Seedling mortality is slight to moderate, depending on the texture of the surface layer and the available water capacity of the soil.

Windthrow hazard is moderate. The erosion hazard is generally moderate, but it is severe on barren areas.

WOODLAND SUITABILITY GROUP 7

Only the mapping unit Wehadkee soils is in this group. These soils occur on flood plains and are poorly drained and wet. Because these soils are wet, a fully stocked stand of pine cannot be established on them. They are generally better suited to bottom-land hardwoods than to pine. The average site index is 90 for loblolly pine, 80 for blackgum, 100 for sweetgum, and 90 for water oak. The annual yield per acre was not estimated because trees grow unevenly.

Plant competition is severe. Excess water favors the growth of many undesirable plants, and these plants must be eradicated before a stand of trees can be established and grow normally.

Equipment limitation is severe, and conventional logging equipment cannot be used following heavy rains.

Seedling mortality is moderate because of the excess moisture in the soils. These soils hold sufficient moisture even during periods of severe drought. Excess moisture causes shallow rooting of some species, and the windthrow hazard is slight to moderate.

Erosion hazard is slight.

Use of the Soils for Engineering [4]

Some soil properties are of special interest to engineers because they affect construction and maintenance of roads, airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the soil properties most important to engineers are permeability to water, shear strength, drainage, grain

[4] STEPHEN A. DANIELS, area engineer, Soil Conservation Service, assisted in preparing this section.

size, plasticity, and degree of acidity or alkalinity. Also important are compaction tendencies, shrink-well characteristics, depth to seasonal high water table, depth to bedrock, and topography. In this section emphasis is placed on interpretation of these properties in the soils of Banks and Stephens Counties so that the information may be used by engineers and others in the area to—

1. Make studies that aid in selecting and developing sites for industrial, business, residential, and recreational uses.
2. Determine the suitability of the soils for agricultural drainage systems, farm ponds, irrigation systems, diversion ditches, and terraces.
3. Make preliminary evaluations that will aid in selecting locations for airports, highways, pipelines, and cables, and in planning detailed investigations at selected sites.
4. Locate probable sources of gravel and other construction materials.
5. Correlate kinds of soils with performance of existing engineering structures and thus gain information that will aid in maintaining these structures and in planning design and maintenance of newer structures.
6. Determine suitability of the soils for cross-country movement of vehicles and construction equipment.
7. Develop other preliminary estimates for construction purposes pertinent to the particular area.

The information in this section was obtained by combining the knowledge of engineers and soil scientists with information obtained from laboratory tests and from field experience.

With the use of the soil map for identification,

TABLE 3.—*Engineering*

Soil name and location	Parent material	Georgia report No.	Depth	Moisture-density [2]		Volume change [3]			Mechanical analysis [4]	
				Minimum dry density	Optimum moisture	Shrinkage	Swell	Total volume change	Discarded [5]	1½-in.
			Inches	*Lb. per cu. ft.*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	
BANKS										
Madison fine sandy loam:		S65-Ga-6								
12 mi. SE. of Homer; 4 mi. NE. of Davis Academy; 1,000 ft. S. of concrete bridge, 75 ft. left of road Hwy. 164 (modal).	Mica schist.	1-1	0-4	113	14	2.7	4.1	6.8	----	----
		1-2	4-26	96	23	10.5	7.2	17.7	----	----
		1-3	26-36	95	22	5.5	13.4	18.9	----	----
		1-4	36	105	18	1.9	7.7	9.6	----	----
4½ mi. N. of New Salem Church off Hwy. 59 to Carnesville, Ga. (finer texture than in modal profile).	Mica schist.	3-1	0-5	106	18	5.9	4.6	10.5	----	100
		3-2	5-31	91	27	13.3	7.4	20.7	----	----
		3-3	31-41	89	26	6.4	18.1	24.5	----	----
		3-4	41	89	26	3.2	17.3	20.5	----	100
STEPHENS										
Cecil sandy clay loam:		S65-Ga-127								
½ mi. W. of Mullins Ford Church; second dirt road to right from Ga. Hwy. 336, E. of Toccoa, 200 ft. down road, 50 ft. to right (modal).	Gneiss and granite.	14-1	0-4	112	14	4.5	2.5	7.0	----	----
		14-2	4-14	89	26	11.3	6.4	17.7	----	----
		14-3	14-39	98	22	8.5	8.9	17.4	----	100
9½ mi. SE. of Toccoa on Hwy. 17; left roadbank, off Ga. Hwy. 17, 330 ft. from intersection	Gneiss, granite and mica schists.	13-1	0-4	103	17	8.1	4.9	13.0	----	----
		13-2	4-32	96	24	14.2	4.2	18.4	----	----
		13-3	32-42	99	20	7.7	11.0	18.7	----	----

the interpretations made here can be useful for many purposes. It should be emphasized, however, that these interpretations are not a substitute for sampling and testing needed at a site chosen for a specific engineering work where heavy loads are involved or at a site where the excavations are to be deeper than the depth here reported.

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some terms may have special meanings in soil science. These and other special terms used in the soil survey are defined in the Glossary at the back of this survey.

Much of the information in this section is in tables 3, 4, and 5. Table 3 gives test data obtained from the testing of samples taken from representative soils in Banks and Stephens Counties. These tests generally were performed by the State Highway Department of Georgia in cooperation with U.S. Department of Commerce, Bureau of Public Roads, in accordance with standard procedures of the American Association of State Highway Officials. Table 4 gives estimated engineering properties of soils. In table 5, the soils are rated as a source of materials used in road construction and named are soil features that affect engineering structures and practices.

In addition to the information in this section, other information valuable to engineers is included in the soil survey. The sections "How This Survey Was Made" and "Descriptions of the Soils" are particularly helpful. In the section "Major Nonfarm Uses of the Soils" the degree of limitation for selected nonfarm uses is rated and the chief limiting properties are given.

test data [1]

COUNTY

Mechanical analysis [4]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve [5]					Percentage smaller than [5]							
⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [6]	Unified [7]
100	99	97	60	26	26	24	17	14	---	[8] NP	A-2-4(0)	SM
---	---	100	80	57	56	51	47	44	---	NP	A-4(4)	ML
---	100	98	68	38	37	30	26	26	---	NP	A-4(1)	SM
---	100	96	60	29	28	23	18	16	---	NP	A-2-4(0)	SM
99	98	97	84	41	39	35	30	26	24	9	A-4(1)	SC
---	---	100	92	67	67	65	56	50	53	24	A-7-6(12)	MH-CH
---	100	99	85	48	48	44	37	33	---	NP	A-2(3)	SM
99	99	96	67	26	25	20	17	16	---	NP	A-2-4(0)	SM
COUNTY												
100	98	96	80	38	36	33	27	22	22	10	A-4(0)	SC
---	100	98	93	79	73	69	58	53	57	19	A-7-5(15)	MH
99	99	97	84	56	54	45	34	28	42	NP	A-5(4)	ML
100	99	95	72	41	39	35	25	22	32	14	A-6(2)	SC
---	100	99	85	63	61	57	54	50	49	18	A-7-5(11)	ML
---	100	99	84	36	34	31	28	27	---	NP	A-4(0)	SM

387-378 O - 71 - 4

TABLE 3.—*Engineering*
STEPHENS

Soil name and location	Parent material	Georgia report No.	Depth	Moisture-density[2]		Volume change[3]				
				Minimum dry density	Optimum moisture	Shrinkage	Swell	Total volume change	Discarded[4]	1½-in.
			Inches	*Lb. per cu. ft.*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	
county road to Eastanollee (finer texture than in modal profile).										
Turn right at Fighting Pine off Ga. 336, 7 mi. W. of Mullins Ford Church, 1 mi. turn left; site 1,320 ft. down road on right (thin).	Gneiss and mica schist.	15-1	0–4	113	14	5.9	2.3	8.2	----	----
		15-2	4–8	88	28	12.9	5.7	18.6	----	----
		15-3	8–22	96	24	6.2	10.0	16.2	----	----
		15-4	22–52	94	23	2.3	13.7	16.0	----	----
		S61-Ga-127								
Chandler loam: 0.5 mi. N. of Yellowback Mountain. (modal).	Mica schist.	11-3	3–9	104	17	9.3	15.7	25.0	----	----
		11-4	9–72	97	19	3.5	23.1	26.6	----	----
Hiwassee loam: Western part of Yellowback Mountain (modal).	Horneblende gneiss and schist.	12-2	2–8	106	21	12.4	1.9	14.3	----	----
		12-3	8–38	92	28	16.1	0.1	16.2	2	----
		12-4	38–50	84	30	6.3	1.5	7.8	30	----
Louisburg loamy sands: 1 mi. E. of Toccoa Waterworks Lake near quarry (modal).	Gneiss.	20-2	3–22	112	13	1.0	2.0	3.0	----	----
		20-3	22–32	109	13	2.6	1.3	3.9	15	----
Madison fine sandy loam: On Old Guard Camp Road in Lake Russell Wildlife Management Area (modal).	Schist with occasional bands of gneiss.	19-1	0–5	95	21	6.2	1.3	7.5	----	----
		19-4	12–36	97	24	8.9	3.7	12.6	----	----
		19-5	36–62	95	24	6.4	14.7	21.1	----	----
Wedowee fine sandy loam: Southern tip of Yellowback Mountain on ridge toward Lee Mountain (modal).	Fine-grained gneiss.	13-2	0–6	111	13	2.6	1.6	4.2	----	----
		13-4	10–22	96	23	9.9	2.8	12.7	----	----
		13-5	22–52	99	18	6.1	9.6	15.7	----	----
		S65-Ga-127								
Wehadkee silt loam: 11 mi. S. of Toccoa on Ga. Hwy. 106; 1,320 ft. S. of concrete bridge, 150 ft. right of road (coarser texture than in modal profile).	Alluvium.	17-1	0–5	84	29	19.6	4.1	23.7	----	----
		17-2	5–22	89	26	14.4	3.3	17.7	----	----

test data [1]—Continued
COUNTY—Continued

Mechanical analysis [4]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve [5]					Percentage smaller than [5]							
⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [6]	Unified [7]
---	100	98	83	40	37	31	24	19	---	NP	A-4(1)	SM
---	---	100	93	76	70	68	61	59	56	23	A-7-5(16)	MH
---	100	99	84	56	56	50	45	42	51	25	A-7-6(11)	CH
---	---	100	70	25	22	14	8	7	---	NP	A-2-4(0)	SM
---	---	100	98	66	57	46	30	24	[9]NP	NP	A-4(6)	ML
---	---	100	99	47	42	21	10	8	NP	NP	A-4(2)	SM
100	99	99	92	78	74	65	43	31	33	13	A-6(9)	CL
---	100	99	94	83	80	75	60	55	41	NP	A-5(8)	ML
---	---	100	87	74	72	64	46	43	48	NP	A-5(9)	ML
---	---	100	87	39	29	20	12	9	NP	NP	A-4(1)	SM
---	100	99	80	39	33	22	16	13	NP	NP	A-4(1)	SM
---	---	100	92	65	56	40	26	19	NP	NP	A-4(6)	ML
---	100	98	96	71	65	60	55	49	52	22	A-7-5(14)	MH-CH
---	---	100	95	70	62	46	32	26	42	NP	A-5(7)	ML
---	---	100	99	42	30	21	14	12	NP	NP	A-4(1)	SM
---	---	100	97	68	62	54	48	45	35	NP	A-4(7)	ML
---	---	100	95	52	42	34	24	23	36	NP	A-4(3)	ML
---	---	100	99	90	85	73	46	36	56	22	A-7-5(16)	MH
---	---	100	99	84	80	64	38	32	38	11	A-6(8)	ML

TABLE 3.—*Engineering*
STEPHENS

Soil name and location	Parent material	Georgia report No.	Depth	Moisture-density [1]		Volume change [2]			Mechanical analyses [4]	
				Minimum dry density	Optimum moisture	Shrinkage	Swell	Total volume change	Discarded [3]	1½-in.
			Inches	*Lb. per cu. ft.*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	
6 mi. S. of Toccoa on Hwy. 106; turn left paved road, go ½ mi.; turn left on Buena Vista Dr. to Stonecypher Lake; site is 1,000 ft. below dam (finer texture than in modal profile).	Alluvium.	18–1 18–2 18–3	0–6 6–18 18–50	83 102 100	27 20 20	18.7 13.6 7.9	9.3 5.6 2.9	28.0 19.2 10.8	---- ---- ----	---- ---- ----

[1] Tests performed by the State Highway Department of Georgia, in cooperation with U.S. Department of Commerce, Bureau of Public Roads, in accordance with standard procedures of the American Association of State Highway Officials (AASHO), except as stated in footnote 6.

[2] Based on the Moisture-Density Relations of Soils Using 5.5-lb. Rammer and 12-in. Drop, AASHO Designation T 99–57, Method A.

[3] Based on "A System of Soil Classification" by W. F. Abercrombie, Proceedings, Highway Research Board, 1954 (*1*).

[4] Mechanical analyses according to the AASHO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 mm. in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 mm. in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

TABLE 4.—*Estimated engineering*
[Gullied land (Gul) is not included because

Soil series and map symbols	Approximate depth to bedrock	Depth from surface to major horizons	Classification	
			Dominant USDA texture	Unified
	Feet	*Inches*		
Altavista: AlB	>6	0–7	Sandy loam	SM, ML
		7–48	Sandy clay loam	CL, ML
Appling: AmB2, AmC2, AmE2, AnC2	>5	0–5	Sandy loam	SM
		5–8	Sandy clay loam	ML, CL
		8–32	Sandy clay	ML, CL, MH, MH–CH
		32–42	Clay loam	CL
		42–54	Sandy loam	SM
Cartecay: Cab	>6	0–22	Loam	SM
		22–48	Stratified sand and loamy sand.	SM
Cecil: CYB2, CYC2, CYD2, CZB2, CZC3 [3], CZD3 [3]	>6	0–5	Sandy loam	SM, SC
		5–11	Sandy clay loam	CL, MH, ML
		11–36	Clay	CL, CH, MH, ML
		36–62	Sandy clay loam and loam	SM, ML
Chandler: CrG, CsF (Estimates were not made for the Rock land part of CrG.)	>5	0–24	Loam	ML
		24–60	Sandy loam	SM
Grover: GiD2, GiF		0–7	Fine sandy loam	SM
		7–37	Sandy clay loam	ML, CL
		37–55	Saprolite and loam	ML, SM

test data [1]—Continued
COUNTY—Continued

Mechanical analysis [4]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve [5]					Percentage smaller than [5]							
⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [6]	Unified [7]
---	100	98	97	91	89	81	52	39	58	18	A–7–5(15)	MH
---	100	99	96	57	49	37	25	19	45	18	A–7–6(7)	ML–CL
---	---	100	97	56	48	38	22	17	---	NP	A–4(4)	ML

[5] Based on sample as received in laboratory. Laboratory test data not corrected for amount discarded in field sampling.
[6] 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, AASHO Designation M 145–49.
[7] Based on the Unified Soil Classification System, Tech, Memo. No. 3–357, v. 1, Corp of Engineers (*9*). SCS and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within two points of the A-line are to be given a borderline classification. Examples of borderline classification obtained by this use are ML–CL and MH–CH.
[8] Estimated percentage larger than 3 in. discarded in field sampling.
[9] NP = Nonplastic.

properties of soils [1]
its properties are too variable]

AASHO	Percentage passing sieve—			Permeability	Available moisture capacity [2]	Reaction	Shrink-swell potential
	No. 4 sieve (4.7 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.07 mm.)	*Inches per hour*	*Inch per inch of soil*	*pH*	
A–4, A–2	95–100	95–100	30–55	2.0–6.3	0.11	5.1–5.5	Low.
A–5, A–6	95–100	95–100	55–65	0.63–2.0	.14	4.5–5.5	Moderate.
A–2	95–100	80–95	25–35	2.0–6.3	.12	5.1–5.5	Low.
A–6	95–100	95–100	50–70	0.63–2.0	.13	5.1–5.5	Moderate.
A–7	95–100	95–100	65–75	0.63–2.0	.13	5.1–5.5	Moderate.
A–6, A–7	95–100	95–100	50–70	0.63–2.0	.13	5.1–5.5	Moderate.
A–4	95–100	95–100	36–50	2.0–6.3	.11	5.1–5.5	Low.
A–4, A–2	95–100	95–100	25–40	2.0–6.3	.15	5.1–5.5	Low.
A–2	95–100	95–100	25–35	2.0–6.3	.15	5.1–5.5	Low.
A–2, A–4	95–100	90–100	20–45	2.0–6.3	.10	5.1–5.5	Low.
A–7	95–100	90–100	60–80	0.63–2.0	.13	5.1–5.5	Moderate.
A–7	95–100	95–100	55–80	0.63–2.0	.14	5.1–5.5	Moderate.
A–2, A–4, A–5	95–100	90–100	25–60	0.63–2.0	.13	5.1–5.5	Low.
A–4	95–100	95–100	60–70	2.0–6.3	.12	5.1–5.5	Low.
A–4	95–100	95–100	36–50	2.0–6.3	.10	5.1–5.5	Low.
A–2	95–100	75–90	25–35	2.0–6.3	.13	5.1–5.5	Moderate.
A–4, A–6	95–100	95–100	55–70	0.63–2.0	.13	5.1–5.5	Moderate.
A–4	95–100	90–100	36–55	0.63–2.0	.13	5.1–5.5	Low to moderate.

TABLE 4.—*Estimated engineering*

Soil series and map symbols	Approximate depth to bedrock	Depth from surface to major horizons	Classification	
			Dominant USDA texture	Unified
	Feet	*Inches*		
Gwinnett: GfB2, GfD2, GfF	5	0–7	Sandy loam	SM
		7–10	Sandy clay loam	CL, SM
		10–36	Clay	MH, ML
		36–50	Clay loam	CL, ML
		50–60	Loose loam	ML
Hiwassee: HSB, HSC2, HSD, HTB2, HTC2, HTD2, HTE2.	>8	0–7	Clay loam	CL
		7–65	Clay	MH, ML
		65–73	Sandy clay and saprolite	ML
Louisa: LOE	>5	0–28	Fine sandy loam	SM
(For properties of Tallapoosa soils in this mapping unit, refer to the Tallapoosa series.)		28–50	Loamy sand	SM
Louisburg: LnE, LnF, LRF	4	0–30	Loamy sand to sandy loam	SM
(Estimates were not made for the Rock land part of unit LRF).		30–37	Sandy loam	SM
Madison: MjB2, MjC2, MjD2, MjE,[3] MIC3, MID3,[3] MIE3[3], MAF.	>6	0–4	Sandy clay loam	CL, ML
		4–21	Clay	MH, ML, MH–CH
(For the Louisa and Tallapoosa soils in mapping unit MAF, refer to their respective series.)		21–30	Clay loam	ML, CL, MH
		30–52	Saprolite.	
Masada: MoB	>6	0–11	Fine sandy loam	SM
		11–26	Sandy clay loam	ML, CL
		26–50	Sandy loam to sandy clay loam.	SC, CL
Mecklenburg: MrE	5	0–5	Fine sandy loam	SC, ML
		5–10	Clay loam	ML
		10–30	Clay	MH, CH, MH–CH
		30–46	Clay loam	CL, ML
		46–64	Partially disintegrated rock.	
Musella: MFE, MGF	3	0–21	Stony clay loam	ML
(For properties of the Gwinnett soil in these units, refer to the Gwinnett series.)		21–37	Partially disintegrated rock.	
Pacelot: PfE, PgE3[3], PjF	>6	0–5	Sandy loam	SM, SC
(For the Louisburg part of PjF, refer to the Louisburg series.)		5–7	Sandy clay loam	SC, CL
		7–21	Clay	CL, MH–CH, MH, ML
		21–27	Sandy clay loam	MH, ML, CL
		27–50	Saprolite.	
Tallapoosa	4	0–4	Fine sandy loam	SM
(Mapped only with Louisa soils.)		4–12	Silty clay loam	ML, CL, SM
		12–20	Sandy loam	SM
		20–45	Soft schist.	
Tate: TfE	>6	0–6	Sandy loam	SM, ML
		6–36	Sandy clay loam	CL
		36–45	Weathered gneiss.	
Toccoa: Toc, Tod	>6	0–52	Sandy loam	SM
Wedowee: WtE2, WtF[3], WuE3	>5	0–6	Fine sandy loam	SM
		6–9	Sandy clay loam	SM, ML
		9–32	Clay loam	ML, MH
		32–45	Fine sandy loam and disintegrated rock.	ML
Wehadkee: Whs	>6	0–6	Silt loam	SM, ML, MH
		6–50	Loam	ML, ML–CL
		50–60	Stratified sand, silt, clay.	

properties of soils [1]—Continued

AASHO	Percentage passing sieve— No. 4 sieve (4.7 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.07 mm.)	Permeability	Available moisture capacity [2]	Reaction	Shrink-swell potential
				Inches per hour	*Inch per inch of soil*	*pH*	
A–4, A–2	95–100	85–95	30–45	2.0–6.3	.13	5.1–5.5	Low.
A–6	95–100	85–95	36–55	0.63–2.0	.14	5.1–5.5	Moderate.
A–7	95–100	95–100	75–85	0.63–2.0	.15	5.1–5.5	Moderate.
A–7, A–6	95–100	95–100	55–70	0.63–2.0	.15	5.1–5.5	Moderate to low.
A–6	95–100	95–100	50–60	0.63–2.0	.13	5.1–5.5	Moderate to low.
A–4, A–6	95–100	85–95	65–80	0.63–2.0	.13	5.1–5.5	Moderate to low.
A–7, A–5	95–100	95–100	75–85	0.63–2.0	.13	5.1–5.5	Moderate.
A–7, A–6	95–100	95–100	55–70	0.63–2.0	.13	5.1–5.5	Moderate to low.
A–2, A–4	90–100	75–100	30–45	2.0–6.3	.10	5.1–5.5	Low.
A–2	90–100	70–90	25–35	2.0–6.3	.08	5.1–5.5	Low.
A–2, A–4	95–100	90–100	25–40	>6.3	.08	5.1–5.5	Low.
A–4, A–2	95–100	95–100	30–45	>6.3	.10	5.1–5.5	Low.
A–4	95–100	95–100	50–70	0.63–2.0	.11	5.1–5.5	Low.
A–4, A–7	95–100	95–100	50–70	0.63–2.0	.11	5.1–5.5	Moderate.
A–4, A–6, A–7	95–100	95–100	50–65	0.63–2.0	.13	5.1–5.5	Moderate.
A–4, A–2	95–100	95–100	25–40	2.0–6.2	.12	5.1–5.5	Low.
A–6	95–100	50–60	50–60	0.63–2.0	.15	5.1–5.5	Moderate.
A–4, A–6	95–100	95–100	36–55	0.63–2.0	.11	5.1–5.5	Moderate.
A–2, A–4	90–100	90–100	30–55	0.63–2.0	.13	5.1–5.5	Low.
A–6	95–100	90–100	50–70	0.63–2.0	.13	5.1–5.5	Low.
A–7	95–100	95–100	80–90	0.2–0.63	.13	5.1–5.5	High.
A–6	95–100	90–100	50–70	0.2–0.63	.13	5.1–5.5	Moderate.
A–4	80–90	80–90	50–65	0.63–2.0	.10	5.1–5.5	Low.
A–2, A–4	95–100	85–95	30–45	2.0–6.3	.10	5.1–5.5	Low.
A–4, A–6	95–100	90–100	40–55	0.63–2.0	.11	5.1–5.5	Moderate.
A–6, A–7	95–100	95–100	60–70	0.63–2.0	.13	5.1–5.5	Moderate.
A–6	95–100	90–100	50–60	0.63–2.0	.14	5.1–5.5	Moderate.
A–2	90–100	60–75	20–30	2.0–6.3	.08	5.1–5.5	Low.
A–4, A–6	80–90	75–80	36–55	0.63–2.0	.12	5.1–5.5	Low.
A–2	80–90	80–90	20–30	2.0–6.3	.10	5.1–5.5	Low.
A–4	95–100	85–95	40–55	2.0–6.3	.15	5.1–5.5	Low.
A–6	95–100	90–100	50–60	0.63–2.0	.16	5.1–5.5	Moderate.
A–2, A–4	95–100	95–100	25–50	2.0–6.3	.11	5.5–6.0	Low.
A–4	95–100	90–100	36–45	2.0–6.3	.12	5.1–5.5	Low.
A–4, A–6	95–100	90–100	45–55	1.5–2.5	.16	5.1–5.5	Moderate.
A–4, A–6, A–7	95–100	90–100	65–80	0.63–2.0	.17	5.1–5.5	Moderate.
A–4	95–100	90–100	50–70	1.5–2.5	.12	5.1–5.5	Low.
A–4, A–7	------	95–100	36–95	0.63–2.0	.15	5.1–5.5	Moderate.
A–6, A–7, A–4	100	95–100	55–85	0.63–2.0	.15	5.1–5.5	Moderate.

TABLE 4.—*Estimated engineering*

Soil series and map symbols	Approximate depth to bedrock	Depth from surface to major horizons	Classification	
			Dominant USDA texture	Unified
	Feet	*Inches*		
Wickham: WgB, WgC, WgD[1], WhC3	>6	0–6	Sandy loam	SC
		6–48	Sandy clay loam to clay loam.	CL, ML
		48–56	Sandy loam	SC
Wilkes: WjF, WpE	2½	0–5	Sandy loam	SM
		5–23	Sandy clay loam	SC, CL
		23	Saprolite.	

[1] Depth to the seasonal high water table in the soil in Banks and Stephens Counties is greater than 5 feet except as noted for the following soils: Altavista, 0 to 5 feet; Cartecay, <1 foot; Masada, about 2 feet; Toccoa, <3 feet; and Wehadkee, <1 foot.

[2] The values in this column are the middle of a five-figured range. For example, the available water capacity for the Altavista soil is given as 0.11 inch per inch of soil. This value represents a range of 0.09 to 0.13 inch per inch of soil.

TABLE 5.—*Engineering interpretations*

[Gullied land (Gul) is not included because

Soil names and map symbol	Road fill	Soil features affecting—		
		Highway location	Farm ponds	
			Reservoir area	Embankment
Altavista: AlB	Poor to fair	Seasonal high water table at a depth of 0 to 5 feet; no excavation hazard.	Soil features favorable	Moisture content generally high.
Appling: AmB2, AmC2, AmE2, AnC2.	Fair	Moderate traffic-supporting capacity; inherent erodibility.	Soil features favorable	Moderate strength and stability.
Cartecay: Cab	Fair	Seasonal high water table at a depth of less than 1 foot; subject to flooding.	Soil features favorable	Moderate strength and stability; moisture content generally high.
Cecil: CYB2, CYC2, CYD2, CZB2, CZC3, CZD3.	Fair	Fair traffic-supporting capacity; inherent erodibility.	Soil features favorable	Moderate strength and stability.
Chandler: CsF	Fair	Moderate stability and strength.	Steep slopes	Moderate strength and stability; seepage likely.
Chandler and Rock land: CrG.	Poor	Steep slopes; rock fragments.	Steep slopes; rock fragments.	Moderate strength and stability; seepage likely.
Grover: GiD2, GiF	Fair	Fair traffic-supporting capacity; inherent erodibility.	Soil features favorable	Moderate strength and stability.
Gwinnett: GfB2, GfD2, GfF	Fair	Fair traffic-supporting capacity; inherent erodibility.	Soil features favorable	Moderate strength and stability.
Hiwassee: HSB, HSC2, HSD, HTB2, HTC2, HTD2, HTE2.	Poor	Slopes easily eroded in deep cuts.	Soil features favorable	Moderate strength and stability.
Louisa-Tallapoosa: LOE	Fair	Slopes easily eroded; bedrock ordinarily within a depth of 1 foot to 5 feet of surface.	Excessive seepage likely where cuts are into parent material.	Low strength and stability.

properties of soils [1]—Continued

AASHO	Percentage passing sieve— No. 4 sieve (4.7 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.07 mm.)	Permeability	Available moisture capacity [2]	Reaction	Shrink-swell potential
				Inches per hour	*Inch per inch of soil*	*pH*	
A–2, A–4	95–100	95–100	25–40	2.0–6.3	.13	5.1–5.5	Low.
A–6	95–100	95–100	50–60	0.63–2.0	.14	5.1–5.5	Moderate.
A–4	95–100	95–100	36–45	0.63–2.0	.14	5.1–5.5	Low.
A–2, A–4	85–95	80–90	10–40	2.0–6.3	.12	5.5–6.5	Low.
A–6, A–2	80–90	80–90	20–55	0.63–2.0	.16	5.5–6.5	Low to moderate.

[3] Because of severe erosion, the surface layer of this mapping unit is more clayey than the surface layer given in this table for the soil series. In AASHO and Unified ratings, the surface layer of this mapping unit more nearly resembles the subsoil given for the series.

of the soils

its properties are too variable]

Soil features affecting—Continued			
Agricultural drainage	Irrigation	Terraces	Waterways
Moderate permeability; seasonal high water table at a depth of 0 to 5 feet; surface drainage needed.	Moderately well drained; moderate permeability.	Soil properties favorable	Soil properties favorable.
Well drained	Features favorable except on stronger slopes.	Soil properties favorable where slope is less than 10 percent; steeper slopes unsuitable.	Features favorable except on strong to steep slopes.
Seasonal high water table at a depth of less than 1 foot; surface drainage needed.	Moderately well drained to somewhat poorly drained; seasonal high water table at a depth of less than 1 foot.	Soils level or nearly level	Seasonal high water table at a depth of less than 1 foot.
Well drained	Features favorable except on steeper slopes.	Soil properties favorable where slope is less than 10 percent; steeper slopes unsuitable.	Features favorable except on strong to steep slopes.
Somewhat excessively drained	Slopes too steep for irrigation	Slopes too steep	Slopes too steep.
Somewhat excessively drained	Nonarable	Nonarable	Nonarable.
Well drained	Features favorable except on steeper slopes.	Soil properties favorable where slope is less than 10 percent; steeper slopes unsuitable.	Features favorable except on strong to steep slopes.
Well drained	Features favorable except where slope is less than 6 percent.	Soil properties favorable where slope is less than 10 percent; steeper soils unsuitable.	Features favorable except on strong to steep slopes.
Well drained	Features favorable except on steep slopes.	Soil properties favorable on slopes of less than 10 percent; steeper soils unsuitable.	High erodibility on steep slopes.
Well drained and somewhat excessively drained.	Low water-holding capacity; steep slopes.	Steep slopes	Low available water capacity; high erodibility; steep slopes.

TABLE 5.—*Engineering interpretations*

Soil names and map symbol	Road fill	Soil features affecting—		
		Highway location	Farm ponds	
			Reservoir area	Embankment
Louisburg: LnE, LnF	Fair	Slopes easily eroded; bedrock ordinarily within a depth of 4 feet of surface.	Rapid permeability; excessive seepage likely where cuts are into parent material.	Low strength and stability.
Louisburg-Rock land: LRF	Poor	Coarse fragments	Coarse fragments; seepage.	Coarse fragments
Madison: MjB2, MjC2, MjD2, MjE, MlC3, MlD3, MlE3.	Fair	Moderate traffic-supporting capacity; inherent erodibility.	Soil features favorable	Moderate strength and stability.
Madison-Louisa-Tallapoosa: MAF.	Fair	Slopes easily eroded; bedrock ordinarily within a depth of 1 foot to 5 feet of surface.	Excessive seepage likely where cuts are into parent material.	Low to moderate strength and stability.
Masada: MoB	Fair	Seasonal high water table at a depth of about 2 feet.	Soil features favorable	Moderate strength and stability.
Mecklenburg: MrE	Poor	High shrink-swell potential; plastic material.	Slow seepage and permeability.	High shrink swell; low stability.
Musella-Gwinnett: MFE	Fair	High shrink-swell potential; plastic material; shallow to rock.	Moderate to slow seepage	Rock fragments common.
Musella and Gwinett stony soils: MGF.	Fair	Rock fragments; plastic material; shallow to rock.	Moderate to slow seepage and permeability.	Rock fragments on surface and throughout profile.
Pacolet: PfE, PgE3	Fair	High strength and stability; moderately shallow to bedrock.	Moderate strength and stability; seepage in deep cuts.	Moderate strength and stability.
Pacolet-Louisburg complex: PjF.	Poor	Stones in subsoil and substratum.	Coarse fragments; seepage.	Coarse fragments
Tate: TfE	Fair	Soil properties favorable	Moderate permeability	Moderate strength and stability.
Toccoa: Toc, Tod	Fair to good	Seasonal high water table at a depth of less than 3 feet; subject to flooding.	Moderately rapid permeability.	Poorly graded material in some areas; seepage likely.
Wedowee: WtE2, WtF, WuE3	Fair to good	Steep slopes	Steep slopes; moderate permeability.	Moderate strength and stability.
Wehadkee: Whs	Poor; excess moisture.	Seasonal high water table at a depth of less than 1 foot; subject to flooding.	Soil features favorable	Moderate strength and stability; moisture content generally high.
Wickham: WgB, WgC, WgD, WhC3.	Fair to good	Slopes easily eroded in deep cuts.	Soil features favorable	Moderate strength and stability.
Wilkes: WjF, WpE	Fair; shallow to bedrock.	Boulders; shallow to bedrock; outcrops in places; unstable slopes.	Slow permeability; rapid seepage; rock at a depth of 1½ to 3 feet.	Rocky, stony, and very permeable soil; low strength and stability.

General soil characteristics that affect engineering uses

Some of the characteristics that affect the engineering uses of soils in Banks and Stephens Counties are (1) stoniness and depth to bedrock, (2) wet periods, (3) frost action, and (4) susceptibility to erosion.

In the western part of Stephens County and the northern part of Banks County, many large areas of steep, stony soils occur in the foothills of the Blue Ridge Mountains. These residual soils are underlain by solid or fractured and weathered rock, and rock crops out in numerous places. Also in these parts of the counties are many small areas of the Louisburg soils, which are shallow to bedrock. The stoniness and shallowness to bedrock of these soils adversely affect

of the soils—Continued

Soil features affecting—Continued			
Agricultural drainage	Irrigation	Terraces	Waterways
Well drained	Low water-holding capacity; steep slopes.	Steep slopes	Low available water capacity; high erodibility; steep slopes.
Nonarable; steep slopes	Nonarable; steep slopes	Nonarable	Coarse fragments; steep slopes.
Well drained	Features favorable except on steeper slopes.	Soil properties favorable where slope is less than 10 percent; steeper soils unsuitable.	Features favorable except on strong to steep slopes.
Well drained and somewhat excessively drained.	Low water-holding capacity; steep slopes.	Steep slopes	Low available water capacity; high erodibility; steep slopes.
Well drained	Moderate permeability	Soil properties favorable	Soil properties favorable.
Well drained	Impervious subsoil; slow intake rate.	Not feasible; plastic subsoil; steep slopes.	Plastic subsoil.
Well drained	Nonarable; stony; steep slopes.	Moderately erodible; rock fragments.	Moderately erodible; shallow to rock.
Well drained	Nonarable; steep slopes	Moderately erodible; shallow to rock.	Moderately erodible; shallow to rock.
Well drained	Steep slopes	Unit PgE3 severely eroded; steep slopes.	Severely eroded.
Well drained	Nonarable; steep slopes	Steep slopes	Steep slopes.
Well drained; steep slopes	Steep slopes	Slopes steep	Slopes steep.
Seasonal high water table at a depth of less than 3 feet; simple surface drainage needed.	Soil properties favorable	Soil level or nearly level	Soil properties favorable.
Well drained	Steep slopes	Slopes too steep	Slopes too steep.
Seasonal high water table at a depth of less than 1 foot; surface and subsurface drainage needed.	Poor drainage; seasonal high water table at a depth of less than 1 foot; slow intake rate; slow permeability.	Soil level or nearly level	Poor drainage; seasonal high water table at a depth of less than 1 foot.
Well drained	Soil properties favorable where slope is less than 10 percent.	Soil properties favorable	Soil properties favorable.
Well drained	Low water-holding capacity; low productivity.	Rock at a depth of 1½ to 3 feet.	Highly erodible; low available water capacity; rock at a depth of 1½ to 3 feet.

the selection of sites and the building of roads and other engineering structures that involve earthmoving and excavation.

Earthmoving and excavation can successfully be performed on well-drained soils throughout the year, but not when the soils are wet. Excess water prohibits good compaction of soil material. In Banks and Stephens Counties, Cartecay and Wehadkee soils at times are wet, generally late in winter and early in spring.

Frost action must be considered in the design and construction of roads and of airports, foundations, retaining walls, and to a lesser extent of cuts and fills. Frost action takes place when a frost-susceptible soil contains enough water to cause ice lenses to form when temperatures are below freezing. Clay, silt, and

fine silty sand are highly susceptible to frost action. Sand and gravel containing only a small amount of fine-grained materials are only slightly susceptible, if at all. In Banks and Stephens Counties, most soils contain a large amount of fine-grained material, and are, in some degree, susceptible to frost action. In these counties, however, subfreezing temperatures are of short duration and cause only minor frost action. Subfreezing temperatures that last long enough cause frost action on susceptible soils to occur about every 2 to 4 years.

Erosion of road shoulders and cut and fill slopes is a hazard unless a good vegetative cover is maintained. Because most of the soils in Banks and Stephens Counties are low in natural fertility, a good fertilizer program is needed to establish vegetation on road shoulders, on cuts, on fills, and in waterways.

Engineering classification systems

The engineering classification systems most widely used are the American Association of State Highway Officials (AASHO) system (*2*) and the Unified system (*9*). Both systems are used in this soil survey. They classify soil material according to gradation and plasticity characteristics.

The Unified system was developed by the U.S. Army, Corps of Engineers. In this system soil materials are classified according to their texture and plasticity and are grouped according to their performance as construction material. Soil material is identified as coarse grained (eight classes), fine grained (six classes), and highly organic (one class). An approximate classification by this system can be made in the field.

The AASHO system is used by many highway engineers. In this system soil materials are classified in seven principal groups. The groups range from A–1, consisting of gravelly soils of high bearing capacity, to A–7, consisting of clayey soils having low strength when wet. In each group the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest. The group index number is shown in table 3 in parentheses following the soil group symbol, for example, A–4(0) and A–7–6 (15).

Engineering test data

Samples from profiles of seven principal soil series in these counties were tested in accordance with standard procedures to help evaluate the soils for engineering purposes. The results of these tests are given in table 3. Footnotes to this table give the methods of testing that were used.

The profiles chosen for testing generally are those most nearly modal for the soil series as they occur in Banks and Stephens Counties. The samples tested generally were taken to a depth of less than 7 feet and do not represent materials at greater depths.

In the moisture-density (compaction) test, soil material is compacted into a mold several times with a constant compactive effort, each time at a progressively higher moisture content. The density (unit weight) of the compacted material increases as the moisture content increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest density obtained in the compaction test is the *maximum dry density*, and the corresponding moisture content is the *optimum moisture*. Moisture-density data are important to earthwork because optimum stability is obtained if the soil is compacted to about the maximum dry density at approximately optimum moisture.

The volume changes noted in table 3 indicate the amount of change that takes place in an ovendry soil sample that is wet to full capacity. The amount of change is expressed in percent.

The engineering classifications in table 3 are based on mechanical analysis and on tests that determine the liquid limit and the plastic limit of the soils. The mechanical analysis was made by combined sieve and hydrometer methods. The results are useful in determining the relative proportions of the different sized particles. The percentages of clay obtained by the hydrometer method are not used for naming soil textural classes, since soil scientists determine percentage of clay by the pipette method.

The tests to determine plastic limit and liquid limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The *plastic limit* is the moisture content at which the material changes from a semisolid to a plastic state. The *liquid limit* is the moisture content at which the material changes 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 the soil material is in a plastic state.

Estimated engineering properties of the soils

In table 4 soil properties that are significant to engineering are estimated. Because these estimates are for the profile typical for the series, variations from the estimates are likely. The typical profile was divided into layers significant to engineering. The estimates are based on the test data in table 3, on examinations made in the field, and on other experience with the soils in the survey area or with similar soil in adjacent counties.

Depth to bedrock is given in feet from the soil surface.

Grain size distribution is given in percentages of material passing the No. 4 (4.7 millimeters), No. 10 (2.0 millimeters), and No. 200 (0.07 millimeter) sieves.

Permeability is estimated according to the rate that water moves downward through undisturbed soil. The rate is expressed in inches per hour.

Available moisture capacity refers to 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. In table 4 it is estimated in fractions of an inch per inch of soil.

Reaction, which indicates the degree of acidity or alkalinity of the soil layers, is expressed in pH values. Most of the soils in the county are strongly acid.

The ratings for shrink-swell potential indicate the volume change resulting from the shrinking of the soil when it dries and the swelling of the soil as it takes in moisture. It is estimated on the basis of the amount and type of clay in the soil layers. In general, soils classified as A–7 and CH have high shrink-swell potential. Clean sands and gravels and those soils having a small amount of nonplastic to slightly plastic fines have low shrink-swell potential, as does most other nonplastic to slightly plastic soil material.

It is not intended that the estimates in this table should replace actual field tests.

Engineering interpretations of the soils

Engineering interpretations of the soils in Banks and Stephens Counties are given in table 5. This table rates the suitability of the soils as a source of road fill, and it also lists soil features that affect specified structures and practices. The information in table 5 is based on the estimated data in table 4, on the actual test data in table 3, and on field experience.

Because there are no deposits of sand or gravel of commercial value in the survey area, no ratings are given for these materials in table 5.

A rating of *good, fair,* or *poor* is given to show suitability of soil material as a source of road fill, primarily in construction of stable fill. Some consideration was given to presence of rocks, boulders, and excess moisture and to depth to bedrock.

Among the soil characteristics that are unfavorable to highway location are a seasonal high water table, susceptibility to flooding (fig. 11), shrink-swell potential, shallowness to bedrock, presence of boulders, unstable material, and erodibility. In these counties

Figure 11.—**Early construction stage of a flood-retarding structure on frequently flooded Toccoa soils.**

Figure 12.—Many acre-feet of water stored behind completed flood-retarding structure on soils in the Toccoa-Cartecay soil association. In both counties, water of this kind is used for wildlife, for recreation including boating and fishing, for irrigation, and to supply communities.

the hazard of flooding generally has been eliminated by the building of flood-retarding structures (fig. 12).

Some soils have characteristics that make them unsuitable as sites for reservoirs and as sources of embankment material for construction of farm ponds. Greater than normal loss of water can be expected in reservoirs on soils that have rapid permeability and excess seepage. Soils that have moderate or slow permeability generally are suitable for reservoirs. Stable embankments generally are constructed with soil material that has moderate strength and stability. Care should be taken where soil material of low strength and stability is used in embankments.

Agricultural drainage is needed for all soils on first bottoms and for some soils on uplands and terraces. Drainage of wet soils that have moderate or moderately slow permeability can be improved if adequate outlets for drainage systems are available (fig. 13). Subsurface drainage is difficult on soils that have slow permeability.

Generally, only soils on which crop growth can be sustained are suitable for irrigation. Best results are obtained on nearly level, well-drained soils that have moderate to moderately rapid infiltration and high available water capacity.

Terraces and waterways for controlling erosion can be established to protect soils of the uplands that are suitable for cultivation. Hazardous to the building of terraces are stones and boulders, bedrock near the surface, and steep slopes. Also interfering with the building of waterways are erodibility and the difficulty in establishing vegetation. In addition, a seasonal high water table limits the use of equipment in shaping and seeding waterways. On slopes of more than 10 percent, terraces are difficult to build and maintain.

Major Nonfarm Uses of the Soils

In this subsection the suitability of the soils in Banks and Stephens Counties for such nonfarm uses as homesites, trafficways, industrial sites, picnic areas, campsites, and golf fairways is discussed. Among the properties affecting the suitability of soils for nonfarm uses are soil texture, reaction, and depth; shrink-

swell potential; slopes; permeability; depth to water table; and flooding hazard. On the basis of these and related characteristics, soil scientists and engineers have rated the soils according to their limitations for particular nonfarm uses.

In table 6, the limitations of the soils in Banks and Stephens Counties are rated slight, moderate, and severe if the soils are used for residential, industrial, recreational, and other nonfarm purposes. The ratings refer to soils as they occur naturally in the landscape. If the rating is *slight*, little or no adjustment is needed for use, and the limitations, if any, are easily overcome. A rating of *moderate* means that some adjustment is needed for use, but the limitations generally can be overcome. A rating of *severe* means that extensive adjustments are needed before the soil is suitable for use, that the limitations are difficult to overcome, and that the soil is generally unsuitable for the purpose indicated. Moderate and severe limitations are listed in the table; slight limitations are not.

Nonfarm uses of the soils are discussed in the following paragraphs. The reader can obtain more information on the limitations on soil use by referring to the section "Descriptions of the Soils."

Figure 13.—**Need for channel improvement and adequate outlets for drainage systems on wet Toccoa soils of capability unit IIw–2.**

TABLE 6.—*Limitations of soils for residential,*

Soils and map symbols	Foundations for—		Sewage disposal	
	Houses	Light industries	Septic tank filter fields	Sewage lagoons
Altavista sandy loam, 2 to 6 percent slopes: AlB.	Moderate: moderately shallow to seasonal water table.	Moderate: moderately shallow to seasonal water table.	Moderate to severe: moderately shallow to seasonal water table.	Moderate: slopes
Appling sandy loam, 2 to 6 percent slopes, eroded: AmB2.	Slight	Moderate: moderate shrink-swell potential.	Moderate: moderate to slow percolation.	Moderate: slopes
Appling sandy loam, 6 to 10 percent slopes, eroded: AmC2.	Slight	Moderate: moderate shrink-swell potential; slopes.	Moderate: moderate to slow percolation.	Severe: slopes
Appling sandy loam, 10 to 25 percent slopes, eroded: AmE2.	Moderate: slopes	Severe: slopes	Severe: slopes	Severe: slopes
Appling sandy clay loam, 2 to 10 percent slopes, eroded: AnC2.	Slight	Slight to moderate: moderate shrink-swell potential.	Moderate: moderate to slow percolation.	Moderate to severe: slopes.
Cartecay soils: Cab	Severe: frequent flooding; high water table.	Severe: frequent flooding; high water table.	Severe: frequent flooding; high water table.	Severe: frequent flooding; high water table.
Cecil sandy loam, 2 to 6 percent slopes, eroded: CYB2.	Slight	Moderate: moderate shrink-swell potential.	Moderate: moderate to slow percolation.	Moderate: slopes
Cecil sandy loam, 6 to 10 percent slopes, eroded: CYC2.	Slight	Moderate: moderate shrink-swell potential; slopes.	Moderate: moderate to slow percolation.	Severe: slopes
Cecil sandy loam, 10 to 15 percent slopes, eroded: CYD2	Moderate: slopes	Severe: slopes	Moderate: slopes	Severe: slopes
Cecil sandy clay loam, 2 to 6 percent slopes, eroded: CZB2.	Slight	Moderate: moderate shrink-swell potential.	Moderate: moderate to slow percolation.	Moderate: slopes
Cecil sandy clay loam, 6 to 10 percent slopes, severely eroded: CZC3.	Slight	Moderate: moderate shrink-swell potential; slopes.	Moderate: moderate to slow percolation.	Severe: slopes
Cecil sandy clay loam, 10 to 15 percent slopes, severely eroded: CZD3.	Moderate: slopes	Severe: slopes	Moderate: moderate to slow percolation; slopes.	Severe: slopes
Chandler complex, 25 to 75 percent slopes: CsF.	Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes
Chandler and Rock land, 60 to 90 percent slopes: CrG.	Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes
Grover fine sandy loam, 6 to 15 percent slopes, eroded: GiD2.	Moderate: slopes	Moderate: slopes	Moderate: slopes; moderate to slow percolation.	Severe: slopes
Grover fine sandy loam, 15 to 60 percent slopes: GiF.	Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes
Gullied land: Gul	Severe: severe erosion	Severe: severe erosion	Severe: severe erosion	Severe: severe erosion
Gwinnett sandy loam, 2 to 6 percent slopes, eroded: GfB2.	Slight	Moderate: moderate shrink-swell potential.	Moderate: moderate to slow percolation.	Moderate: slopes
Gwinnett sandy loam, 10 to 15 percent slopes, eroded: GfD2.	Moderate: slopes	Severe: slopes	Severe: moderate to slow percolation; slopes.	Severe: slopes

industrial, recreational, and related uses

Recreational facilities			Trafficways	Suitability for topsoil
Picnic areas	Campsites and intensive play areas	Golf fairways		
Moderate: ponding	Moderate: moderately high water table.	Moderate: occasional flooding.	Moderate: moderate traffic supporting capacity.	Fair.
Slight	Slight	Slight	Moderate: moderate traffic supporting capacity.	Fair.
Slight	Moderate: slopes	Moderate: slopes	Moderate: moderate traffic supporting capacity.	Fair.
Moderate to severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes	Fair.
Slight	Moderate: slopes; clayey surface layer.	Slight to moderate: slopes.	Moderate: moderate traffic supporting capacity.	Poor.
Severe: frequent flooding; high water table.	Severe: frequent flooding; high water table.	Severe: frequent flooding; high water table.	Severe: frequent flooding; high water table.	Poor.
Slight	Slight	Slight	Moderate: moderate traffic supporting capacity.	Fair.
Slight	Moderate: slopes	Moderate: slopes	Moderate: moderate traffic supporting capacity.	Fair.
Moderate: slopes	Severe: slopes	Moderate: slopes	Moderate: slopes; moderate traffic supporting capacity.	Fair.
Slight	Slight	Slight	Moderate: moderate traffic supporting capacity and erosion hazard.	Poor.
Slight	Moderate: clayey surface layer; slopes.	Moderate: slopes	Moderate: moderate traffic supporting capacity and erosion hazard.	Poor.
Moderate: slopes; clayey surface layer.	Severe: slopes; clayey surface layer.	Moderate: slopes	Moderate: slopes; moderate traffic supporting capacity.	Poor.
Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes	Poor.
Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes	Poor.
Moderate: slopes	Severe: slopes	Moderate: slopes	Moderate: slopes; moderate traffic supporting capacity.	Fair.
Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes	Fair.
Severe: severe erosion	Severe: severe erosion	Severe: severe erosion	Severe: severe erosion	Poor.
Slight	Slight	Slight	Moderate: moderate traffic supporting capacity.	Fair.
Moderate: slopes	Severe: slopes	Severe: slopes	Moderate: moderate traffic supporting capacity; slopes.	Fair.

TABLE 6.—*Limitations of soils for residential,*

Soils and map symbols	Foundations for—		Sewage disposal	
	Houses	Light industries	Septic tank filter fields	Sewage lagoons
Gwinnett sandy loam, 15 to 45 percent slopes: GfF.	Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes
Hiwassee clay loam, 2 to 6 percent slopes, eroded: HTB2.	Slight	Moderate: moderate shrink-swell potential.	Moderate: moderate percolation.	Moderate: slopes
Hiwassee clay loam, 6 to 10 percent slopes, eroded: HTC2.	Slight	Moderate: moderate shrink-swell potential; slopes.	Moderate: moderate percolation.	Severe: slopes
Hiwassee clay loam, 10 to 15 percent slopes, eroded: HTD2.	Moderate: slopes	Severe: slopes	Moderate: slopes; moderate percolation.	Severe: slopes
Hiwassee clay loam, 15 to 25 percent slopes, eroded: HTE2.	Moderate: slopes	Severe: slopes	Severe: slopes	Severe: slopes
Hiwassee loam, 2 to 6 percent slopes: HSB.	Slight	Moderate: moderate shrink-swell potential.	Moderate: moderate percolation.	Moderate: slopes
Hiwassee loam, 6 to 10 percent slopes, eroded: HSC2.	Slight	Moderate: moderate shrink-swell potential; slopes.	Moderate: moderate to slow percolation.	Severe: slopes
Hiwassee loam, 10 to 15 percent slopes: HSD.	Moderate: slopes	Severe: slopes	Moderate: moderate percolation; slopes.	Severe: slopes
Louisa-Tallapoosa complex, 10 to 25 percent slopes: LOE.	Severe: shallow to rock; slopes.	Severe: slopes	Severe: shallow to rock.	Severe: slopes; seepage.
Louisburg loamy sand, 10 to 25 percent slopes: LnE.	Severe: shallow to rock; slopes.	Severe: slopes	Severe: shallow to rock.	Severe: slopes; seepage.
Louisburg loamy sand, 25 to 60 percent slopes: LnF.	Severe: shallow to rock; slopes.	Severe: slopes	Severe: shallow to rock.	Severe: slopes; seepage.
Louisburg-Rock land complex, 25 to 60 percent slopes: LRF.	Severe: shallow to rock; slopes.	Severe: slopes	Severe: shallow to rock.	Severe: slopes; seepage.
Madison fine sandy loam, 2 to 6 percent slopes, eroded: MjB2.	Slight	Moderate: moderate shrink-swell potential.	Moderate: moderate percolation.	Moderate: slopes
Madison fine sandy loam, 6 to 10 percent slopes, eroded: MjC2.	Slight	Moderate: moderate shrink-swell potential.	Moderate: moderate percolation.	Severe: slopes
Madison fine sandy loam, 10 to 15 percent slopes, eroded: MjD2.	Moderate: slopes	Severe: slopes	Moderate: moderate percolation; slopes.	Severe: slopes
Madison fine sandy loam, 15 to 25 percent slopes: MjE.	Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes
Madison sandy clay loam, 6 to 10 percent slopes, severely eroded: MlC3.	Slight	Moderate: moderate shrink-swell potential; slopes.	Moderate: moderate percolation.	Severe: slopes
Madison sandy clay loam, 10 to 15 percent slopes, severely eroded: MlD3	Moderate: slopes	Severe: slopes	Moderate: moderate percolation; slopes.	Severe: slopes
Madison sandy clay loam, 15 to 25 percent slopes, severely eroded: MlE3.	Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes

industrial, recreational, and related uses—Continued

Recreational facilities			Trafficways	Suitability for topsoil
Picnic areas	Campsites and intensive play areas	Golf fairways		
Moderate to severe: slopes	Severe: slopes	Severe: slopes	Severe: moderate traffic supporting capacity; slopes.	Fair.
Moderate: clayey, sticky surface layer.	Moderate: clayey, sticky surface layer.	Moderate: clayey, sticky surface layer.	Moderate: moderate traffic supporting capacity.	Poor.
Moderate: clayey, sticky surface layer.	Moderate: clayey, sticky surface layer; slopes.	Moderate: clayey, sticky surface layer; slopes.	Moderate: moderate traffic supporting capacity.	Poor.
Moderate: clayey, sticky surface layer; slopes.	Severe: clayey, sticky surface layer; slopes.	Moderate: clayey, sticky surface layer; slopes.	Moderate: moderate traffic supporting capacity.	Poor.
Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes; moderate traffic supporting capacity.	Poor.
Slight	Slight	Slight	Moderate: moderate traffic supporting capacity.	Fair.
Moderate: fair trafficability.	Moderate: slopes	Moderate: slopes	Moderate: moderate traffic supporting capacity.	Fair.
Moderate: slopes	Severe: slopes	Moderate: slopes	Moderate: moderate traffic supporting capacity; slopes.	Poor.
Severe: slopes; poor trafficability.	Severe: rocky; slopes	Severe: rocky; slopes	Moderate: rocky; slopes	Poor.
Moderate: slopes; fair trafficability.	Severe: rocky; slopes	Severe: rocky; slopes	Moderate: rocky; slopes.	Fair to poor.
Severe: slopes; poor trafficability.	Severe: rocky; slopes	Severe: rocky; slopes	Severe: rocky; slopes.	Poor.
Severe: slopes; poor trafficability.	Severe: rocky; slopes	Severe: rocky; slopes	Severe: rocky; slopes	Poor.
Slight	Slight	Slight	Moderate: moderate traffic supporting capacity.	Fair.
Slight	Moderate: slopes	Moderate: slopes	Moderate: moderate traffic supporting capacity.	Fair.
Moderate: slopes	Severe: slopes	Moderate: slopes	Moderate: slopes; moderate traffic supporting capacity.	Fair.
Moderate to severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes	Fair to poor.
Slight	Moderate: clayey surface layer; slopes.	Moderate: slopes	Moderate: moderate traffic supporting capacity.	Poor.
Moderate: slopes	Severe: slopes	Moderate: slopes	Moderate: slopes; moderate traffic supporting capacity.	Poor.
Moderate to severe: slopes	Severe: slopes	Severe: slopes	Moderate: moderate traffic supporting capacity; slopes.	Poor.

TABLE 6.—*Limitations of soils for residential,*

Soils and map symbols	Foundations for—		Sewage disposal	
	Houses	Light industries	Septic tank filter fields	Sewage lagoons
Madison-Louisa–Tallapoosa complex, 25 to 60 percent slopes: MAF.	Severe: shallow to rock; slopes.	Severe: slopes	Severe: shallow to rock.	Severe: slopes; seepage.
Masada fine sandy loam, 2 to 6 percent slopes: MoB.	Moderate: occasional flooding.	Moderate to severe: occasional flooding.	Moderate to severe: frequent flooding; moderate percolation.	Moderate: frequent flooding.
Mecklenburg fine sandy loam, 10 to 25 percent slopes: MrE.	Moderate: slopes; shrink-swell potential.	Severe: slopes	Severe: moderately slow percolation.	Severe: slopes
Musella-Gwinnett stony complex, 10 to 25 percent slopes: MFE.	Severe: shallow to rock; slopes.	Severe: slopes	Severe: shallow to rock.	Severe: slopes; rock
Musella and Gwinnett stony soils, 25 to 60 percent slopes: MGF.	Severe: shallow to rock; slopes.	Severe: slopes	Severe: shallow to rock.	Severe: slopes; rock
Pacolet sandy loam, 15 to 25 percent slopes: PfE.	Moderate: slopes	Severe: slopes	Severe: slopes	Severe: slopes
Pacolet sandy clay loam, 15 to 25 percent slopes, severely eroded: PgE3.	Moderate: slopes	Severe: slopes	Severe: slopes	Severe: slopes
Pacolet-Louisburg complex, 25 to 60 percent slopes: PjF.	Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes
Tate fine sandy loam, 10 to 25 percent slopes: TfE.	Moderate: slopes	Severe: slopes	Severe: slopes	Severe: slopes
Toccoa sandy loam, local alluvium: Tod.	Moderate: high seasonal water table.	Moderate: high seasonal water table.	Severe: high seasonal water table.	Moderate: moderate seepage.
Toccoa soils: Toc	Severe: frequent flooding.	Severe: frequent flooding.	Severe: frequent flooding.	Severe: frequent flooding.
Wedowee fine sandy loam, 10 to 25 percent slopes, eroded: WtE2.	Moderate: slopes	Severe: slopes	Moderate to severe: slopes.	Severe: slopes
Wedowee fine sandy loam, 25 to 60 percent slopes: WtF.	Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes
Wedowee sandy clay loam, 10 to 25 percent slopes, severely eroded: WuE3.	Moderate: slopes	Severe: slopes	Moderate: slopes	Severe: slopes
Wehadkee soils: Whs	Severe: very frequent flooding; high seasonal water table.	Severe: very frequent flooding; high seasonal water table.	Severe: very frequent flooding; high seasonal water table.	Severe: very frequent flooding; high seasonal water table.
Wickham sandy loam, 2 to 6 percent slopes: WgB.	Slight	Slight	Slight	Moderate: slopes
Wickham sandy loam, 6 to 10 percent slopes: WgC.	Slight	Moderate: slopes	Slight	Severe: slopes
Wickham sandy loam, 10 to 15 percent slopes: WgD.	Moderate: slopes	Severe: slopes	Moderate: slopes	Severe: slopes

industrial, recreational, and related uses—Continued

Recreational facilities			Trafficways	Suitability for topsoil
Picnic areas	Campsites and intensive play areas	Golf fairways		
Severe: slopes; poor trafficability.	Severe: rocky; slopes	Severe: rocky; slopes	Severe: rocky; slopes	Poor.
Moderate: flooding	Moderate: moderately high water table; flooding.	Moderate: frequent flooding.	Moderate: moderate traffic supporting capacity.	Fair.
Moderate: slopes	Severe: slopes	Severe: slopes	Severe: low traffic supporting capacity.	Fair.
Severe: rocky; slopes	Severe: rocky; slopes	Severe: rocky; slopes	Severe: rocky; slopes	Poor.
Severe: rocky; slopes	Severe: rocky; slopes	Severe: rocky; slopes	Severe: rocky; slopes	Poor.
Moderate: slopes	Severe: slopes	Severe: slopes	Moderate: slopes	Fair.
Moderate to severe: clayey surface layer; slopes.	Severe: slopes	Severe: slopes	Severe: slopes	Poor.
Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes	Poor.
Moderate to severe: slopes.	Severe: slopes	Severe: slopes	Moderate: slopes	Fair.
Moderate: high seasonal water table.	Moderate: high seasonal water table.	Moderate: high seasonal water table.	Moderate: moderate traffic supporting capacity.	Good.
Moderate: frequent flooding.	Moderate: frequent flooding.	Moderate: frequent flooding.	Moderate: moderate traffic supporting capacity.	Good.
Moderate to severe: slopes.	Severe: slopes	Moderate to severe: slopes.	Moderate to severe: slopes; moderate traffic supporting capacity.	Fair.
Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes	Poor.
Moderate: slopes	Severe: slopes	Moderate to severe: slopes.	Moderate: slopes; moderate traffic supporting capacity.	Fair.
Severe: very frequent flooding; high seasonal water table.	Severe: very frequent flooding; high seasonal water table.	Severe: very frequent flooding; high seasonal water table.	Severe: very frequent flooding; high seasonal water table.	Poor.
Slight	Slight	Slight	Slight	Fair.
Slight	Slight	Moderate: slopes	Slight	Fair.
Moderate: slopes	Severe: slopes	Moderate: slopes	Moderate: slopes; moderate traffic supporting capacity.	Fair.

TABLE 6.—*Limitations of soils for residential,*

Soils and map symbols	Foundations for—		Sewage disposal	
	Houses	Light industries	Septic tank filter fields	Sewage lagoons
Wickham clay loam, 6 to 10 percent slopes, severely eroded: WhC3.	Slight	Moderate: moderate shrink-swell potential; slopes.	Moderate: moderate percolation.	Severe: slopes
Wilkes complex, 10 to 25 percent slopes: WpE.	Severe: shallow to rock; slopes.	Severe: shallow to rock; slopes.	Severe: shallow to rock; slopes.	Severe: shallow to rock; slopes.
Wilkes stony complex, 25 to 60 percent slopes: WjF.	Severe: stony; slopes	Severe: stony; slopes	Severe: stony; slopes	Severe: stony; slopes

Foundations for houses.—The soils are rated for use as foundations for houses of three stories or less in areas served by public or community sewage systems. Features that affect their suitability for this use are shrink-swell potential, depth to seasonal high water table, flooding hazard, slopes, and depth to bedrock.

Generally limitations are *slight* if slopes are less than 10 percent, if the soils are well drained or moderately well drained and are not flooded, and if the depth to bedrock is more than 36 inches. Limitations are *moderate to severe* if slopes are more than 10 percent, if the soils are somewhat poorly drained to poorly drained and are flooded occasionally, and if depth to bedrock is less than 36 inches.

Foundations for light industries.—The soils are rated for use as foundations for commercial buildings, such as stores, offices, and other small industries. Ratings are for buildings not more than three stories high, and it is assumed that sewage disposal facilities are available for them. Soil properties affecting this use are slope, depth to the water table, depth to rock, hazard of flooding, and shrink-swell potential.

Limitations are *slight* if slopes are less than 6 percent, if depth to bedrock is more than 36 inches, if the seasonal water table is below 30 inches most of the year, if the soils are not flooded, and if the shrink-swell potential is low. Limitations are *moderate to severe* if slopes are steeper than 6 percent, if the soils are flooded, and if the shrink-swell potential is moderate or high.

Septic tank filter fields.—The term "septic tank filter field" refers to a sewage system in which waste is collected in a central tank and then dispersed over a fairly large area by means of absorptive field lines that are buried in the soil (*8*). The properties affecting the limitations of soils for use as filter fields are shrink-swell potential, depth to seasonal high water table, depth to hard rock, flooding hazard, slopes, and percolation rate.

Limitations are *slight* if the soils are not flooded, if the percolation rate is more than 45 minutes per inch of soil, if slopes are less than 10 percent, if the water table is at a depth of more than 60 inches, and if the depth to bedrock is more than 50 inches.

Limitations are *moderate to severe* if the percolation rate is 45 to 75 minutes per inch, if the water table is at a depth of 30 to 60 inches throughout the year, if depth to hard rock is 30 to 50 inches, if slopes are 10 percent or more, and if the soils are subject to flooding.

Sewage lagoons.—A sewage lagoon or oxidation pond (fig. 14) consists of an impounded area and a dike. A sewage lagoon is ordinarily planned so that it holds not less than 2 feet and not more than 5 feet of liquid. The chief requirements of a soil for use as a floor for the basin of a lagoon are (1) effective sealing against seepage, (2) an even, fairly level surface, and (3) little or no organic matter. The soil properties most important in rating the soils for a sewage lagoon are permeability, the suitability of the soil as a reservoir site, the suitability of the material at the site for use as a dike, depth to hard rock, slopes, content of organic matter, and content of fragments more than 6 inches in diameter.

Limitations are *slight* if permeability is moderate, if depth to hard rock is more than 60 inches, if slopes are less than 2 percent, and if coarse fragments are less than 6 inches in diameter. Limitations are *moderate to severe* if permeability is moderately rapid, if slopes are more than 6 percent, if depth to hard rock is 30 to 60 inches, and if coarse fragments more than 6 inches in diameter cover 10 percent of the area.

Picnic grounds.—Limitations to use of soils for picnic grounds are *slight* if the soils are well drained and free of flooding during the season of use, if slopes are less than 10 percent, and if trafficability is good. Limitations are *moderate to severe* if the soils are moderately wet to wet and are subject to flooding during the season of use, if slopes are more than 10 percent, and if trafficability is moderate to poor.

Campsites and intensive play areas.—Campsites are areas where tents and small camp trailers can be set up for extended periods. Soils suitable for campsites require little preparation other than that needed for tentsites and parking areas. The soils must support heavy pedestrian and vehicular traffic. Limitations are *slight* if soils are well drained and free of flooding, if permeability is moderate to rapid, if slopes are less than 6 percent, and if rock fragments that are less than 6 inches in diameter cover no more than 5 percent of the soil surface. Limitations are *moderate to severe* if soils are moderately wet to wet, if permeability is moderate to slow, if slopes are more than 6 percent, and

industrial, recreational, and related uses—Continued

Recreational facilities			Trafficways	Suitability for topsoil
Picnic areas	Campsites and intensive play areas	Golf fairways		
Moderate: clayey surface layer.	Moderate: clayey surface layer; slopes.	Moderate: slopes; clayey surface layer.	Moderate: moderate traffic supporting capacity.	Poor.
Severe: shallow to rock; slopes.	Severe: shallow to rock; slopes.	Severe: shallow to hard rock; slopes.	Moderate to severe: slopes.	Poor.
Severe: stony; slopes -----	Severe: stony; slopes --	Severe: stony; slopes ---	Severe: stony; slopes --	Poor.

if rock fragments that are larger than 6 inches in diameter cover more than 5 percent of the soil surface.

Play areas are used for children's playgrounds and for baseball, football, tennis, and other outdoor sports. The requirements for play areas are similar to those for campsites. Limitations are *slight* if the soils are free of large stones or rock fragments and slopes are less than 2 percent.

Golf fairways.—Only ratings of suitability for golf fairways are given in table 6, because most greens are constructed from fill materials. Limitations for fairways are *slight* on loamy sand, fine sandy loam, sandy loam, or loam soils that have slopes of less than 6

***Figure 14.*—Sewage lagoons located on Toccoa soils.**

percent and moderate to rapid permeability and are not subject to flooding. Limitations are *moderate to severe* on loose sandy, stony, or compact clayey soils that have slopes of more than 6 percent and moderate to slow permeability and are subject to flooding.

Trafficways.—Characteristics that affect suitability for trafficways, or low-cost roads and residential streets that require limited cut-and-fill and subgrade preparation, are slopes, depth to hard rock and water table, flooding and erosion hazards, and traffic-supporting capacity.

Limitations are *slight* if soils are well drained and not subject to flooding, if slopes are less than 10 percent, if the traffic-supporting capacity is good, if depth to bedrock is 36 inches or more, and if the seasonal water table is at a depth of more than 30 inches. Limitations are *moderate to severe* if soils are moderately wet to wet and subject to flooding, if depth to bedrock is less than 35 inches, and if a water table is at a depth of less than 30 inches.

Topsoil.—Features that affect suitability of a soil for use as topsoil to establish vegetation are fertility, the depth and texture of the material, and the content of coarse rock fragments. Good sources of topsoil are friable sandy loam, loam and light sandy clay loam soils 20 inches or more thick that are fertile and contain no coarse fragments. Thin, infertile soils that are clayey or sticky and contain stones or large rock fragments are fair to poor sources of topsoil.

Use of the Soils for Wildlife and Fish

Most areas in Banks and Stephens Counties provide food and cover for many kinds of wildlife and have sites that are suitable for fishponds. Bobwhite, mourning dove, rabbit, squirrel, and many nongame birds are common. Deer and wild turkey live in extensive woodland areas, such as the Chattahoochee National Forest. Some of the long narrow bottom lands along streams are well suited to wild ducks, and beaver are common on many of the smaller streams.

Food and cover needed by wildlife

The food and cover needed by the more important kinds of wildlife in Banks and Stephens Counties are discussed in the following paragraphs.

Beaver.—Beavers eat only vegetation, mainly bark, roots, and green plants. Their principal tree foods are from ash, birch, cottonwood, maple, pine, sweetgum, willow, and the tender bark of alder. Beavers also eat honeysuckle, grasses, weeds, acorns, corn, and the tender shoots of elder. The chief feeding areas are within 150 feet of water.

Bobwhite.—Choice foods for bobwhite are acorns, blackberries, browntop millet, wild black cherries, corn, cowpeas, dewberries, flowering dogwood, annual lespedeza, bicolor lespedeza, mulberries, pecans, pine seeds, proso, common ragweed, and sweetgum seeds. They also eat many insects. The food must be close to vegetation that provides shade and protection from predators and adverse weather.

Deer.—Choice foods for deer are acorns, bahiagrass, clover, cowpeas, greenbrier, honeysuckle, annual lespedeza, bicolor lespedeza, oats, rescuegrass, ryegrass, and wheat. A woodland tract of 500 acres or more generally provides enough cover for deer, which also need drinking water daily.

Dove, mourning.—Choice foods for mourning dove are browntop millet, dove proso, corn, Japanese millet, pine seeds, common ragweed, and sweetgum seeds. Doves do not eat insects, green leaves, or fruits. They drink water daily.

Duck.—Choice foods are acorns, browntop millet, corn, Japanese millet, soybeans, and smartweed seeds. Food plants in water are the most acceptable to ducks, though ducks occasionally feed on acorns, corn, and soybeans on dry land.

Rabbit.—Rabbits require cover vegetation such as a blackberry or plum thicket. Choice foods are clover, winter grasses, and other succulent plants.

Squirrel.—Choice foods for squirrels are acorns, blackgum, black cherries, corn, flowering dogwood, hickory nuts, mulberries, pecans, and pine seeds.

Turkey, wild.—Wild turkeys can survive only in areas of woodland at least 1,000 acres in size. Turkeys need a daily supply of drinking water and often roost in large trees over or near water. Choice foods are insects, acorns, bahiagrass seed, blackberries and dewberries, browntop millet, clover leaves, corn, cowpeas, flowering dogwood, wild grapes, mulberries, oats, pecans, pine seeds, rescuegrass and ryegrass forage, and wheat.

Nongame birds.—The foods for the many kinds of nongame birds in the two counties vary greatly. Several species eat only insects; a few eat insects and fruit; and several others eat insects, fruits, and acorns.

Fish.—The principal fish in the two counties are bluegill, bass, and channel catfish. Bluegills eat mostly aquatic worms, insects, and insect larvae. Bass and channel catfish feed mostly on small fish. The supply of food depends on the fertility of the water and the characteristics of the soils at the bottom of the pond.

Wildlife suitability groups

The soils in Banks and Stephens Counties have been placed in eight wildlife suitability groups. The soils in each group have a similar capacity to produce food and cover for wildlife. A shortage of cover is not likely to be a problem in the counties, because the climate favors the growth of vegetation. The wildlife suitability groups are described in the following paragraphs. To find the soils in each group, refer to the "Guide to Mapping Units" at the back of this survey.

WILDLIFE SUITABILITY GROUP 1

This group consists of deep, well-drained soils on uplands and stream terraces. Slopes range from 2 to 10 percent. The surface layer is sandy loam, fine sandy loam, and clay loam 3 to 8 inches thick. The subsoil is moderately permeable clay to sandy clay loam. These soils are easy to work, and the available water capacity is moderate.

The soils in this group occur extensively throughout the two counties and are mostly cultivated or in pas-

ture. They are suited to many kinds of plants that provide choice food for wildlife. These soils generally are not suited to flooding for duck fields, but many drainageways in these areas provide favorable sites for ponds.

WILDLIFE SUITABILITY GROUP 2

This group consists of deep, well-drained soils on uplands. Slopes range from 6 to 25 percent. The subsoil is sandy clay loam or sandy clay. Plant roots penetrate to a depth of 26 inches or more These soils are difficult to cultivate and are highly susceptible to erosion. Permeability is moderate to moderately slow, and the available water capacity is moderate.

These soils occur extensively throughout the two counties and are mostly wooded. They are not well suited to annual plants. Perennial grasses, lespedeza, and some woody plants grow fairly well on them. The soils are well suited to blackgum, wild black cherry, flowering dogwood, hickory, and pine. Many drainageways in these areas provide favorable sites for ponds.

WILDLIFE SUITABILITY GROUP 3

This group consists mainly of deep, well-drained, severely eroded soils on uplands. Slopes range from 6 to 15 percent. The surface layer is sandy clay loam and clay loam 4 to 7 inches thick. The subsoil is sandy clay to clay. Plant roots penetrate to a depth of 36 inches or more. Tilth is poor, permeability is moderate to moderately slow, and the available water capacity is medium.

These soils occur extensively throughout the counties. Most of the soils have been cultivated. Plants do not grow well because the soils are severely eroded and have poor tilth. These soils are suited to dewberry, lespedeza, pine, millet, and tickclover. Cultivated crops, clover, grass, small grains, most shrubs, and hardwoods grow fairly well. Many drainageways in these areas provide favorable sites for ponds.

WILDLIFE SUITABILITY GROUP 4

This group consists of well-drained, eroded soils and areas of Gullied land. Erosion is slight to severe. Slopes range from 10 to 25 percent. The surface layer of the soils is sandy clay loam 3 to 7 inches thick. In areas of Gullied land the substratum is exposed. Tilth is poor, but the root zone in included areas that are not severely eroded is 36 inches or more. The available moisture capacity is low to moderate, and the water intake is slow. Permeability in the subsoil is moderate.

These soils are extensive throughout the counties. The soils were once cultivated, but most have reverted to pine. These steep, eroded soils are not well suited to plants that provide food for wildlife. Lespedeza, pine, and tickclover grow fairly well. Many drainageways in these areas provide favorable sites for ponds.

WILDLIFE SUITABILITY GROUP 5

This group consists of steep, well-drained to somewhat excessively drained soils on uplands. Slopes range from 10 to 90 percent. The surface layer is mainly loamy sand or sandy loam 5 to 15 inches thick. Depth to bedrock ranges from a few inches to several feet. These soils are too steep to cultivate. The available water capacity is low, and the root zone is thin.

These soils are not well suited to most plants that provide food for wildlife. They are better suited to pine and flowering dogwood. Only blackjack oak and other scrub oaks and hardwoods grow on the steeper slopes. Deer, wild turkey, and quail are often in these areas, but food is scarce.

WILDLIFE SUITABILITY GROUP 6

This group consists of steep, well-drained soils on uplands. These soils are eroded to slightly eroded, and are moderately shallow to bedrock. Slopes range from 10 to 60 percent. The surface layer is fine sandy loam and sandy loam. Stones and cobblestones occur in places. The subsoil is moderately permeable sandy clay loam, clay loam, or clay. The available water capacity is medium, and the range of moisture content within which these soils can be worked is narrow.

Wild black cherry, flowering dogwood, and pine grow well on these soils. Among the plants that grow fairly well are bahiagrass, browntop millet, crimson clover, corn, cowpeas, annual lespedeza, bicolor lespedeza, sericea lespedeza, ryegrass, tickclover, small grains, sweetgum, oak, hickory, wild grapes, greenbrier, dewberry, and blackberry.

WILDLIFE SUITABILITY GROUP 7

This group consists of deep, well drained to moderately well drained soils in heads of drainageways or on first bottoms along streams. Soils on first bottoms are flooded at intervals of a few months to several years, but flooding generally lasts for less than 2 days. The surface layer is loamy sand to sandy loam 5 to 10 inches thick. The texture of the subsoil varies. These soils are easy to work. Except for small areas of sandy, droughty soils, the soils in this group have adequate water available for the growth of many kinds of plants.

These soils occur in small areas scattered throughout Banks and Stephens Counties. Many areas are cultivated or in pasture. Most of the plants that provide choice food for wildlife grow well. Some areas can be flooded for duck fields, and favorable sites for ponds are common.

WILDLIFE SUITABILITY GROUP 8

Wehadkee soils is the only mapping unit in this group. They are deep, wet soils that occur on first bottoms, in heads of drains, and on low slopes. The surface layer is silt loam to loamy sand 5 to 8 inches thick. The soils are poorly drained and have a high water table. The soils on first bottoms are flooded for periods of 1 to 5 days almost every year. The available water capacity is medium, and water tends to perch on the substratum.

These soils are mostly in woods, pasture, or are idle. Only a few plants that provide choice food for wildlife grow on these soils. Among them are browntop millet, Japanese millet, white clover, tall fescue, and smartweed. Many areas can be flooded for duck fields. Water can be impounded, and ponds can be dug on these soils.

Formation and Classification of Soils

This section lists the factors of soil formation and discusses the effect these factors have had on the soils of Banks and Stephens Counties. It also explains the current system of soil classification and places the soil series in higher categories. The soil series in the two counties are described in detail in the section "Descriptions of the Soils."

Formation of Soils

Soils form in parent material that is altered by the combined effect of climate, topography, and plant and animal life over long periods of time. The characteristics of a soil at any given location are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material developed; (3) the topography of the land that influences drainage; (4) the plants and animals living in and on the soil; and (5) the length of time these factors have acted on the parent material.

Parent material

Parent material is the unconsolidated mass from which a soil develops. It largely determines the chemical and mineralogical composition of soils. The soils of Banks and Stephens Counties formed in two kinds of parent material: (1) residual material weathered in place from rock, and (2) material transported by water and laid down as deposits of clay, silt, sand, and larger rock fragments.

The soils that formed in residual material are generally related to particular rock formations or parts of rock formations. For example, the Cecil and Appling soils were derived from ordinary gneiss, granite, and schist, the Madison soils were derived from mica schist, and the Gwinnett soils were derived from diorite and hornblende or mixed acid and basic rock.

Transported material or alluvium has been moved from one place to another by water. This alluvium is deposited continually in the valleys of flowing streams. Older deposits occur on high terraces along former streambeds that are now dry. Soils that developed in alluvium on first bottoms show little profile development, whereas soils on former streambeds have been in place long enough for distinct horizons to form. Transported materials are mixed and sorted by the stream and deposited in strata as the flow of water changes speed. Cartecay soil is an example of a stratified soil in alluvium. The transported material has properties similar to those of the soil from which it was removed. For example, soils on bottom lands that formed in material washed from mica schist on uplands contain large amounts of mica.

A fairly consistent relationship exists between the parent material and soil characteristics. However, some soil characteristics cannot be correlated with the kind of parent material and must be attributed to other factors.

Topography

The topography, or shape of the landscape, affects soil formation through its influence on drainage, runoff, erosion, plant cover, and soil temperature. Most soils in Banks and Stephens Counties occur on slopes of 6 to 25 percent. Slopes as steep as 90 percent occur in the northern part of the survey area, and nearly level slopes occur on some ridgetops and along streams.

Cecil and Madison soils are well-drained soils that formed on slopes where runoff is moderate to rapid. The subsoil is bright in color and is not mottled. Altavista soils formed on gentle slopes where runoff is slower.

Because these soils are wet for short periods, gray mottles have formed in the subsoil. Wehadkee soils formed on level flood plains and have slow internal drainage. These soils are often wet, and the subsoil contains very strong mottles or is gray in color.

Slopes also determine the thickness of the soil and the degree of profile development. Soils on steep slopes erode faster than those on level slopes. For example, shallow Chandler soils occur on very steep slopes of more than 25 percent, and deeper Madison soils occur on less steep slopes. Both soils are underlain by mica schist.

Time

The length of time required for a well-developed profile to form in a soil depends on the degree that the other factors affect soil formation. Less time is generally required for a profile to develop in a warm, humid climate than is required in a cold, dry climate. This is because moisture and a warm temperature accelerate the chemical and biological activity in the soil material. Also, less time is required for the formation of a distinct profile in moderately permeable material. If time is sufficient, the soil is modified so that genetic horizons of an A, B, C sequence are formed. Soils formed in recent materials have very weak horizons and almost no profile development, but those formed in older materials may have distinct horizons and well-developed profiles. For example, Toccoa soil is a young soil on flood plains that lacks developed horizons because the materials have been in place only a short time. Altavista soil occurs at higher elevations than Toccoa soil and formed in alluvium that has been in place long enough for distinct horizons to develop. The B horizon of Altavista soil contains more clay than the A horizon. Hiwassee soil is a mature soil in which the B horizon is rich in clay.

Plant and animal life

Plants, animals, insects, bacteria, and fungi are important in the formation of soils. They determine the content of organic matter and nitrogen in the soil and affect the soil structure and porosity.

Native vegetation, particularly the native forests, has had the greatest influence on soil formation in Banks and Stephens Counties. The forests consisted mainly of oak, hickory, and pines in well-drained areas and yellow-poplar, gum, ash, oak, willow, and beech in wet areas. Windthrow of trees and the burrowing of

animals bring weathered fragments of stone and subsoil to the surface where they are subjected to rapid chemical and physical weathering. Earthworms move mineral and organic matter through the soil horizons, and bacteria and fungi break down plant residues into simpler compounds that eventually affect the chemical and physical composition of the soil.

Man has changed the direction and rate of development of the soils by clearing the forests, cultivating the soils, introducing new kinds of plants, and adding minerals, lime, and nitrogen fertilizers to the soil. The content of organic matter in the soils declines sharply after the soils are cultivated a few months. In most of the sloping areas under cultivation, the somewhat coarse-textured surface layer is lost through accelerated erosion. Although some results probably will not be evident for many centuries, the complex of living organisms affecting soil formation in Banks and Stephens Counties has been drastically changed as a result of man's activity.

Climate

The climate of Banks and Stephens Counties is characterized by mild winter, warm summers, and abundant rainfall. Annual precipitation and temperature influence the rate and kind of weathering and leaching that help to produce soil. The average annual rainfall in the counties is more than 50 inches. Large amounts of water move through the soils and remove or relocate dissolved and suspended materials. The average annual temperature is about 59° F. High temperatures promote chemical reactions in the soils. Plant residues decompose rapidly, and the organic acids thus produced hasten the development of clay materials and the removal of carbonates. For example, most soils on uplands are strongly acid and have a clay enriched subsoil.

Temperatures are a few degrees cooler on the mountains in the northwestern part of Stephens County than on the lower plateaus. A change of a few degrees affects the type of native vegetation, particularly the type of understory plants, that grow on a soil, and this difference in the kind of vegetation causes significant differences in soil characteristics.

The soils in Banks and Stephen Counties are frozen to a depth of several inches for short periods during the winter. Freezing aids soil formation by mechanically breaking down coarse fragments. However, very cold temperatures slow the processes of bacterial and chemical decomposition in the soil.

Climatic data for the county are given in the section "General Nature of the Area."

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to organize what we know about the soils, to see their interrelationships, and to develop principles that help us to understand soil behavior and response to manipulation (*7*). 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.

Thus, in classification, soils are placed in narrow classes that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. The large number of narrow classes are placed in fewer, broader categories to facilitate study and comparison over large areas, such as countries and continents.

The system of classification used in this soil survey was adopted for use by the National Cooperative Soil Survey in January 1965. This system defines classes in terms of observable or measurable properties of soils. The properties chosen are primarily those that permit the grouping of soils that are similar in origin. Because this system is under continual study, readers interested should search the latest literature available (*7*, *4*). The system has six categories. Beginning with the most inclusive the categories are order, suborder, great group, subgroup, family, and series. Following are brief descriptions of the first five categories in the system. The series is defined in the section "How This Survey Was Made." In table 7, soil series of Banks and Stephens Counties are placed in some of the categories of the current system.

ORDER: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions are Entisols and Histosols, which occur in many different climates. Table 7 shows the four soil orders represented in Banks and Stephens Counties. They are Entisols, Inceptisols, Alfisols, and Ultisols.

Entisols are young mineral soils that do not have genetic horizons or have only the beginning of such horizons.

Inceptisols are mineral soils in which horizons have definitely started to develop. They generally are on young but not recent land surfaces.

Alfisols are soils containing a clay-enriched B horizon that has high base saturation.

Ultisols are mineral soils that commonly occur on old land surfaces and have distinct horizons. These soils contain a clay-enriched B horizon that has low base saturation. The base saturation decreases with depth.

SUBORDER: Each order is subdivided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders have a narrower climatic range than the orders. The criteria for suborders chiefly reflect the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP: Each suborder is divided into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons.

SUBGROUP: Each great group is subdivided into subgroups. One of these subgroups represents the cen-

TABLE 7.—*Soil series classified according to the current system of classification* [1]

Series	Current classification		
	Family	Subgroup	Order
Altavista	Fine-loamy, mixed, thermic	Aquic Hapludults	Ultisols.
Appling	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols.
Cartecay	Coarse-loamy, mixed, nonacid, thermic	Aquic Udifluvents	Entisols.
Cecil	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols.
Chandler	Coarse-loamy, micaceous, mesic	Typic Dystrochrepts	Inceptisols.
Grover	Fine-loamy, micaceous, thermic	Typic Hapludults	Ultisols.
Gwinnett	Clayey, kaolinitic, thermic	Typic Rhodudults	Ultisols.
Hiwassee	Clayey, kaolinitic, thermic	Typic Rhodudults	Ultisols.
Louisa	Loamy, micaceous, thermic, shallow	Ruptic Ultic Dystrochrepts	Inceptisols.
Louisburg	Coarse-loamy, mixed, thermic	Ruptic Ultic Dystrochrepts	Inceptisols.
Madison	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols.
Masada	Fine-loamy, mixed, thermic	Typic Hapludults	Ultisols.
Mecklenburg	Fine, mixed, thermic	Ultic Hapludalfs	Alfisols.
Musella	Fine-loamy, mixed, thermic	Typic Rhodudults	Ultisols.
Pacolet	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols.
Tallapoosa	Loamy, micaceous, thermic, shallow	Ochreptic Hapludults	Ultisols.
Tate [2]	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Toccoa	Coarse-loamy, mixed, nonacid, thermic	Typic Udifluvents	Entiosls.
Wedowee	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols.
Wehadkee	Fine-loamy, mixed, nonacid, thermic	Fluventic Haplaquepts	Inceptisols.
Wickham	Fine-loamy, mixed, thermic	Typic Hapludults	Ultisols.
Wilkes	Loamy, mixed, thermic, shallow	Typic Hapludalfs	Alfisols.

[1] Placement of some series in the current system of classification, particularly in families, may change as more precise information becomes available.

[2] The soils of Banks and Stephens Counties that are correlated in the Tate series are outside the revised standard description for the Tate series because they have a C horizon of saprolite.

tral (typic) segment of the great group. The other subgroups, also called intergrades, comprise those soils having properties mostly of one great group, but also one or more properties of soils in 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: Each subgroup is divided into families, primarily on the basis of properties important to the growth of plants or behavior of soils where used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, consistence, and thickness of horizons.

SERIES: Most of the soil series described in this survey have been established earlier. The Gwinnett, Pacolet, Wedowee, Toccoa, and Cartecay series were described only recently, and their status was tentative at the time this survey was sent to the printer.

General Nature of The Area

This section describes the climate, geology, drainage, physiography, water supply, social and industrial development, and farming in Banks and Stephens Counties.

Climate [5]

Banks and Stephens Counties are located in the southern foothills of the Blue Ridge Mountains. Elevation ranges from 1,500 feet in the northwestern part of Stephens County to less than 800 feet in the southeastern part of Banks County. The higher elevation moderates summer temperatures. Temperatures are higher in winter than might be expected because mountains to the north and northwest restrict the flow of cold air into the survey area. Table 8 gives temperature and precipitation data from the records at Toccoa, in Stephens County.

In summer, temperatures are 90° F. or more on less than half the days in June, July, and August. A temperature of 100° or more occurs only once in 3 years, and the record high of 107° occurred on July 21, 1926. The temperature drops steadily after sunset and reaches the mid and upper 60's by early morning. The average minimum temperature for the three summer months is less than 67°.

In winter, weather alternates frequently between periods of freezing and thawing. A temperature of 32° or less occurs on about 50 days during an average winter. Except for cold spells, winter days are usually mild. Temperature frequently reaches the 60's during winter afternoons, and a reading in the 70's is not unusual. The record low of −5° F. occurred on January 30, 1966. A subzero temperature was recorded only once before this, in February 1899.

Probabilities of the last freezing temperature in spring and the first in fall at Toccoa in Stephens County are given in table 9. The frost-free season averages 210 to 220 days. This is slightly longer than the average for most areas in Georgia at the same latitude. The length of the growing season at Toccoa for a 30-year period ranged from a low of 190 days in 1962 to a high of 257 days in 1946. Because the terrain is hilly, the minimum temperature may differ greatly within short distances. On clear, still nights cool air drains down the hillsides into lower areas

[5] By HORACE S. CARTER, State climatologist, U.S. Weather Bureau, Athens, Ga.

TABLE 8.—*Temperature and precipitation data for Banks and Stephens Counties*

Month	Temperature				Precipitation		
	Average daily maximum	Average daily minimum	2 years in 10 will have at least 4 days with—		Average	1 year in 10 will have—	
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—
	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*
January	54.6	34.3	69	19	5.51	2.8	10.4
February	57.5	35.5	73	20	5.87	2.2	10.4
March	64.3	40.6	78	27	6.86	3.9	11.6
April	74.0	49.1	85	36	5.10	1.7	8.2
May	82.0	57.3	92	44	3.43	1.2	5.8
June	87.3	64.8	96	57	4.33	1.7	7.4
July	88.9	67.3	97	62	5.67	1.6	10.8
August	88.5	66.8	96	61	5.46	2.4	11.1
September	82.9	61.3	92	51	4.17	1.0	7.2
October	74.0	50.9	85	36	3.30	.4	7.5
November	63.6	40.9	78	26	3.80	1.6	7.3
December	55.1	34.7	70	20	5.02	1.9	10.2
Year	72.7	50.3	[1] 98	[1] 14	58.52	46.1	74.4

[1] The extreme temperature that will be equaled or exceeded on at least 4 days in 2 years out of 10.

and is replaced by warmer air from above. Under extreme conditions, the minimum temperatures may be 10 to 15° colder in the low areas than on the surrounding hillsides and the frost-free season may be several days shorter in valleys and low areas than on nearby uplands. South-facing slopes are usually warmer than north-facing slopes.

Precipitation is usually ample for farming. Winter and early spring are normally the wettest seasons, though precipitation is also high in midsummer. October and May are the driest months, but more than 3 inches of precipitation falls during each month. Ample rainfall can be depended on. In the last 75 years, at least 40 inches of precipitation fell each year, and more than 50 inches fell during 56 years. Relatively little snow falls in the counties, but measurable amounts are recorded during more than half the winters. The winter of 1935–36, where over 18 inches fell at Toccoa, was one of the snowiest on record.

Geology, Drainage, and Physiography

The two counties are in the extreme northern part of the Piedmont Plateau of Georgia. A small area is in the foothills of the Blue Ridge Major Land Resource Area. About 90 percent of the acreage in the Blue Ridge foothills is underlain by biotite gneiss and schist, and the rest, at the extreme northern tip of Stephens County, is underlain by brevard schist. About 75 percent of the acreage south of the Blue Ridge foothills is underlain by granite gneiss, 15 percent by biotite gneiss and schist, and the rest by diorite injection gneiss (*3*).

The Tugaloo River and its tributaries drain the eastern part of Stephens County. Hartwell Dam backs up water on this river along the boundary of Stephens County, except for about a mile at the northernmost part. The rest of Banks and Stephens Counties is drained by the North Fork Broad, Middle Fork Broad, and Hudson Rivers, and Grove Creek and their tributaries. Practically all of the uplands and foothills are well drained by one of many branching creeks or intermittent streams in the watersheds of these rivers.

Most of the area in the Blue Ridge foothills is steep to very steep. Slopes are short and broken, and the terrain is dissected by many narrow, rapid streams. In the areas south of Toccoa are broader and smoother ridges and plateaus that are dissected by many small

TABLE 9.—*Probabilities of the last freezing temperature in spring and the first in fall* [1]

Probability	Dates for given probability at temperatures of—		
	24° F. or lower	28° F. or lower	32° F. or lower
Spring:			
1 year in 10 later than	March 24	April 5	April 16
2 years in 10 later than	March 15	March 29	April 12
5 years in 10 later than	February 23	March 18	March 29
Fall:			
1 year in 10 earlier than	November 19	November 1	October 25
2 years in 10 earlier than	November 23	November 10	October 27
5 years in 10 earlier than	December 2	November 20	November 6

[1] All data from Toccoa, Stephens County.

and a few large streams that are much as 100 feet wide.

Water Supply

Excellent sources of water are Toccoa Creek, Lake Louise, Hartwell Lake, and the Tugaloo, North Fork Broad, Middle Fork Broad, and Hudson Rivers, and Grove Creek and many other small streams. Many dams have been built to control flooding. These dams are widely scattered throughout the survey area. The reservoirs behind these structures are excellent sources of water. Dug and bored wells supply adequate water for the farms of the area, and many small ponds are available for livestock and fish.

Social and Industrial Development

Banks County was formed in 1958 from parts of Habersham, Franklin, and Jackson Counties. It covers an area of 231 square miles and had a population of 6,497 in 1960. Only small towns are in Banks County. The major towns are Homer and Hollingsworth within the county and Alto, Baldwin, Bellton, Gillsville, and Maysville along the borders between Banks and neighboring counties.

Banks County is mostly agricultural, but many part-time farmers work in industries in other counties. A garment factory, cotton gin, and a few sawmills are the main industries. Markets are limited within the county, but good paved roads make Toccoa, Gainesville, Athens, and Atlanta easily accessible. U.S. Highway No. 441 pases through the center of the county, and Interstate Highway No. 85 crosses the southeastern corner. The Southern Railroad is on the boundary between Banks, Hall, and Habersham Counties.

Flood-retarding structures, channel improvements, farm planning, and other means of soil and water conservation are being developed throughout Banks County. The lakes behind these structures provide water for towns and irrigation and are used for fishing, boating, and other recreational activities.

Stephens County was formed in 1905. It covers an area of about 180 square miles and had a population of 18,391 in 1960. Toccoa, the county seat, is the major town and had a population of 7,303 in 1960. Like many towns, Toccoa developed along the railroad that was constructed from Charlotte, North Carolina, to Atlanta, Georgia, in the late 1800's. The railroad and a good system of paved roads link Stephens County with markets in Westminister and Greenville, South Carolina, and Gainesville, Athens, and Atlanta, Georgia.

Although the county is mainly agricultural, industry has flourished in Toccoa during recent years. The industries include food-processing plants, cotton and synthetic-fabric mills, thread-processing mills, and factories for manufacturing heavy earthmoving equipment and home and office furniture. Workers no longer needed on farms have found employment in these enterprises.

Electricity and telephone service are available in all parts of Banks and Stephens Counties. Natural gas facilities are limited in Banks County and in the rural sections of Stephens County.

Farming

About 48 percent of the land in Banks County and 29.1 percent of the land in Stephens County was in farms in 1964. The number of farms in Banks County declined from 631 in 1959 to 523 in 1964. The number of farms in Stephens County declined from 496 in 1959 to 382 in 1964. The acreage used for the principal crops and fruit trees is given in table 10.

The main livestock enterprise in both counties is raising chickens. The number of chickens more than doubled in the period 1959 to 1964. Table 11 gives the number of livestock in both counties.

TABLE 10.—*Acreage of principal crops and number of fruit trees*

Crop	Banks County		Stephens County	
	1959	1964	1959	1964
Corn for all purposes	3,804	1,582	2,554	1,016
Cotton, harvested	666	2,323	348	116
Oats, threshed	875	89	632	96
Wheat for grain	1,832	363	615	303
Hay crops[1]	1,553	1,599	1,416	2,215
	Number	*Number*	*Number*	*Number*
Apple trees of all ages	775	786	1,247	849
Peach trees of all ages	11,372	9,455	1,188	706

[1] Excluding sorghum, soybean, cowpea, and peanut hay.

TABLE 11.—*Total number of livestock*

Livestock	Banks County		Stephens County	
	1959	1964	1959	1964
Cattles and calves	4,021	5,680	2,802	3,973
Hogs and pigs	3,906	1,152	2,383	691
Chickens[1]	37,355	84,611	55,360	123,692

[1] More than 4 months old.

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Glossary

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

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.

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.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

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.

Deep soil. Generally, a soil in which the depth to parent material or to other unconsolidated rock material not modified by soil forming processes is about 40 inches.

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

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

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

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.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Igneous rock. Rock that has been formed by the cooling of molten mineral material, such as granite, syenite, diorite, and gabbro.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. It may be limited either by the infiltration capacity of the soil or by the rate at which water is applied to the soil surface.

Metamorphic rock. Rock of any origin that has been greatly altered or completely changed physically by heat, pressure, and moisture. Igneous and sedimentary rocks may be changed to metamorphic rock, or one kind of metamorphic rock may be changed to another kind. Gneiss, schist, and slate are examples of metamorphic rock.

Mottled. 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.

Parent material (soil). The unconsolidated mass of rock material (or peat) from which soil has formed.

Parent rock (soil). The rock from which the parent material of soil was derived.

Natural soil drainage. 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 water-holding capacity.

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

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

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

Somewhat poorly drained soils are wet for significant periods but not all the time, and in Podzolic soils commonly have mottlings below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

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

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

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Plow layer. The soil ordinarily moved in tillage; equivalent to surface soil.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of 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.

Root zone. The part of the soil that plant roots can penetrate in search of water and plant nutrients.

Runoff. The water that flows off the land surface.

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

Saprolite. Disintegrated, somewhat decomposed rock that lies in its original place.

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 (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

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

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

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion 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."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Upland (geological). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Weathering. The action of the elements in altering the color, texture, composition, and structure of a soil.

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