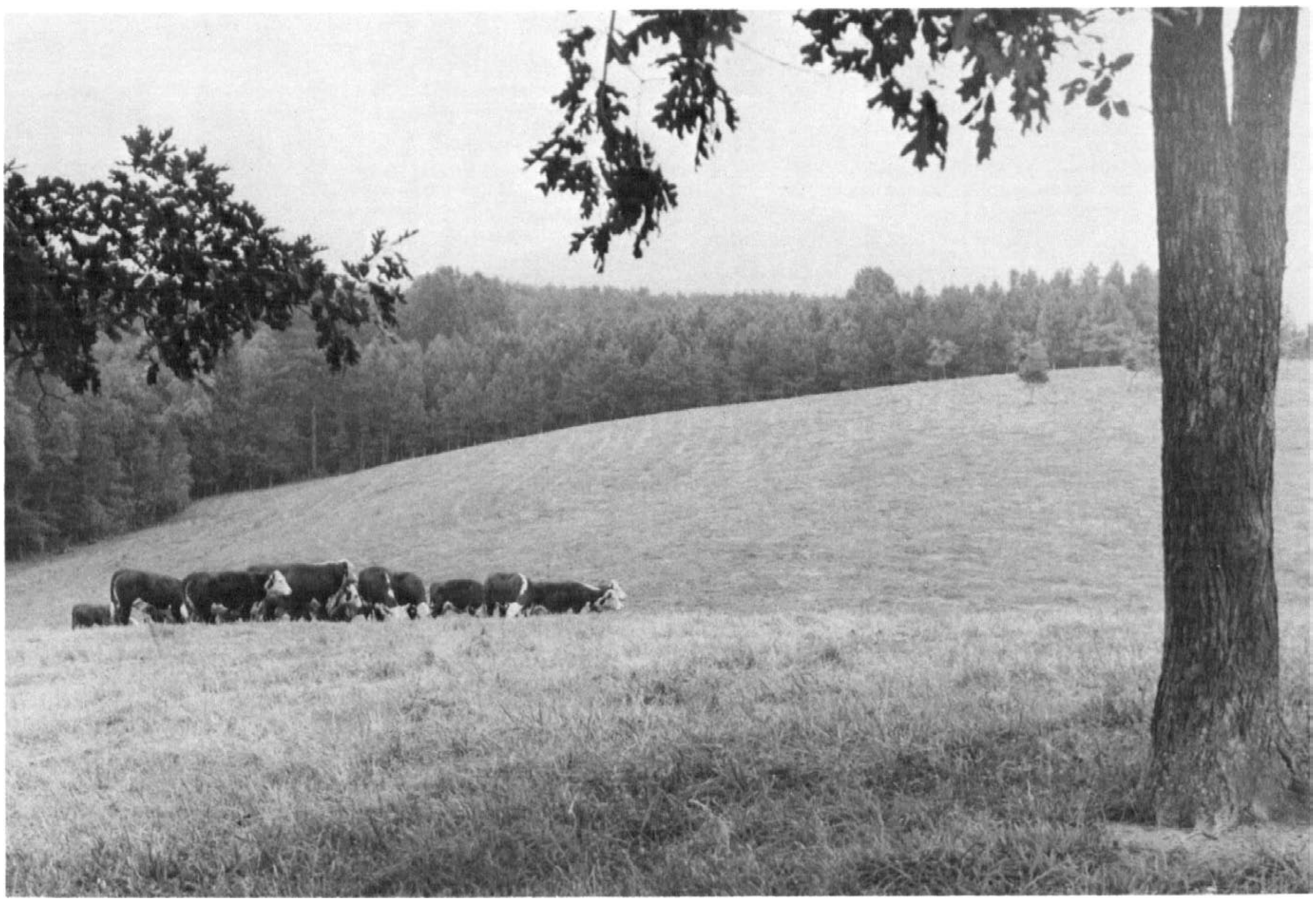
SOIL SURVEY OF

Barrow, Hall and Jackson Counties, Georgia



United States Department of Agriculture
Soil Conservation Service
In cooperation with
University of Georgia
College of Agriculture
Agricultural Experiment Stations

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

Major fieldwork for this soil survey was completed in the period 1969-72. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1972. This survey was made cooperatively by the Soil Conservation Service and the University of Georgia, College of Agriculture, Agricultural Experiment Stations. It is part of the technical assistance furnished to the Oconee River and Upper Chattahoochee River Soil and Water Conservation Districts.

HOW TO USE THIS SOIL 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 Barrow, Hall, and Jackson Counties are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

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

Finding and Using Information

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

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

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the 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, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils as Wildlife Habitat."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and for recreation areas in the section "Engineering Uses of the Soils."

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

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

Newcomers in Barrow, Hall, and Jackson Counties 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 "Additional Facts About the Counties."

Cover: **Typical area of Cecil sandy loam, 6 to 10 percent slopes, in Hall County.**

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Summary of Tables

SOIL SURVEY OF BARROW, HALL, AND JACKSON COUNTIES, GEORGIA

BY GEORGE G. BROCK, SOIL CONSERVATION SERVICE

FIELDWORK BY GEORGE G. BROCK, STANLEY M. ROBERTSON, AND C. L. MCINTYRE, SOIL CONSERVATION SERVICE

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

BARROW, HALL, AND JACKSON COUNTIES are in the northeastern part of Georgia (fig. 1). This survey area is bounded on the north by Lumpkin and White Counties. It joins Clarke, Oconee, Walton, and Gwinnett Counties on the south and Habersham, Banks, and Madison Counties on the east. The Chestatee River flows into the Chattahoochee River and forms Lake Sidney Lanier which separates the northwestern part of the area from Dawson and Forsyth Counties. Gwinnett County joins the southwestern part of the survey area.

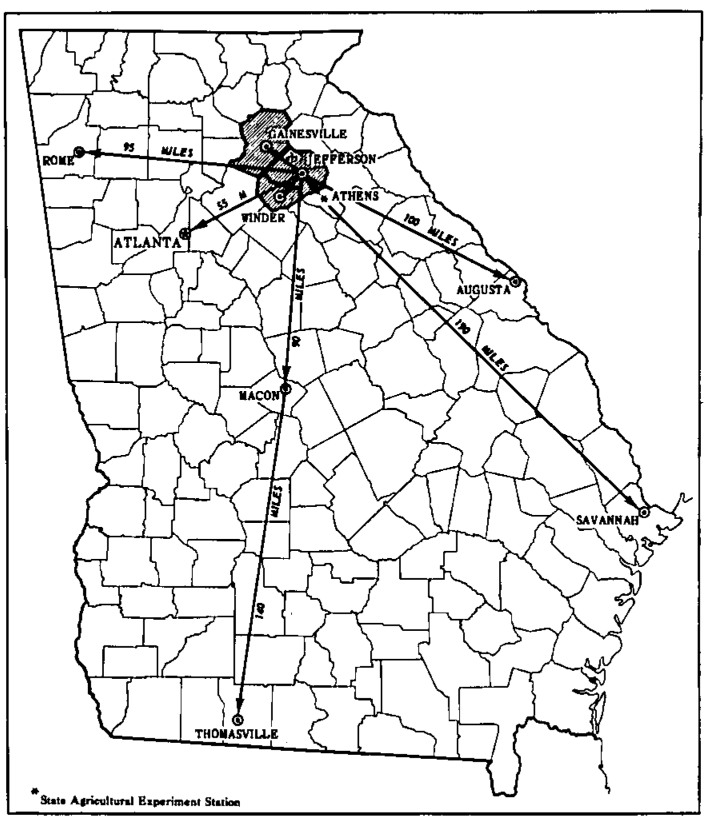

Figure 1.—**Location of Barrow, Hall, and Jackson Counties in Georgia.**

The total area of Barrow, Hall, and Jackson Counties is 894.5 square miles, or 572,480 acres. The soils in Barrow, Jackson, and southern part of Hall County are mainly rolling, but in northern Hall, they are rolling to hilly.

Most of the income from farming is from the sale of poultry, livestock, and livestock products. Corn, cotton, soybeans, small grains, and vegetables are grown for sale on a number of farms.

The population of the three counties was 82,714 in 1960 and 97,357 in 1970. About 58.6 percent of the people live in rural areas. Gainesville is the largest town and county seat of Hall County. Winder is the county seat of Barrow County, and Jefferson is the county seat of Jackson County.

The climate of the area is characterized by long, moderately hot summers and short, mild winters. In summer, daytime temperatures between 80° and 90° F. are common, but the nights are moderately cool. Occasionally the temperature drops to 15° F or less for short periods in winter. Precipitation averages about 55 inches per year.

How This Survey Was Made

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

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

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 layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Cecil sandy loam, 6 to 10 percent slopes, 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 at the back of this publication was prepared from 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. Three such kinds of mapping units are shown on the soil map of Barrow, Hall, and Jackson Counties: soil complexes, soil associations, and undifferentiated groups.

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

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils joined by a hyphen. Pacolet-Tallapoosa association, steep, is an example.

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

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in this survey. They are classified at the appropriate category of the soil classification system. Orthents of the Pacolet-Orthents complex, 10 to 25 percent slopes, severely eroded, is an example.

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

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

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

General Soil Map

The General Soil Map at the back of this survey shows, in color, the soil associations in Barrow, Hall, and Jackson 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 a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of 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.

The soil associations in Barrow, Hall, and Jackson Counties are discussed in the following pages.

1. Chewacla-Toccoa Association

Deep, somewhat poorly drained and well drained, nearly level, mainly brown and reddish-brown soils that are mottled in the subsoil or underlying layers; on flood plains

This association consists of nearly level soils on broad to narrow flood plains. It is along streams that flood more than once every 5 years. Most channels of these streams are well defined and have cut to bedrock in some places, especially in streams that flow out of the foothills in Hall County. In a few places, however, the channels are clogged and silted. The depth to the water table generally is 15 to 40 inches or more. Separate tracts of this association are scattered throughout the survey area.

This association makes up about 6 percent of the three counties. It is about 41 percent Chewacla soils, 30 percent Toccoa soils, and 29 percent minor soils.

In a representative profile of Chewacla soils the surface layer is brown loam about 7 inches thick. The upper part of the subsoil is brown loam about 5 inches thick. The middle layer is reddish-brown sandy clay loam mottled with grayish brown and gray and is about 26 inches thick. The lower layer is grayish-brown silty clay loam mottled with brown. It extends to a depth of 60 inches. The depth to rock is more than 6 feet.

In a representative profile of Toccoa soils the surface layer is reddish-brown loam about 7 inches thick. The next layer is loam or fine sandy loam that extends to a depth of 46 inches. The upper part of this layer is yellowish red and is about 11 inches thick. The lower part of this layer is mainly brown. The lower layer is pale-brown silty clay loam mottled with shades of gray and brown. It extends to a depth of 65 inches.

The minor soils in this association are the well-drained Wickham soils, the moderately well drained Altavista soils, the somewhat poorly drained Augusta and Cartecay soils, and the poorly drained Wehadkee soils.

Some areas of the naturally well-drained soils in this association are used for permanent grass-legume pasture and for such row crops as corn, sorghum, and soybeans. Some areas of the naturally poorly drained soils that have been artificially drained are suited to row crops, pasture, or trees.

No particular type or size of farm is dominant in this association. Generally, farms are not located entirely within the association, but extend into adjacent areas. About 40 percent of the association is wooded. About 30 percent is too wet for row crops. Floods are particularly damaging in areas where row crops are grown and are mechanically harvested.

Because of wetness and flooding, this association is severely limited for dwellings and industrial development. Many areas are favorable for development of habitat for wetland wildlife.

2. Pacolet-Madison-Tallapoosa Association

Shallow to deep, well-drained, sloping to very steep soils that have a red to yellowish-red subsoil; on narrow ridgetops and hillsides

This association consists of upland areas highly dissected and the slopes are steeper. These slopes range generally narrow with slopes ranging from 10 to 15 percent. Near the streams the landscape is highly dissected and the slopes are steeper. These slopes range from 10 to 45 percent.

This association makes up about 16 percent of the three counties. It is about 43 percent Pacolet soils, 33 percent Madison soils, 10 percent Tallapoosa soils, and 14 percent minor soils.

In a representative profile of Pacolet soils the surface layer is brown sandy loam about 5 inches thick. The subsoil is clay loam about 27 inches thick. The upper part of the subsoil is red, and the lower part is red with brownish-yellow weathered rock fragments. The underlying layer is weathered rock that has thin layers of red clay loam between fragments. This material crushes to sandy loam. It extends to a depth of 60 inches.

In a representative profile of Madison soils the surface layer is sandy loam about 5 inches thick. The upper part of the surface layer is grayish brown, and the lower part is brown. The upper part of the subsoil is yellowish-red clay loam that extends to a depth of 9 inches, and the lower part is red clay that extends to a depth of 29 inches. The next layer is red clay loam that extends to a depth of 36 inches. The lower layer is firm, red saprolite that contains tongues of clay loam. It extends to a depth of 50 inches. Mica flakes are common in the upper part of the profile, and there are many of these in the lower part. Depth to hard rock is generally more than 5 feet.

In a representative profile of Tallapoosa soils the surface layer is brown sandy loam about 2 inches thick. The subsurface layer is grayish-brown sandy loam about 5 inches thick. The subsoil is red clay loam about 9 inches thick. The underlying layer is tilted, thin layers of friable, grayish schist fragments that have thin coatings of red clay loam. It extends to a depth of 50 inches.

The minor soils in this association are mainly the somewhat excessively drained Louisburg soils.

Some of the smoother soils of less than 15 percent slopes are cultivated and used for permanent grass-legume pasture, but the steeper soils are wooded. The size of farms is small.

Because of steepness, this association generally has moderate or severe limitations for industrial sites and for some recreational uses, such as intensive play areas. It is better suited to wildlife habitat and woodland.

3. Cecil-Madison Association

Deep to moderately deep, well-drained, very gently sloping and gently sloping soils that have mainly a red to yellowish-red subsoil; on broad interstream divides

This association consists of large areas of well-drained soils on smooth plateaus and gently sloping soils on hillsides. Slopes mainly range from 2 to 10 percent.

This association makes up about 39 percent of the three counties. It is about 70 percent Cecil soils, 11 percent Madison soils, and 19 percent minor soils.

In a representative profile of Cecil soils the surface layer is dark yellowish-brown sandy loam about 7 inches thick. The subsoil extends to a depth of about 42 inches. The upper part of the subsoil is yellowish-red clay loam about 5 inches thick, the middle part is red clay about 20 inches thick, and the lower part is red clay loam. The underlying layer is reddish saprolite material that crushes to loam. It extends to a depth of 60 inches. Bedrock is at a depth of 6 to 8 feet in most places.

In a representative profile of Madison soils the surface layer is sandy loam about 5 inches thick. The upper part of the surface layer is grayish brown, and the lower part is brown. The upper part of the subsoil is mainly red clay that extends to a depth of about 29 inches. Beneath this layer is red clay loam that extends to a depth of about 36 inches. The lower layer is firm, red saprolite that contains tongues of clay loam and extends to a depth of about 50 inches. Mica flakes are common in the upper part of the profile, and many are in the lower part. Depth to hard rock is generally more than 5 feet.

The minor soils in this association are mainly the well-drained Hiwassee and Appling soils on the uplands and the Cartecay and Chewacla soils on alluvial plains. In some areas of this association, Appling soils are in moderately large acreages, but not large enough to be a dominant soil in the association. Localities where Appling soils are prominent are mainly in the eastern part of Jackson County and in the vicinity of Russell, Winder, and Gainesville, Georgia.

About 60 percent of the acreage is in field crops or is pastured. About 30 percent is wooded or is idle. The rest is used for roads, residential areas, small businesses, or other nonfarm purposes. This association is well suited to cultivated crops, pasture, small grains, sorghum, soybeans, or any of the locally grown crops. The farms are small, averaging 100 acres or less, and are operated part-time by owners and tenants.

This association has mainly slight to moderate limitations for uses associated with community development and the more common recreational uses.

4. Pacolet-Madison Association

Moderately deep and deep, well-drained, sloping to steep soils that have a red to yellowish-red subsoil; mainly on hillsides

This association consists of sloping soils on narrow to medium ridges and strongly sloping to steep soils on hillsides. Small drainageways are numerous. The association generally joins or is near soil association 3. Soils in this association are steeper than those in association 3, and in many places, hard rock is nearer the surface in this association. Slopes range from 10 to 25 percent.

This association makes up about 33 percent of the three counties. It is about 58 percent Pacolet soils, 16 percent Madison soils, and 26 percent minor soils.

In a representative profile of Pacolet soils the surface layer is brown sandy loam about 5 inches thick. The subsoil is clay loam about 27 inches thick. The upper part of the subsoil is red, and the lower part is red with brownish-yellow, weathered rock fragments. The underlying layer is weathered rock that has thin layers of red clay loam between fragments that crush to sandy loam. It extends to a depth of 60 inches.

In a representative profile of Madison soils the surface layer is sandy loam about 5 inches thick. The upper part of the surface layer is grayish brown, and the lower part is brown. The upper part of the subsoil is yellowish-red clay loam that extends to a depth of 9 inches. The next layer is red clay that extends to a depth of 29 inches. The lower part of the subsoil is red clay loam that extends to a depth of 36 inches. The underlying layer is firm, red saprolite that contains tongues of clay loam. It extends to a depth of 50 inches. Mica flakes are common in the upper part of the profile, and there are many of these flakes in the lower part. Hard rock is generally at a depth of more than 5 feet.

The minor soils in this association are the well-drained Cecil, Musella, and Gwinnett soils on the uplands and Chewacla, Cartecay, and Wehadkee soils along the small drainageways.

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

Most of the farms in this association are small and are operated by their owners. In addition to crops, broilers and beef cattle are raised. Because slopes are 10 percent or more, the soils in this association are severely limited for such nonfarm uses as development of intensive play areas and sites for light industry.

5. Gwinnett-Musella-Pacolet Association

Shallow and moderately deep, well-drained, gently sloping to steep soils that have a dark-red to red subsoil; on ridgetops and hillsides

This association consists of gently sloping soils on narrow to medium ridges and sloping to steep soils on hillsides of the uplands. Slopes range from 6 to 35 percent, but in about 60 percent of the area slopes are less than 15 percent. Small drainageways are numerous.

This association makes up about 6 percent of the three counties. It is about 70 percent Gwinnett soils, 15 percent Musella soils, and 7 percent Pacolet soils. The remaining 8 percent is other minor soils.

In a representative profile of the Gwinnett soils the surface layer is dark reddish-brown clay loam about 5 inches thick. The subsoil is dark-red clay in the upper 25 inches and dark-red clay loam in the lower 5 inches. The underlying parent material is reddish-yellow weathered gneiss, diorite, and biotite rock fragments and loamy material. Depth to hard rock is more than 5 feet.

In a representative profile of Musella soils the surface layer is dark reddish-brown cobbly clay loam about 5 inches thick. The subsoil is dark-red gravelly clay loam about 12 inches thick. The C horizon is a mixture of dark-red clay loam and dark-colored fractured rock that extends to a depth of 30 inches. This layer is about 60 percent rock fragments and 40 percent clay loam.

In a representative profile of Pacolet soils the surface layer is brown sandy loam about 5 inches thick. The subsoil is clay loam about 27 inches thick. The upper part of the subsoil is red, and the lower part is red with brownish-yellow weathered rock fragments. The underlying layer is weathered rock that has thin layers of red clay loam between fragments. This material crushes to sandy loam. It extends to a depth of 60 inches.

Minor soils in this association are the well-drained Hiwassee, Cecil, Chestatee, and Madison soils and the somewhat excessively drained Louisburg soils.

On the smoother ridges and slopes, the Gwinnett and Pacolet soils in this association are used for temporary pasture, permanent pasture, trees, and, to a limited extent, for cultivated crops. The clay loam surface layer of some of the Gwinnett soils and the gravelly surface layer of the Musella soils make these soils difficult to cultivate in row crops. The steeper soils are wooded. The size of farms is generally small, ranging to about 100 acres.

This association is also used for wildlife, particularly for hunting deer and wild turkey, and to a limited extent, for recreation. Because of steepness and coarse fragments, this association has moderate or severe limitations for uses associated with community development, such as dwelling sites, septic-tank absorption fields, and roads or streets.

Descriptions of the Soils

This section describes the soil series and mapping units in Barrow, Hall, and Jackson Counties. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

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

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Orthents, for example, do not belong to a soil series, but nevertheless, are listed in alphabetic order along with the soil series.

The symbol of each mapping unit precedes the name of the mapping unit. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and woodland group in which the mapping unit has been placed. The page for the description of each capability unit can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*8*).[1]

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those of the soil maps in nearby counties published at different dates. Differences result because of a better knowledge of soils, modifications in the series concepts, intensity of mapping, and the extent of soils in the survey area.

Altavista Series

The Altavista series consists of moderately well drained soils that formed in old alluvium on long, narrow, low stream terraces adjacent to the larger streams. Slopes range from 2 to 6 percent.

In a representative profile the surface layer is light olive-brown sandy loam about 7 inches thick. The upper part of the subsoil is yellowish-brown sandy clay loam, about 5 inches thick. The middle layer is yellowish-brown clay loam, mottled with shades of red, gray, and brown. It is 24 inches thick. The lower layer is and brown. It is 24 inches thick. The lower layer is brownish-yellow sandy clay loam, mottled with shades of gray and red. It extends to a depth of 42 inches. The underlying layer is mottled light-gray, brownish-yellow, and red sandy clay loam that extends to a depth of 60 inches. Depth to hard rock is more than 5 feet.

[1] Italic numbers in parentheses refer to Literature Cited p. 58.

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

Soil	Barrow County	Hall County	Jackson County	Total	
				Area	Extent
	Acres	*Acres*	*Acres*	*Acres*	*Percent*
Altavista sandy loam, 2 to 6 percent slopes	45	1,420	960	2,425	0.4
Appling sandy loam, 2 to 6 percent slopes	4,130	1,380	2,690	8,200	1.4
Appling sandy loam, 6 to 10 percent slopes	4,500	5,320	6,580	16,400	2.9
Appling sandy loam, 10 to 15 percent slopes	1,230	2,200	2,020	5,450	1.0
Augusta loam	350	960	460	1,770	.3
Cartecay and Chewacla soils	3,800	2,320	7,930	14,050	2.5
Cecil sandy loam, 2 to 6 percent slopes	14,400	2,730	24,390	41,520	7.3
Cecil sandy loam, 6 to 10 percent slopes	20,650	7,010	22,000	49,660	8.7
Cecil sandy clay loam, 6 to 10 percent slopes, eroded	12,500	12,220	53,780	78,500	13.7
Chestatee stony sandy loam, 15 to 25 percent slopes	410	1,840	1,050	3,300	.6
Chewacla loam, frequently flooded	750	350	2,300	3,400	.6
Chewacla-Wehadkee complex	2,660	2,000	5,500	10,160	1.8
Gwinnett clay loam, 6 to 10 percent slopes, eroded	1,200	8,560	4,740	14,500	2.5
Gwinnett clay loam, 10 to 25 percent slopes, eroded	1,070	16,500	6,340	23,910	4.2
Hiwassee loam, 2 to 6 percent slopes	85	500	780	1,365	.2
Hiwassee loam, 6 to 10 percent slopes	40	1,240	380	1,660	.3
Hiwassee loam, 10 to 15 percent slopes	70	1,330		1,400	.2
Hiwassee clay loam, 2 to 10 percent slopes, eroded		2,220	160	2,380	.4
Louisburg sandy loam, 10 to 25 percent slopes	2,760	6,270	3,720	12,750	2.2
Madison sandy loam, 2 to 6 percent slopes	1,220	1,730	1,250	4,200	.7
Madison sandy loam, 6 to 10 percent slopes	1,470	4,020	950	6,440	1.1
Madison sandy loam, 10 to 15 percent slopes	860	6,540	400	7,800	1.4
Madison sandy loam, 15 to 25 percent slopes	860	16,500	700	18,060	3.2
Madison sandy clay loam, 6 to 10 percent slopes, eroded	1,240	12,360	2,370	15,970	2.8
Madison sandy clay loam, 10 to 15 percent slopes, eroded	760	31,340	3,250	35,350	6.2
Musella cobbly clay loam, 6 to 15 percent slopes	220	2,400	400	3,020	.5
Musella cobbly clay loam, 15 to 35 percent slopes	1,100	7,800	500	9,400	1.6
Pacolet sandy loam, 15 to 25 percent slopes	3,470	14,360	3,940	21,770	3.8
Pacolet-Orthents complex, 10 to 25 percent slopes, severely eroded	150	160	1,980	2,290	.4
Pacolet-Tallapoosa association, steep	680	36,140	770	37,590	6.6
Pacolet soils, 10 to 15 percent slopes, eroded	23,270	26,150	54,720	104,140	18.2
Toccoa soils	3,250	4,590	2,710	10,550	1.8
Wickham sandy loam, 2 to 6 percent slopes	240	1,140	1,720	3,100	.5
Total	109,440	241,600	221,440	572,480	100.0

Natural fertility and content of organic matter are low in these soils. Permeability is moderate, and available water capacity is medium. The root zone is deep. Reaction is strongly acid to medium acid in the upper part of the profile and strongly acid in the lower part.

These soils are suited to most crops grown in the survey area, and they can be cultivated intensively. The crops respond well if fertilizer is applied according to results of soil tests and other good management is practiced. Slightly more than half of the acreage is used as pasture or is cultivated, and the rest is idle or wooded. In the wooded areas sweetgum, yellow-poplar, hickory, white oak, and loblolly pine are the chief trees.

Representative profile of Altavista sandy loam, 2 to 6 percent slopes, in Hall County; 0.5 mile east of Gillsville on Georgia Highway 52, 2.2 miles southwest on a dirt county road to crossroads, and 0.5 mile northwest to a roadbank 200 feet east of West Fork of Little River.

Ap—0 to 7 inches, light olive-brown (2.5Y 5/4) sandy loam; weak, fine, granular structure; very friable; many fine roots and pores; medium acid; clear, smooth boundary.

B1—7 to 12 inches, yellowish-brown (10YR 5/6) sandy clay loam; weak, fine, subangular blocky structure; friable; many fine roots and pores; medium acid; gradual, smooth boundary.

B21t—12 to 18 inches, yellowish-brown (10YR 5/6) clay loam; few, fine, faint yellowish-red (5YR 5/6) mottles; weak, medium, subangular blocky structure; friable; patchy clay films on ped faces; medium acid; gradual, smooth boundary.

B22t—18 to 36 inches, yellowish-brown (10YR 5/6) clay loam; common, medium, distinct light brownish-gray (2.5Y 6/2) and common, medium, faint strong-brown (7.5YR 5/6) mottles; moderate, coarse, subangular blocky structure; friable; few fine mica flakes; patchy clay films on ped faces; medium acid; gradual, smooth boundary.

B23t—36 to 42 inches, brownish-yellow (10YR 6/6) sandy clay loam; common medium, prominent light brownish-gray (2.5Y 6/2) and red (2.5YR 5/6) mottles; weak, coarse, subangular blocky structure; friable; few, fine mica flakes; strongly acid; gradual, smooth boundary.

B3—42 to 60 inches, mottled, light-gray (2.5Y 7/2), brownish-yellow (10YR 6/6), and red (2.5YR 7/6) sandy clay loam; weak, medium, subangular blocky structure; firm; few pebbles; strongly acid.

The solum is about 40 to 60 inches thick. The Ap horizon is dark brown through grayish brown, dark yellowish brown, light olive brown, olive, and olive gray in color. The Ap horizon is 4 to 7 inches thick, and gravel content ranges from none to few. The B2t horizon is clay loam or sandy clay loam. It is pale brown through light brownish yellow, yellowish brown, and strong brown in color. Few to common mica flakes are present in all of the B2t horizons. The B22t horizon has few to common mottles in shades of gray, brown, and red.

Altavista soils are commonly near Augusta, Chewacla, Toccoa, and Wickham soils. They are better drained and have gray mottles deeper than those in the B horizon of the Augusta soils. They are better drained than Chewacla soils, and they have well developed B horizons that are lacking in Toccoa soils. They are less well drained than the Wickham soils.

AlB—Altavista sandy loam, 2 to 6 percent slopes. This is the only Altavista soil mapped in the survey area. It is on terraces along the flood plains of the larger streams. Mapped areas generally range from 5 to 20 acres.

Included with this soil in mapping are small areas that have 0 to 2 percent slopes and are subject to brief flooding in winter and early in spring. Also included are similar soils that are eroded to the extent that a few shallow gullies and an occasional deep gully have formed. A few small areas of Wickham soils are present in places. The inclusions make up about 5 to 15 percent of the mapped areas.

Because this Altavista soil has a deep root zone, good tilth, and slopes are very gently sloping, it is suited to most of the crops grown locally. The crops respond well if fertilizer is applied according to results of soil tests and other good management practices are used. Capability unit IIe–2; woodland suitability group 2w8.

Appling Series

The Appling series consists of well-drained soils that formed in material weathered from gneiss and granitoid gneiss that are sometimes mixed with schist. These soils are on medium to narrow ridgetops and moderately long hillsides. Slopes range from 2 to 15 percent.

In a representative profile the surface layer is dark grayish-brown sandy loam about 7 inches thick. It is underlain by a light olive-brown sandy loam about 3 inches thick. The upper part of the subsoil is strong-brown sandy clay loam that extends to a depth of about 18 inches. The next layer is clay or sandy clay that extends to a depth of 40 inches. This layer is strong brown in the upper part and yellowish red in the lower part, and it is mottled with shades of red and yellow. Below this is yellowish-red sandy clay loam mottled with shades of yellow that extends to a depth of 72 inches.

Natural fertility and content of organic matter are low in these soils. Permeability is moderate, and available water capacity is medium. The root zone is deep. According to field observations these soils are 10 to 20 days later warming up in spring than are Cecil soils. Reaction is strongly acid throughout.

Most of the acreage has been cultivated, but where slopes are greater than 10 percent, the land use has reverted to trees, mostly shortleaf pine and loblolly 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.

Representative profile of Appling sandy loam, 2 to 6 percent slopes, in Jackson County; 1.8 miles east of Hoschton on Georgia Highway 332, 0.5 mile south on a dirt road on west side of road, and 0.5 mile west of Indian Creek:

Ap—0 to 7 inches, dark grayish-brown (2.5Y 4/2) sandy loam; weak, fine, granular structure; very friable; many fine roots and pores; strongly acid; gradual, wavy boundary.

A2—7 to 10 inches, light olive-brown (2.5Y 5/4) sandy loam; few, large, distinct strong-brown (7.5YR 5/6) mottles; moderate, medium, granular structure; friable; common fine roots; few small pores; strongly acid; gradual, wavy boundary.

B1—10 to 18 inches, strong-brown (7.5YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; friable; many fine pores; few pores filled with organic matter; few fine mica flakes; strongly acid; gradual, wavy boundary.

B21t—18 to 40 inches, strong-brown (7.5YR 5/6) clay; common, medium, prominent red (2.5YR 5/6) and many, medium, distinct brownish-yellow (10YR 6/6) mottles; moderate, medium and fine, subangular blocky structure; friable; about 3 to 4 percent gravel; common mica flakes; films on some ped faces; strongly acid; gradual, wavy boundary.

B22t—40 to 48 inches, yellowish-red (5YR 5/6) clay; common, medium, prominent red (2.5YR 5/6) and many, medium, distinct brownish-yellow (10YR 6/6) mottles; moderate, medium, subangular blocky structure; friable; few peds coated with brown (7.5YR 4/4); few coarse sand grains; patchy clay films on some ped faces; strongly acid; gradual, wavy boundary.

B3—48 to 58 inches, yellowish-red (5YR 5/6) sandy clay loam; common, medium, prominent brownish-yellow (10YR 6/6) and yellow (2.5Y 8/6) mottles; weak, medium, subangular blocky structure; friable; common fine mica flakes; few clay films on some ped faces; common fine pores; few coarse sand grains and pebbles; strongly acid; gradual, wavy boundary.

C—58 to 72 inches, yellowish-red (5YR 5/6) sandy clay loam; many, medium, prominent yellow (10YR 7/6) mottles; structureless; friable; many fine mica flakes; common coarse sand grains; strongly acid.

The solum ranges from 40 to 62 inches in thickness. Hard rock is 5 to 20 feet deep. The Ap horizon is dark grayish brown, grayish brown, yellowish brown, or pale olive. It is 6 to 10 inches thick. The B1 horizon is sandy clay loam or clay loam. The B2t horizon is yellowish-brown, strong-brown, reddish-yellow, and yellowish-red clay, clay loam, or sandy clay that has fine to coarse, distinct, prominent red, yellowish-red, pale-yellow, or very pale brown mottles. The C horizon is yellowish-red or mottled brown, light yellowish-brown, pale-brown, yellowish-red, red, and pinkish-white friable sandy loam or loam.

Appling soils are near Cecil, Louisburg, Madison, and Pacolet soils. They have a less red and a more mottled B horizon than Cecil, Madison, and Pacolet soils. They have more clay in the B horizon than Louisburg soils.

ApB—Appling sandy loam, 2 to 6 percent slopes. This soil is on moderately broad ridgetops of the uplands. It has the profile described as representative of the series.

Included with this soil in mapping are a few depressions where similar soils that have gray mottles in the subsoil are present. Also included are a few small areas of a similar soil that contains slightly less clay in the subsoil than Appling soils. In places most of the original surface layer has been removed by erosion, and a few shallow gullies have formed. The inclusions make up about 5 to 10 percent of the mapped areas.

This soil has good tilth. It responds well to good management, especially to additions of fertilizer. It is cultivated extensively and is suited to all crops grown locally. In wooded areas the vegetation is mostly loblolly pine, shortleaf pine, white oak, red oak, and sweetgum. Capability unit IIe-2; woodland suitability group 3o7.

ApC—Appling sandy loam, 6 to 10 percent slopes. This soil generally is on moderately long side slopes. It has a profile similar to that described as representative of the series, but the surface layer is yellowish brown or grayish brown, and the subsoil is clay or clay loam.

Included with this soil in mapping are a few eroded areas where the surface layer is strong-brown or yellowish-red sandy clay loam. Also included are a few small areas of similar soils near small drainageways that have gray mottled in the subsoil. In a few areas Cecil soils are included. The inclusions make up about 5 to 10 percent of the mapped areas.

This soil is well suited to all crops or pasture plants grown locally. Most of the acreage has been cultivated but about half of it has reverted to trees. This soil responds well to good management, especially to the addition of fertilizer according to results of soil tests. In wooded areas the vegetation is mostly loblolly pine, shortleaf pine, red oak, white oak, and sweetgum. Capability unit IIIe-2; woodland suitability group 3o7.

ApD—Appling sandy loam, 10 to 15 percent slopes. This soil generally is in 10 to 30 acre areas on hillsides, and it is often close to large drainageways. The surface layer is grayish-brown sandy loam 6 to 7 inches thick over a strong-brown to yellowish-red sandy clay or clay subsoil that has brownish mottles in the lower part.

Included with this soil in mapping are a few small areas of similar soils that have lesser and greater slopes and a few small areas of Chewacla, Louisburg, or Cecil soils. Also included are a few small areas of similar soils that are severely eroded. The inclusions make up about 10 percent of the mapped areas.

This soil is not well suited to intensive cultivation, but is well suited to pasture and hay crops. It responds well to good management. The hazard of erosion is severe if this soil is cultivated and not protected. Most of this soil is in pines; therefore very little is cultivated or used for pasture or hay. Capability unit IVe-1; woodland suitability group 3o7.

Augusta Series

The Augusta series consists of nearly level, somewhat poorly drained soils that formed in old deposits of alluvium. These soils are mainly on low terraces along the major streams throughout Barrow, Hall, and Jackson Counties. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is dark grayish-brown loam about 6 inches thick. The subsurface layer is grayish-brown loam about 6 inches thick. The subsoil is clay loam that extends to a depth of 60 inches. The upper part of the subsoil is yellowish brown, and it is mottled with light olive gray. It extends to a depth of about 21 inches. The middle part is grayish brown, is mottled with shades of yellow, and is 27 inches thick. The lower part of the subsoil is gray, and is mottled with shades of brown.

Natural fertility and content of organic matter are low in these soils. Permeability is moderate, and available water capacity is medium. The water table is near the surface, especially during winter and early in spring. The plow layer has good tilth. The depth of the root zone is dependent on the depth of the water table during the growing season. Reaction is strongly acid throughout.

Augusta soils are suited to farming, although flooding and wetness are hazards. The acreage is mostly pastured, but about one-fourth of it is cultivated and wooded. The vegetation is white oak, yellow-poplar, sweetgum, and mixed stands of pines.

Representative profile of Augusta loam in Hall County; 0.5 mile east of Gillsville on Georgia Highway 52, 2.5 miles southwest to foot of hill, 200 feet north of paved road, 200 yards east of the North Oconee River:

Ap—0 to 6 inches, dark grayish-brown (2.5Y 4/2) loam; weak, fine, granular structure; very friable; many fine roots and pores; few mica flakes; strongly acid; gradual, smooth boundary.

A2—6 to 12 inches, grayish-brown (10YR 5/2) loam; few, medium, distinct strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; friable; common fine mica flakes; strongly acid; gradual, smooth boundary.

B21t—12 to 21 inches, yellowish-brown (10YR 5/6) clay loam; common, fine, distinct light olive-gray (5Y 6/2) mottles; moderate, coarse, subangular blocky structure; friable; few fine mica flakes; common fine roots, strongly acid; diffuse, smooth boundary.

B22tg—21 to 48 inches, grayish-brown (2.5Y 5/2) clay loam; many, coarse, distinct brownish-yellow (10YR 6/8) mottles; weak, coarse, subangular blocky structure; friable; few mica flakes; strongly acid; gradual, smooth boundary.

B23tg—48 to 60 inches, gray (N 6/0) clay loam; many, medium, prominent yellowish-brown (10YR 5/8) mottles; weak, coarse, subangular blocky structure; friable; common fine mica flakes; strongly acid.

The solum ranges from 56 to 72 inches in thickness. The Ap horizon is pale-brown, dark grayish-brown, or pale-yellow sandy loam 6 to 9 inches thick. The B horizons are clay loam or sandy clay loam. The B21t horizon is yellowish brown or light olive brown and has grayish-brown or light olive-gray mottles. The B22tg horizon is gray, light gray, or grayish brown and has many mottles in shades of brown. Mica flakes are few to many in all horizons.

Augusta soils commonly are mainly near Altavista, Appling, Chewacla, Cartecay, and Wehadkee soils. They are wetter than Altavista and Appling soils. They exhibit a higher expression of horizonation and structure than Chewacla and Cartecay soils and are less wet than Wehadkee soils.

Au—Augusta loam. This is the only Augusta soil mapped in Barrow, Hall, and Jackson Counties. It is on low terraces along the flood plains of larger streams. This soil is subject to brief flooding in winter and early in spring. Mapped areas generally range from about 5 to 25 acres. Slopes are 0 to about 2 percent.

Included with this soil in mapping are small areas of coarse textured sandy overwash 5 to 12 inches thick. Also included are small areas of Altavista soils.

The seasonal high water table influences the depth to which roots normally grow; therefore, the range of suitable crops is somewhat limited. Drainage is needed to remove excess surface water and improve internal drainage if most crops are to be grown. Most areas are used for pasture, for which the soil is well suited. Corn is grown in some areas. Capability unit IIIw–3; woodland suitability group 2w8.

Cartecay Series

The Cartecay series consists of nearly level, moderately well drained to somewhat poorly drained soils. These soils are on flood plains of creeks and rivers. They formed in loamy sediment washed from surrounding uplands. They are subject to flooding when rains are excessive.

In a representative profile the surface layer is yellowish-red silt loam about 6 inches thick. It is underlain by brown silt loam that has reddish-brown mottles and is about 4 inches thick. The next layer is yellowish-red sandy loam about 8 inches thick. Below this is reddish-brown sandy loam mottled with shades of brown and about 13 inches thick. The next layer is mottled, reddish-brown and grayish-brown silt loam that extends to a depth of 50 inches.

Natural fertility and content of organic matter are low in these soils. Permeability is moderately rapid, and available water capacity is medium. The root zone is moderately deep. Reaction is medium acid throughout.

Cartecay soils are suited to few cultivated crops. Most cleared areas are in hay, pasture, or corn, and these crops grow well if adequate drainage is provided. The woody vegetation is mainly gums, white oak, and yellow-poplar.

Representative profile of Cartecay silt loam in an area of Cartecay and Chewacla soils in Jackson County; 4.0 miles southeast of Jefferson, 120 yards south of paved county road along Big Curry Creek:

Ap—0 to 6 inches, yellowish-red (5YR 5/6) silt loam; weak, fine, granular structure; friable; common fine mica flakes; medium acid; gradual, smooth boundary.

A2—6 to 10 inches, brown (7.5YR 4/4) silt loam; common, medium, faint reddish-brown (5YR 4/4) mottles; weak, fine, granular structure; friable; common fine roots and mica flakes; medium acid; clear, smooth boundary.

C1—10 to 18 inches, yellowish-red (5YR 4/6) sandy loam; massive; very friable; few fine mica flakes; thin strata of silt loam and clay loam; medium acid; clear, smooth boundary.

C2—18 to 31 inches, reddish-brown (5YR 4/4) sandy loam; common, fine, distinct grayish-brown (10YR 5/2) and common, medium, distinct brown (10YR 5/3) mottles; massive; very friable; medium acid; clear, smooth boundary.

C3—31 to 50 inches, mottled, reddish-brown (5YR 4/4) and grayish-brown (10YR 5/2) silt loam; massive; friable; common fine mica flakes; medium acid.

The Ap horizon is silt loam, loam, sandy loam, or loamy sand that ranges from dark grayish brown to reddish brown and yellowish red in color. The C horizons are mainly sandy loam, fine sandy loam, or loam. The C1 horizon has matrix colors of yellowish red, brown, and strong brown. In some profiles, between depths of 10 and 40 inches, very thin strata of clay loam or sandy clay loam are present. Mottles of chroma of 2 or less are within a depth of 20 inches. The C2 horizon and the C3 horizon are reddish brown, gray, or grayish brown and are distinctly mottled. Underlying the C3 horizon in some profiles are sandy or gravelly strata. Few to many fine to medium mica flakes are in the C horizons.

Cartecay soils are mainly near Chewacla, Toccoa, and Wehadkee soils. They are not as well drained as the Toccoa soils. They contain less clay between depths of 10 to 40 inches than Chewacla soils and are less wet than Wehadkee soils.

Cc—Cartecay and Chewacla soils. This is an undifferentiated group, chiefly of Cartecay and Chewacla soils. These soils are on flood plains along the major streams and their tributaries in areas of 10 to 400 acres. Slopes range from 0 to 2 percent. These soils are together without regularity of pattern or proportion. An individual area may contain either or both of these soils, and many mapped areas contain both Cartecay and Chewacla soils. Of the total acreage of this undifferentiated group mapped in the county, about 50 percent is Cartecay soils, about 40 percent Chewacla soils, and the rest is included soils.

The Cartecay soil has a profile similar to the one described as representative of the Cartecay series, but the texture of the surface layer ranges from silt loam to loamy sand. The Chewacla soil has a profile similar to the one described as representative of the Chewacla series, but the texture is mainly loam, sandy loam, or silt loam.

Included with these soils in mapping are small areas of Wehadkee and Toccoa soils. Also included are small areas of soils similar to Cartecay soils except they are sandy.

Cartecay and Chewacla soils were not separated in mapping because of their similarity in behavior. Flooding and wetness are the limiting factors that greatly influence the current use and management of these soils.

Because of the high water table and flooding during periods of heavy rainfall, these soils are limited in suitability to a small range of crops. When adequately drained these soils are suited to pasture, corn, and hay crops. About half of the acreage is cultivated or is in pasture, and the rest is in such trees as oaks, gums, and yellow-poplar. Capability unit IIIw–2; woodland suitability group 2w8.

Cecil Series

The Cecil series consists of well-drained soils that formed in material weathered from granite, gneiss, and schist. These soils are in the uplands on broad plateaus, on ridgetops, and on hillsides. Slopes range from 2 to 10 percent. Cecil soils are widely distributed throughout the survey area.

In a representative profile the surface layer is dark yellowish-brown sandy loam about 7 inches thick. The subsoil extends to a depth of about 42 inches. The upper part of the subsoil is yellowish-red clay loam about 5 inches thick, the middle part is red clay about 20 inches thick, and the lower part is red clay loam about 10 inches thick. The underlying material is reddish saprolite material that crushes to loam and extends to a depth of 60 inches. Bedrock is at a depth of 6 to 8 feet in most places.

Natural fertility is low in these soils. They contain little organic matter. Permeability is moderate, and available water capacity is medium. Reaction is strongly acid throughout. These soils have good tilth if they are not eroded and have a deep root zone.

Cecil soils are extensive in the three counties. These soils are well suited to such crops as cotton, corn, small grains, and pasture, and they are used extensively for these crops. The less sloping Cecil soils are considered by most farmers in the area to be some of the best suited to crops in the three counties. The vegetation in wooded areas is chiefly loblolly pine, shortleaf pine, white oak, red oak, and sweetgum.

Representative profile of Cecil sandy loam, 6 to 10 percent slopes, in Jackson County; 0.25 mile south on Georgia Highway 82 from intersection of Georgia Highway 346, 0.7 mile west on a field road on north side of road:

Ap—0 to 7 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, fine, granular structure; very friable; many fine roots and pores; strongly acid; gradual, smooth boundary.

B1t—7 to 12 inches, yellowish-red (5YR 4/8) clay loam; weak, medium, subangular blocky structure; friable; common fine roots, few root holes; few pores; patchy clay films on ped faces; strongly acid; gradual, smooth boundary.

B2t—12 to 32 inches, red (2.5YR 4/8) clay; moderate, medium, subangular blocky structure; firm; few roots; about 2 percent gravel; continuous clay films on ped faces; strongly acid; gradual, smooth boundary

B3—32 to 42 inches, red (2.5YR 5/8) clay loam; weak, medium and coarse, subangular blocky structure; firm; few mica flakes; patchy clay films on some ped faces; few roots; about 2 percent gravel; strongly acid; gradual, smooth boundary.

C—42 to 60 inches, red (2.5YR 4/8) saprolite material; rock structure; firm but crushes to loam; common fine mica flakes; strongly acid.

The solum ranges from 40 to 58 inches in thickness in most places. The depth to bedrock is mainly between 6 and 8 feet but ranges to 50 feet in places. In the areas of less eroded soils, the Ap horizon is reddish-brown to dark yellowish-brown, brown to dark-brown sandy loam 4 to 8 inches thick, but in the areas of eroded soil the Ap horizon is yellowish-red or brown sandy clay loam. Gravel on the surface ranges from none to common. The clay content of the B2t horizon ranges from 35 to 55 percent.

Cecil soils are near Madison, Appling, Hiwassee, Louisburg, and Pacolet soils. They have a B2t horizon that is mainly red, whereas in the Appling soils it is yellowish red or brown and is mottled. They contain less mica than Madison soils and are less sticky and less reddish in the surface layer than Hiwassee soils. They contain more clay in the B2t horizons and have a thicker solum than Louisburg soils. Cecil soils have a thicker solum than Pacolet soils.

CeB—Cecil sandy loam, 2 to 6 percent slopes. This soil is on moderately broad to broad ridgetops and plateaus. It has a profile similar to the one described as representative of the Cecil series, but the surface layer is sandy loam 4 to 8 inches thick, and the subsoil is mainly clay 35 to 50 inches thick.

Included with this soil in mapping are small areas of a similar soil but most of the original surface layer has been removed by erosion and the Ap horizon is sandy clay loam. Also included are small areas of similar soils that have a reddish-brown surface layer and a dark-red subsoil. These inclusions make up about 20 percent of the mapped areas of this soil.

This soil has good tilth, has a deep root zone, and responds well to good management. The hazard of erosion is slight to moderate if this soil is cultivated and not protected. This soil is well suited to locally grown row crops, pasture, small grains, hay, and trees and is used extensively for these crops. The vegetation in wooded areas is shortleaf pine, loblolly pine, sweetgum, white oak, and red oak. Capability unit IIe–1; woodland suitability group 3o7.

CeC—Cecil sandy loam, 6 to 10 percent slopes. This soil is on narrow, moderately long, gently sloping ridgetops and moderately long side slopes. It has the profile described as representative of the series.

Included with this soil in mapping are a few small, irregularly shaped areas of a similar soil that has most of the original surface layer removed by erosion and has an Ap horizon of sandy clay loam. Also included are small areas of a soil that has a reddish-brown sandy loam surface layer and a dark-red clay subsoil. These inclusions make up about 10 to 15 percent of the mapped acreage of this soil.

This soil has good tilth and a deep 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 has reverted to shortleaf pine, loblolly pine, and such mixed hardwoods as red oak, white oak, and gums. Although this soil is suited to cultivated crops, there is enough runoff to cause a severe erosion hazard in cultivated areas unless management is good. Capability unit IIIe–1; woodland suitability group 3o7.

CfC2—Cecil sandy clay loam, 6 to 10 percent slopes, eroded. This upland soil is on fairly long hillsides. It has a profile similar to the one described as representative of the series, but the surface layer is a mixture of the upper part of the subsoil and remnants of the original surface layer. Accelerated erosion has formed rills and shallow gullies, and in a few places an occasional deep gully has formed. The surface layer is mainly yellowish-red or reddish-brown sandy clay loam 4 to 6 inches thick.

Included with this soil in mapping are small areas that contain many shallow gullies and a few deep ones that form an intricate pattern. Also included are a few small areas of Pacolet soils. These inclusions make up about 20 percent of the mapping unit.

Most of the acreage has been cultivated, but a significant amount of the acreage has reverted to shortleaf pine and loblolly pine. The surface layer has poor tilth because of the texture and erosion. The surface layer is sticky when wet and hard when dry; therefore tillage can be performed satisfactorily only within a relatively narrow range of moisture content. The hazard of erosion in cultivated fields is severe if this soil is not carefully managed. This soil is suited to pasture, hay, and other close-growing crops. Capability unit IVe–3; woodland suitability group 4c2e.

Chestatee Series

The Chestatee series consists of well-drained soils. These soils formed in loamy materials weathered from granites, gneisses, schists, and quartzite. They are sloping to steep soils on fairly irregular landscapes. Slopes range from 15 to 25 percent.

In a representative profile the surface layer is brown sandy loam about 9 inches thick. The upper part of the subsoil is red sandy clay loam about 4 inches thick, the middle part is red clay about 15 inches thick, and the lower part is red clay about 8 inches thick. Mica flakes in the subsoil range from few in the upper part to many in the lower part. Gravel, cobbles, and stones vary from 25 percent by volume in the upper part of the subsoil to nearly 45 percent by volume in the lower part. Rock fragments vary in size from 1 inch in diameter to 40 inches. Below the subsoil is weathered, red, pinkish-white, very dark grayish-brown, and strong-brown rock material that crushes to coarse sandy loam and extends to a depth of 72 inches.

Natural fertility and content of organic matter are low in these soils. Permeability is moderate, and available water capacity is low. The root zone is moderately deep. Reaction is very strongly acid to strongly acid throughout.

These soils are not suited to cultivated row crops and are very limited in their use for pasture. They are better suited to trees. The vegetation consists of oaks, shortleaf pine, Virginia pine, hickory, gums, and dogwood.

Representative profile of Chestatee stony sandy loam, 15 to 25 percent slopes, in Hall County; in a wooded area 6.0 miles northwest of Gainesville on Georgia Highway 60, 4.7 miles north-northeast on Georgia Highway 283, 0.95 mile west on Mt. Vernon Road and 0.25 mile south on dirt county road:

Ap—0 to 9 inches, brown (7.5YR 4/4) stony sandy loam; weak, fine, granular structure; friable; many fine roots; 20 percent, by volume, angular rock fragments 1 to 20 inches in diameter; very strongly acid; clear, irregular boundary.

B1—9 to 13 inches, red (2.5YR 4/6) sandy clay loam; moderate, medium and coarse, subangular blocky structure; friable; few fine roots and mica flakes; 25 percent, by volume, angular rock fragments 1 to 20 inches in diameter; common fine pores and root holes; common fine roots; very strongly acid; gradual, wavy boundary.

B21t—13 to 28 inches, red (2.5YR 4/6) clay; moderate, medium, subangular blocky structure; firm; 25 percent, by volume, rock fragments 3 to 40 inches in diameter; common fractured, soft, subangular rock fragments; common mica flakes; few clay films on ped faces; common fine roots; very strongly acid; gradual, irregular boundary.

B22t—28 to 36 inches, red (2.5YR 4/6) clay; moderate, medium, subangular, blocky structure; firm; about 45 percent, by volume, slightly hard to hard gneiss and granite stones, cobbles, and gravel; many mica flakes; few patchy clay films on ped faces; few fine roots; irregular tongues 2 to 12 inches thick that extend to depth of this layer; tongues are oriented to tilted bedding of weathered rock; very strongly acid; gradual, irregular boundary.

C1—36 to 66 inches, soft weathered rock that has bedding tilted about 30 degrees and crushes to red (2.5YR 5/6) and strong-brown (7.5YR 5/6) loam; firm; strongly acid; clear, wavy boundary.

C2—66 to 72 inches, pinkish-white (7.5YR 8/2), red (2.5YR 4/6), and very dark grayish-brown (10YR 3/2) massive, weathered rock that crushes to coarse sandy loam; firm; common mica flakes; strongly acid.

The solum is about 20 to 40 inches thick, but irregular tongues of the Bt horizons extend to a depth of about 60 inches. The Ap horizon is brown, light yellowish brown, dark yellowish brown, or yellowish brown. The B1 horizon is red, reddish-brown, yellowish-red, strong-brown, or brown sandy clay loam or clay loam. The B21t horizon has the same range of colors as the B1 horizon, but textures range from clay to clay loam. The B22t horizon has the same colors as the B21t horizon, but textures range from sandy clay loam to clay. Beneath the subsoil is saprolite 1 to 15 feet thick, and colors range through shades of red, brown, and yellow.

Chestatee soils commonly are near Cecil, Madison, Pacolet, and Tallapoosa soils. They have more and larger rock fragments throughout than the associated soils.

ChE—Chestatee stony sandy loam, 15 to 25 percent slopes. This is the only Chestatee soil mapped in Barrow, Hall, and Jackson Counties. It is a sloping to steep soil on irregular side slopes, mainly adjacent to drainageways of the uplands.

Included with this soil in mapping are small areas of Pacolet and Tallapoosa soils. Also included, in places, are a few small areas of Madison soils. These inclusions make up about 15 percent of the mapped areas.

This soil is not suited to cultivated crops and is very limited in its suitability for pasture. It is better suited to trees. The wooded vegetation consists of oaks, pines, hickory, gums, and dogwood. Capability unit VIe-4; woodland suitability group 3x3.

Chewacla Series

The Chewacla series consists of nearly level, somewhat poorly drained soils that formed in alluvial sediment washed from materials weathered from granite, gneiss, schist, and similar rocks. These soils are mainly on moderately broad flood plains along the larger streams in the area. A few areas are along the smaller drainageways. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is brown loam about 7 inches thick. The upper part of the subsoil is brown loam about 5 inches thick. The next layer is reddish-brown sandy clay loam mottled with grayish brown and gray and is about 26 inches thick. The lower layer is grayish-brown silty clay loam mottled with brown, and extends to a depth of 60 inches. The depth to rock is more than 6 feet.

Natural fertility and content of organic matter are low in these soils. Permeability is moderate, and available water capacity is medium to high. The root zone is moderately shallow because of the high water table. Many areas flood frequently for brief periods. Reaction is medium acid to strongly acid throughout.

Where properly drained these soils are used for row crops. They are better suited to such pasture plants as fescue and clover. Most of the acreage is used for pasture or as woodland. A few areas are cultivated or are idle. The main trees are sweetgum, yellow-poplar, water oak, alder, willow, and other trees that tolerate wetness.

Representative profile of Chewacla loam in an area mapped in Jackson County as Cartecay and Chewacla soils; 2.7 miles northwest of Mayesville, 0.8 mile west on Georgia Highway 52 on the east side of Candler Creek, and 100 feet south of dirt road:

Ap—0 to 7 inches, brown (7.5YR 5/4) loam; few, fine, faint, brown mottles; weak, fine, granular structure; very friable; many fine roots; many mica flakes; medium acid; gradual, smooth boundary.

B1—7 to 12 inches, brown (7.5YR 4/4) loam; weak, medium, subangular blocky structure; very friable; many mica flakes; medium acid; gradual, smooth boundary.

B21—12 to 15 inches, reddish-brown (5YR 4/4) sandy clay loam; few, medium, faint, gray (5YR 6/1) mottles and common, medium, distinct black (N 2/0) specks; weak, medium, subangular blocky structure; friable; few mica flakes; medium acid; gradual, smooth boundary.

B22—15 to 38 inches, reddish-brown (5YR 4/4) loam; common, fine, distinct grayish-brown (2.5Y 5/2) mottles; common, fine distinct black (N 2/0) specks; weak, medium, subangular blocky structure; friable; many mica flakes; few fine roots and pores; medium acid; gradual, smooth boundary.

B3g—38 to 60 inches, grayish-brown (10YR 5/2) silty clay loam; common, medium, prominent brown (7.5YR 4/4) mottles; massive; few fine roots; many mica flakes; strongly acid.

The solum ranges from about 43 inches to 60 inches in thickness. The depth to hard rock is greater than 6 feet and ranges to 20 feet or more. Reaction ranges from strongly acid to medium acid. The A horizon is mainly brown but is dark grayish brown, yellowish brown, or reddish brown in places. This horizon is loam, silt loam, or sandy loam and ranges from 5 to 10 inches in thickness. The B1 and B21 horizons are reddish-brown, brown, dark yellowish-brown, or dark-brown loam, silty clay loam, sandy clay loam, or loam. Grayish-brown, very dark gray, light-brownish-gray, or light-gray mottles are between depths of 15 and 20 inches. In the B3 horizon the amount of gray color increases as depth increases. The B3 horizon is mainly grayish-brown silty clay loam but ranges to sandy loam, loam, or sandy clay loam. It is prominently mottled with shades of gray, brown, and yellow.

Chewacla soils are near Cartecay, Toccoa, and Wehadkee soils. They contain more silt and clay below the surface layer than Cartecay and Toccoa soils, and they are wetter than Toccoa soils. They are less wet than Wehadkee soils.

Ck—Chewacla loam, frequently flooded. This soil is on flood plains of larger creeks and rivers. It floods frequently for short periods during winter and early in spring. Slopes range from 0 to 2 percent. This soil has a profile similar to the one described as representative of the series, but the surface layer is dark grayish-brown loam about 6 inches thick.

Included with this soil in mapping are a few small areas of a similar soil that has thin layers of sand throughout the profile. Also included are areas of a similar soil that has a sandy loam, fine sandy loam, or silt loam surface layer.

The high water table during rainy seasons restricts the growth of roots. This soil is not suited to cultivated crops because of wetness and flooding. Most of the acreage is in water-tolerant plants. The woody vegetation consists mainly of such hardwoods as sweetgum, blackgum, water oak, yellow-poplar, elm, and alder. Capability unit Vw–1; woodland suitability group 1w8.

Cw—Chewacla-Wehadkee complex. This complex is mainly on the narrow flood plains of creeks and smaller streams. These areas vary in size from 25 to 300 acres.

The pattern and relative proportions of each soil are about the same in all mapped areas. The complex is about 60 percent Chewacla soils and about 25 percent Wehadkee soils. The rest is mainly small, widely scattered areas of Toccoa and Cartecay soils. The Chewacla soils have a profile very similar to the one described as representative of the Chewacla series. The Wehadkee soils have the profile described as representative of the Wehadkee series. Within this complex, the surface texture ranges from sandy loam to loam or silt loam.

These soils have fair tilth. The growth of roots is restricted by a water table that is near the surface for long periods. These soils are suited to only a limited number of cultivated crops, but they can be used for pasture. Adequate drainage is needed if row crops are grown. About three-fourths of this acreage is wooded or pastured, and the rest is cultivated or is left idle. Capability unit IVw–1; woodland suitability group 1w8.

Gwinnett Series

The Gwinnett series consists of well-drained soils that formed in material weathered from rocks containing dark-colored minerals such as biotite and hornblende. These soils are on moderately broad ridgetops and sloping side slopes along drainageways. They are not extensive in the survey area but are in scattered acreages. Slopes range from 6 to 25 percent.

In a representative profile the surface layer is dark reddish-brown clay loam about 5 inches thick. The subsoil is dark-red clay in the upper 25 inches and dark-red clay loam in the lower 5 inches. The underlying parent material is reddish-yellow weathered gneiss, diorite, and biotite rock fragments and loamy material. Depth to hard rock is more than 5 feet.

Natural fertility and content of organic matter are low in these soils. Permeability is moderate, and available water capacity is medium. The root zone is moderate to deep. Reaction is medium acid throughout.

Where slopes are less than 10 percent, these soils are well suited to such crops as cotton, corn, small grains, and pasture, and they are used extensively for them. On slopes greater than 10 percent they are used mainly for pasture and trees. The vegetation is chiefly loblolly pine, shortleaf pine, red oak, white oak, and various gums.

Representative profile of Gwinnett clay loam, 10 to 25 percent slopes, eroded, in Hall County; 0.5 mile south of Union Church, 0.4 mile northwest of Pleasant Hill Church, 400 feet north of Mulberry River on roadbank on a paved county road:

Ap—0 to 5 inches, dark reddish-brown (2.5YR 3/4) clay loam; weak, medium, granular structure; friable; many fine roots; few pebbles; medium acid; gradual, smooth boundary.

B2t—5 to 30 inches, dark-red (2.5YR 3/6) clay; moderate, medium, subangular blocky structure; firm; few fine mica flakes, content increases with depth; few pebbles; few medium roots; medium acid; clear, wavy boundary.

B3—30 to 35 inches, dark-red (2.5YR 3/6) clay loam; moderate, medium, subangular blocky structure; firm; common mica flakes; black specks; few soft rock fragments; medium acid; gradual, wavy boundary.

C—35 to 75 inches, reddish-yellow (7.5YR 6/8) weathered gneiss and diorite; soil material coated with black specks; medium acid.

The solum ranges from 32 to 39 inches in thickness. The A1 or Ap horizon ranges from dusky red to dark reddish brown in color. It is 4 to 8 inches thick. The B2t horizon is dark-red to dusky-red clay loam or clay 25 to 30 inches thick. The B horizons are continuous but vary in thickness within short distances. Broken and fractured rock are vertically interspersed in the horizons. Dark-colored rock is at a depth of 5 to 8 feet.

Gwinnett soils are near Appling, Cecil, Madison, and Musella soils. Gwinnett soils have a thinner solum than the Appling or Cecil soils, and they are redder in the B2t horizon. They contain less mica and have a redder B2t horizon than Madison soils. The B2t horizon of Gwinnett soils is thicker than that of Musella soils.

GwC2—Gwinnett clay loam, 6 to 10 percent slopes, eroded. This soil is on narrow ridgetops and on the upper part of moderately long hillsides. Mapped areas range from 5 to 50 acres in size. This soil has a profile similar to the one described as representative of the Gwinnett series, but the surface layer is dark reddish-brown or dusky-red clay loam 4 to 7 inches thick and consists of material from the upper part of the subsoil that has been mixed with that of remnants of the original surface layer. Shallow gullies have formed. The subsoil is dark-red clay or clay loam 28 to 32 inches thick.

Included with this soil in mapping are small areas of a similar soil that are less steep. Also included are a few areas that have a gravelly sandy loam surface layer. These inclusions make up about 10 percent of the mapped area.

The slopes and slow intake make runoff moderately rapid on this soil if the surface is bare. The hazard of further erosion is severe in cultivated areas. Although this soil has poor tilth and a moderately deep root zone, it can be cultivated occasionally if it is well managed. It is well suited to permanent pasture and to pine trees. About half of the acreage is cultivated or pastured, and the rest is wooded, is idle, or is used for recreation or as wildlife habitat. Capability unit IVe-3; woodland suitability group 4c2e.

GwE2—Gwinnett clay loam, 10 to 25 percent slopes, eroded. This soil is on short and long hillsides adjacent to drainageways. It is in areas that range from 5 to 65 acres or more in size. It has the profile described as representative of the series. It is eroded to the extent that much of the original surface layer has been removed and shallow gullies have formed. An occasional deep gully is present in places.

Included with this soil in mapping are small areas of a soil that has partly weathered rock fragments on the surface and scattered throughout the profile. Also included are small areas of similar soils that are steeper. These inclusions make up about 15 percent of the mapped area.

The slopes and slow intake make runoff on this soil rapid unless the surface is protected, thus the hazard of further erosion is very severe. Tilth is poor. This soil is better suited to permanent pasture or trees than to other uses. Wooded vegetation is mixed hardwoods and pines. About three-fourths of the acreage is wooded or idle, and the rest is pastured or cultivated. Capability unit VIe-2; woodland suitability group 4c3e.

Hiwassee Series

The Hiwassee series consists of well-drained soils formed in residual materials weathered chiefly from mixed acid and basic crystalline rocks. These soils are on broad ridgetops and narrow side slopes adjacent to drainageways. Slopes range from 2 to 15 percent.

In a representative profile the surface layer is dusky-red loam about 8 inches thick. The upper part of the subsoil is dark reddish-brown clay about 4 inches thick. Underneath this is dark-red clay 31 inches thick. The lower part of the subsoil is dark-red or red clay loam that extends to a depth of about 62 inches. Depth to hard rock is more than 6 feet.

Natural fertility is low in these soils. The soils contain little organic matter. Permeability is moderate, and available water capacity is medium. The root zone is deep. Reaction is medium acid throughout.

These soils are in somewhat large areas, and slopes of less than 10 percent are well suited to cultivated crops, such as corn, small grains, cotton, and soybeans. Production is good where recommended management practices are used. Where slopes are greater than 10 percent, the soil is generally more eroded and is used for pasture and trees. Woody vegetation is mainly shortleaf pine, loblolly pine, white oak, red oak, black gum, and sweetgum.

Representative profile of Hiwassee loam, 2 to 6 percent slopes, in Jackson County; 0.6 mile south of Oconee Church on Georgia Highway 82, west on a field road, and 0.46 mile to hill crest in cutover woodland:

O1—½ inch to 0, dark grayish-brown (10YR 4/2) decomposed leaves.

A1—0 to 8 inches, dusky-red (2.5YR 3/2) loam; moderate, medium, granular structure; friable; many fine roots; few black concretions; medium acid; clear, smooth boundary.

B1t—8 to 12 inches, dark reddish-brown (2.5YR 3/4) clay; weak, medium, subangular blocky structure; friable; many fine roots; patchy clay films on ped faces; medium acid; gradual, wavy boundary.

B21t—12 to 43 inches, dark-red (2.5YR 3/6) clay; moderate, medium, subangular blocky structure; friable; few black concretions; continuous clay films on ped faces; few medium roots; medium acid; gradual, wavy boundary.

B22t—43 to 58 inches, red (2.5YR 4/6) clay loam; moderate, medium, subangular blocky structure; friable; continuous clay films on ped faces; common mica flakes; few clean sand grains; medium acid; gradual, wavy boundary.

B3—58 to 62 inches, red (2.5YR 4/6) clay loam; weak, medium, subangular blocky structure; friable; many mica flakes; few clay films on ped faces; medium acid.

The solum is mostly 42 to 72 inches thick, but it is slightly thicker in a few areas. The A horizon is dusky-red or dark reddish-brown loam or clay loam 3 to 10 inches thick. The B1t horizon is clay or clay loam. It is absent in some profiles. The B2t horizon is clay or clay loam. The B3 horizon is red or dark-red clay loam or clay. The C horizon is mostly red to yellowish-brown sandy clay loam or loam, but in some profiles it is soft weathered basic rock.

Hiwassee soils are mainly near Appling, Cecil, Gwinnett, and Wickham soils. The Hiwassee soils have a thicker B horizon than Gwinnett soils. They have a darker red B horizon than Appling, Cecil, and Wickham soils.

HsB—Hiwassee loam, 2 to 6 percent slopes. This soil is on moderately broad to broad ridgetops of the uplands. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Gwinnett soils. Also included are small areas of Hiwassee soils that are eroded.

Tilth is good. Cultivated row crops are well suited if management is good. Most of this soil has been cleared for cultivation, but about one-fourth the acreage has reverted to mixed pines and hardwoods. Capability unit IIe–1; woodland suitability group 3o7.

HsC—Hiwassee loam, 6 to 10 percent slopes. This soil is on fairly short hillsides. It has a profile similar to the one described as representative of the series, but the surface layer is dark reddish-brown loam about 6 inches thick, and the subsoil is dark-red clay or clay loam 40 inches or more thick.

Included with this soil in mapping are small areas of a similar soil that has a dark-red clay subsoil less than 40 inches thick. These inclusions make up about 20 percent of the mapped areas.

This soil is well suited to all of the locally grown row crops, small grains, and temporary and permanent grass-legume pastures. It is suited to shortleaf pine, loblolly pine, oaks, and sweetgum. About half of the acreage is in cultivated crops, and the rest is in trees or pasture. Capability unit IIIe–1; woodland suitability group 3o7.

HsD—Hiwassee loam, 10 to 15 percent slopes. This soil is on hillsides in areas that range from 10 to 40 acres or more. It has a profile similar to the one described as representative of the series, but the surface layer is dark reddish-brown loam 5 to 10 inches thick.

Included with this soil in mapping are small areas of a similar soil that has a dark-red clay subsoil less than 40 inches thick. Also included are areas where erosion has removed most of the original surface layer, and the existing surface layer is a mixture of part of the subsoil and remnants of the original surface layer. Also included are a few small areas of a soil that has a red clayey subsoil. These inclusions make up about 20 percent of the mapped area.

This soil is moderately well suited to the locally grown cultivated crops and pasture plants, but it is better suited to trees because of steepness. Woody vegetation consists of mixed pines and hardwoods. Capability unit IVe–1; woodland suitability group 3o7.

HtC2—Hiwassee clay loam, 2 to 10 percent slopes, eroded. This soil is on ridgetops and hillsides. It has a profile similar to the one described as representative of the series, but the surface layer is dark reddish-brown clay loam. Most of the original surface layer and part of the subsoil have been removed by accelerated erosion. The existing surface layer is a mixture of the upper part of the subsoil and remnants of the original surface layer. A few shallow gullies have formed. The subsoil is dark-red clay loam or clay about 40 inches thick.

Included with this soil in mapping are small areas of similar soils that are eroded. In these soils an intricate pattern of shallow gullies and an occasional deep gully have formed. These inclusions make up about 10 percent of the mapped areas.

Most of this soil has been cleared for cultivation, but about three-fourths of it has reverted to mixed stands of pines and hardwoods. The rest is cultivated to row crops, small grains, and pasture. Although the surface layer of clay loam is sticky when wet and difficult to cultivate, production is moderate when good management is practiced. Capability unit IVe–3; woodland suitability group 4c2e.

Louisburg Series

The Louisburg series consists of well-drained to excessively drained soils. These soils formed mainly in material weathered from granite and gneiss, but in places this material was derived partly from quartz and mica schist. Louisburg soils are in small areas on long, narrow hillsides adjacent to drainageways. Slopes range from 10 to 25 percent.

In a representative profile the surface layer is brown sandy loam about 7 inches thick. The subsoil is light yellowish-brown sandy loam about 17 inches thick. Partly decomposed light yellowish-brown gneiss and granite rock are at a depth of 24 inches, but they can be penetrated with handtools to a depth of 60 inches.

Natural fertility is low in these soils. They contain little organic matter. Permeability is rapid, and available water capacity is low. The root zone is mainly moderately deep. Reaction is medium acid to strongly acid throughout.

These soils are not well suited to cultivated row crops or pasture because of the shallowness of the root zone. Available water capacity is too low for the good growth of plants, and slopes are mainly too steep for effective use of farm implements. These soils are better suited to trees or some other perennial vegetation. Woody vegetation is mainly shortleaf pine, blackjack oak, and sweetgum. The forest cover is mainly scrubby pine and oaks.

Representative profile of Louisburg sandy loam, 10 to 25 percent slopes, in Hall County; 2.6 miles south on Georgia Highway 53 from junction of U.S. Highway 23 and Georgia Highway 53 and 300 yards west on a paved county road on south roadbank:

Ap—0 to 7 inches, brown (10YR 5/3) sandy loam; weak, fine, granular structure; loose; many fine roots; many pores; medium acid; gradual, wavy boundary.

B1—7 to 15 inches, light yellowish-brown (10YR 6/4) sandy loam; weak, fine, granular structure; very friable; few fine roots; medium acid; gradual, wavy boundary.

B2—15 to 24 inches, light yellowish-brown (2.5YR 6/4) sandy loam; weak, fine, granular structure; very friable; few fine roots; medium acid; gradual, wavy boundary.

C—24 to 60 inches, partly decomposed light yellowish-brown (10YR 6/4) gneiss and granite rock; faint structure of parent rock present; firm in place if undisturbed but crushes to loamy material under moderate pressure.

The A horizon ranges from brown to grayish brown and very dark grayish brown. It is about 4 to 8 inches thick. A few stones and cobbles are in the A horizon in a few places. The predominant color of the B2 horizon of each profile ranges from light yellowish brown and yellowish brown to brownish-yellow. Texture is sandy loam. Intermittently within this horizon, however, is yellowish-red, strong-brown, or yellowish-brown sandy clay loam or clay loam that makes up 30 to 40 percent of the horizon. The depth to discontinuous rippable rock ranges from 2 to 6 feet.

Louisburg soils are mainly near Appling, Cecil, and Pacolet soils. They contain less clay in the B horizon than Appling and Cecil soils and generally have a thinner solum. They are sandier throughout the B horizon than Pacolet soils and generally less red.

LuE—Louisburg sandy loam, 10 to 25 percent slopes. This soil is the only Louisburg soil mapped in the survey area. Included in the mapping are a few areas of eroded soil that has much of the original surface layer removed and a few shallow gullies. Also included are small areas of a similar soil that is steep and small areas where the underlying rock is mainly boulders or large stones. These inclusions make up about 20 percent of the mapped areas.

Although tilth is good, this soil is not suited to cultivated crops or pasture, because it is too steep and available water capacity is low. Woody vegetation is a sparse stand of pines and poor quality hardwoods. Capability unit VIIe-2; woodland suitability group 3r8.

Madison Series

The Madison series consists of well-drained soils that formed in material weathered from mica schist and granite gneiss. These soils are on narrow to moderately broad ridgetops, long sloping hillsides, and short slopes adjacent to drainageways. Slopes range from 2 to 25 percent.

In a representative profile the surface layer is sandy loam about 5 inches thick. The upper part of the surface layer is grayish brown, and the lower part is brown. The upper part of the subsoil is yellowish-red clay loam that extends to a depth of 9 inches. Underneath it is red clay that extends to a depth of 29 inches. Beneath this layer is red clay loam that extends to a depth of 36 inches. The lower layer is firm, red saprolite that contains tongues of clay loam and extends to a depth of 50 inches. Mica flakes are common in the upper part of the profile, and many are in the lower part. Depth to hard rock is generally more than 5 feet.

Natural fertility and content of organic matter are low in these soils. Permeability is moderate, and available water capacity is medium. The root zone is moderately deep. Reaction is very strongly acid to strongly acid throughout.

About three-fourths of the acreage of these soils is pastured or wooded, and the rest is cultivated, idle, or used for industrial and other nonfarm uses. Woody vegetation is white oak, post oak, red oak, hickory, dogwood, and mixed stands of pines. Although natural fertility is low in the Madison soils, the slightly eroded, more gently sloping phases are suited to most locally grown crops.

Representative profile of Madison sandy loam, 10 to 15 percent slopes, in Hall County; 50 feet east of Gainesville city limit on Cleveland road (U.S. Highway 129), 0.1 mile on Moore Boulevard, 0.2 mile on an unnamed street:

O1—1 inch to 0, dark-brown (7.5YR 3/2), loose decayed leaves.

A1—0 to 1 inch, grayish-brown (10YR 5/2) sandy loam; weak, fine, granular structure; very friable; many fine roots; few pebbles; common fine mica flakes; strongly acid; abrupt, smooth boundary.

A2—1 to 5 inches, brown (10YR 4/3) sandy loam; moderate, medium, granular structure; very friable; common mica flakes; few pebbles; strongly acid; clear, wavy boundary.

B1t—5 to 9 inches, yellowish-red (5YR 5/6) clay loam; weak, medium, subangular blocky structure; friable; common mica flakes; many fine pores; few patchy clay films on ped faces; strongly acid; clear, wavy boundary.

B2t—9 to 29 inches, red (2.5YR 4/6) clay; moderate, medium, subangular blocky structure; firm; few black concretions; many fine mica flakes which give the soil material a greasy feel when rubbed; many clay films on ped faces; strongly acid; gradual, wavy boundary.

B3—29 to 36 inches, red (2.5YR 4/6) clay loam; weak, medium, subangular blocky structure; friable; many fine mica flakes which give the soil material a greasy feel when rubbed; few clay films on ped faces; soil material is about 20 percent weathered schist fragments; very strongly acid; gradual, wavy boundary.

C—36 to 50 inches, red (2.5YR 4/6) saprolite or parent material that contains tongues of red clay loam between schist dikes; massive; firm; many fine and medium mica flakes; very strongly acid.

The solum ranges from 31 to 48 inches thick. Hard rock is at a depth of 6 to 20 feet. The A horizon is commonly grayish-brown or brown sandy loam about 4 to 9 inches thick, but it is reddish yellow, strong brown, dark yellowish brown, or dark grayish brown in some profiles. The B1 horizon is yellowish-red to red sandy clay loam or clay loam. The B2t horizon is red or yellowish-red clay or clay loam. The C horizon is firm to friable saprolite composed mostly of highly micaceous schists or gneiss.

Madison soils are near Appling, Cecil, Hiwassee, and Pacolet soils. They have more mica throughout the profile than Appling, Cecil, Hiwassee, and Pacolet soils.

MdB—Madison sandy loam, 2 to 6 percent slopes. This soil is on moderately broad to broad ridgetops of the uplands in areas of about 5 to 40 acres in size. It has a profile similar to the one described as representative of the series, but the surface layer is sandy loam about 7 inches thick. The combined thickness of the surface layer and subsoil is between 21 and 48 inches. In places many small flat fragments of schist and a few quartz pebbles are in this soil. The hazard of further erosion is slight to moderate when this soil is cultivated, provided good management is practiced (fig. 2).

Included with this soil in mapping are a few areas of a similar soil that has a fine sandy loam surface layer. Also included are a few small areas of a gravelly phase. These inclusions make up about 15 percent of the mapped areas.

This soil is suited to a wide range of crops, and it can be farmed somewhat intensively. The tilth is good. Crops on it respond well under recommended management practices. Most of the acreage has been planted to row crops at some time, chiefly to cotton and corn, but about one-third of it is now wooded. The rest is cultivated, pasture (fig. 3), idle, or is used as building sites for residences or industries. Capability unit IIe-1; woodland suitability group 3o7.

MdC—Madison sandy loam, 6 to 10 percent slopes. This soil is on long, narrow ridgetops and moderately long side slopes in areas of 5 to 50 acres. It has a profile similar to the one described as representative of the series, but the surface layer is reddish-brown to dark grayish-brown sandy loam about 5 inches thick.

Included with this soil in mapping are a few small areas of a similar soil that has a fine sandy loam surface layer. These inclusions make up about 10 percent of the mapped areas.

This soil has good tilth and is suited to a wide range of cultivated row crops, small grains, pasture grasses

Figure 2.—**Vineyard on Madison sandy loam, 2 to 6 percent slopes, in Hall County.**

and legumes, and trees. Responses are good provided good management is used. Because of the slopes, however, further erosion will be a moderate to severe hazard when cultivated to row crops if good management is not used. Most of the acreage has been cleared for cultivation, but about 50 percent of the cleared areas have reverted to mixed stands of pines and hardwoods. The rest is cultivated, pastured, left idle, or used as building sites for residences or industries. Capability unit IIIe-1; woodland suitability group 3o7.

MdD—Madison sandy loam, 10 to 15 percent slopes. This soil is on moderately long side slopes of the uplands in areas of 5 to 40 acres or more. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of a similar soil that has a surface layer of fine sandy loam, gravelly sandy loam, or sandy clay loam. In a few places slopes are slightly more than 15 percent, and in some other places they are less than 10 percent. Pacolet soils are included in a few places. These inclusions make up about 20 percent of the mapped areas.

This soil has good tilth and can be cultivated in row crops occasionally, provided good management is practiced. It is better suited to pasture, small grains, hay crops, and trees because of the steepness of the slopes. Response of crops is favorable where fertility rates are satisfactory and management is good. About one-fourth of the acreage is cultivated or pastured, and the rest is wooded or idle. Reforested areas are mainly in loblolly pine and shortleaf pine. Capability unit IVe-1; woodland suitability group 3o7.

MdE—Madison sandy loam, 15 to 25 percent slopes. This soil is on short to moderately long side slopes. It is generally adjacent to drainageways in areas of 5 to 20 acres. The surface layer is dark grayish-brown, strong-brown, or dark-brown sandy loam about 6 inches thick. The upper part of the subsoil is yellowish-red sandy clay loam, the middle part is red clay or clay loam, and the lower part is red clay loam or sandy clay loam. The combined thickness of the surface layer and the subsoil is about 35 inches.

Included with this soil in mapping are some areas of a similar soil that has a fine sandy loam, gravelly sandy loam, or sandy clay loam surface layer. In a few places slopes are steeper than 25 percent, and in other places they are slightly less than 15 percent. Also

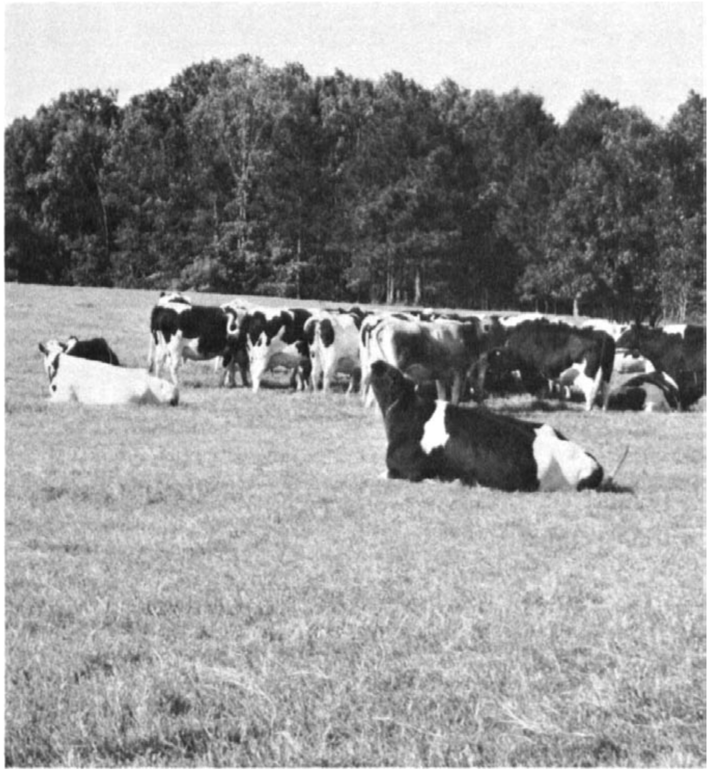

Figure 3.—**This 6-year-old Coastal bermudagrass pasture is good forage for dairy cattle. The soil is Madison sandy loam, 2 to 6 percent slopes.**

included in a few places are small areas of Pacolet soils. These inclusions make up about 15 percent of the mapped areas, but the delineations are too small to be mapped separately.

This soil is not suited to cultivated row crops because of the steepness of slopes and the hazard of accelerated erosion. Pasture and hay crops respond moderately well if adequately fertilized according to results of soil tests and other good management is used. Less than one-fourth of the acreage is used for pasture, and the rest is wooded or is idle. Reforested areas are mainly in loblolly pine or shortleaf pine. Capability unit VIe–2; woodland suitability group 3r8.

MlC2—Madison sandy clay loam, 6 to 10 percent slopes, eroded. This soil is on long, narrow ridgetops and moderately long hillsides in areas of 5 to 50 acres or more. It has a profile similar to the one described as representative of the series, but the surface layer is more eroded. This layer is yellowish-red sandy clay loam 3 to 6 inches thick. It consists of material from the upper part of the subsoil that has been mixed with remnants of the original surface layer by cultivation. The subsoil is red clay loam or clay. The solum is 25 to 48 inches thick.

Included with this soil in mapping are a few small areas of a soil that has a gravelly sandy loam or sandy loam surface layer. These included soils are too small to be mapped separately and make up about 5 percent of the mapped areas.

This soil has poor tilth, because the plow layer contains sufficient clay to make it sticky when wet. It can only be cultivated within a narrow range of moisture content. It is moderately suited to locally grown crops. Intake is slow, surface runoff is rapid, and the hazard of erosion is severe if the soil is not carefully managed. This soil is well suited to pasture, hay, and other close-growing crops. About half of the acreage is in pine trees. The rest is being used for pasture, cultivated crops, or urban developments. Capability unit IVe–3; woodland suitability group 4c2e.

MlD2—Madison sandy clay loam, 10 to 15 percent slopes, eroded. This soil is on short to moderately long hillsides. The surface layer is yellowish-red sandy clay loam about 6 inches thick. It is mostly a mixture of the upper part of the subsoil and remnants of the original surface layer. The subsoil is red clay or clay loam about 20 to 30 inches thick. A few shallow gullies and an occasional deep gully are scattered throughout the mapped areas.

Included with this soil in mapping are areas of a soil that has a thin subsoil or in places lacks a subsoil entirely. Also included are small areas of a similar soil that is less eroded than this one. These inclusions make up about 10 percent of the mapped areas.

This soil has poor tilth because it is eroded and the surface layer contains significant amounts of clay to make it sticky when wet. Cultivated crops are not suited because slopes are too steep and the hazard of further erosion is severe. This soil is suited to pasture, perennial vegetation, and pine treees. Capability unit VIe–2; woodland suitability group 4c2e.

Musella Series

The Musella series consists of well-drained soils that formed in material weathered from rocks such as diorite, schist, or hornblende gneiss. These soils are on narrow ridgetops and short hillsides, mainly adjacent to drainageways. They are in small bodies, but the areas are scattered throughout the three counties. Slopes range from 6 to 35 percent, but mostly they are less than 25 percent.

In a representative profile the surface layer is dark reddish-brown cobbly clay loam about 5 inches thick. The subsoil is dark-red gravelly clay loam about 12 inches thick. The underlying material is dark-red clay loam and dark-colored fractured rock. This layer is about 60 percent rock fragments and 40 percent clay loam. It extends to a depth of 30 inches.

Natural fertility and content of organic matter are low in these soils. Permeability is moderate, and available water capacity is low. The root zone is chiefly shallow. Reaction is medium acid or slightly acid throughout.

Musella soils are used mostly for woodland. They are mainly too steep to be cultivated. Present vegetation is mixed stand of hardwoods and pines.

Representative profile of Musella cobbly clay loam, 15 to 35 percent slopes, in Hall County; 12.2 miles south of Gainesville on Georgia Highway 53, 1.2 miles north of the Barrow-Hall County line:

Ap—0 to 5 inches, dark reddish-brown (2.5YR 3/4) cobbly clay loam; moderate, fine, subangular blocky structure; friable; many fine roots, many cobbles and pebbles; medium acid; gradual, wavy boundary.

B2t—5 to 17 inches, dark-red (10YR 3/6) gravelly clay loam; moderate, medium, subangular blocky structure; firm; few fine and medium roots; thin patchy clay films on ped faces and rock fragments; 70 percent clay loam, 30 percent gravel and cobbles; slightly acid; gradual, irregular boundary.

C—17 to 30 inches, dark-red (2.5YR 3/6) clay loam and weathered hornblende gneiss and diorite; massive; dark-red clay loam in seams and in tongues between the rock fragments make up 40 percent of the horizon; medium acid.

The solum is about 15 to 20 inches thick. The Ap horizon ranges from dusky red to dark reddish brown and is 4 to 6 inches thick. Cobble and gravel content in the Ap horizon ranges from about 15 to 25 percent by volume. The Bt horizon is dark red or dark reddish brown. It is mainly clay loam, but thin pockets of clay are present in some profiles. The Bt horizon ranges from 12 to 14 inches in thickness. The C horizon is weathered basic rock or a mixture of weathered hornblende, gneiss, and schist.

Musella soils commonly are near Gwinnett, Hiwassee, Cecil, and Madison soils. Musella soils mainly are shallower and have more coarse fragments throughout the profile than the associated soils.

MuD—Musella cobbly clay loam, 6 to 15 percent slopes. This soil is on narrow ridgetops and short hillsides in areas less than 25 acres in size. It has a profile similar to the one described as representative of the series, but it has a surface layer of dark reddish-brown or dusky-red cobbly clay loam about 4 to 6 inches thick.

Included with this soil in mapping are a few small areas of similar soils that are steeper than this one. Also included are a few small areas of soils that are within the Gwinnett and Pacolet series.

The cobbly surface layer and poor tilth make this soil unsuited to cultivation. A greater part of the acreage is wooded, and the rest is cultivated or pastured. Vegetation is mixed stand of hardwoods and pines. Capability unit VIe-4; woodland suitability group 4f3.

MuF—Musella cobbly clay loam, 15 to 35 percent slopes. This soil is generally adjacent to drainageways where slopes are short. It is in small areas in landscape that has irregular relief. It has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of Musella soils that have slopes of slightly less than 15 percent. Also included are small areas of soils that are in the Gwinnett and Pacolet series. These areas are too small to be delineated separately and make up less than 15 percent of the mapped areas.

The steep slopes and poor tilth make this soil better suited to pine trees than to cultivated crops and pasture. A large percentage of the acreage is wooded. The rest is pastured, is left idle, or is used for recreation to a limited extent. Capability unit VIIe-3; woodland suitability group 4f3.

Orthents

These are soils that formed on recent erosional surfaces. Field examinations indicate that the former soils were dissected and truncated by erosion induced by cultivation, and diagnostic layers or horizons are nonexistent or cannot be identified. Locally, areas of these soils are known as "gullied land." The present mantle of soil materials is variable in thickness. It ranges from loamy to clayey in texture and is generally reddish in color. Orthents exhibit no evidence of wetness. The presence of underlying rock varies intermittently from one area to another, and the depth to this rock varies.

In Barrow, Hall, and Jackson Counties these soils are mapped only as a part of the Pacolet-Orthents complex, 10 to 25 percent slopes, severely eroded.

Pacolet Series

The Pacolet series consists of well-drained soils that formed in material weathered from granite, gneiss, and mica schist. These soils are on moderately long or short hillsides that are mainly adjacent to drainageways in the area. They are scattered throughout Barrow, Hall, and Jackson Counties, but about half or more of the acreage is in Hall County. Slopes range from 10 to 25 percent.

In a representative profile the surface layer is brown sandy loam about 5 inches thick. The subsoil is clay loam about 27 inches thick. The upper part of the subsoil is red, and the lower part is red with brownish-yellow, weathered rock fragments. The underlying layer is weathered rock that has thin layers of red clay loam between fragments that crush to sandy loam. It extends to a depth of 60 inches (fig. 4).

Natural fertility and content of organic matter are low in these soils. Permeability is moderate, and available water capacity is medium. The root zone is moderately deep. Reaction is strongly acid throughout.

About three-fourths of the acreage of these soils is wooded, and the rest is used for cultivated crops, pasture, building sites for homes, recreation and wildlife, or left idle. Soils that have slopes of less than 15 percent and that are not severely eroded are moderately well suited to cultivated crops. Steeper soils are better suited to pasture and trees. The vegetation is a mixed stand of pines and hardwoods.

Representative profile of Pacolet sandy loam in an area of Pacolet soils, 10 to 15 percent slopes, eroded, in Hall County; 5.5 miles from Hall County courthouse, northwest on Georgia Highway 115 to Corinth Church, 3.6 miles northeast on paved county road to crossroad, and 1.6 miles east on paved county road to crest of ridge on north side of road:

Ap1—0 to 3 inches, brown (7.5YR 4/4) sandy loam; weak, fine, granular structure; very friable; many fine roots; few pebbles; strongly acid; clear, smooth boundary.

Ap2—3 to 5 inches, brown (7.5YR 5/4) sandy loam; moderate, medium, granular structure; very friable; many fine roots; few pebbles; strongly acid; clear, smooth boundary.

B2t—5 to 20 inches, red (2.5YR 4/6) clay loam; moderate, medium, subangular blocky structure; friable; few medium roots; few fine mica flakes; clay films on most ped faces; few weathered rock fragments; strongly acid; gradual, wavy boundary.

B3—20 to 32 inches, red (2.5YR 4/6) clay loam; moderate, medium, subangular blocky structure; friable; few fine mica flakes; few clay films on some ped faces; few brownish-yellow, weathered, platy rock fragments; strongly acid; gradual, wavy boundary.

C—32 to 60 inches, weathered rock that has thin layers of red clay loam between fragments; massive; friable to firm; crushes to sandy loam; strongly acid.

Figure 4.—**Intermittent weathered rock in the lower part of typical profile of Pacolet soils.**

The solum ranges from 21 to 39 inches in thickness. The A horizon ranges from sandy loam to sandy clay loam that is dark grayish brown, grayish brown, brown, strong brown, reddish brown, yellowish brown, or yellowish red in color. The A horizon ranges from 4 to 9 inches in thickness. The B2t horizon ranges from clay loam to sandy clay or clay and is 10 to 18 inches thick. Few to common mica flakes are within the B2t, B3, and C horizons. The C horizon is friable to firm saprolite that ranges from a few inches to several feet in thickness.

Pacolet soils are mainly near Cecil, Madison, Hiwassee, and Louisburg soils. They have a thinner solum than Cecil soils and are less micaceous than Madison soils. They are not as sticky and red in the Bt horizon as Hiwassee soils. Pacolet soils have more clay in the B horizon than Louisburg soils.

PaE—Pacolet sandy loam, 15 to 25 percent slopes. This soil is on short to moderately long slopes in areas of 5 to 50 acres or more. It has a profile similar to the one described as representative of the series, but the surface layer is dark grayish-brown, reddish-brown, or yellowish-red sandy loam.

Included with this soil in mapping are small areas of an eroded soil that is similar to Cecil soils. Also included are areas of similar soils that have a reddish-brown surface layer and a dark-red subsoil.

This soil is not suited to cultivated crops because of steepness, but it is moderately suited to permanent pasture. It is better suited to trees. The forest vegetation is mixed stands of hardwoods and pines. About three-fourths of the acreage of this soil is wooded, and the rest is in permanent pasture. Capability unit VIe-2; woodland suitability group 3r8.

PgE3—Pacolet-Orthents complex, 10 to 25 percent slopes, severely eroded. This complex consists of areas of Pacolet soils in an intricate pattern of shallow and deep gullies with severely eroded soils. About 65 percent of it is Pacolet sandy loam, and about 35 percent of it is Orthents soils.

Pacolet soils are eroded to the extent that the original surface layer and, in places, part of the subsoil have been removed.

Orthents are variable, consisting mainly of side walls and bottoms of deep gullies. In places the soil material is clayey or loamy, similar to the lower subsoil of Pacolet soils. In other places the soil material is similar to the parent material of the Pacolet soils (fig. 5).

This complex is not suited to farming. It can be managed as woodland to protect watersheds or to produce a limited amount of food and cover for wildlife. Establishing vegetation on this complex is difficult and costly. To establish a close-growing crop to help control further erosion requires reshaping with machinery and additions of large amounts of fertilizer. Capability unit VIIe–4; not assigned to a woodland suitability group.

PTF—Pacolet-Tallapoosa association, steep. This association consists of well-drained soils that are on narrow ridges and dissected side slopes of the uplands. Slopes range from 15 to 45 percent. The soils in this association are in areas large enough to be shown individually on the soil map, but they are shown as one unit because the behavior of each soil is similar for the current land use. These soils are wooded and will likely remain so for a number of years.

This association is about 60 percent Pacolet soils and 30 percent Tallapoosa soils. Included soils make up the rest of the association. The Pacolet soils have a profile similar to the one described as representative of the series, and the Tallapoosa soils have the profile described as representative of the series. Included in mapping are soils that do not have the well-developed subsoil that is characteristic of Pacolet and Tallapoosa soils. In these included soils, the surface layer and subsoil combined are 1 to 2 feet thick. Small areas of Madison and Cecil soils are also included.

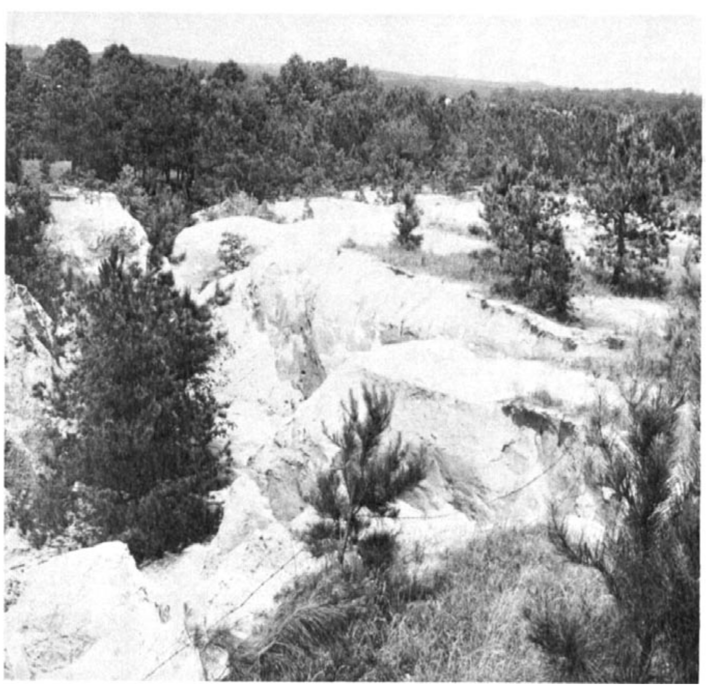

***Figure 5.*—An area of Pacolet-Orthents complex, 10 to 25 percent slopes, severely eroded. These gullied soils are a significant source of sediment in areas where the surface has not been reshaped and protected against further erosion.**

This association is not suited to cultivated crops or pasture. It is suited to trees or to perennial vegetation. Adapted equipment is needed for logging because of steepness. The vegetation is mostly a mixed stand of hardwoods and shortleaf pine. Capability unit VIIe–1; woodland suitability group 3r8.

PuD2—Pacolet soils, 10 to 15 percent slopes, eroded. This is an undifferentiated unit of Pacolet soils on short to moderately long hillsides in areas of about 5 to 50 acres. Some of these soils have the profile described as representative of the series; others are similar but have a reddish sandy clay loam surface layer 4 to 7 inches thick.

No separation of individual soils was made in mapping because of the pattern of occurrence on the landscape, the anticipated use, and the similarity in behavior.

Included with these soils in mapping are areas of similar soils that have a dark-red subsoil. Also included are small areas of soils similar to Cecil and Madison soils.

Most of the acreage of these soils was cleared, but about half of it has reverted mainly to pine trees. The rest is used for cultivated crops, pasture, recreation, or building sites for residences. The vegetation in wooded areas is shortleaf pine, loblolly pine, sweetgum, white oak, red oak, persimmon, and dogwood. Capability unit IVe–1; woodland suitability group 3o7.

Tallapoosa Series

The Tallapoosa series consists of well-drained soils that formed chiefly in material derived from mica schist and admixtures of gneiss. These soils are commonly on narrow ridges and dissected side slopes of the uplands. Slopes range from 15 to 45 percent.

In a representative profile the surface layer is brown sandy loam about 2 inches thick. The subsurface layer is grayish-brown sandy loam about 5 inches thick. The subsoil is red clay loam about 9 inches thick. Below this layer, to a depth of 50 inches, are tilted, thin layers of friable, grayish schist fragments that have thin coatings of red clay loam.

Natural fertility and content of organic matter are low in these soils. Permeability is moderate, and available water capacity is low. The root zone is shallow. Tilth is poor. Reaction is strongly acid throughout.

Most of the acreage is wooded, primarily with scrubby hardwoods in mixed stands with shortleaf pine and Virginia pine.

Tallapoosa soils are not mapped separately in Barrow, Hall, and Jackson Counties; they are mapped as a part of the Pacolet-Tallapoosa association, steep.

Representative profile of Tallapoosa sandy loam in an area of Pacolet-Tallapoosa association, steep, in Hall County; 2.4 miles southeast of Hall County Courthouse on U.S. Highway 129, across bypass road and 200 yards to crossroads, 0.4 mile south on a new road to Candler road, and 100 yards west of new road on ridgetop.

A1—0 to 2 inches, brown (10YR 4/3) sandy loam; weak, fine, granular structure; very friable; many fine roots; common gravel and schist fragments; strongly acid; gradual, smooth boundary.

A2—2 to 7 inches, grayish-brown (10YR 5/2) sandy loam; moderate, medium, granular structure; friable; common medium and fine roots; few gravel and schist fragments; strongly acid; gradual, wavy boundary.

Bt—7 to 16 inches, red (2.5YR 4/6) clay loam; moderate, fine and medium, subangular blocky structure; friable; common very fine mica ffakes; common clay films on ped faces; few medium roots; few small schist fragments; strongly acid; gradual, wavy boundary.

C—16 to 50 inches, tilted thin layers of grayish schist fragments that crush to sandy loam when slight pressure is applied; massive; friable; thin coatings of red clay loam on surfaces of fragments; strongly acid.

The solum ranges from 8 to 20 inches in thickness. The A1 horizon ranges from sandy loam to gravelly loam that ranges from brown to dark yellowish brown, grayish brown, and strong brown in color. The Bt horizon is continuous and normally ranges from 2 to 10 inches in thickness. This horizon ranges from strong brown to yellowish red and red in color. Tongues of the B horizon, 1 to 8 inches thick, occasionally extend into the C horizon to a depth of 5 to 6 feet. The C horizon is mainly friable, micaceous schist, but admixtures of gneiss and quartzite are present. In some profiles it is mottled with shades of yellow and red.

Tallapoosa soils are mainly near Pacolet, Louisburg, and Madison soils. The Bt horizon of Tallapoosa soils contains more clay than that of the Louisburg soils and is thinner than that of Pacolet and Madison soils.

Toccoa Series

The Toccoa series consists of nearly level, well-drained loamy soils that formed in recent alluvium. These soils formed in sediment from adjacent upland soils. They are on flood plains along the major streams and depressions throughout the survey area. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is reddish-brown loam about 7 inches thick. The underlying layers are loam or fine sandy loam that extend to a depth of 46 inches. The upper layer is yellowish red, and it is about 11 inches thick. The next layer is brown, and it extends to a depth of about 42 inches. Under this layer the soil material is yellowish brown. The lower layer is pale-brown silty clay loam that is mottled with shades of gray and brown and extends to a depth of 65 inches.

Figure 6.—Toccoa soils are occasionally flooded in areas where drainage is inadequate and runoff from adjacent upland soils is not controlled.

Natural fertility and organic-matter content are moderate to low in these soils. Permeability is moderately rapid, and available water capacity is medium. The root zone is deep. Reaction is slightly acid to medium acid throughout.

Toccoa soils are suited to a wide range of crops and pasture grasses grown locally. Flooding is an occasional hazard for short periods (fig. 6). Toccoa soils respond well to good management and are among the best soils in the survey area for farming. Most of the acreage has been cleared and cultivated. About three-fourths of it is cultivated or in pasture, and the rest is wooded. The woodland vegetation is oak, hickory, yellow-poplar, ash, maple, elm, alder, and loblolly pine.

Representative profile of Toccoa loam in an area of Toccoa soils in Jackson County; 1 mile north of Talmo on U.S. Highway 129 and 100 yards west of highway along Allen Creek:

Ap—0 to 7 inches, reddish-brown (5YR 4/4) loam; weak, fine, granular structure; friable; many fine roots; few fine mica flakes; medium acid; gradual, smooth boundary.

C1—7 to 18 inches, yellowish-red (5YR 4/6) loam; weak, fine, granular structure; friable; many fine roots; few fine mica flakes; medium acid; clear, smooth boundary.

C2—18 to 36 inches, brown (7.5YR 4/4) fine sandy loam; weak, massive; friable; few fine roots; few fine mica flakes; slightly acid; gradual, smooth boundary.

C3—36 to 42 inches, brown (10YR 4/3) loam; few, fine, faint mottles of brown; massive; friable; few fine mica flakes; slightly acid; gradual, smooth boundary.

C4—42 to 46 inches, yellowish-brown (10YR 5/6) loam; few, fine, distinct pale-brown mottles; massive; friable; few fine mica flakes; slightly acid; gradual, wavy boundary.

C5—46 to 65 inches, pale-brown (10YR 6/3) silty clay loam; common, medium, distinct mottles of light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6); massive; friable; few fine mica flakes; medium acid.

The Ap horizon is mainly loam but ranges to sandy loam. The C1 horizon ranges from loam to sandy loam that is reddish brown, yellowish red, yellowish brown, and dark reddish brown to 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 C2 horizon, although in other places common mottles of light brownish gray or yellowish red are present. Bedding planes of sandy loam and loamy sand are more pronounced in some C3 horizons where there also are thin gravelly layers.

Toccoa soils are mainly near Altavista, Chewacla, and Cartecay soils. They are not so fine textured between depths of 10 and 40 inches as Altavista and Chewacla soils. Toccoa soils are better drained than Cartecay soils.

To—Toccoa soils. This is an undifferentiated unit of Toccoa soils and similar soils that respond to use and management in a similar manner. These nearly level, well-drained soils are mainly in long, narrow areas along sizable streams. The size of mapped areas ranges from a few acres to 80 or more acres. Slopes range from 0 to 2 percent.

These Toccoa soils have a profile similar to the one described as representative of the series, but the surface layer ranges from loam to sandy loam. The other soils in this unit have a similar profile, but they contain slightly more silt and clay in the layer between depths of 10 and 40 inches. These soils were not mapped separately because use and management is very similar to that of Toccoa soils.

These soils are well suited to many of the row crops, hay crops, and pasture plants commonly grown within the survey area. Although the hazard of flooding is moderate in some wet years, these soils can be used intensively. Vegetation is loblolly pine, oaks, yellow-poplar, elm, hickory, green ash, red maple, and alder. Capability unit IIw-2; woodland suitability group 1o7.

Wehadkee Series

The Wehadkee series consists of nearly level, poorly drained soils on flood plains, mainly along the smaller streams in Barrow, Hall, and Jackson Counties. These soils formed in alluvium sediment washed from soils that formed in material derived from granite, gneiss, schist, and other similar rocks. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsoil is clay loam that extends to a depth of 42 inches. The upper part of the subsoil is gray, the middle part is dark gray, and the lower part is gray. Mottles in shades of gray and brown are present in this layer. Below the subsoil is dark grayish-brown sandy loam that is mottled with shades of brown and extends to a depth of 60 inches. The depth to rock is more than 6 feet.

Natural fertility is low to medium in these soils. Organic-matter content is medium. Permeability is moderate, and available water capacity is medium. Most areas are subject to frequent flooding. The water table is near the surface for long periods, especially during rainy seasons. Reaction is medium acid to slightly acid throughout.

Most of the acreage is wooded, mainly with water-tolerant hardwoods such as sweetgum, blackgum, water oak, yellow-poplar, elm, and alder. Drained areas of these soils are moderately well suited to pasture but are mainly unsuited to most row crops.

Wehadkee soils are mapped only in a complex with Chewacla soils in Barrow, Hall. and Jackson Counties.

Representative profile of Wehadkee silt loam in an area of Chewacla-Wehadkee complex in Jackson County; 3.6 miles southwest of Jefferson, on Georgia Highway 11, 200 feet southeast of highway on Buffalo Creek:

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

B1g—7 to 15 inches, gray (10YR 5/1) clay loam; few, fine, faint light brownish-gray mottles; weak, medium, subangular blocky structure; friable; few fine mica flakes; few fine roots; medium acid; clear, smooth boundary.

B21g—15 to 28 inches, dark-gray (10YR 4/1) clay loam; few, medium, faint light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; friable; few fine mica flakes; medium acid; gradual, smooth boundary.

B22g—28 to 42 inches, gray (10YR 6/1) clay loam; common, medium, faint dark grayish-brown (10YR 4/2) mottles; weak, medium, subangular blocky structure; friable; common fine mica flakes; medium acid; clear, wavy boundary.

Cg—42 to 60 inches, dark grayish-brown (10YR 4/2) sandy loam; common, medium, faint yellowish-brown (10YR 5/4) mottles; massive; very friable; common fine mica flakes; medium acid.

The solum ranges from about 35 to 55 inches in thickness. Depth to hard rock is 6 to 8 or more feet. The mica content ranges from few to common in all horizons. The A horizon is loam, silt loam, or sandy loam 7 to 12 inches thick. It is brown, dark grayish brown, or grayish brown. The B2 horizons are clay loam or loam that are dark gray, gray, or light gray. They have few to common mottles in shades of brown. The C horizon is sandy loam or loamy sand. It is commonly stratified with sand and gravel.

Wehadkee soils commonly are near Cartecay, Toccoa, and Augusta soils. They are more poorly drained than the somewhat poorly drained Cartecay and Augusta soils and the well-drained Toccoa soils.

Wickham Series

The Wickham series consists of well-drained, very gently sloping soils that formed in materials washed from soils on uplands. Areas of these soils are moderately broad. They are on ridgetops and side slopes of stream terraces, mainly along the larger streams in Barrow, Hall, and Jackson Counties. They are in scattered areas 5 to 10 acres in size. Slopes range from 2 to 6 percent.

In a representative profile the surface layer is brown sandy loam about 7 inches thick. The subsoil is sandy clay loam to a depth of 59 inches and clay loam below that. The upper 37 inches is yellowish red. The 15 inches below that is yellowish brown and has mottles in shades of red. The lower part of the subsoil, between depths of 59 and 66 inches, is mottled with shades of red, yellow, and brown. Depth to hard rock is 6 to more than 10 feet.

Natural fertility and content of organic matter are low in these soils. Permeability is moderate, and available water capacity is medium. The root zone is deep. Reaction ranges from strongly acid to medium acid throughout.

About three-fourths of the acreage of these soils is pastured or cultivated, and the rest is wooded or idle. The chief trees in wooded areas are white oak, red oak, post oak, water oak, and hickory, but shortleaf pine and loblolly pine grow in some of the abandoned fields. These soils are well suited to cultivated crops, small grains, hay, and pasture.

Representative profile of Wickham sandy loam, 2 to 6 percent slopes, in Barrow County; 5.1 miles north of Statham on Georgia Highway 211 to junction of Georgia Highway 319, 2.1 miles northeast on Georgia Highway 319 to county dirt road, 0.5 mile east on dirt road, 0.3 mile north of road:

Ap—0 to 7 inches, brown (10YR 4/3) sandy loam; weak, fine, granular structure; very friable; many fine roots and pores; medium acid; clear, smooth boundary.

B1—7 to 12 inches, yellowish-red (5YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; very friable; common, fine roots; medium acid; gradual, smooth boundary.

B21t—12 to 44 inches, yellowish-red (5YR 4/6) sandy clay loam; moderate, medium, subangular blocky structure; friable; few fine roots; few patchy clay films on some ped faces; medium acid; gradual, smooth boundary.

B22t—44 to 59 inches, yellowish-brown (10YR 5/6) sandy clay loam; few, medium, prominent yellowish-red (5YR 4/6) mottles; weak, coarse, subangular blocky structure; friable; few patchy clay films on ped faces; few medium roots, few rounded quartz pebbles; strongly acid; gradual, smooth boundary.

B3—59 to 66 inches, mottled, yellow (10YR 7/6), brownish-yellow (10YR 6/6), very pale brown (10YR 7/3), and yellowish-red (5YR 5/6) clay loam; weak, coarse, subangular blocky structure; friable; few fine mica flakes; few clay films on some ped faces; strongly acid.

The solum ranges from 40 to 60 inches or more in thickness. The A horizon is yellowish-red, reddish-brown, light yellowish-brown, or brown sandy loam 6 to 8 inches thick. The B1 horizon is yellowish-red, brown, or reddish-brown sandy clay loam or sandy loam about 3 to 5 inches thick. The B21t horizon is red or yellowish-red sandy clay loam or clay loam. Rounded quartz pebbles and cobbles are none to common in the B22t horizon.

Wickham soils are mainly near Altavista, Augusta, and Gwinnett soils. They are better drained than Altavista and Augusta soils and have less red Bt horizons than Gwinnett soils.

WhB—Wickham sandy loam, 2 to 6 percent slopes. Areas of this soil mainly make up small bodies of stream terraces. This is the only Wickham soil mapped in the survey area.

Included with this soil in mapping are areas of a similar soil that is eroded. In these areas a few shallow gullies have formed, and in galled spots the sandy clay loam subsoil is exposed. Also included are a few small areas of a similar soil that has a brown subsoil more than 40 inches thick. These inclusions make up about 25 percent of the mapped areas.

This soil is suited to most kinds of crops grown locally. It responds well to good management, especially to additions of fertilizer. All of the acreage has been cultivated in previous years, but about one-fourth of it has reverted to mixed stands of pines and hardwoods for which it is suited. Capability unit IIe-1; woodland suitability group 3o7.

Use and Management of the Soils

This section contains interpretations about the predicted behavior of the soils in Barrow, Hall, and Jackson Counties under specified conditions of use and management. The interpretations are for soils used for crops and pasture, as woodland, for engineering purposes, for community development, and as wildlife habitat. Changing economic conditions, new techniques of farm management, new machines and materials, and improved crop varieties are some of the things that affect the behavior of the soils and influence soil use and management. These factors must be considered when the interpretations in this section are applied.

Use of the Soils for Crops and Pasture [2]

In this section behavior and management of soils in Barrow, Hall, and Jackson Counties are described for specified conditions. Actual management of soils for crops and pasture is emphasized, but the system of capability classification used by the Soil Conservation Service is also explained in this section. The capability classification of each soil mapped in the counties can be obtained by referring to the "Guide to Mapping Units." Other information about management of soils is given in the section "Descriptions of the Soils."

Changes in the behavior of soils under new and different management techniques are not unusual and should be anticipated. Thus, in addition to suggested management practices presented here, those who manage soils need to keep alert to alternate practices possibly dictated by new techniques, improved technology, economic changes, and special conditions peculiar to a specific site. Also, since many soil series concepts have undergone changes in the last 10 to 20 years, it is recommended that present interpretations and predictions about a particular soil be carefully studied before applying them to the soils of the same name in older soil surveys.

General management

In this section general practices of management are discussed and the system of capability classification is described. Plant suitability and suitable cropping systems are discussed for each capability unit.

Management is needed for the soils in Barrow, Hall, and Jackson Counties mainly to control erosion by controlling the flow of water runoff on uplands, dispose of excess water on flood plains, and maintain good tilth and productivity. These general practices are discussed mainly in terms of capability classes and subclasses of the capability classification system.

All of the upland soils in the three counties, for example, Cecil, Madison, Gwinnett, and Hiwassee, are susceptible to erosion. The degree of susceptibility depends on the erodibility, the frequency and intensity of rainfall, the steepness and length of slopes, and the kind and amount of ground cover. The more gently sloping soils need only contour cultivation in combination with terraces and a cropping system that includes annual close-growing crops, crops producing large quantities of residue, or perennial crops. Slopes greater than 10 percent may require stripcropping in addition to these practices. Regardless of the practices used, a grassed waterway or proper outlet is essential.

Excess water is the main limitation of several soils on flood plains. Chewacla, Cartecay, and Wehadkee soils are in this category. The drainage needed depends on the amount of water in the soil and the kinds of crops grown. After the water is controlled, only practices that help to maintain productivity and good tilth are needed.

Several management practices contribute to maintenance of soil productivity and good tilth and help

[2] J. N. NASH, conservation agronomist, Soil Conservation Service, supplied information concerning management for crops and pasture.

to control soil loss. Among these are regular applications of lime and fertilizer according to plant needs, good management of crop residue, usually by shredding and leaving the residue on the surface between seasons of crop production, and use of suitable cropping systems.

Complementary practices include grassed waterways or outlets. These are essential for the disposal of runoff water from straight row farming, contour farming, terracing, or stripcropping. A field border of perennial grass to control erosion at some locations along the edge of fields and to reduce weed growth is another desirable practice. Such a border is attractive and allows more efficient operation of farm equipment. Farm roads and fences need to be located on the crest of slopes where the watershed divides or on the contour, yet their location should not interfere with a field and row arrangement that will facilitate efficient farming operations. Fences can be located in or adjacent to natural waterways.

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.

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 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. (None in the survey area.)

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.

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, water supply, or to esthetic purposes. (None in the survey area.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States and not in this survey area shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, although they have other limitations that restrict their use largely 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 any 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 paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following paragraphs the capability units in Barrow, Hall, and Jackson Counties are described and suggestions for the use and management of the soils are given.

CAPABILITY UNIT IIe-1

This unit consists of well-drained soils on uplands and high stream terraces. These soils formed in loamy and clayey materials. They are in the Cecil, Hiwassee, Madison, and Wickham series. Slopes range from 2 to 6 percent.

The uppermost 4 to 8 inches of the soil is friable loam or sandy loam. The subsoil is friable sandy clay loam, clay loam, sandy clay, or firm clay.

Natural fertility and organic-matter content are low.

Tilth is good. Permeability is moderate. Available water capacity is medium. The root zone is deep, except in the Madison soils; in these it is moderately deep. Reaction ranges from medium acid to very strongly acid. The hazard of erosion is slight to moderate if these soils are cultivated and not protected (fig. 7).

About half of the acreage is cultivated, about one-fourth is pasture, and the rest is wooded. These soils are well suited to cotton, corn, small grains, soybeans, peaches, pecans, truck crops, and nursery crops. Pasture and hay crops to which they are well suited are tall fescue, lespedeza, crimson and white clover, millet, and grain sorghum (fig. 8).

Erosion is the major hazard if these soils are cultivated. The steepness and length of the slopes and the practices used to control erosion influence the kind of cropping system needed to keep losses of soil and water within tolerable limits. A suitable cropping system is one in which cotton or some other row crop is planted in parallel contour strips that alternate with strips of a small grain. With this system the crops are rotated each year. The straw and stubble should be left on the surface after harvest.

CAPABILITY UNIT IIe-2

This unit consists of well drained and moderately well drained, very gently sloping soils that formed in clayey or loamy materials. These soils are in the Altavista and Appling series. Slopes range from 2 to 6 percent.

The surface layer is sandy loam about 4 to 10 inches thick. The subsoil is friable sandy clay loam and clay loam to clay.

Natural fertility and organic-matter content are low. Permeability is moderate. Available water capacity is medium. The root zone is deep, and tilth is good. Reaction is strongly acid to medium acid in the upper part of these soils and strongly acid in the lower part. The soils in this unit are moderately susceptible to erosion if cultivated and not protected.

Figure 7.—**Sheet and gully erosion on freshly plowed Madison sandy loam, 2 to 6 percent slopes, after a 1-inch rain that fell during a period of 1½ hours.**

Figure 8.—**Cattle grazing fescue-clover pasture on Cecil sandy loam, 2 to 6 percent slopes.**

About half of the acreage is cultivated, a third is pastured, and the rest is wooded. The soils are well suited to crops such as small grains, pimento peppers, grain sorghum, soybeans, peaches, and pecans. They are slow to warm up in spring; consequently, cotton, corn, and truck crops grow poorly if they are planted early. Grasses and clover are suitable for hay and pasture. Close-growing crops contribute to good tilth. They also help to control erosion and help to maintain the content of organic matter.

The steepness and length of the slopes and the practices used to control erosion influence the kind of cropping system needed to keep soil losses from erosion within tolerable limits. Where suitable practices are used to control erosion, row crops can be grown on this soil year after year. For example, if the field is terraced, a suitable cropping system is one in which corn or some other row crop is grown for two years and is followed by one year of cotton.

CAPABILITY UNIT IIw-2

This unit consists of only one mapping unit—Toccoa soils. These soils are well drained and nearly level. They are on bottom lands that are flooded occasionally. Slopes are mainly 0 to 2 percent.

The plow layer or surface layer is sandy loam or loam about 7 inches thick. The underlying layers are loamy to a depth of about 42 inches.

Natural fertility and organic-matter content are moderate to low. Tilth is good. Permeability is moderately rapid. Available water capacity is medium. Plant roots penetrate to a depth of 30 to 36 inches or more. Reaction ranges from medium acid to slightly acid throughout.

Crops grown in these soils respond well to good management. The soils are suited to such crops as corn, grain, sorghum, oats, rye, ryegrass, fescue, dallisgrass, bahiagrass, annual lespedeza, and vetch. They are poorly suited to alfalfa. Cotton and bermudagrass grow well only on these soils at the higher sites. Small grains, corn, and sorghum planted for grain are occasionally damaged by floodwater. About three-fourths of the acreage is in pasture and row crops, and the rest is in trees.

Flooding is the main concern when managing these soils, because streams overflow during long periods of heavy rains. These soils generally are not subject to erosion, but they are subject to occasional scouring by floodwaters. A cropping system that maintains organic-matter content is helpful.

Any suitable crop can be grown year after year if enough plant residue is returned to the soil to maintain good tilth. A planned sequence of crops helps in controlling weeds, insect and plant diseases, and in using fertilizer, more efficiently.

CAPABILITY UNIT IIIe-1

This unit consists predominantly of well-drained, gently sloping soils on the crests and sides of upland divides. These soils are in Cecil, Madison, and Hiwassee series. Slopes range from 6 to 10 percent.

These soils are very friable to friable in the upper 5 to 7 inches. The subsoil is sandy clay loam, clay loam, or clay.

Natural fertility and organic-matter content are low. Tilth is good. Permeability is moderate. Available water capacity is medium. The root zone is deep, except for Madison soils; in these, it is moderately deep. Reaction is very strongly acid to medium acid throughout.

About three-fourths of the acreage is cultivated or pastured, and the rest is wooded or idle. These soils are suited to crops such as cotton, corn, small grains, millet, soybeans, peas, peaches, and pecans. Lespedeza, bermudagrass (fig. 9), dallisgrass, tall fescue, and orchardgrass are suitable plants for hay and pasture.

Erosion is the major hazard if these soils are not well protected by a cover of plants. The steepness and length of the slopes and the practices used to control erosion influence the kind of cropping system that can be used. Where these soils are terraced, a suitable cropping system is corn or some other row crop grown for one year and grass grown for two years.

CAPABILITY UNIT IIIe-2

Appling sandy loam, 6 to 10 percent slopes, is the only soil in this unit. This soil is well drained and is on moderately long side slopes of interstream divides.

The surface layer is very friable sandy loam about 7 inches thick. The subsoil is predominantly friable clay loam to clay.

Natural fertility and organic-matter content are low. Tilth is good. Permeability is moderate. Available water capacity is medium. The root zone is deep. Reaction is strongly acid throughout.

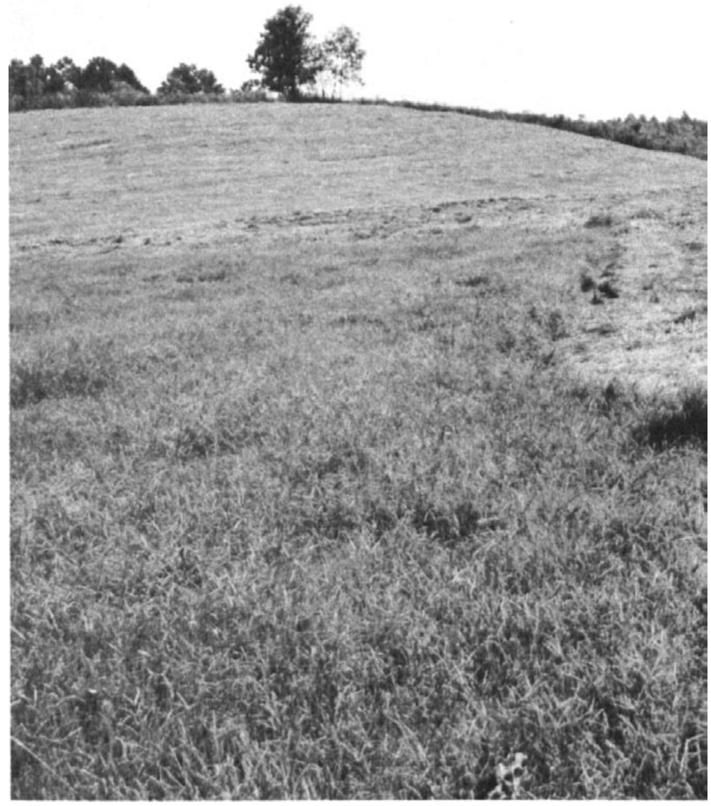

Figure 9.—Coastal bermudagrass on Cecil sandy loam, 6 to 10 percent slopes, at time third cutting was in process.

About half of the acreage is wooded, one-third is in pasture, and the rest is cultivated or used for house sites, roads, or is idle. This soil is suited to cotton, corn, and truck crops. Field observations indicate that this soil is slower to warm up than those in Capability unit IIIe-1. Small grains, soybeans, peaches, and pecans are among the suitable crops. Crimson clover, annual lespedeza, sericea lespedeza, Coastal bermudagrass, and tall fescue are among the plants suitable for hay and pasture. Close-growing crops contribute to good tilth, help to control erosion, and help to maintain the organic-matter content.

Erosion is the chief hazard if this soil is cultivated. The steepness and length of the slopes and the practices used to control erosion influence the kind of cropping system that can be used. Where stripcropping is done on the contour, a suitable cropping system is one in which cotton or some other row crop is planted in parallel contour strips that alternate with strips of a grass such as fescue. With this system, the crops are rotated every two years.

CAPABILITY UNIT IIIw-2

Only the mapping unit Cartecay and Chewacla soils is in this unit. These somewhat poorly drained, nearly level soils are on flood plains.

The surface layer is very friable to friable sandy loam, loam, silt loam, or, in a few places, loamy sand.

It is underlain by layers of soil material that range from silty clay loam to friable sandy clay loam, silt loam, loam, and sandy loam. No evidence of erosion is present, but in places floodwaters have deposited sand and silt on the surfaces.

Natural fertility and organic-matter content are low. Permeability is moderate to moderately rapid. Available water capacity is medium to high. The root zone ranges from moderately shallow to moderately deep, depending upon the extent of drainage and depth to the water table during the growing season. Reaction is medium acid to strongly acid throughout.

About half of the acreage is pasture or is cultivated, and the rest is in trees or is idle. The soils of this unit are suited mainly to hay, pasture, and trees. Tall fescue, Coastal bermudagrass, annual lespedeza, crimson clover, and ladino clover, however, are among the plants suitable for forage. Corn, grain, sorghum, soybeans, velvet beans, and peas can be grown, but these crops are likely to be damaged or harvest impaired by flooding. If adequately drained and protected from flooding, these soils are suited to row crops year after year, if the crop residue is well managed. Crops need to be planted that supply organic matter, help to maintain productivity, and preserve good tilth.

Flooding from streams once or twice annually for a period of a few days is the main hazard where these soils are cultivated. In order to improve crop responses, a drainage system that removes excess surface water and improves internal drainage is needed.

CAPABILITY UNIT IIIw-3

Augusta loam is the only soil in this unit. It is somewhat poorly drained and is on the low terraces along the major streams. Slopes are 0 to 2 percent.

The surface layer is very friable loam about 6 inches thick. The subsoil is friable clay loam to a depth of about 60 inches.

Natural fertility and organic-matter content are low. Tilth is good. Permeability is moderate. Available water capacity is medium. The depth to which roots penetrate depends on the depth to the water table during the growing season. Reaction is very strongly acid throughout.

A small acreage is in trees, a greater amount of acreage is in pasture, and the rest is in water-tolerant plants used mostly by wildlife. This unit is suited to pasture that consists of fescue, lespedeza, and small grains. Corn and truck crops can be planted, but if they are planted early they do not grow well because this soil warms up slowly in spring. A suitable cropping system is one in which row crops are grown for two years and are followed by two years of legumes or grasses. If this soil is cultivated when wet, it tends to form clods, and cracks as it dries. All crop residue should be retained.

Annual flooding and wetness during periods of heavy rainfall are the chief limitations. A drainage system that removes excess surface water and improves internal drainage will improve crop responses. Diversions are needed in places to intercept runoff from higher areas.

CAPABILITY UNIT IVe-1

This unit consists of well-drained, slightly eroded and eroded soils on hillsides of interstream divides. These soils are in the Appling, Hiwassee, Madison, and Pacolet series.

The uppermost layers in the less eroded soils are sandy loam or loam about 5 to 10 inches thick. In the more eroded areas of Pacolet soils, these layers are sandy clay loam about 4 to 7 inches thick. The subsoil is sandy loam, sandy clay, clay loam, or clay.

Natural fertility and organic-matter content are low. The slightly eroded soils are generally in good tilth, but in areas of eroded Pacolet soils, tilth is poor. Permeability is moderate. Available water capacity is medium. Roots penetrate effectively to 24 inches or more. Reaction is very strongly acid to medium acid throughout. These soils are subject to further erosion if cleared and not protected.

Only a small acreage of these soils is cultivated or is used for pasture. The rest is wooded or idle or is used as building sites for residences or industries. These soils generally are suited to most of the crops grown locally but are better suited to grasses and legumes than to row crops. Row crops can be grown occasionally in rotation with perennial crops. The eroded soils are difficult to till and can be cultivated without clodding only within a narrow range of moisture content.

Where these soils are cultivated, erosion is the chief hazard. Contour tillage, terracing, grassed waterways, and stripcropping are practices that help control erosion. In addition a close-growing crop should be included in the cropping system. An example of a suitable cropping system where slope is 9 percent is three years of grass and one year of corn planted on the contour.

CAPABILITY UNIT IVe-3

This unit consists of well-drained soils that are eroded. These soils are in the Cecil, Gwinnett, Hiwassee, and Madison series. Slopes are 2 to 10 percent.

The surface layer is sandy clay loam or clay loam 3 to 7 inches thick. The subsoil is clay loam or clay.

Natural fertility and organic-matter content are low. Tilth is generally poor. The mixture of the subsoil with remnants of the original surface layer causes these soils to be difficult to cultivate without clodding, except in a narrow range of moisture content. Permeability is moderate. Available water capacity is medium. The root zone is thick, deep, or moderately deep. The hazard of further erosion is very severe if these soils are cultivated and not protected. Reaction is very strongly acid to medium acid.

About three-fourths of the acreage of these soils is wooded. The rest is in row crops or is used for pasture. These soils generally are suited to most of the crops grown locally, but they are better suited to grasses and legumes than to row crops. Row crops can be grown occasionally with perennial crops. Good stands of plants used in a row-crop system are somewhat difficult to obtain. The sandy clay loam and clay loam surface layers form a hard crust over the seedbed if optimum moisture conditions do not prevail. Growth of the plants is retarded because of this crusting characteristic of the soils.

Where these soils are cultivated, further erosion is the chief hazard. Contour tillage, terracing, grassed waterways, and stripcropping are practices that help control erosion. In addition, a close-growing crop should be included in the cropping system. An example of a suitable cropping system where the slope is 7 percent is three years of grass and one year of cotton planted on the contour.

CAPABILITY UNIT IVw-1

The Chewacla-Wehadkee complex is the only mapping unit in this capability unit. These soils are somewhat poorly drained and poorly drained and are flooded during parts of the year. They are in low positions on large flood plains, and water is trapped on them for long periods. Slopes range from 0 to 2 percent.

The surface layer ranges from sandy loam to silt loam. It is 5 to 10 inches thick. The subsoil or underlying layers are loamy. Because the water table is commonly near the surface, plant roots penetrate only to a depth of about 8 to 12 inches in undrained areas.

Natural fertility is low to medium, and organic-matter content is low. Permeability is moderate, but water remains on the surface of some areas for long periods. Available water capacity is medium to high. These soils are wetter than the soils in capability unit IIIw-2, and they are flooded for longer periods. Reaction is medium acid to strongly acid.

These soils are too wet for row crops in undrained areas, but corn can be grown continuously where drainage is provided. They are fairly well suited to tall fescue, white clover, and dallisgrass. Response to fertilizer and lime is fairly good. Most areas in this unit are wooded, but a few are in permanent pasture. Tall fescue and white clover can be grown in undrained areas. Such areas are not grazed during rainy periods.

Frequent flooding and wetness are the main hazards. Drainage is needed where the soils of this unit are farmed.

CAPABILITY UNIT Vw-1

Chewacla loam, frequently flooded, is the only soil in this unit. It is mainly on flood plains of larger streams. Slopes range from 0 to 2 percent.

The surface layer is loam about 6 inches thick. The subsoil is loamy and mainly friable.

Natural fertility and organic-matter content are low. Tilth is generally poor because of the wetness of the soil. Permeability is moderate, although the water table commonly is near the surface, especially during prolonged rainy seasons. The root zone is, therefore, generally moderately shallow. This soil is flooded several times each year. Reaction is medium acid to strongly acid.

Excess surface water and internal wetness are the chief limitations. Artificial drainage is not feasible in most areas because of the slow lateral movement of water and the need for close spacing of drains. This soil can be used for pasture or for growing hardwoods that are suited to bottom land. Suitable pasture plants are tall fescue and ladino clover.

CAPABILITY UNIT VIe-2

This unit consists of well-drained, slightly eroded to eroded, sloping to steep soils on hillsides in areas that join or are near drainageways. These soils formed in residual clayey materials. They are in the Gwinnett, Madison, and Pacolet series. Slopes range from 10 to 25 percent.

The surface layer of the slightly eroded Madison and Pacolet soils is sandy loam about 6 to 7 inches thick. The surface layer in areas of eroded Gwinnett and Madison soils is sandy clay loam or clay loam 5 to 6 inches thick. The subsoil is sandy clay loam, clay loam, or clay.

Natural fertility and organic-matter content are low. The slightly eroded Madison and Pacolet soils have good tilth. The eroded Gwinnett and Madison soils have poor tilth and can be tilled only within a narrow range of moisture content without clodding. Permeability is moderate. Available water capacity is medium. The root zone is mainly moderately deep. Reaction ranges from medium acid to very strongly acid.

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 plants. The dominant acreage is in trees, and the rest is in permanent pasture. Controlled grazing aids in preventing the deterioration of the pasture sod and thus helps to control erosion. For woodland management practices, see the woodland section.

CAPABILITY UNIT VIe-4

This unit consists of well-drained, sloping to steep, cobbly and stony soils on ridgetops and hillsides. They are in the Chestatee and Musella series. Slopes range from 6 to 25 percent.

The surface layer ranges from stony sandy loam to cobbly clay loam. This layer is 4 to 9 inches thick. The subsoil is thin and mainly sandy clay loam to gravelly clay loam or clay. It is underlain by weathered and fractured rock containing pockets of clayey or loamy materials in the fractures.

Natural fertility and organic-matter content are low. Tilth is poor. Permeability is moderate. Available water capacity is low. The root zone ranges from shallow to moderately deep. Reaction of Chestatee soils is very strongly acid to strongly acid; reaction of the Musella soils is medium acid to slightly acid.

These soils are used mainly for woodland, but some few areas are pastured. In establishing pasture these soils need to be tilled and seeded on the contour to control erosion. They are moderately suited to bermudagrass, tall fescue, and serica lespedeza. Recommended amounts of fertilizer should be added yearly.

CAPABILITY UNIT VIIe-1

Pacolet-Tallapoosa association, steep, is the only mapping unit in this capability unit. Slopes range from 15 to 45 percent.

The surface layer of the Pacolet soils is mainly sandy loam that is 3 inches thick, and the subsurface layer is sandy loam that is 2 inches thick. The subsoil is clay loam. The underlying layer is weathered rock fragments coated with clay. The surface layer of the Tallapoosa soils is sandy loam or gravelly sandy loam about

7 inches thick. The subsoil is thin clay loam. The underlying layer is weathered schist.

Natural fertility and organic-matter content are low. Tilth is good. Permeability is moderate. Available water capacity is low for Tallapoosa soils and medium for Pacolet soils. The root zone ranges from shallow to moderately deep. Reaction is strongly acid throughout.

The soils in this unit are unsuited to cultivation because of the steepness of slopes and a severe erosion hazard. They afford limited grazing. Trees are moderately well suited to the Pacolet soils, but their growth is slow on the Tallapoosa soils. Present vegetation on the Pacolet soils consists of mixed pines and hardwoods, but on the Tallapoosa soils, scrub oaks and other poor-quality hardwoods predominate. See the section "Use of the Soils as Woodland" for more specific woodland management practices.

CAPABILITY UNIT VIIe-2

Louisburg sandy loam, 10 to 25 percent slopes, is the only soil in this unit. It is a shallow to moderately deep, well-drained to excessively drained soil on uplands. This soil is on long, narrow hillsides adjacent to drainageways.

The surface layer is chiefly loose sandy loam 7 inches thick. The subsoil is sandy loam. Partly weathered gneiss rock underlies the subsoil at a depth of 24 inches but can be penetrated with handtools to a depth of 60 inches.

Natural fertility and organic-matter content are low. Tilth is good. Permeability is rapid. This soil is generally droughty, and the available water capacity is low. The root zone is mainly moderately deep. Reaction is strongly acid to medium acid.

This soil is unsuitable for cultivation because of steepness and a severe hazard of erosion, but it does support pasture, hay crops, and trees (wooded areas) to a limited extent. Grasses and legumes are somewhat difficult to establish and to maintain because of the low available water capacity and low fertility.

To establish pasture, contour tilling and contour planting need to be used to reduce erosion. To obtain the best responses, apply a complete fertilizer according to a soil test. Renew pasture or hay stands in alternate strips to aid in checking erosion. In pastures, control grazing to avoid weakening the plant cover. See the section "Use of the Soils as Woodland" for more specific woodland management practices.

CAPABILITY UNIT VIIe-3

Musella cobbly clay loam, 15 to 35 percent slopes, is the only soil in this capability unit. It is a shallow, well-drained soil that is on hillsides of uplands.

The surface layer is cobbly clay loam 5 inches thick. The subsoil is gravelly clay loam and soft, fractured, weathered rocks.

Natural fertility and organic-matter content are low. Tilth is poor because of the cobbly clay loam surface layer. Permeability is moderate. The root zone is shallow. Reaction is medium acid to slightly acid.

This unit is not suited to cultivation and pasture because of a severe erosion hazard, a cobbly clay loam surface layer, and steepness of slopes. It is moderately well suited to shortleaf pine and loblolly pine.

CAPABILITY UNIT VIIe-4

Pacolet-Orthents complex, 10 to 25 percent slopes, severely eroded, is the only mapping unit in this capability unit. Pacolet soils are well drained. Erosion has greatly altered the original profile. The present surface layer is mainly the upper part of the subsoil, and the subsoil is clayey and gullied in most locations. Orthents are known locally as "Gullied land." The original soils are eroded to the extent that they have lost their identity.

Natural fertility and organic-matter content are low. Reaction is strongly acid, and permeability is moderate in Pacolet soils. The available water capacity is medium, except in the gullied parts, where it is low. Most properties of Orthents are too variable to list. The root zone of these soils is mainly shallow, and tilth is poor.

These soils are unsuited to crops and pasture unless the surfaces are smoothed. Reclamation for pasture and crops requires extensive inputs. Pine trees can be grown, but growth rates are severely limited. Most areas of this complex are idle.

Estimated yields

Table 2 lists estimated yields of the principal crops grown in the counties. The predictions are based on estimates made by farmers, soil scientists, and others who have knowledge of yields in the counties and on information taken from research data. The predicted yields are average yields per acre that can be expected by good commercial farmers at the level of management which tends to produce the highest economic returns.

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

The predicted yields given in table 2 can be expected if the following management practices are applied:

1. Rainfall is conserved and used effectively.
2. Systems for surface or subsurface drainage (or both) are installed.
3. Crop residues are managed in such a manner that they maintain soil tilth.
4. Minimum but timely tillage is used.
5. Insect-, disease-, and weed-control measures are consistently used.
6. Fertilizer is applied according to soil tests and crop needs.
7. Adapted crop varieties are used at recommended seeding rates.

In the following paragraphs are some specific practices recommended to obtain the yields shown in table 2. The rates given for plant nutrients are on a per acre basis.

Cotton.—Plant enough seed to produce 40,000 to 60,000 plants per acre. Apply 60 to 120 pounds of nitrogen, 50 to 80 pounds of phosphoric acid, and 75 pounds of potash. Apply 0.5 pound of elemental boron

TABLE 2.—*Estimated yields per acre of the principal*

[These estimates do not reflect increased yields resulting from irrigation.

Soil	Cotton (lint)	Corn
	Lb	*Bu*
Altavista sandy loam, 2 to 6 percent slopes	500	90
Appling sandy loam, 2 to 6 percent slopes	700	85
Appling sandy loam, 6 to 10 percent slopes	600	75
Appling sandy loam, 10 to 15 percent slopes	450	65
Augusta loam		65
Cartecay and Chewacla soils		85
Cecil sandy loam, 2 to 6 percent slopes	700	90
Cecil sandy loam, 6 to 10 percent slopes	675	85
Cecil sandy clay loam, 6 to 10 percent slopes, eroded	550	75
Chestatee stony sandy loam, 15 to 25 percent slopes		
Chewacla loam, frequently flooded		
Chewacla-Wehadkee complex		
Gwinnett clay loam, 6 to 10 percent slopes, eroded	575	65
Gwinnett clay loam, 10 to 25 percent slopes, eroded		
Hiwassee loam, 2 to 6 percent slopes	525	90
Hiwassee loam, 6 to 10 percent slopes	475	80
Hiwassee loam, 10 to 15 percent slopes	425	68
Hiwassee clay loam, 2 to 10 percent slopes, eroded	375	65
Louisburg sandy loam, 10 to 25 percent slopes		
Madison sandy loam, 2 to 6 percent slopes	650	85
Madison sandy loam, 6 to 10 percent slopes	550	80
Madison sandy loam, 10 to 15 percent slopes	450	65
Madison sandy loam, 15 to 25 percent slopes		
Madison sandy clay loam, 6 to 10 percent slopes, eroded	500	65
Madison sandy clay loam, 10 to 15 percent slopes, eroded		
Musella cobbly clay loam, 6 to 15 percent slopes		
Musella cobbly clay loam, 15 to 35 percent slopes		
Pacolet sandy loam, 15 to 25 percent slopes		
Pacolet-Orthents complex, 10 to 25 percent slopes, severely eroded		
Pacolet-Tallapoosa association, steep		
Pacolet soils, 10 to 15 percent slopes, eroded	500	65
Toccoa soils		90
Wickham sandy loam, 2 to 6 percent slopes	700	90

[1]Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep,

and 2.5 pounds of elemental manganese per acre on soils that have a reaction (pH) above 5.6. Fertilizer should contain sufficient sulfur to supply a minimum of 10 pounds of elemental sulphur per acre; and to provide adequate control of weeds, plant diseases, and insects.

Corn.—Plant enough seed to produce 16,000 to 18,000 plants per acre. Apply 100 to 160 pounds of nitrogen, 40 to 50 pounds of phosphoric acid, and 60 to 75 pounds of potash. Return all crop residue to the soil.

Wheat.—For soils on which the expected acre yield is 35 bushels or more, apply 40 to 60 pounds of nitrogen per acre and 50 to 60 pounds each of phosphoric acid and potash at planting time and 32 to 64 pounds of nitrogen late in winter.

Sericea lespedeza.—For soils on which the expected acre yield is 2 tons or more of hay, apply 8 to 12 pounds of nitrogen per acre, 40 to 50 pounds each of phosphoric acid and potash, and 1 ton of lime at seeding time. Thereafter apply 48 to 72 pounds each of phosphoric acid and potash per acre annually, and add 1 ton of lime every 4 or 5 years or add it according to the need indicated by the results of soil tests.

Soybeans.—Plant approximately 1 bushel of seed per acre. Apply 0 to 29 pounds of nitrogen, 20 to 50 pounds of phosphoric acid, and 40 to 60 pounds of potash. Use nitrogen when soybeans are not following a fertilized crop. Inoculate seed and apply 1 ounce of molybdenum salt per bushel of seed as seed treatment. Use lower fertilizer rates when soybeans follow a heavily fertilized crop. Provide adequate control of weeds and insects.

Oats.—If oats are to be used for grazing and grain, plant at the rate of 4 bushels per acre. Apply 100 to 140 pounds of nitrogen, 50 to 70 pounds of phosphoric acid, and 75 to 120 pounds of potash. Split the nitrogen application—half in fall and half in mid-March. Seeding and fertilizer rates should be reduced if oats are used only for grain. Provide adequate control of weeds.

Coastal bermudagrass for pasture.—Apply 100 to 200 pounds of nitrogen, 40 to 60 pounds of phosphoric acid, and 50 to 100 pounds of potash. Adjust fertilizer amounts with stocking rates. Provide adequate control of weeds and insects.

If the Coastal bermudagrass is used for hay, apply 200 to 400 pounds of nitrogen, 25 to 100 pounds of phosphoric acid, and 50 to 200 pounds of potash. Split nitrogen applications, applying the first early in spring and then after each cutting for hay. Provide adequate control of weeds and insects.

Tall fescue and white clover for pasture.—Apply 25 to 50 pounds of nitrogen, 50 pounds of phosphoric acid, *crops grown under an improved level of management*

Absence of a yield figure indicates the crop is not suited to the soil]

Soybeans	Wheat	Oats	Sericea lespedeza	Coastal bermudagrass and crimson clover for pasture	Tall fescue and white clover for pasture
Bu	*Bu*	*Bu*	*Tons*	*AUM* [1]	*AUM* [1]
35		80	3.0	8.0	6.0
40	40	90	3.0	8.0	6.0
30	35	80	2.6	7.7	5.5
30	25	65	2.5	6.3	5.3
35	25	55	2.0		6.5
35				6.6	6.6
40	45	95	3.0	8.3	6.5
35	40	85	2.8	8.3	6.0
30	30	70	2.2	7.5	5.0
					4.0
					7.0
					6.5
30	30	65	2.5	7.8	5.8
				6.6	4.2
40	45	95	3.0	8.8	5.8
40	40	85	2.7	8.3	5.5
35	35	65	2.5	7.5	5.1
28	30	65	2.5	7.5	5.0
40	45	85	3.0	8.3	6.3
35	40	85	2.6	8.3	5.5
30	35	65	2.5	6.6	5.0
				6.0	4.6
25	30	60	2.1	7.5	4.8
				5.3	4.0
					4.5
				5.8	4.5
25	30	60	2.1	7.5	4.8
45	45	90	3.1	7.8	7.0
40	45	80	3.0	8.3	6.0

or five goats) for a period of 30 days.

and 75 pounds of potash. Adjust fertilizer amount with stocking rates. Provide adequate control of weeds and insects.

Use of the Soils as Woodland [3]

This section has been provided to explain how soils affect tree growth and management in the counties. Field information was gathered by teams of foresters and soil scientists. Representatives of Federal and State agencies, the wood-using industry, and others cooperated in gathering field data.

Originally Barrow, Hall, and Jackson Counties were mainly wooded. Now trees cover about 65 percent of the area. Good stands of commercial trees are produced in the woodland of these counties. Needleleaf forest types are most frequently on the hills, and broadleaf types generally predominate on the bottom land along the rivers and creeks.

The wood-products industry provides a substantial income, although this income is below its potential. Other values of wooded areas include those that result from grazing of livestock, uses of the areas for recreation and enjoyment of natural beauty, and conservation of soil and water.

In table 3 the soils of the survey area are placed in woodland suitability groups, and potential productivity and management concerns are listed. Each group is made up of soils that are suited to the same kinds of trees, that need about the same kind of management to produce these trees, and that have about the same potential productivity. Each is identified by a three-part symbol. The significance of each part is explained in the following paragraphs.

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

The second part of the symbol, a letter, indicates the important soil property that imposes a moderate or severe hazard or limitation in managing the soils for wood production. The letter *x* shows that the main limitation is stoniness or rockiness; *w* shows that excessive water in or on the soil is the chief limitation; *c* shows that clay in the upper part of the soil is a limitation; *f* shows that the soils have large amounts of coarse fragments; *r* shows the soils have steep slopes; and *o* shows the soils have no significant restrictions or limitations for woodland use or management.

[3] W. P. THOMPSON, forester, Soil Conservation Service, assisted in the preparation of this section.

TABLE 3.—*Woodland*

Woodland suitability group	Map symbols in group[1]
Group 1o7: Well-drained soils that have a loamy surface layer and underlying layers; that are on stream flood plains; that have very high productivity; and that are suited to hardwoods and southern pines.	To.
Group 1w8: Somewhat poorly drained and poorly drained soils that have a loamy surface layer and subsoil; that are on stream flood plains; that have very high productivity; and that are suited to southern pines and hardwoods.	Ck, Cw.
Group 2w8: Moderately well drained to somewhat poorly drained soils that have a loamy surface layer and subsoil or underlying layers; that are on stream terraces and flood plains; that have high productivity; and that are suited to southern pines and hardwoods; slopes range from 0 to 6 percent.	AlB, Au, Cc.
Group 3o7: Well-drained soils that have a loamy surface layer and loamy to clayey subsoil; that are on uplands; that have moderately high productivity; and that are suited to southern pines and hardwoods; slopes range from 2 to 15 percent.	ApB, ApC, ApD, CeB, CeC, HsB, HsC, HsD, MdB, MdC, MdD, PuD2, WhB.
Group 3r8: Well-drained to somewhat excessively drained upland soils that have a loamy surface layer and loamy to clayey subsoil; that are on uplands; that have moderately high productivity; and that are suited to southern pines and hardwoods; most slopes exceed 15 percent, but the range is 10 to 45 percent.	LuE, MdE, PaE, PTF.
Group 3x3: Well-drained, stony soils that have a loamy surface layer and clayey subsoil; that are on uplands; that have moderately high productivity; and that are better suited to southern pines; slopes range from 15 to 25 percent.	ChE.
Group 4c2e: Well-drained, eroded soils that have a loamy surface layer and clayey subsoil; that are on uplands; that have moderately high productivity; and that are better suited to southern pines; slopes range from 2 to 15 percent.	CfC2, GwC2, HtC2, MlC2, MlD2.
Group 4c3e: Well-drained, eroded soils that have a loamy surface layer and clayey subsoil; that are on uplands; that have moderate productivity; and that are better suited to southern pines; slopes range from 10 to 25 percent.	GwE2.
Group 4f3: Well-drained soils that have a cobbly, loamy surface layer and gravelly loamy subsoil; that are on uplands; that have moderate productivity; and that are better suited to southern pines; slopes range from 6 to 35 percent.	MuD, MuF.

[1] PgE3 better suited to pines than to other trees but not assigned to a suitability group because properties are too variable.

The third element in the symbol indicates the degree of management problems and the general suitability of the soils for certain kinds of trees, either pines, hardwood, or both.

A list of some of the commercially important trees which are adapted to the soil are presented in the "Potential productivity" column of table 3. These are the trees that woodland managers will generally favor in intermediate or improvement cuttings. The potential productivity of these trees is given in terms of site index. The site index is the average height of dominant trees, in feet, at age 30 for cottonwood, at age 35 for sycamore, at age 25 for planted pines, and at age 50 for all other species or types.

use and management

Potential productivity		Management concerns			Trees to plant
Important trees	Site index	Erosion hazard	Equipment limitations	Seedling mortality	
Loblolly pine Shortleaf pine Yellow-poplar Black walnut Sweetgum Cottonwood Sycamore Black cherry	90 80 110 100 100 110 90 90	Slight	Slight	Slight	Loblolly pine, yellow-poplar, black walnut, cottonwood, sycamore, white pine.
Loblolly pine Yellow-poplar Green ash Sweetgum Cottonwood Sycamore Red maple Water oaks White ash	100 100 100 100 100 90 70 90 80	Slight	Moderate	Moderate	Loblolly pine, yellow-poplar, green ash, sweetgum, cottonwood, sycamore.
Loblolly pine Yellow-poplar Sweetgum Sycamore Cottonwood White oaks Red oaks	90 100 90 90 100 80 80	Slight	Moderate	Slight to moderate.	Loblolly pine, yellow-poplar, sweetgum, sycamore, cottonwood.
Loblolly pine Shortleaf pine Virginia pine Yellow-poplar White oaks Red oaks	80 70 70 90 70 80	Slight	Slight	Slight	Loblolly pine, Virginia pine, yellow-poplar.
Loblolly pine Virginia pine Yellow-poplar White oaks Red oaks	80 70 90 70 80	Moderate	Moderate	Slight	Loblolly pine, Virginia pine, yellow-poplar, northern red oak.
Loblolly pine Virginia pine Red oaks White oaks	80 80 80 70	Moderate	Moderate	Slight	Loblolly pine, Virginia pine.
Loblolly pine Virginia pine Shortleaf pine	70 60 60	Moderate	Moderate	Slight	Loblolly pine, Virginia pine.
Loblolly pine Virginia pine Shortleaf pine	70 60 60	Severe	Moderate to severe.	Moderate	Loblolly pine, Virginia pine.
Loblolly pine Virginia pine Shortleaf pine	70 60 60	Slight to moderate.	Slight to moderate.	Moderate to severe.	Loblolly pine, Virginia pine.

The management concerns evaluated in columns of table 3 are erosion hazard, equipment limitations, and seedling mortality. Erosion hazard is a measure of the risk of soil losses in well-managed woodland. The hazard is *slight* if expected soil loss is small, *moderate* if some measure to control erosion are needed in logging and construction, and *severe* if intensive treatment or special equipment and methods are needed to prevent excessive soil losses (fig. 10).

Equipment limitation ratings reflect the soil conditions that restrict the use of equipment normally used in woodland management or harvesting. A rating of *slight* indicates equipment use is not limited to kind or time of year, and a rating of *moderate* indicates a

Figure 10.—**Planted slash pines that have been thinned according to recommended forestry practices. The soil is Appling sandy loam, 2 to 6 percent slopes.**

seasonal limitation or need for modification in methods of equipment. A rating of *severe* indicates the need for special equipment or special operations.

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

In the column "Trees to plant" of table 3 is a list of trees suitable to plant for commercial wood production.

Use of the Soils as Wildlife Habitat [4]

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

In table 4 soils of this survey area are rated for producing seven elements of wildlife habitat and for three groups, or kinds, of wildlife.

Habitat Elements.—Each soil is rated in table 4 according to its suitability for producing various kinds of plants and other elements that make up wildlife habitats. The ratings take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account climate, present use of soils, or present distribution of wildlife and people. For this reason, selection of a site for development as a habitat for wildlife requires inspection at the site. The ratings indicate relative suitability for various elements. A rating of *good* means the element of wildlife habitat generally is easily created, improved, and maintained. Few or no limitations affect management in this category, and satisfactory results are expected when the soil is used for the prescribed purpose.

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

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

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

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

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

Grasses and legumes.—Making up the group are domestic grasses and legumes that are established by planting. They provide food and cover for wildlife. Grasses include bahiagrass, ryegrass, and panicgrass; legumes include annual lespedeza, shrub lespedeza, and other clovers and vetches.

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

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

Coniferous woody plants.—These plants are cone-bearing trees and shrubs that provide cover and fre-

[4] JESSIE MERCER, JR., biologist, Soil Conservation Service, assisted in the preparation of this section.

quently furnish food in the form of browse, seeds, or fruitlike cones. They commonly grow in their natural environment, but they can be planted and managed. Typical plants in this category are pines, cedars, and ornamental trees and shrubs.

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

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

Kinds of Wildlife.—Table 4 rates soils according to their suitability as habitat for the three kinds of wildlife in the counties—open-land, woodland, and wetland. These ratings are related to ratings made for the elements of habitat. For example, soils rated very poor for shallow water developments are rated very poor for wetland wildlife. The significance of each subheading under "Kinds of Wildlife" is given in the following paragraphs.

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

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

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

Engineering Uses of the Soils [5]

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

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

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

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

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

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 5 and 6, and it also can be used to make other useful maps.

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

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

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified System used by the SCS engineers, Department of Defense, and others (*3*), and the AASHTO System adopted by the American Association of State Highway and Transportation Officials (*2*).

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

[5] STEPHEN A. DANIELS, civil engineer, Soil Conservation Service, assisted in the preparation of this section.

TABLE 4.—*Suitability of the soils for elements*

Soil series and map symbols	Habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Altavista: AlB	Good	Good	Good
Appling			
ApB	Good	Good	Good
ApC, ApD	Fair	Good	Good
Augusta: Au	Fair	Good	Fair
Cartecay: Cc	Fair	Good	Good
Cecil:			
CeB	Good	Good	Good
CeC	Fair	Good	Good
CfC2	Fair	Good	Fair
Chestatee: ChE	Poor	Fair	Good
Chewacla:			
Ck	Very poor	Fair	Fair
Cw	Poor	Fair	Fair
Gwinnett:			
GwC2	Good	Good	Fair
GwE2	Poor	Fair	Fair
Hiwassee:			
HsB	Good	Good	Good
HsC	Fair	Good	Good
HsD	Fair	Good	Good
HtC2	Fair	Good	Fair
Louisburg: LuE	Poor	Fair	Fair
Madison:			
MdB	Good	Good	Good
MdC	Fair	Good	Good
MdD	Fair	Good	Good
MdE	Fair	Fair	Good
MlC2	Fair	Good	Fair
MlD2	Fair	Good	Fair
Musella:			
MuD	Poor	Poor	Fair
MuF	Very poor	Poor	Fair
Pacolet:			
PaE	Poor	Fair	Good
PgE3	Very poor	Very poor	Very poor
PTF	Very poor	Very poor	Fair
PuD2	Fair	Good	Fair
Toccoa: To	Good	Good	Good
Wickham: WhB	Good	Good	Good

are designated by symbols for both classes; for example, CL–ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 7; the estimated classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

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

Soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 5. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 5.

Depth to hard rock is distance from the surface of the soil to the upper surface.

of wildlife habitat and kinds of wildlife

Habitat elements—Continued				Kinds of wildlife		
Hardwood trees, shrubs, and vines	Coniferous woody plants	Wetland food and cover plants	Shallow-water developments	Open-land	Woodland	Wetland
Good	Good	Poor	Poor	Good	Good	Poor.
Good	Good	Very poor	Very poor	Good	Good	Very poor.
Good	Good	Very poor	Very poor	Good	Good	Very poor.
Good	Good	Fair	Fair	Fair	Good	Fair.
Good	Good	Fair	Fair	Good	Good	Fair.
Good	Good	Very poor	Very poor	Good	Good	Very poor.
Good	Good	Very poor	Very poor	Good	Good	Very poor.
Fair	Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor.
Good	Fair	Good	Good	Poor	Good	Good.
Good	Fair	Good	Good	Fair	Good	Good.
Fair	Good	Very poor	Very poor	Good	Good	Very poor.
Fair	Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Good	Very poor	Very poor	Good	Good	Very poor.
Good	Good	Very poor	Very poor	Good	Good	Very poor.
Good	Good	Very poor	Very poor	Good	Good	Very poor.
Fair	Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor.
Good	Good	Very poor	Very poor	Good	Good	Very poor.
Good	Good	Very poor	Very poor	Good	Good	Very poor.
Good	Good	Very poor	Very poor	Good	Good	Very poor.
Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor.
Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor.
Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor.
Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Fair	Fair	Very poor	Very poor	Very poor	Fair	Very poor.
Fair	Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Good	Poor	Poor	Good	Good	Poor.
Good	Good	Poor	Very poor	Good	Good	Very poor.

Soil texture is described in table 5 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plasic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 5, but in table 7 the data on liquid and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

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

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms

TABLE 5.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The the instructions for referring to other series that appear in the first column of

Soil series and map symbols	Depth to hard rock	Depth from surface	USDA texture	Classification: Unified	Classification: AASHTO
	Feet	*Inches*			
Altavista: AlB	>5	0–7	Sandy loam	SM	A–2
		7–12	Sandy clay loam.	SM, ML, CL, SC, CL-ML, or SM-SC	A–4, A–6,
		12–36	Clay loam	CL, SC, CL-ML, or SM-SC	A–4, A–6
		36–60	Sandy clay loam.	CL, SC, SM-SC, or CL-ML	A–4, A–6 A–2
Appling: ApB, ApC, ApD	>5	0–10	Sandy loam	SM	A–2
		10–18	Sandy clay loam.	CL	A–6
		18–48	Clay	CL, ML, or MH	A–7
		48–72	Sandy clay loam.	ML, MH, or SM	A–5, A–7
Augusta: Au	>6	0–12	Loam	SM or ML	A–4
		12–60	Clay loam	CL-ML, CL	A–4, A–6
*Cartecay: Cc For Chewacla part, see Chewacla series.	>6	0–10	Silt loam	ML, SM	A–4
		10–31	Sandy loam	SM	A–4
		31–50	Silt loam	ML	A–4
Cecil: CeB, CeC, CfC2	>6	0–7	Sandy loam and clay loam.	SM, SM-SC	A–2, A–4, A–6
		7–12	Clay loam	CL, ML, CL-ML	A–4
		12–32	Clay	CL, MH, ML	A–7
		32–42	Clay loam	ML, MH	A–5, A–7, A–4
		42–60	Saprolite		
Chestatee[1]: ChE	>6	0–9	Sandy loam	SM	A–2, A–4
		9–36	Sandy clay loam and clay.	SC, ML, SM, MH, CL, CH	A–7
		36–72	Loam and coarse sandy loam.	SM	A–2, A–1–b
*Chewacla: Ck, Cw For Wehadkee part of Cw, see Wehadkee series.	>6	0–12	Loam	ML, SM, SM-SC, CL-ML	A–4
		12–15	Sandy clay loam.	CL-ML, ML, SM-SC, SM	A–6, A–4
		15–38	Loam	ML, CL, CL-ML	A–4, A–6
		38–60	Silty clay loam.	ML, MH	A–7
Gwinnett: GwC2, GwE2	>5	0–5	Clay loam	CL	A–4, A–6
		5–35	Clay	MH, CL	A–7, A–6
		35–75	Saprolite and rock fragments.		
Hiwassee: HsB, HsC, HsD, HtC2	>6	0–8	Loam and clay loam.	ML, CL, CL-ML	A–4, A–6
		8–43	Clay	ML, CL	A–7, A–6
		43–62	Clay loam	CL, ML	A–7, A–6

significant in engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully this table. The symbol > means more than; the symbol < means less than]

Percentage passing sieve[1]—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	*Percent*		*Inches per hour*	*Inches per inch of soil*	*pH*	
95–100	95–100	60–85	25–35		[2]NP	2.0–6.0	0.11–0.13	5.1–6.0	Low.
95–100	95–100	70–90	36–55	20–40	5–15	0.6–2.0	0.12–0.14	5.1–6.0	Low.
95–100	95–100	60–80	40–70	20–40	5–20	0.6–2.0	0.12–0.14	5.1–6.0	Low.
95–100	95–100	45–65	28–65	20–35	5–15	0.6–2.0	0.12–0.14	5.1–5.5	Low.
95–100	85–95	55–85	25–35		NP	2.0–6.0	0.11–0.13	5.1–5.5	Low.
95–100	95–100	75–85	50–65	20–35	11–14	0.6–2.0	0.12–0.14	5.1–5.5	Low.
100	95–100	80–90	55–75	41–70	14–28	0.6–2.0	0.12–0.14	5.1–5.5	Low to moderate.
100	98–100	75–85	36–55	42–54	8–14	0.6–2.0	0.12–0.14	5.1–5.5	Low.
95–100	95–100	75–95	36–55		NP	2.0–6.0	0.10–0.14	5.1–5.5	Low.
95–100	95–100	75–95	50–70	25–40	5–20	0.6–2.0	0.10–0.14	5.1–5.5	Moderate to low.
	100	95–100	45–55	<30	NP	2.0–6.0	0.14–0.16	5.6–6.0	Low.
	100	95–100	36–45		NP	2.0–6.0	0.09–0.12	5.6–6.0	Low.
	100	95–100	50–70		NP	2.0–6.0	0.14–0.16	5.6–6.0	Low.
95–100	90–100	67–80	25–45	<40	NP–11	2.0–6.0	0.12–0.14	5.1–5.5	Low.
95–100	95–100	85–95	50–60	21–35	5–10	0.6–2.0	0.13–0.15	5.1–5.5	Low.
97–100	95–100	75–95	55–80	41–65	16–27	0.6–2.0	0.13–0.15	5.1–5.5	Low.
100	99–100	82–90	50–70	<59	NP–19	0.6–2.0	0.13–0.15	5.1–5.5	Low.
85–95	60–80	25–45	20–40	<30	NP–4	2.0–6.0	0.06–0.12	4.5–5.5	Low.
80–95	75–90	60–80	45–65	41–60	15–30	0.6–2.0	0.08–0.12	4.5–5.5	Low.
90–100	60–80	40–65	15–35		NP	2.0–6.0	0.06–0.10	5.1–6.0	Low.
98–100	95–100	80–95	36–55	<35	NP–10	0.6–2.0	0.15–0.20	5.1–6.0	Low.
98–100	95–100	60–80	40–65	<40	NP–13	0.6–2.0	0.12–0.15	5.1–6.0	Low.
98–100	95–100	80–95	50–75	<35	NP–12	0.6–2.0	0.15–0.18	5.1–6.0	Low.
96–100	95–100	80–95	70–90	41–55	11–18	0.6–2.0	0.15–0.20	5.1–6.0	Low.
95–100	90–100	75–90	50–65	27–35	10–15	0.6–2.0	0.11–0.15	5.6–6.0	Low.
95–100	95–100	80–90	55–75	38–58	16–27	0.6–2.0	0.12–0.14	5.6–6.0	Low to moderate.
94–100	89–100	78–90	51–70	<36	NP–12	0.6–2.0	0.12–0.15	5.6–6.0	Low.
99–100	99–100	88–95	64–85	36–50	17–25	0.6–2.0	0.12–0.15	5.6–6.0	Low.
100		85–95	60–80	36–45	11–23	0.6–2.0	0.12–0.15	5.6–6.0	Low.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to hard rock	Depth from surface	USDA texture	Classification	
				Unified	AASHTO
	Feet	*Inches*			
Louisburg[1]: LuE	>6	0–7	Sandy loam	SM	A–2
		7–24	Sandy loam	SM	A–2, A–4
		24–60	Weathered rock and soil material.		
Madison: MdB, MdC, MdD, MdE, MlC2, MlD2	>6	0–5	Sandy loam	SM-SC, SM	A–2, A–4
		5–9	Clay loam	CL	A–6
		9–29	Clay	MH, ML	A–7
		29–36	Clay loam	CL, ML, SC	A–7, A–6
		36–50	Weathered saprolite.		
Musella[1]: MuD, MuF	>2	0–5	Cobbly clay loam.	SM-SC, SM	A–2, A–4
		5–17	Gravelly clay loam.	SM, SC	A–6, A–4
		17–30	Weathered saprolite and soil material. Properties too variable to estimate.		
Orthents: Mapped only in complex with Pacolet soils. Too variable to rate.					
*Pacolet: PaE, PgE3, PTF, PuD2. For Tallapoosa part of PTF, see Tallapoosa series. Orthents part of PgE3 is too variable to rate.	>6	0–5	Sandy loam	SM	A–2
		5–32	Clay loam	ML, MH	A–7
		32–60	Weathered rock fragments and soil material.		
Tallapoosa: Mapped only with Pacolet soils.	>6	0–7	Sandy loam	SM	A–2, A–4
		7–16	Clay loam	CL, SC	A–6, A–4
		16–50	Schist fragments and loamy material.		
Toccoa: To	>6	0–46	Loam, fine sandy loam.	SM, ML	A–2, A–4
		46–65	Silty clay loam.	ML, MH	A–4, A–6, A–7
Wehadkee: Mapped only with Chewacla soils.	>6	0–42	Loam and clay loam.	ML, CL	A–7, A–6
		42–60	Sandy loam	SM, ML	A–4
Wickham: WhB	>6	0–7	Sandy loam	SM	A–2, A–4
		7–66	Sandy clay loam and clay loam.	CL, SC	A–4, A–6

[1] Soils in three of the soil series of the survey area have coarse fragments that are more than 3 inches in diameter: Chestatee soils are 25 to 35 percent coarse fragments, Louisburg are 0 to 2 percent, and Musella are 25 to 45 percent.

significant in engineering—Cont.

Percentage passing sieve[1]—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential
No .4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)						
				Percent		*Inches per hour*	*Inches per inch of soil*	*pH*	
95–100	90–100	55–70	15–25		NP	6.0–10.0	0.05–0.08	5.1–6.0	Low.
85–95	75–90	40–70	30–40	<21	NP	6.0–10.0	0.06–0.10	5.1–6.0	Low.
90–100	85–100	65–85	32–41	<28	NP–7	2.0–6.0	0.10–0.12	4.5–5.5	Low.
95–100	85–100	80–90	50–65	20–35	12–20	0.6–2.0	0.12–0.14	4.5–5.5	Low.
95–100	95–100	85–95	55–80	41–65	12–24	0.6–2.0	0.12–0.14	4.5–5.5	Low.
95–100	95–100	80–95	45–65	20–45	11–20	2.0–6.0	0.12–0.14	4.5–5.5	Low.
80–95	75–90	55–70	30–45	<28	NP–7	0.6–2.0	0.13–0.15	5.6–6.5	Low.
69–80	60–75	50–70	36–45	30–40	8–15	0.6–2.0	0.10–0.13	5.6–6.5	Low.
95–100	85–95	70–85	20–35	<30	NP–4	2.0–6.0	0.10–0.12	5.1–5.5	Low.
95–100	95–100	80–95	50–70	44–60	14–25	0.6–2.0	0.12–0.14	5.1–5.5	Low.
95–100	85–95	55–65	30–45		NP	2.0–6.0	0.10–0.12	5.1–5.5	Low.
95–100	95–100	80–90	45–65	20–38	8–15	0.6–2.0	0.10–0.12	5.1–5.5	Low.
100	95–100	80–95	30–55		NP	2.0–6.0	0.08–0.11	5.6–6.5	Low.
100	95–100	75–95	60–80	38–55	9–25	2.0–6.0	0.12–0.14	5.6–6.5	Low.
100	99–100	96–99	60–75	38–50	11–22	0.6–2.0	0.15–0.18	5.6–6.5	Low.
98–100	95–100	65–95	36–55		NP	2.0–6.0	0.14–0.16	5.6–6.5	Low.
	100	70–90	30–45		NP	2.0–6.0	0.11–0.13	5.1–6.0	Low.
100	95–100	80–90	40–55	25–35	8–15	0.6–2.0	0.13–0.15	5.1–6.0	Low.

[2] Nonplastic.

TABLE 6.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series that

Soil series and map symbols	Degree and kind of limitations for—				
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Trench-type sanitary landfills
Altavista: AlB	Severe: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.
Appling:					
ApB	Moderate: moderate permeability.	Moderate: slope.	Moderate: clayey texture of subsoil.	Moderate: clayey texture of subsoil.	Moderate: kaolinitic clay in subsoil.
ApC	Moderate: slope; moderate permeability.	Severe: slope.	Moderate: clayey texture of subsoil.	Moderate: slope; clayey texture of subsoil.	Moderate: kaolinitic clay in subsoil.
ApD	Moderate: slope; moderate permeability.	Severe: slope.	Moderate: slope; clayey texture of subsoil.	Moderate: slope.	Moderate: kaolinitic clay in subsoil.
Augusta: Au	Severe: seasonal high water table; shallow, brief flooding.	Slight to moderate: shallow, brief flooding.	Severe: seasonal high water table; shallow, brief flooding.	Severe: seasonal high water table.	Severe: seasonal high water table; shallow, brief flooding.
*Cartecay: Cc For Chewacla part, see Chewacla series.	Severe: seasonal high water table; flooding.	Moderate where protected from flooding. Severe in other places.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.
Cecil:					
CeB	Moderate: moderate permeability.	Moderate: moderate permeability; slope.	Moderate: kaolinitic clay in subsoil.	Slight: shrink-swell potential.	Moderate: kaolinitic clay in subsoil.
CeC	Moderate: moderate permeability.	Moderate to severe: slope.	Moderate: kaolinitic clay in subsoil.	Slight to moderate: slope.	Moderate: kaolinitic clay in subsoil.
CfC2	Moderate: moderate permeability.	Moderate to severe: slope.	Moderate: kaolinitic clay in subsoil.	Slight to moderate: slope.	Moderate: kaolinitic clay in subsoil.
Chestatee: ChE	Severe: slope.	Severe: slope.	Severe: slope; rock throughout profile.	Severe: slope; stoniness.	Severe: slope.

properties of the soil

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the appear in the first column of this table]

Degree and kind of limitations for—Continued		Suitability as source of—		Soil features affecting—				
Local roads and streets	Light industries	Topsoil	Road fill	Pond reservoirs	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Moderate: seasonal high water table.	Moderate: seasonal high water table.	Fair: wetness.	Fair: wetness.	Moderate permeability.	Medium susceptibility to piping and erosion.	Seasonal high water table; other features favorable.	Features generally favorable.	Features generally favorable.
Moderate: fair traffic-supporting capacity.	Moderate: clayey texture of subsoil.	Fair: clayey material below a depth of 18 inches.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Fair to good compaction properties.	Well drained	Features generally favorable.	Features generally favorable.
Moderate: fair traffic-supporting capacity.	Moderate to severe: slope; clayey texture of subsoil.	Fair: clayey material below a depth of about 15 inches.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Fair to good compaction properties.	Well drained	Slope	Features generally favorable.
Moderate: fair traffic-supporting capacity; slope.	Severe: slope.	Fair to poor: 6 to 9 inches of suitable material.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Fair to good compaction properties.	Well drained	Slope	Generally too steep; slope.
Moderate: seasonal high water table; shallow, brief flooding.	Severe: seasonal high water table; shallow, brief flooding.	Fair: about 18 inches of suitable material; wetness.	Fair: wetness.	Moderate permeability.	Poor to fair compaction properties.	Seasonal high water table.	Seasonal high water table.	Nearly level; features generally favorable for diversions.
Moderate: seasonal high water table; flooding.	Severe: seasonal high water table; flooding.	Fair to good.	Fair to good: wetness.	Moderately rapid permeability.	Low to medium permeability of compacted soil.	Seasonal high water table; flooding.	Seasonal high water table; supplemental water generally not needed.	Nearly level; features generally favorable for diversions
Moderate: fair traffic-supporting capacity.	Moderate: clayey texture of subsoil.	Fair if the upper 12 inches are mixed.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Fair to good compaction properties.	Well drained	Features generally favorable.	Features generally favorable.
Moderate: fair traffic-supporting capacity.	Moderate to severe: slope.	Fair if the upper 12 inches are mixed.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Fair to good compaction properties.	Well drained	Slope	Features generally favorable.
Moderate: fair traffic-supporting capacity.	Moderate to severe: slope.	Poor: less than 8 inches of suitable material.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Fair to good compaction properties.	Well drained	Slow intake rate; slope.	Features generally favorable.
Severe: slope.	Severe: slope; stoniness.	Poor: coarse fragments; slope.	Poor: slope.	Moderate permeability.	Stoniness	Well drained	Slope	Slope.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—				
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Trench-type sanitary landfills
*Chewacla: Ck, Cw. For Wehadkee part of Cw, see Wehadkee series.	Severe: flooding; wetness.	Severe: flooding.	Severe: flooding; wetness.	Severe: flooding; wetness.	Severe: flooding; wetness.
Gwinnett:					
GwC2	Moderate: moderate permeability; underlying rock.	Moderate to severe: slope.	Moderate: underlain by rock fragments.	Slight to moderate: slope.	Moderate: underlain by rock fragments.
GwE2	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope; underlain by rock fragments.
Hiwassee:					
HsB	Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: kaolinitic clay in subsoil.	Slight	Moderate: kaolinitic clay in subsoil.
HsC	Moderate: moderate permeability.	Moderate to severe: slope.	Moderate: kaolinitic clay in subsoil.	Slight to moderate: slope.	Moderate: kaolinitic clay in subsoil.
HsD	Moderate: moderate permeability.	Severe: slope.	Moderate: slope; kaolinitic clay in subsoil.	Moderate: slope.	Moderate: kaolinitic clay in subsoil.
HtC2	Moderate: moderate permeability.	Moderate to severe: slope.	Moderate: kaolinitic clay in subsoil.	Slight to moderate: slope.	Moderate: kaolinitic clay in subsoil.
Louisburg: LuE	Moderate to severe: depth to rock; slope.	Severe: slope.	Severe: underlain by rippable rock and boulders.	Moderate to severe: slope; underlain by rippable rock and boulders.	Severe: slope.
Madison:					
MdB	Moderate: depth to saprolite; moderate permeability.	Moderate: moderate permeability; slope.	Moderate: depth to saprolite.	Slight	Moderate: kaolinitic clay in subsoil.
MdC, MlC2	Moderate: depth to saprolite; moderate permeability.	Moderate to severe: slope.	Moderate: depth to saprolite.	Slight to moderate: slope.	Moderate: kaolinitic clay in subsoil.

properties of the soil—Cont.

Degree and kind of limitations for—Continued		Suitability as source of—		Soil features affecting—				
Local roads and streets	Light industries	Topsoil	Road fill	Pond reservoirs	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Severe: flooding; wetness.	Severe: flooding; wetness.	Fair: wetness hinders accessibility in wet seasons.	Fair: wetness.	Moderate permeability.	Medium to high susceptibility to piping.	Seasonal high water table; flooding.	Seasonal high water table; flooding.	Nearly level; features generally favorable for diversions.
Moderate: underlain by rock fragments.	Moderate to severe: slope; underlain by rock fragments.	Poor: less than 8 inches of suitable material.	Fair: underlain by coarse rock fragments at a depth of about 3 feet.	Moderate permeability.	Fair to good compaction properties; underlying rock fragments.	Well drained	Clay loam surface layer; slope.	Features generally favorable.
Severe: slope.	Severe: slope.	Poor: less than 8 inches of suitable material.	Poor: slope.	Moderate permeability.	Fair to good compaction properties; underlying rock fragments.	Well drained	Slope	Slope.
Moderate: fair traffic-supporting capacity.	Moderate: clayey texture of subsoil.	Fair: less than 16 inches of suitable material.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Medium compressibility.	Well drained	Features generally favorable.	Features generally favorable.
Moderate: fair traffic-supporting capacity.	Moderate to severe: slope.	Fair: less than 16 inches of suitable material.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Medium compressibility.	Well drained	Slope	Features generally favorable.
Moderate: fair traffic-supporting capacity.	Severe: slope.	Fair: less than 16 inches of suitable material.	Fair: slope.	Moderate permeability.	Medium compressibility.	Well drained	Slope	Slope.
Moderate: fair traffic-supporting capacity.	Moderate: slope.	Poor: less than 8 inches of suitable material.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Medium compressibility.	Well drained	Slope; clay loam surface layer.	Features generally favorable.
Moderate to severe: slope.	Severe: slope.	Poor: slope.	Poor: slope.	Rapid permeability.	Course rock fragments below a depth of about 2 feet.	Well drained to excessively drained.	Slope	Slope.
Moderate: fair traffic-supporting capacity.	Moderate: clayey texture of subsoil.	Fair: about 9 inches of suitable soil.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Medium to high compressibility.	Well drained	Features generally favorable.	Features generally favorable.
Moderate: fair traffic-supporting capacity.	Moderate to severe: slope.	Fair to poor: 5 to 9 inches of suitable material.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Medium to high compressibility.	Well drained	Slope	Features generally favorable.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—				
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Trench-type sanitary landfills
Madison—Cont. MdD, MID2	Moderate: slope.	Severe: slope.	Moderate: depth to saprolite.	Moderate: slope.	Moderate: kaolinitic clay in subsoil.
MdE	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Musella: MuD, MuF	Severe: rock at moderately shallow depths.	Severe: slope.	Moderate: rock at moderately shallow depths.	Moderate to severe: slope; rock at moderately shallow depths.	Severe: rock at moderately shallow depths.
Orthents: Mapped only in complex with Pacolet soils. Properties too variable to interpret.					
*Pacolet: PaE, PgE3, PTF. For Tallapoosa part of PTF, see Tallapoosa series. Orthents part of PgE3 is too variable to interpret.	Severe: slope.	Severe: slope.	Severe: underlain by saprolite and rock fragments.	Severe: slope.	Severe: slope.
PuD2	Severe: slope.	Severe: slope.	Severe: underlain by saprolite and rock fragments.	Moderate: slope.	Moderate: slope.
Tallapoosa: Mapped only in association with Pacolet soils.	Severe: slope.	Severe: slope.	Severe: shallow to saprolite and rock fragments.	Severe: slope.	Severe: shallow to saprolite and rock fragments.
Toccoa: To	Severe: flooding.	Severe: subject to seepage; probable flood damage to dike.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Wehadkee: Mapped only in complex with Chewacla soils.	Severe: flooding; seasonal high water table.	Severe: flooding.	Severe: flooding; seasonal high water table.	Severe: flooding; seasonal high water table.	Severe: flooding; seasonal high water table.
Wickham: WhB	Slight	Slight	Slight	Slight	Slight

properties of the soil—Cont.

Degree and kind of limitations for—Continued		Suitability as source of—		Soil features affecting—				
Local roads and streets	Light industries	Topsoil	Road fill	Pond reservoirs	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Moderate: fair traffic-supporting capacity.	Severe: slope.	Fair to poor: 6 to 9 inches of suitable material.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Medium to high compressibility.	Well drained	Slope	Slope.
Severe: slope.	Severe: slope.	Poor: slope.	Poor: slope.	Moderate permeability.	Medium to high compressibility.	Well drained	Slope	Slope.
Moderate to severe: slope; rock at moderately shallow depths.	Severe: slope; rock at moderately shallow depths.	Poor: coarse fragments.	Poor: coarse fragments.	Moderate permeability.	Rock at moderately shallow depths; coarse fragments.	Well drained	Slope	Coarse rock fragments; slope.
Severe: slope.	Severe: slope.	Poor: slope.	Poor: slope.	Moderate permeability.	Medium to high compressibility; coarse fragments below a depth of 3 feet.	Well drained	Slope	Slope.
Moderate: slope.	Severe: slope.	Poor: slope.	Poor: slope.	Moderate permeability.	Medium to high compressibility; coarse fragments below a depth of 3 feet.	Well drained	Slope	Slope.
Severe: slope.	Severe: slope.	Poor: slope.	Poor: slope.	Moderate permeability.	Medium to high susceptibility to piping.	Well drained	Slope	Slope.
Severe: flooding.	Severe: flooding.	Good	Fair: fair traffic-supporting capacity.	Moderately permeability.	Medium susceptibility to piping.	Well drained	Features generally favorable.	Nearly level; features generally favorable for diversions.
Severe: flooding; seasonal high water table.	Severe: flooding; wetness.	Poor: wetness hinders accessibility.	Poor: wetness.	Moderate permeability.	Fair to good compaction properties.	Seasonal high water table; flooding.	Generally too wet for row crops.	Nearly level; features generally favorable for diversions.
Slight	Slight	Fair to good if the upper part of the subsoil and surface layer are mixed.	Fair: fair traffic-supporting capacity.	Moderate permeability.	Fair to good compaction properties.	Well drained	Features generally favorable.	Features generally favorable.

TABLE 7.—*Engineering*

[Tests performed by State

Soil name and location	Parent material	Report No. S67–Ga–78—	Depth	Moisture density[1]		Volume change in percent		
				Maximum dry density	Optimum moisture	Shrinkage	Swelling	Total volume change
			In	*Pct*	*Pct*			
Cecil sandy loam: Jackson County: 9 miles south of Jefferson, about 800 yards south of U.S. Route 129 on road that connects spur of State Route 330.	Residuum from granitic rocks; few intrusions of schist and gneiss.	14–1	0–10	113	14	4.7	4.5	9.2
		14–4	27–43	96	24	7.3	9.3	16.6
		14–5	43–63	98	22	2.9	17.1	20.0
Hiwassee loam: Jackson County: 1½ miles southwest of Jefferson on State Route 11, 1 mile northeast of Middle Oconee River.	Residuum and transported material from basic rocks.	15–1	0–10	104	18	5.1	8.7	13.8
		15–2	10–40	96	22	10.4	4.3	14.7
		15–5	79–115	93	23	5.2	12.9	18.1

1 Based on the Moisture-density Relations of Soils using 5.5-lb. Rammer and 12-in. Drop, AASHTO Designation T 99, Method (*2*).

2 Mechanical analyses according to the AASHTO Designation T88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-sized fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is

used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet (*1*). Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Engineering interpretations of soils

The estimated interpretations in table 6 are based on the engineering properties of soils shown in table 5, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Barrow, Hall, and Jackson Counties. In table 6, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for drainage of cropland and pasture, irrigation, ponds and reservoirs, embankments, and terraces and diversions. For these particular uses, table 6 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties are generally favorable for the rated use, or, in other words, limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable, but they can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome that major soil reclamation, special designs, or intensive maintenance is required. For some ratings the term very severe is used. *Very severe* means one or more soil properties are so unfavorable for a particular use that overcoming the limitations is most difficult and costly and commonly is not practical for the rated use.

Soil suitability in table 6 is rated by the terms *good, fair,* and *poor* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

In the following paragraphs are explanations of some of the columns in table 6.

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

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet, long enough for bacteria to decompose the solids (*4*). A lagoon has a nearly level floor and has sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter, and slope. Also if the floor needs to be leveled, depth to bedrock becomes impor-

test data

Highway Department of Georgia]

Mechanical analysis[2]											Liquid limit	Plasticity index	Classification	
Percentage passing sieve—							Percentage smaller than—							
1-in.	¾-in.	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			AASHTO[3]	Unified[4]
											Pct			
100	99	99	97	95	71	43	40	37	27	24	37	11	A-6(1)	SM
				100	79	65	64	59	48	43	52	16	A-7-5(10)	MH
			100	99	70	56	55	51	37	29	56	19	A-7-5(10)	MH
	100	98	94	89	78	51	49	45	36	31	34	12	A-6(4)	CL
		100	99	99	88	64	62	60	52	48	47	25	A-7-6(13)	CL
				100	85	55	53	48	37	32	19	6	A-4(4)	CL-ML

analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-sized fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[3]Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO Designation M 145-49, (*2*).

[4]Based on the Unified Soil Classification System (*3*).

tant. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified Soil Classification System and the amount of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings, as rated in table 6, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. They are without basements. The features that affect the rating of a soil for dwellings are those that relate to its capacity to support a load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 6 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet; but regardless of that, every site should be investigated before it is selected.

Local roads and streets, as rated in table 6 have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil material at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are the load-supporting capacity and stability of the subgrade material and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Soil requirements for light industries are comparable to those for dwellings except for slope; suitable site can be only half as steep as for dwellings.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural

Figure 11.—**This well-kept pond in the Chewacla-Toccoa association is used for recreation and irrigation.**

fertility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

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

The soil characteristics that affect the construction and operation of certain engineering features are discussed in the following paragraphs.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material (fig. 11).

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

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

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

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

Soil test data

Table 7 contains engineering test data for some of the major soil series in Barrow, Hall, and Jackson Counties. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analysis and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

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

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material, as has been explained for table 5.

Use of Soils for Recreational Development

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 8 the soils of Barrow, Hall, and Jackson Counties are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, and paths and trails.

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

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

Playgrounds are areas used intensively for baseball, football, badminton, and similar types of organized games. Soils suitable for this use need to be able to withstand intensive foot traffic. The best soils have a nearly level surface that is firm after rains but not dusty when dry and is free of coarse fragments and rock outcrops. They have good drainage and are free from flooding during periods of heavy use. If grading and leveling are required, depth to rock is important.

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

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

Formation and Classification of the Soils [6]

This section consists of two main parts. In the first part the factors of soil formation and how they affected the development of soils in Barrow, Hall, and Jackson Counties are explained. In the second part the system of soil classification currently used is explained, and each soil series in the three counties is placed in classes of this system.

Formation of the Soils

Soil is produced when parent material, climate, relief, and plants and animals interact for a period of time (*7*). These factors determine the nature of the soil that forms at any point on the earth. All these factors affect the formation of each soil, but the relative importance of each factor differs from place to place. In some areas one factor may dominate in the formation of a soil and determine most of the properties. For example, soils that formed in quartz sand generally have faint horizons, because quartz sand is highly resistant to weathering. Even in quartz sand, however, a distinct profile can be formed under certain types of vegetation, if the relief is low and flat and if the water table is high. The five factors of soil formation are discussed in the paragraphs that follow.

[6] GLENN L. BRAMLETT, soil scientist, Soil Conservation Service, assisted in the preparation of this section.

TABLE 8.—*Limitations for recreational development*

Soil series and map symbols	Camp areas	Playgrounds	Picnic areas	Paths and trails
Altavista: AlB	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness.
Appling:				
ApB	Slight	Moderate: slope	Slight	Slight.
ApC	Slight to moderate: slope.	Severe: slope	Slight to moderate: slope.	Slight.
ApD	Moderate: slope	Severe: slope	Moderate: slope	Slight.
Augusta: Au	Severe: seasonal high water table; flooding in some areas during period of use.	Severe: seasonal high water table; flooding in places during period of use.	Moderate: seasonal high water table; flooding in some areas during some periods of use.	Moderate: seasonal high water table.
Cartecay: Cc	Severe: flooding; seasonal high water table.	Severe: flooding; seasonal high water table.	Moderate: flooding; seasonal high water table.	Moderate: flooding; seasonal high water table.
Cecil:				
CeB	Slight	Moderate: slope	Slight	Slight.
CeC	Slight to moderate: slope.	Severe: slope	Slight to moderate: slope.	Slight.
CfC2	Moderate: slope; texture of surface layer.	Severe: slope; texture of surface layer.	Moderate: slope; texture of surface layer.	Moderate: texture of surface layer.
Chestatee: ChE	Severe: slope	Severe: slope	Severe: slope	Moderate: slope; stoniness.
Chewacla:				
Ck	Severe: wetness; flooding.	Severe: wetness; flooding.	Severe: wetness; flooding.	Moderate: wetness; flooding.
Cw	Severe: wetness and flooding.	Severe: wetness and flooding.	Severe: wetness and flooding.	Severe: wetness and flooding.
Gwinnett:				
GwC2	Moderate: slope; texture of surface layer.	Severe: slope; texture of surface layer.	Moderate: slope; texture of surface layer.	Slight.
GwE2	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Hiwassee:				
HsB	Slight	Moderate: slope	Slight	Slight.
HsC	Slight to moderate: slope.	Severe: slope	Slight to moderate: slope.	Slight.
HsD	Moderate: slope	Severe: slope	Moderate: slope	Slight.
HtC2	Moderate: slope; texture.	Moderate: slope; texture.	Moderate: slope; texture.	Slight.
Louisburg: LuE	Moderate to severe: slope.	Severe: slope	Moderate to severe: slope.	Moderate: slope.
Madison:				
MdB	Slight	Moderate: slope	Slight	Slight.
MdC	Slight to moderate: slope.	Severe: slope	Slight to moderate: slope.	Slight.
MdD	Moderate: slope	Severe: slope	Moderate: slope	Slight.
MdE	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
MlC2, MlD2	Moderate: slope; texture of surface layer.	Severe: slope	Moderate: slope; texture of surface layer.	Slight.
Musella:				
MuD	Moderate: slope; texture of surface layer.	Severe: slope	Moderate: slope; texture of surface layer.	Moderate: slope; texture; coarse fragments.
MuF	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Pacolet:				
PaE	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
PgE3	Severe: gullied; slope.	Severe: gullied; slope.	Severe: gullied; slope.	Severe: gullied.
PTF	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
PuD2	Moderate: slope	Severe: slope	Moderate: slope	Slight to moderate: texture of surface layer.
Toccoa: To	Severe: flooding	Severe: flooding	Moderate to severe: flooding.	Moderate: flooding.
Wickham: WhB	Slight	Moderate: slope	Slight	Slight.

Parent material

Parent material is the unconsolidated mass from which a soil forms. It largely determines the chemical and mineralogical composition of soils. The soils of Barrow, Hall, and Jackson Counties formed in two kinds of parent material: residual material weathered in place from rock and 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 and deposited continually in the valleys of flowing streams. Older deposits are on high terraces along former streambeds that are now dry. Soils that formed 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. The Cartecay soil is an example of a stratified soil that formed 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. Some soil characteristics cannot be correlated with the kind of parent material, however, and must be attributed to other factors.

Climate

Climate affects the formation of soils through its influence on the rate of weathering of rocks and the decomposition of minerals and organic matter. It also affects biological activity in the soils and the leaching and movement of weathered materials.

Barrow, Hall, and Jackson Counties have a moist, temperate climate with an average daily minimum temperature of about 33° F in January and an average daily maximum temperature of about 90° F in July. The warm, moist climate promotes rapid weathering of rock. Consequently, in much of the area the soils are 3 to 6 feet thick over a thick layer of loose, disintegrated, weathered rock which blankets the hard rock underlying the counties.

About 52 inches of water falls annually. Much of this percolates through the soil and moves dissolved or suspended materials downward, leaving the soils generally low in bases. Plant remains decay rapidly and produce organic acids that help to hasten the breakdown of minerals in the underlying rock. Thus, the organic-matter content is low in the surface layer of soils that have good drainage. Since the climate is fairly uniform over the three-county area, one soil cannot be set apart from another because of climate influences alone.

Plants and animals

Plants, animals, bacteria, and other organisms are active in the soil-forming processes. The changes they bring about depend mainly on the kinds of life processes peculiar to each. The kinds of plants and animals that live on and in the soil are affected, in turn, by the climate, the parent material, the relief, and the age of the soil.

Most of the soils in Barrow, Hall, and Jackson Counties formed under forest consisting of various kinds of hardwoods and of such softwoods as pines. These plants supply most of the organic matter available in the soils, although the hardwoods contribute more than the softwoods. The organic-matter content in most of the soils is low to medium.

Growing plants provide a cover that helps to reduce erosion and stabilize the surface so that the soil-forming processes can continue. Leaves, twigs, roots, and entire plants accumulate on the surface of forest soils and then decompose as the result of the action of percolating water and of micro-organisms, earthworms, and other forms of life. The roots of plants widen cracks in the rocks, thus permitting the entrance of more water. Also, the uprooting of trees by wind decidedly influences formation of soils through the mixing of soil layers and the loosening of underlying material.

Small animals, earthworms, insects, and micro-organisms also influence the formation of soils by mixing organic matter into the soil and by accelerating the formation of organic matter by breaking down the remains of plants. Small animals burrow into the soil and thus mix the layers. Earthworms and other small invertebrates feed on the organic matter in the upper few inches. They slowly but continually mix the soil material and in places alter it chemically. Bacteria, fungi, and other micro-organisms hasten the weathering of rocks and the decomposition of organic matter.

Relief

Relief influences soil formation through its effect on runoff, movement of water within the soil, plant cover, and to some extent, soil temperature. Most soils in Barrow, Hall, and Jackson Counties have slopes of 10 to 25 percent. Slopes as steep as 45 percent, however, are on narrow ridges and dissected side slopes. Slopes of 0 to 10 percent are on some ridgetops and along streams.

The length, shape, and steepness of slope determine the rate of runoff. Runoff is more rapid on steep slopes than it is in areas where the soil is level or nearly level. Thus, steep soils erode faster than level ones, even though both are made up of the same kind of material. In this survey area, for example, moderately deep Pacolet soils slope more than 10 percent and deeper Cecil soils are less sloping, yet both are underlain by the same parent material.

Where a soil is level or nearly level, more time is available for water to penetrate and percolate through the material in the profile. The amount of water, in turn, influences the translocation of soluble materials. The moisture available in the soil also determines to a significant extent the number and kinds of plants that grow.

Augusta and Wehadkee soils are examples of nearly level soils that have slow internal drainage. These soils are usually wet, and the subsoil is gray or contains gray mottles.

Time

Generally, a long time is required for a soil to form. Most of the soils on uplands in Barrow, Hall, and Jackson Counties have been in place long enough for distinct horizons to develop, but some of those that formed in alluvium have not.

Most soils in the survey area have distinct horizons. The surface layer contains an accumulation of organic matter, and silicate clay minerals have formed and moved downwards to produce horizons that are relatively high in clay. Also, in such soils, oxidation or reduction of iron has had its effect, depending on natural drainage. Many of the soils have been drained well enough to have a red or dark-red subsoil, and they contain highly oxidized iron. A few have had impaired drainage and, consequently, have a gray subsoil that contains reduced iron. In addition, leaching of soluble calcium, magnesium, potassium, and other weatherable products has caused an increase in exchangeable hydrogen. Cecil and Hiwassee soils are examples of soils that are old.

The soils that have essentially the same parent material and drainage sometimes differ in degree of profile development, chiefly because of time. Examples of these are the Altavista soils on stream terraces and the Chewacla soils on flood plains. These soils are similar in texture and are in similar positions on the landscape. The Altavista soils, however, have been in place long enough to have a distinct, dark-colored surface layer and a subsoil that has an accumulation of clay. The Chewacla soils, on the other hand, have not been in place long enough for as distinct horizons to form.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification (*6*), and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

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

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available (*6, 9*).

The current system of classification has six categories. Beginning with broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the groups of similar genesis, or mode of origin, are grouped. The soil series of Barrow, Hall, and Jackson Counties have been placed in three categories of the current system (table 9). Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol).

TABLE 9.—*Classification of the soils*

Series	Family	Subgroup	Order
Altavista	Fine-loamy, mixed, thermic	Aquic Hapludults	Ultisols.
Appling	Clayey, kaolonitic, thermic	Typic Hapludults	Ultisols.
Augusta	Fine-loamy, mixed, thermic	Aeric Ochraquults	Ultisols.
Cartecay	Coarse-loamy, mixed, nonacid, thermic	Aquic Udifluvents	Entisols.
Cecil	Clayey, kaolonitic, thermic	Typic Hapludults	Ultisols.
Chestatee	Clayey, kaolonitic, thermic	Typic Hapludults	Ultisols.
Chewacla	Fine-loamy, mixed, thermic	Fluvaquentic Dystrochrepts	Inceptisols.
Gwinnett	Clayey, kaolonitic, thermic	Typic Rhodudults	Ultisols.
Hiwassee	Clayey, kaolonitic, thermic (oxidic)	Typic Rhodudults	Ultisols.
Louisburg	Coarse-loamy, mixed, thermic	Ruptic-Ultic Dystrochrepts	Inceptisols.
Madison	Clayey, kaolonitic, thermic	Typic Hapludults	Ultisols.
Musella	Loamy, mixed, thermic, shallow	Typic Rhodudults	Ultisols.
Orthents			Entisols.
Pacolet	Clayey, kaolonitic, thermic	Typic Hapludults	Ultisols.
Tallapoosa	Loamy, micaceous, thermic, shallow	Ochreptic Hapludults	Ultisols.
Toccoa	Coarse-loamy, mixed, nonacid, thermic	Typic Udifluvents	Entisols.
Wickham	Fine-loamy, mixed, thermic	Typic Hapludults	Ultisols.

SUBORDER. Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquent* (*Aqu,* meaning water or wet, and *ent,* from Entisol).

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and those surface horizons that are thick and dark colored. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is *Haplaquents* (*Hapl,* meaning simple horizons, *aqu,* for wetness or water, and *ent,* from Entisols).

SUBGROUP. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is *Typic Haplaquents* (a typical Haplaquent).

FAMILY. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reactions, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae (table 9). An example is the coarse-loamy, siliceous, acid, thermic family of Typic Haplaquents.

SERIES. The series consists of a group of soils that formed from a particular kind of parent material and having genetic horizons that, except for texture of the surface layers, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

New soil series must be established and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series concept at the State, Regional, and national levels of responsibility for soil classification results in a judgment that the new series should be established. The soil series described in this publication have been established earlier. Many have been revised since they were first established.

In table 9 the soil series in Barrow, Hall, and Jackson Counties are classified according to the current system.

Additional Facts About the Counties

This section discusses the organization, settlement and population, physiography, relief, and drainage of the three counties. It also gives some facts about farming, water supply, and climate.

Organization, Settlement, and Population

Barrow County was created by an act of legislature on July 7, 1914. It was formed from land taken from Gwinnett, Jackson, and Walton Counties. Hall County was the 44th Georgia County created as an original county. It was created by an act of legislature on December 15, 1818, from lands acquired by treaty with the Cherokee Indians the same year. Jackson County was created by an act of legislature on February 11, 1796. It was formed from land taken from Franklin County.

Settlement of the survey area began in the early part of the nineteenth century. The first settlers came from older settlements in Georgia and the Carolinas. They were largely descendants of English, Scottish, and Irish.

Winder, the county seat of Barrow County, has the largest population, and Statham has the next largest population of the towns in Barrow County. The urban population of Barrow County was 5,553 in 1960, and the rural population was 8,930. The urban population in 1970 had increased to 9,289, and the rural population had increased to 10,254.

The population of Hall County increased from 49,739 in 1960 to 59,405 in 1970. Gainesville, the county seat of Hall County, has a larger population than any one of the seven other towns in the county. It is the principal trade area for the counties in northeastern Georgia.

The population of Jackson County increased from 18,490 in 1960 to 21,093 in 1970. Jefferson is the county seat of Jackson County. Commerce has the largest population of any town in Jackson County.

Barrow, Hall, and Jackson Counties still have a larger rural population than urban. A large percentage of the labor for operating the industrial plants in the towns live in the rural areas of the counties.

Physiography, Relief, and Drainage

Barrow, Hall, and Jackson Counties are within a broad physiographic province, probably of Precambrian age—the upper fringes of the Piedmont Plateau (*5*). The Piedmont Plateau is a series of prominent hills near the base of the mountains and larger streams, but it changes to flattopped, undulating hills toward the south. Rocks are crystalline and complex, and they contain many kinds of diverse minerals. Most of the farmland is on the broader, more gentle landscapes.

The highest elevations, more than 2,000 feet, in the tricounty area are in the northern part of Hall County on Long Mountain, Skitt Mountain, and Wauka Mountain. The lowest elevation, 580 feet, is in the southern part of Barrow County where the Apalachee River leaves the county. The lowest elevation in Hall County is 1,050 feet and is in the southwestern corner where the Chattahoochee River leaves the county. The lowest elevation in Jackson County is 600 feet and is in the southeastern corner where the North Oconee River leaves the county.

The drainage pattern in the survey area is dendritic. Streams formed in the higher elevations in V-shaped valleys and generally flow southward. In the northern part of the survey area the stream flow is more rapid through narrow bottom lands. Farther south, the flow is slower and the bottom lands are broader. The larger streams in Barrow County are the Apalachee and Mulberry Rivers and the Rock and Cedar Creeks.

The larger streams in Hall County are the Chattahoochee, Chestatee, North Oconee, and Little Rivers. Some of the larger creeks are Walnut, Big, Flat, Candler, and Yellow.

The larger streams in Jackson County are the North, Middle Oconee, and Mulberry Rivers and the Buffalo, Burry, Gravelly, Curry, and Candler Creeks. Most of the drainage from Hall County flows into the Gulf of Mexico, and all of the drainage from Barrow and Jackson Counties flows into the Atlantic Ocean.

Farming

Before the white settlers arrived in the area now named Barrow, Hall, and Jackson Counties, the Cherokee Indians farmed some of the well-drained soils along the larger streams. Corn, beans, and potatoes were the main crops, as well as some tobacco. The Indians did not depend entirely on farming to eat, however, and included fish, game, and wild fruit in their diet. After the settlers came, the land was cleared for corn, wheat, barley, vegetables, and fruit. As transportation was improved around 1830, cotton rapidly changed this self-sufficient farm economy to a semicrop system. Short staple cotton soon became the cash crop, and slave labor became more and more important. The combination of clean cultivation, moderate to steeply sloping topography, and high rainfall, particularly during winter while the ground was barren, rapidly depleted soil fertility and greatly accelerated erosion. Fields of severely eroded soils were abandoned and other fields were cleared, resulting in enormous soil and fertility losses from erosion.

The acreage in farms in the survey area increased steadily from the 1830's to 1935. From 1935 to 1940, farm acreage steadily decreased, but it reached a peak in 1950. By 1969 the tricounty area had only 251,141 acres in farms. Most of the acreage that was no longer farmed was been acquired by timber companies.

According to the U.S. Bureau of the Census, the number of farms in Barrow County decreased from 619 in 1964 to 529 in 1969. The average size of farms in Barrow County was 103 acres in 1964 and 123 in 1969. About 39 percent of the farms are between 1 and 49 acres; only 3 percent are more than 500 acres.

The number of farms in Hall County decreased from 1,419 in 1964 to 1,086 in 1969. The average size of farms in Hall County was 81 acres in 1964 and 76 acres in 1969. About 50 percent of the farms are between 1 and 49 acres in size; only 1 percent is larger than 500 acres.

The number of farms in Jackson County increased from 783 in 1964 to 784 in 1969. The average size of farms in Jackson County was 145 acres in 1964 and 131 in 1969. About 34 percent of the farms are between 1 and 49 acres in size; only 1 percent is larger than 500 acres.

Cotton was the principal cash crop in the three counties from the 1830's to 1940. Poultry and livestock farming have prevailed since 1940. Corn, soybeans, and cotton are the main row crops in Barrow and Jackson Counties, and corn and soybeans are the main row crops in Hall County. Vegetables are grown mainly for home use, but a few farmers produce small quantities for markets.

Growing row crops was the chief farm enterprise from the time this survey area was settled until early in 1940. The acreage used for row crops decreased significantly between 1940 and 1960. The acreage in pasture and forest, however, increased. Now, only a few operators are planting row crops, mainly on the larger well-drained bottom lands and more gently sloping uplands where machinery can be used satisfactorily.

Before 1945 pastures were located for the convenience of the farm operators. The suitability of soils for pasture was seldom considered. If an area was too steep or stony for cultivated crops or if yields of row crops became very low, the area was fenced and used for pasture. In 1964 Barrow County had 28,000 acres in pasture. About two-thirds of this was improved pasture. Hall County had 15,200 acres in pasture in 1964. About three-fourths of this was improved pasture. In 1964 Jackson County had 44,600 acres in pasture. Approximately two-thirds of this was improved. Each year an increasing acreage is being fertilized and seeded to adapted grasses. The availability of chicken litter for fertilizers and the low income from row crops are reasons that contribute to the increase of the acreage in pasture.

From 1964 to 1969 the number of cattle in Barrow County increased from 6,772 to 7,999, and in Hall County it increased from 12,909 to 14,806. In Jackson County the increase was from 8,769 to 13,101 during the same period. The increase was mostly in beef cattle. The horses and mules have been replaced by tractors for farm power.

During the same period the number of hogs in Barrow County increased from 843 to 1,371, and in Hall County the number of hogs decreased from 1,940 to 1,304. In Jackson County the number of hogs increased from 576 to 4,784. Most of the hogs are grown by a few operators and are marketed locally.

Poultry has been important to the economy of this survey area since early 1940's. Broilers were first produced in flocks of 500 to 1,000, but improved feeds, housing, equipment and breeds make it possible for fewer producers to raise larger flocks. Flocks of 30,000 to 200,000 are now common. The number of broilers produced in Barrow County increased from 307,184 in 1964 to 332,636 in 1969. In Hall County this increase was from 1,569,707 to 1,743,467, and in Jackson County it was from 503,037 to 1,059,296. Although the number of broilers has increased since 1964, there are fewer growers.

About half of Barrow County, two-thirds of Hall County, and half of Jackson County are wooded. The value of timber products is expected to increase from year to year as better management is practiced.

Water Supply

Wells and springs supply adequate water for farm and home use. The wells are about 30 to 90 feet deep and supply water throughout the year. Small springs are common. Branches, creeks, large streams, and farm ponds are the main source of water for poultry and livestock. Wells, springs, creeks, and rivers supply water for towns.

Lake Sidney Lanier, which has a surface area of 38,000 acres, forms the western boundary of Hall County. It has become tremendous for sporting attractions as fishing, boating, water sports, bathing, and camping.

Climate [7]

Barrow, Hall, and Jackson Counties are located along the transition zone between the Mountain and Intermountain Plateau and the Piedmont Plateau. The area has a temperate climate with warm summers and moderately cold winters. Average annual precipitation ranges between 50 and 55 inches, increasing from south to north. Temperature and precipitation data are given in tables 10 and 11 of this section.

Temperatures vary because of the differences in elevation, but summer weather usually arrives by late May when the first 90° F readings can be expected. From then until early September, afternoon temperatures range from the high 80's to the low 90's with a few readings in the upper 90's, especially in the southern part of the area. Summer nights are quite pleasant. Average minimums range from 63° to 68°, and early morning temperatures in the 50's are not unusual. Most summer rainfall occurs as showers and thundershowers. Amounts show large variations over the area, but one-tenth of an inch or more is likely at any one place on about one day out of five. Slightly less than one-fourth of the annual precipitation generally falls during summer. Thunderstorms occur about one day out of three, and a few are accompanied by hail and strong winds.

Summer gradually gives way to autumn after mid-September. Average daily high and low temperatures drop about 20° during the period of September to November. The fall season, one of the area's most pleasant, has long periods of mild sunny days and progressively cooler nights. The average date of the first fall freeze ranges from about November 1 in the northern part of the area to November 8 in the southern part. Fall is the driest season, and October is the driest month. The three fall months account for 20 percent of the annual average, and one-tenth of an inch or more is likely on one day out of six. Showers and thunderstorms decrease through autumn and by late October most rainfall comes from large scale weather systems. Tropical cyclones seldom affect the area.

[7] By HORACE S. CARTER, climatologist for Georgia, National Weather Service, U.S. Department of Commerce.

TABLE 10.—*Temperature and precipitation data*

Month	Temperature				Precipitation		
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average monthly total	One year in 10 will have—	
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—
	°F	°F	°F	°F	Inches	Inches	Inches
January	53.6	32.7	68	17	4.89	2.6	9.3
February	56.4	33.7	73	18	4.90	1.9	9.4
March	64.1	39.2	78	24	6.05	3.0	10.2
April	74.5	47.9	86	32	4.80	1.9	6.8
May	82.0	55.8	92	42	3.78	1.4	6.5
June	87.9	63.4	96	54	4.19	1.7	6.7
July	89.9	66.7	96	60	4.98	2.0	8.5
August	89.2	65.9	97	58	3.72	1.1	7.3
September	83.4	60.9	93	50	3.56	1.5	6.0
October	74.4	49.4	84	34	3.17	4.4	7.2
November	63.6	39.1	77	25	3.70	1.7	7.0
December	54.2	33.3	68	19	4.71	1.8	8.9
Year [1]	72.8	49.0	98	12	52.45	44.5	65.3

[1] Average annual maximum temperature.

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

Probability	Dates for given probability and temperature		
	24° F or lower	28° F or lower	32° F or lower
Spring:			
1 year in 10 later than	March 25	April 10	April 15
2 years in 10 later than	March 18	April 2	April 12
5 years in 10 later than	February 28	March 20	April 2
Fall:			
1 year in 10 earlier than	November 12	October 31	October 23
2 years in 10 earlier than	November 16	November 4	October 26
5 years in 10 earlier than	November 28	November 14	November 4

Periods of cold weather generally begin in early November (table 11) and increase in frequency and intensity as midwinter approaches. Freezing occurs on more than half the days from December through February and on nearly a third of the days in November and March. Most winters have a few days with minimums around 10°, and readings of nearly zero occur occasionally. Gainesville had a record low of —8° in January 1966. Winter afternoons are usually mild. Maximums average almost 55° and frequently reach the mid 60's. Average precipitation increases about an inch from November to December and then changes little through January and February. About 28 percent of the annual average falls in winter and results almost entirely from weather fronts and associated low pressure systems. Significant rainfall is likely on 7 or 8 days during each winter month. Snow falls in the area during most winters with averages ranging from 2 to 4 inches. Thunderstorms are rare in winter, but they do occur.

Spring weather is usually quite variable. The conflict between cool air from the north and rapidly warming air from the south gives rise to potentially stormy conditions. The threat of tornadoes is greatest in spring, and thunderstorm activity increases toward a summer maximum. The average date of the last spring freeze is around April. The average freeze-free season is 210 to 220 days. Average rainfall reaches a peak of 5.5 to 6.0 inches in March and then decreases to less than 4.0 inches in May. Showery precipitation predominates again by early May. Spring accounts for 28 percent of the annual average.

Average windspeeds range from 10 miles per hour in early spring to 6 miles per hour in midsummer. Directions are variable but are usually northerly from fall through spring and southerly in summer. Relative humidities average between 78 and 92 percent in early morning and between 50 and 60 percent in early afternoon. Both morning and afternoon averages are higher in summer and lower in spring.

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Glossary

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

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

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 sesquiozides (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 another kind. Gneiss, schist, and slate are examples of metamorphic rock.

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

Parent material. Disintegrated and partly weathered rock 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 mottling in the lower B and the C horizons.

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

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

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

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

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 6.5	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 a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent 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 either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles) adhering together without any regular cleavage, as in many claypans and hardpans).

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

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 surface 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.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which it belongs. To learn about the management of a capability unit or a woodland suitability group, read the description of the unit or group and also the introduction to the section in which the unit is described.

Map symbol	Mapping unit	Page	Capability unit Symbol	Capability unit Page	Woodland suitability group Number
AlB	Altavista sandy loam, 2 to 6 percent slopes	7	IIe-2	25	2w8
ApB	Appling sandy loam, 2 to 6 percent slopes	7	IIe-2	25	3o7
ApC	Appling sandy loam, 6 to 10 percent slopes	8	IIIe-2	26	3o7
ApD	Appling sandy loam, 10 to 15 percent slopes	8	IVe-1	27	3o7
Au	Augusta loam	8	IIIw-3	27	2w8
Cc	Cartecay and Chewacla soils	9	IIIw-2	26	2w8
CeB	Cecil sandy loam, 2 to 6 percent slopes	10	IIe-1	24	3o7
CeC	Cecil sandy loam, 6 to 10 percent slopes	10	IIIe-1	26	3o7
CfC2	Cecil sandy clay loam, 6 to 10 percent slopes, eroded	10	IVe-3	27	4c2e
ChE	Chestatee stony sandy loam, 15 to 25 percent slopes	11	VIe-4	28	3x3
Ck	Chewacla loam, frequently flooded	12	Vw-1	28	1w8
Cw	Chewacla-Wehadkee complex	12	IVw-1	28	1w8
GwC2	Gwinnett clay loam, 6 to 10 percent slopes, eroded	13	IVe-3	27	4c2e
GwE2	Gwinnett clay loam, 10 to 25 percent slopes, eroded	13	VIe-2	28	4c3e
HsB	Hiwassee loam, 2 to 6 percent slopes	13	IIe-1	24	3o7
HsC	Hiwassee loam, 6 to 10 percent slopes	14	IIIe-1	26	3o7
HsD	Hiwassee loam, 10 to 15 percent slopes	14	IVe-1	27	3o7
HtC2	Hiwassee clay loam, 2 to 10 percent slopes, eroded	14	IVe-3	27	4c2e
LuE	Louisburg sandy loam, 10 to 25 percent slopes	14	VIIe-2	29	3r8
MdB	Madison sandy loam, 2 to 6 percent slopes	15	IIe-1	24	3o7
MdC	Madison sandy loam, 6 to 10 percent slopes	15	IIIe-1	26	3o7
MdD	Madison sandy loam, 10 to 15 percent slopes	16	IVe-1	27	3o7
MdE	Madison sandy loam, 15 to 25 percent slopes	16	VIe-2	28	3r8
MlC2	Madison sandy clay loam, 6 to 10 percent slopes, eroded	17	IVe-3	27	4c2e
MlD2	Madison sandy clay loam, 10 to 15 percent slopes, eroded	17	VIe-2	28	4c2e
MuD	Musella cobbly clay loam, 6 to 15 percent slopes	18	VIe-4	28	4f3
MuF	Musella cobbly clay loam, 15 to 35 percent slopes	18	VIIe-3	29	4f3
PaE	Pacolet sandy loam, 15 to 25 percent slopes	19	VIe-2	28	3r8
PgE3	Pacolet-Orthents complex, 10 to 25 percent slopes, severely eroded	19	VIIe-4	29	---
PTF	Pacolet-Tallapoosa association, steep	20	VIIe-1	28	3r8
PuD2	Pacolet soils, 10 to 15 percent slopes, eroded	20	IVe-1	27	3o7
To	Toccoa soils	21	IIw-2	25	1o7
WhB	Wickham sandy loam, 2 to 6 percent slopes	23	IIe-1	24	3o7

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